



The Planning Inspectorate

Report to the Secretary of State for Environment, Food and Rural Affairs

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an Inspector appointed by the Secretary of State

Date: 7 December 2021

ENVIRONMENTAL PERMITTING REGULATIONS 2016

ENVIRONMENT AGENCY

APPEAL BY NNB GENERATING COMPANY (HPC) LTD

Removal of Acoustic Fish Deterrent Conditions from

Water Discharge Activity (WDA) Permit

Inquiry held from 8 June 2021 – 24 June 2021

Hinkley Point C

Permit Variation Ref: EPR/HP3228XT/V004

APP/EPR/573

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Appeal Ref: APP/EPR/573
Hinkley Point C Power Station, Near Bridgwater, Somerset TA5 1UD

- The appeal is made under Regulation 31(1) of the Environment Permitting (England and Wales) Regulations 2016 (the EPR).
- The appeal is made by NNB Generation Company (HPC) Limited against the deemed refusal by the Environment Agency under Schedule 5, Part 1, paragraph 15(1) of the EPR.
- The Environmental Permit, Ref EPR/HP3228XT, was granted on 13 March 2013. The application sought variation of the permit for the:
 - removal of Operating Condition set out in Schedule 1, Table S1.2 - Operating Techniques.
 - removal of requirement to provide design information and an as-built description of the AFD system as set out in Schedule 1, Table S1.4 – Pre-Operational Measure PO2.
 - removal of references to the AFD system referenced in PO8 as set out in Schedule 1, Table S1.4 – Pre-Operational Measure PO8.

Summary of Recommendation: that the appeal is dismissed and the Environmental Permit not be varied

1. PROCEDURAL MATTERS

- 1.1 The application for variation of the permit was submitted on the 14 February 2019. In accordance with Schedule 5, Part 1 of the EPR, the applicant served notice of deemed refusal on 4 August 2020, stating that the Agency had not determined the application within the relevant period, leading to this appeal. The appeal was submitted on 23 September 2020.
- 1.2 On the 24 March 2021, the Secretary of State for Defra confirmed that the appeal would be recovered. Appendix 1 of the published appeal procedure guidance sets out the criteria for the Secretary of State recovering an appeal. In line with those criteria, his grounds were that the case:
- involves processes or sites of major importance. This is clearly an important site environmentally. The cooling water system for HPC is to be built in the Severn Estuary European marine sites which are designated under the Habitats Directive and Ramsar Convention.
 - could give rise to significant public controversy. There has been (and it is expected there will be further) significant interest from a range of respondents.
- 1.3 I held a pre-Inquiry meeting on 24 March 2021 to discuss procedural matters relating to the Inquiry. There was no discussion of the merits of any cases for or

against the proposals. A note following the meeting was circulated to all parties who had submitted objections or other representations.

- 1.4 Owing to the ongoing pandemic, the Inquiry was run on a virtual basis. It opened on 8 June 2021 and closed on 24 June 2021.
- 1.5 The proceedings were live-streamed in addition to the PINS' Teams platform. This allowed all those who wished to participate and/or observe to do so.
- 1.6 The main parties to the Inquiry were the appellant, NNB Generation Company (HPC) Limited; the Environment Agency (the Agency); and a Rule 6(6) Party, Severn Estuary Interests (SEI), comprising the Blue Marine Foundation and Somerset Wildlife Trust, the Wildfowl and Wetlands Trust, the Angling Trust, the Severn Rivers Trust, and the Burnham Boats / Bristol Channel Federation of Sea Anglers.
- 1.7 There was a significant volume of representation in relation to the application for variation when it was before the Agency, as well as in response to the notification of appeal and a number of interested parties addressed the Inquiry, who were subject to examination and subsequently were also able to question witnesses. Where appropriate, I have summarised their positions below after those of the main parties.
- 1.8 As a virtual Inquiry, all documentation was made available on-line and was maintained throughout the event to include any material submitted during the Inquiry itself (ID documents). The Core Documents (CD) referred to throughout the Report, as well as Inquiry Documents (ID) submitted, are listed with hyperlinks in Appendix 4 below, and these and all relevant documentation can be found at the following address:

<https://ea.sharefile.com/share/view/s52cdc7c3f6f64bbfb50faa3965d155df/foa35f32-8794-4909-af94-026950180576>
- 1.9 I am grateful for the efficient management of this documentation by the Agency during the event.
- 1.10 As agreed before the Inquiry opened, a site visit was not felt to be necessary in this case.

2. BACKGROUND AND REGULATORY POSITION

- 2.1 HPC was granted a water discharge activity environmental permit on 13 March 2013, (EPR/HP3228XT)¹, alongside a Marine Licence (L/2013/00178/5)², 7 June 2013, and the Development Consent Order (DCO), made on 18 March 2013³. The

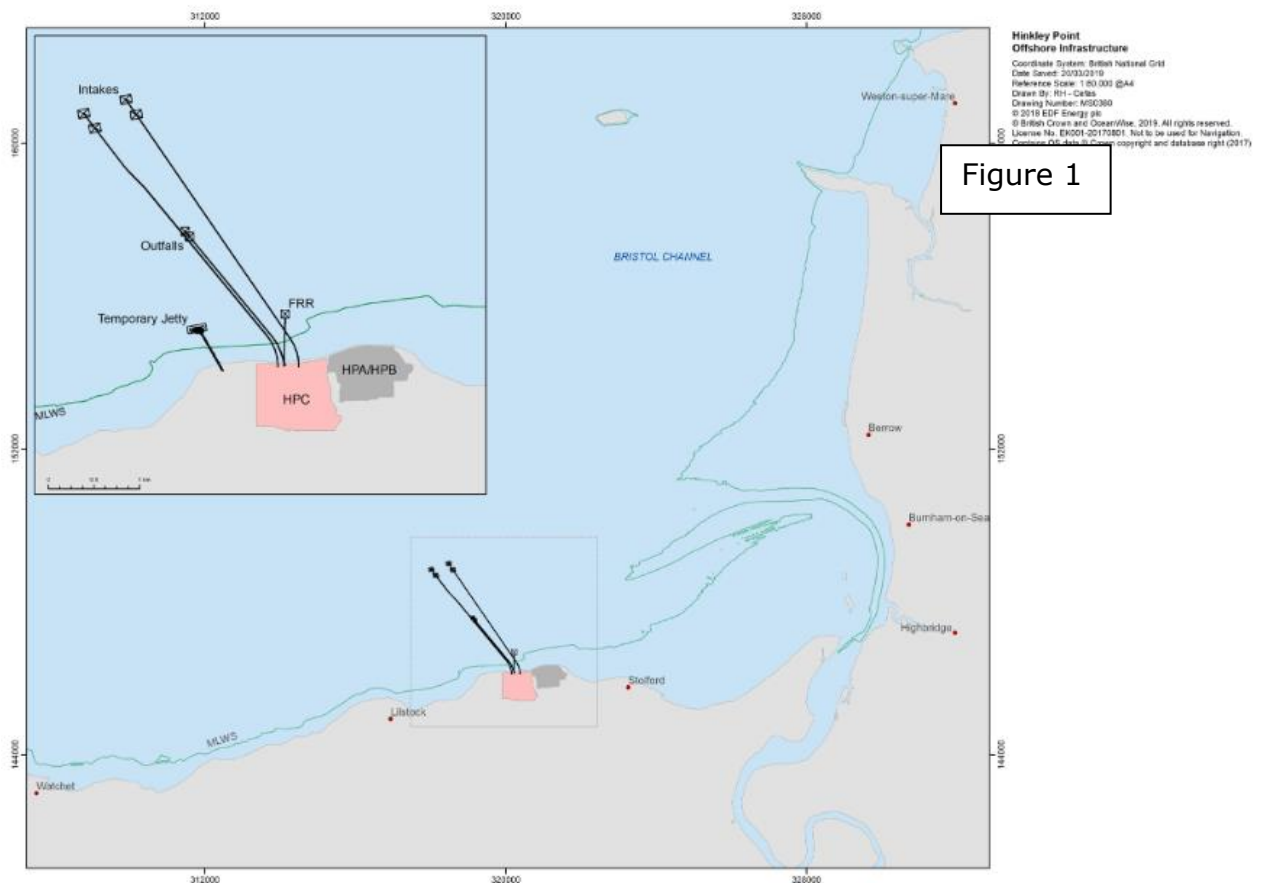
¹ CD5.5

² CD5.2

³ CD5.1

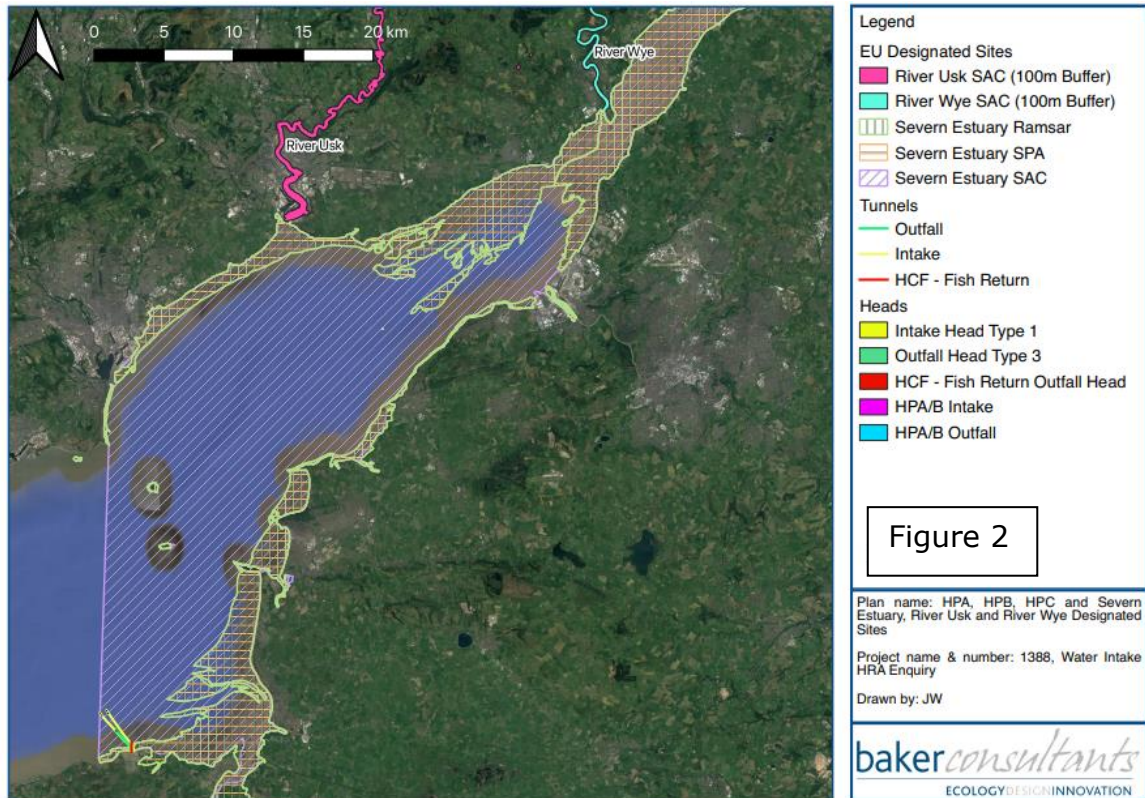
HPC plant is to be 'direct cooled' through abstracting water from the sea in Bridgwater Bay before returning that water back to the sea.

2.2 The new station (the 'C' station) will be the third nuclear power station at Hinkley Point, and is being built immediately to the west of the existing 'A' station (which is now being decommissioned), which itself lies to the west of the 'B' station, which is still in operation, albeit it too is soon to be decommissioned. The following shows the location of the cooling water system, the offshore location of the intake heads and outfalls, as well as the relationship with the previous power stations, Hinkley Point A and B.



2.3 There are a number of international and national designated environmental sites close to Hinkley Point. However, it is common ground that those relevant to a decision in this case, and shown in Figure 2 below are the:

- Severn Estuary Special Protection Area (SPA);
- Severn Estuary Special Area of Conservation (SAC);
- Severn Estuary Ramsar site;
- River Usk SAC; and
- River Wye SAC;



2.4 At the time of the granting of the original consents and licenses for HPC, the United Kingdom was part of the European Union, under which much of the relevant legislation was established. As of 1 January 2021, the legislation derived from European Legal Instruments relevant to this case continues to have effect under section 2 of the European Union (Withdrawal) Act 2018. Similarly, previous decisions of the Court of Justice of the European Union (CJEU), continue to have effect under section 3 of the Withdrawal Act.

2.5 Nonetheless, as a result of this and amendments to the Habitats Regulations 2019, the relevant SACs and SPAs are no longer part of the European Natura network but form part of the National Site Network (NSN). Ramsar sites do not form part of the NSN but national policy and guidance specifies that they should be given the same protection as SACs and SPAs. The very recent revision to the National Planning Policy Framework (NPPF) has not altered this position, albeit relevant paragraph references have been changed.

3. THE PROPOSED VARIATION

3.1 The proposal made here is a variation to the Environmental Permit, explicitly to remove conditions relating to the requirement for installation of an Acoustic Fish Deterrent (AFD). The appellant has set out that at the time of the original permit application, and indeed the DCO decision, their intention was to construct a cooling water system with an AFD. However, they argue that such a system has still not been installed in an offshore situation such as here and that a full understanding of relevant matters, including the technical requirements, health and safety

implications and environmental benefits of such a system had not been fully established at the time of the original consent assessment.

- 3.2 It is set out by the appellant now that, in the period up to 2017, a review of those matters identified substantial concerns with technical and operational constraints with particular regard to the safety of personnel in installing and maintaining such a system. They requested an assessment of the benefits of an AFD from the Centre for Environment, Fisheries and Aquaculture Science (Cefas), who indicated that there would be no adverse effects on relevant species from its removal.
- 3.3 As a consequence, the appellant argues that the detailed design of the system, including the Low Velocity Side Entry (LVSE) intake head, with a pelagic cap, and the provision of a Fish Recovery and Return (FRR) system would be sufficient to ensure that the proposed cooling water system would operate, in absence of the AFD, without a detrimental impact on fish populations or the integrity of the designated sites.
- 3.4 It is acknowledged that there are also requirements within the associated DCO and Marine Licence relevant to provision of an AFD system.

4. COMMON GROUND AND CORRECTIONS

- 4.1 A Statement of Common Ground (SoCG) was agreed between the Agency and the appellant, which included proposed varied conditions, a helpful glossary, included at the start of this Report, and a set of definitions, that have been added, with the Glossary, as an appendix. The SoCG covered matters relating to legislation, case law, the regulatory position, design and engineering and the Habitats Regulations Assessment (HRA) Process. Areas of disagreement included whether no adverse effect on the integrity of designated sites could be concluded, the conclusions on fish assessments and the LVSE scaling factor, although this is subject to a correction, addressed below.
- 4.2 SEI were able to comment on this agreed position⁴, notably considering that the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WFD) imposes further legal obligations, and expressing additional concerns with regard to the LVSE head design, FRR system, impingement predictions and affected species.
- 4.3 Similarly, the Agency and appellant agreed on a set of legal principles⁵, this included the status of Directives and European case law following Brexit, the status of Ramsar sites, and the relevant legal tests. In addition, SEI requested consideration of the WFD⁶.
- 4.4 Following submission of the Proofs of Evidence (PoE), a number of substantive changes were made to the agreed position either as a result of errors in

⁴ CD6.5 c-d

⁵ CD6.21

⁶ CD6.22

calculations or agreement on principles. Two in particular should be noted to inform any review of the relevant cases.

- 4.5 The LVSE intake intercept area factor, one of a number of scaling factors relating to the entrapment assessment between HPB and HPC, was initially proposed as a point of difference between the main parties, with the Agency assessing this as 1.394. Following corrections based on calculation errors, the Agency accepted initially that this should be revised down and subsequently, that the factor should be 1⁷. This is comparable to the appellant's proposed factor, although differences remain over whether this figure is a 'conservative' one or not, which is addressed in evidence and reasoning below.
- 4.6 Secondly, the Agency accepted that a further error in calculations and the associated change in their position over the LVSE intake factor led to an over-estimate of potential salmon impacts at the 99th percentile, and an accepted reduction in figures for potential salmon impingement from 17 to 12⁸.
- 4.7 The final position showing a comparison of the Agency and, for the appellant, Cefas figures, was provided in document CD6.26.
- 4.8 In terms of the interest features and sites relevant to the appeal, the agreed position was set out in Table 3A of the SoCG. The appellant disagreed with the Agency's further consideration of the notable estuarine fish assemblage as an interest feature of the Estuaries qualifying habitat. At the Inquiry, a further proposition was advanced by the appellant, that the fish assemblage was also not relevant to Criterion 8 of the Ramsar site. These matters are dealt with in my reasoning below.

5. REPORT FORMAT

- 5.1 In the followings sections, 6-10, I have set out the cases as presented to the Inquiry from the main parties, from interested parties who contributed directly and, in summary, those who had made written representations. These are produced as close to the originals as is practicable, but have been edited to assist the reader.
- 5.2 The cases are then followed by my reasoning, Section 11, leading to an HRA conclusion, Section 12, and a recommendation, Section 14, in relation to this case. Alternative approaches are set out, to inform the Secretary of State's conclusions, providing a full assessment of a variation to the permit, Section 13, including appropriate conditions.
- 5.3 A listing of all the Inquiry Documents, cross referenced to the Core Documents with hyperlinks is included in the appendices for reference.

⁷ CD6.6 a-c

⁸ CD6.26, CD15.9

6. THE CASE FOR THE APPELLANT

6.1 The full submission made by the appellant can be found at CD6.28, the material points are as follows:

Introduction

- 6.2 Hinkley Point C ("HPC") is currently under construction. Once operational HPC will generate approximately 7% of the UK's national energy needs.⁹ The electricity generated by HPC's two nuclear reactors will offset nine million tons of carbon dioxide emissions a year.¹⁰
- 6.3 The intake heads are located approximately 3.3km offshore in relatively deep water compared to the intake for HPA and HPB. The selection of the siting of the heads was based upon operational, nuclear safety and environmental considerations.¹¹ Of particular relevance to this Inquiry, the location of the intake heads avoids the main tidal streams utilised by migratory fish species,¹² the spawning areas of Atlantic cod, whiting and herring and the main spawning areas of sea bass,¹³ and the shallower intertidal habitats favoured by juvenile fish. The siting of the intake head above the seabed (approx. 1.5m) will avoid species that live on and in close association with the sea bed. Further, the intakes will be capped and fully submerged throughout the tidal cycle and for a significant majority of the time, the intake heads will be submerged by around 10 metres (m) of water such that fish swimming close to the surface of the bay will not be at risk of entrapment.
- 6.4 It is a condition of the permit that an AFD be installed. As is further described below, the result of a long period of detailed design and optioneering work is that the appellant has reached the clear conclusion that the AFD could not be installed and maintained throughout the lifetime of the project without the risk of serious harm or fatality for divers in particular. The appellant therefore requested that Cefas assess the cooling water discharge activity without the AFD to ascertain whether it would have a detrimental impact upon fish populations.
- 6.5 Having been advised that it would not, the appellant applied to the Agency on 14 February 2019 to vary the WDA Permit to remove the AFD.
- 6.6 This appeal has been made against the deemed refusal by the Agency of the appellant's application to vary the WDA Permit, the application not having been determined within the statutory period.
- 6.7 The appellant argues that the case of the Agency has been little more than to throw up its hands and state that the impacts are uncertain. But, as agreed by Dr Edwards¹⁴ merely because there is some degree of uncertainty does not in and of itself justify an assumption of an adverse effect on integrity. Dr Edwards further agreed that there must be credible evidence of a real risk as opposed to a

⁹ PoE of Dr Manus O'Donnell CD6.11 p.13 para 3.3

¹⁰ PoE of Dr Manus O'Donnell CD6.11

¹¹ PoE of Dr Manus O'Donnell CD6.11 p.15-16 para.3.13

¹² PoE of Dr Simon Jennings CD6.12 Figures 4 and 5, 4.69 to 4.76

¹³ CD6.12f

¹⁴ Cross-examination of Dr Karen Edwards, Day 2 of Inquiry, 9 June 2021

hypothetical risk. Indeed, any project which involves the assessment of likely environmental effects will include a degree of uncertainty. There is nothing unusual about this appeal.

- 6.8 Now that the evidence has been thoroughly tested, the appellant considers that there is no real risk and the Secretary of State can be certain beyond reasonable scientific doubt that there will not be an adverse effect upon the integrity of any designated site. On day 3 of the Inquiry¹⁵, counsel for the Agency confirmed that the Agency no longer alleged that the impact of HPC without an AFD would be worse than HPB. As is addressed below, for the qualifying species for which the relevant sites were designated (Atlantic salmon and both species of shad) and also for Atlantic herring, the impact can be predicted to be better than for HPB. This is highly significant. HPB has extracted cooling water from the Severn Estuary since 1976. Water abstraction from HPB for cooling will reduce markedly upon the commencement of defueling (due to commence in July 2022) and will cease once defueling is completed (due to be completed by the end of 2025), which would be before the first unit of HPC begins commercial operation in June 2026.¹⁶ There is no evidence that HPB has had an adverse effect upon any designated site. Indeed, the appellant contends there is positive evidence that it has not.
- 6.9 The case of the Agency is that the impact of HPB is 'uncertain'. However, Mr Waugh described the fish populations of the Severn Estuary as some of the most well studied in the world and described the Routine Impingement Monitoring Programme (RIMP) and Comprehensive Impingement Monitoring Programme (CIMP) in combination as one of the most powerful data sets of its type in the UK, if not Europe.¹⁷ It is therefore particularly notable against this background that no party to the Inquiry has produced any evidence or even an allegation that the extraction of cooling water by HPB has resulted in an adverse effect upon the integrity of any European Site or has adversely impacted upon the populations of relevant species.
- 6.10 In 2013 the clear finding of the Secretary of State in his HRA for the original DCO was that there is 'no evidence that the operation of HPB has led to adverse impacts on fish populations.'¹⁸ Similarly, at that time the Agency highlighted:

'An analysis of the abundance trends by species group from 1981 to 2008 from the long-term impingement monitoring programme dataset for HPB collected and collated by Pisces Conservation Ltd shows that HPB has not had any obvious positive or negative effect on the fish community structure at Hinkley Point.'

- 6.11 There is no evidence providing any reason to displace that previous conclusion of the Secretary of State and of the Agency in relation to the impacts of HPB. Given the Agency now does not pursue a case that HPC (without an AFD) will lead to worse impacts than HPB upon the species for which the relevant SACs were designated, quite apart from the additional evidence addressed below, on that basis

¹⁵ Exchange between Mr Moules, counsel for the Agency, and the Inspector (at 5:56 of YouTube recording)

¹⁶ Note from Dr Manus O'Donnell "Abstraction associated with HPB during defueling operations" CD6.11e [\(ID 18\)](#)

¹⁷ Evidence-in-chief of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

¹⁸ CD5.8

alone the appellant argues that the Secretary of State can have confidence that HPC will not adversely affect any of the relevant designated sites.

Reason for the application and design of the cooling water system

- 6.12 The WDA Permit (and DCO and associated marine licence) required the provision of three measures designed to mitigate the impact of the water discharge activity on fish. The first of these was the specially designed intake heads. The second is the FRR. The third is the AFD.
- 6.13 The clear evidence of Dr O’Donnell is that the strong preference of the appellant would have been to proceed with the AFD and not to apply for the permit variation.¹⁹ However, it is clear that this was not an option for the appellant. The appellant’s design and optioneering process, and consideration of the safety implications of maintaining the AFD in the very difficult environment of the Severn Estuary, has demonstrated that to pursue it would be irresponsible and inconsistent with its duties as to the safety of its employees and contractors. Dr O’Donnell conducted a thorough review of the process which the appellant went through and outlined the basis on which the appellant reached the conclusion in 2017 that the installation and maintenance of the AFD presented a real risk to health and safety. Whilst the difficulties of the Severn Estuary in terms of range and speed of tides and extremely low visibility were known at the time of the DCO, there was no experience of an AFD having been deployed in such conditions and the true nature and extent of the safety difficulties could only be assessed following the post-DCO optioneering process.
- 6.14 At that point, the appellant sought advice from Cefas as to what the impact of removing the AFD would be on fish. The resulting report (BEEMS Technical Report TR442)²⁰ concluded that not fitting the AFD would cause ecologically negligible increases in impingement loss for species which respond to sound and no adverse effect on the migratory fish and fish assemblage. At around the same time the appellant commissioned an independent review of the safety implications of installing and maintaining the AFD, including a quantitative risk assessment from Bureau Veritas.²¹ This report concluded that there was a 39% chance of human fatality over the 60 year operation of the plant.²²
- 6.15 Dr O’Donnell’s review of the process taken by the appellant and the relevant evidence has led him to conclude that he agrees with the decision taken by the appellant and that his 'professional judgement is that Nuclear New Build (NNB) should not proceed with the AFD because the risk of human fatality is too high.'²³
- 6.16 Dr O’Donnell has also considered whether technology has moved on in such a way as to materially alter the risk of installing and maintaining the AFD. He has concluded, as set out in some detail in his PoE, that it has not. Some participants to the Inquiry sought to argue that it would be possible to reduce the risk materially.

¹⁹ PoE of Dr Manus O'Donnell CD6.11 p.54 para 8.2

²⁰ CD7.21

²¹ Bureau Veritas, Acoustic Fish Deterrent Health and Safety Review, CD 1.6

²² PoE of Dr Manus O'Donnell CD6.11 p.57 para 8.11

²³ PoE of Dr Manus O'Donnell CD6.11 p.59 para 8.21

However, it is notable that no objector has demonstrated that there is a solution which would obviate the need for divers to maintain the system, i.e. that robots could do the job instead, or that there is currently a remote operated vehicle which would be able safely to undertake the necessary operations. Whilst there may be future developments in robotic technology, as Dr O’Donnell confirmed it would be irresponsible and unacceptable to install a system which would require exposing divers to immediate and material risk, in the hope that other solutions might come forward on an indeterminate timescale.

- 6.17 The evidence of Dr O’Donnell has highlighted that the cooling system has been highly engineered in ways which are specifically designed to minimise the abstraction of fish. These include the LVSE intake heads which are addressed in greater detail below.
- 6.18 The LVSE intake heads also have a pelagic cap. This will materially reduce the impingement of pelagic species which are susceptible to being impinged through a vertical draw of water. The Agency and the appellant agree that a factor of 0.23 can be applied in relation to the estimated impingement of Allis shad, Twaite shad, Atlantic salmon and Atlantic herring.²⁴ In other words, the cap renders the intake heads at HPC more than four times as effective as those at HPB for avoiding the impingement of those species.
- 6.19 The FRR also merits some emphasis. HPB does not have an FRR. The evidence of Dr O’Donnell details how the FRR (approved by the Marine Management Organisation (MMO)) has been carefully engineered to minimise fish mortality. As he states, this is a *‘significant improvement over the fish protection measures employed at HPB’*.²⁵ The appellant and Agency have agreed the level of effectiveness which the FRR can be expected to have in relation to all of the species in issue, save for Atlantic salmon. The SoCG records agreement that the FRR can be taken to apply a predicted mortality factor of 0.61 to sea bass, 0.56 to Atlantic cod and 0.55 for whiting.²⁶ Despite considering that the FRR is likely to be effective for salmon (which is addressed further below), Dr Jennings has adopted a precautionary approach and not assigned any benefit from the FRR in relation to Atlantic salmon.²⁷

Legal Context and the Test to be Applied

The test to be applied, integrity and conservation objectives

- 6.20 The main parties have agreed a number of legal principles which apply to the Secretary of State’s decision²⁸, they are not repeated wholesale here. We have set out the law on the test in some detail below because the legal position can be somewhat difficult to follow, leading to possible confusion. It would seem that the Agency has fallen prey to such confusion in its approach, in particular by taking its eye off the ball of the test of integrity in relation to the specific features for which

²⁴ SoCG CD6.5 p.8 Table 1

²⁵ PoE of Dr Manus O’Donnell CD6.11 p.35 para 6.13

²⁶ SoCG CD6.5 p.9 Table 2

²⁷ See Table 6 and 7 in the PoE of Dr Simon Jennings (CD6.12) Also paras 4.162 and 4.178.

²⁸ CD6.21

the Severn Estuary SAC in particular was designated and by according to non-qualifying species (either in their own right or as part of a fish “assemblage”) a status which they do not have in law. In addition the Agency has ascribed undue legal status to conservation objectives and to guidance, leading to untenable conclusions as to the significance to the integrity test of the loss of members of the relevant species.

6.21 The appellant argues that the Secretary of State can only grant the permit variation if he decides that it ‘will not adversely affect the integrity of’ each of the various European Sites (Reg 63(6) Conservation of Habitats and Species Regulations 2017 (“Habitats Regulations”).

6.22 The term ‘integrity’ is not defined in the Habitats Regulations or the Habitats Directive. The EC Guidance on Art.6 of the Habitats Directive is instructive (specific sections are emphasised as being of particular relevance):

‘It is clear from the context and from the purpose of the Directive that the ‘integrity of a site’ relates to the site’s conservation objectives (see point 4.6.3 above). For example, it is possible that a plan or project will adversely affect the site only in a visual sense or only affect habitat types or species other than those listed in Annex I or Annex II for which the site has been designated. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3).

In other words if none of the habitat types or species for which the site has been designated is significantly affected then the site’s integrity cannot be considered to be adversely affected. However, if just one of them is significantly affected, taking into account the site’s conservation objectives, then the site integrity is necessarily adversely affected.

This is supported by the Court in its ruling in case C-258/11, paragraph 48: ‘Article 6(3) of the Habitats Directive must be interpreted as meaning that a plan or project not directly connected with or necessary to the management of a site will adversely affect the integrity of that site if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of SCIs, in accordance with the directive. The precautionary principle should be applied for the purposes of that appraisal. The logic of such an interpretation would also be relevant to non-priority habitat types and to habitats of species.

The expression ‘integrity of the site’ shows that the focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State.

As regards the connotation or meaning of ‘integrity’, this clearly relates to ecological integrity. This can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having

the sense of resilience and ability to evolve in ways that are favourable to conservation.

The 'integrity of the site' can be usefully defined as the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.

A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required.

When looking at the 'integrity of the site', it is therefore important to take into account a range of factors, including the possibility of effects materialising in the short, medium and long-term.

*The integrity of the site involves its constitutive characteristics and ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the habitats and species for which the site has been designated and the site's conservation objectives.'*²⁹

6.23 No party alleges that the removal of the AFD in this case will adversely affect the physical structure or ecological functioning of any European Site. The sole issue between the appellant and the Agency relates to the potential impact upon the populations of certain species of fish which inhabit the various European sites. The species in issue between the appellant and the Agency are: sea bass, Atlantic cod, whiting, Atlantic herring, Twaite shad, Allis shad and Atlantic salmon (Table 3 SoCG).³⁰ The first four of these species are marine species which complete their lifecycle in saltwater, the last three are diadromous species which migrate between marine and freshwater habitats.

Qualifying features

6.24 As the Guidance set out above makes clear the focus of the decision as to whether the integrity of a site is adversely affected should be '*limited to the habitats and species for which the site has been designated and the site's conservation objectives.*' We address each of these in turn. First, 'the species for which the site has been designated'.

6.25 Of those species of relevance to this Inquiry, the species which are the qualifying features for each site in issue are as follows:

Severn Estuary SAC³¹ - Annex II qualifying species

- Twaite shad

²⁹ CD12.2, p.46 – 47, para 4.6.4

³⁰ CD 6.5 Table 3A p.10 para. 4.2

³¹ CD6.13d p.21 (of pagination)

River Usk SAC³² - Annex II qualifying species

- Atlantic salmon
- Twaite shad
- Allis shad (listed as an Annex II species, but not as a primary reason for site selection)

River Wye SAC³³ - Annex II qualifying species

- Atlantic salmon
- Twaite shad
- Allis shad

6.26 The appellant notes that none of the relevant marine species (Atlantic cod, whiting, sea bass or Atlantic herring) are qualifying features of any of the European Sites. Nor could they be, as they are not Annex II species under the Habitats Directive. Further, there is no provision under the Habitats Directive or Habitats Regulations for an 'assemblage' to be elevated to a 'qualifying feature' of a designated site. Therefore, although the Regulation 33 Advice for the 'Severn Estuary European Marine Site'³⁴ in places appears to elevate the 'assemblage' to a qualifying feature, it cannot in fact do so. This is effectively explained in Tim Goodwin's PoE.³⁵ It is also the approach taken by the Secretary of State in his Record of the HRA on the DCO application, where he stated that the '*... fish assemblage ... is not included in the SAC qualifying features*'.³⁶

6.27 The Agency's case in respect of the Severn Estuary SAC is that Atlantic salmon, Atlantic cod, whiting, sea bass and Atlantic herring are qualifying features as they are 'typical species'. However, in the appellant's view, this is wrong. The qualifying features of the Severn Estuary SAC are limited to:

- 'H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks
- H1130. Estuaries
- H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats
- H1170. Reefs
- H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);

³² CD6.13d p.101 (of pagination)

³³ CD6.13d p.25 (of pagination)

³⁴ CD12.16

³⁵ CD6.13 p.29-31 paras. 4.42-4.48

³⁶ CD5.8 p.27 para. 4.11

- S1095. *Petromyzon marinus*; Sea lamprey
- S1099. *Lampetra fluviatilis*; River lamprey
- S1103. *Alosa fallax*; Twaite shad³⁷

6.28 It is notable that Atlantic salmon, Atlantic cod, whiting, sea bass and Atlantic herring are not listed. The Agency's case, it was argued, depends upon relying upon the conservation objectives for the site being used to elevate these species into qualifying features. The relevant conservation objective states:

'Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring....

'The structure and function (including typical species) of qualifying natural habitats.'

6.29 In the appellant's considerations, it is not legally possible for the conservation objectives to be used to elevate a non-qualifying species to a qualifying feature. Article 3(1) of the Habitats Directive sets out the requirement to develop an ecological network of special areas of conservation and states that this is to be composed of 'sites hosting the natural habitat types listed in Annex I and habitats of the species listed in Annex II...'. Article 3(2) sets out that member states are to designate, in accordance with article 4, sites as special areas of conservation 'taking account of the objectives set out in paragraph 1'. Article 4, which addresses designation, makes clear that the list of sites shall indicate 'which natural habitat types in Annex I and which species in Annex II that are native to its territory the sites host'. Therefore, the Habitats Directive does not contemplate special areas of conservation being designated for species other than those listed in Annex II or for species other than those for which the site is originally identified.

6.30 Further, the conservation objectives clearly relate to the habitats and species for which a special area of conservation has been designated, as opposed to the other way around. As is clear from article 4(4) the 'priorities' for the site follow the designation (article 4(4) is addressed further below).

6.31 If there were any doubt about this, the case of *Holohan* (C-461/17)³⁸ makes this clear. Paragraph 39 states: 'typical habitats and species must be included in the AA, if they are necessary to the conservation of the habitat types and species listed.' The case emphasises that the focus of the assessment is on the species and habitats for which the site is designated.

6.32 Therefore, species other than those which are listed as qualifying features may be relevant to an Appropriate Assessment (AA) but only in so far as they are necessary to the conservation of the habitat types and species, which are themselves qualifying features. The Agency, in the appellant's view, has not demonstrated any link between the alleged impact on Atlantic salmon, Atlantic cod,

³⁷ CD6.13d p.21 (of pagination)

³⁸ CD13.6 para.39

whiting, sea bass or Atlantic herring on any of the qualifying features, indeed there is none. As such, the impact of the proposal on Atlantic salmon, Atlantic cod, whiting, sea bass and Atlantic herring is simply not relevant to the AA of the Severn Estuary SAC. In any event, and as set out below, Mr Waugh candidly confirmed in cross examination that his assessment of the marine species was limited to the Ramsar site and not the Severn Estuary SAC. This may, in relation to the four marine species, therefore be a moot point. Below, we address why the assemblage is not to be treated as a qualifying feature for the Ramsar in any event.

- 6.33 Just as a conservation objective cannot elevate a non-qualifying species or habitat to a qualifying feature, the same is true, it was argued, for the Regulation 33 advice for the Severn Estuary SAC.
- 6.34 The Agency's suggested approach would allow for any habitat or species which could be termed a 'typical species' found within the SAC to be protected in the same manner as a qualifying feature. The appellant argues that this is contrary to the whole purpose of the designation of the European Sites which was to protect Annex II species and Annex I habitats. The appellant argues that it is not difficult to understand why the Agency's approach is wrong. It might be possible that a species which is 'typical' of a site causes harm to a qualifying feature for example by predateding it or out-competing it. On the Agency's case such a harmful non-Annex II species would enjoy the same protection as the qualifying feature.

Conservation objectives and favourable conservation status

- 6.35 The conservation objectives for the Severn Estuary SAC, the River Wye SAC and the River Usk SAC are formal objectives set either at or close to the time when a site is designated. This is clear from the terms of the Habitats Directive. Article 4(1) provides that Member States must provide a list of sites indicating which Annex I habitats and species occurring in Annex II are present. Article 4(4) further states:

*'Once a site of Community importance has been adopted in accordance with the procedure laid down in paragraph 2, the Member State concerned shall designate that site as a special area of conservation as soon as possible within six years at most, establishing priorities in the light of the importance of the sites for the maintenance or restoration, at a favourable conservation status, of a natural habitat type in Annex I or a species in Annex II and for the coherence of Natura 2000, and in the light of the threats of degradation or destruction to which those sites are exposed.'*³⁹

- 6.36 The Commission Guidance 'Managing Natura 2000 Sites – The provisions of Article 6 of the Habitats Directive 92/43/EEC (2019)⁴⁰ assists further. Section 4.6.3 states (again emphasis supplied):

'As explained in section 2.3.1, 'conservation objectives' should be set at the level of each individual site and should concern, within that site, all the species and habitat types for which the site has been designated under the Habitats Directive or classified under the Birds Directive.'

³⁹ CD11.3 p.46

⁴⁰ CD12.2

These conservation objectives should be based on the ecological requirements of the species and habitats present and should define the desired conservation condition of these species and habitat types on the site. This should be established in function of the conservation condition of each species and habitat type as recorded in the Standard Data Form. The conservation objectives should also reflect the importance of the site for the coherence of Natura 2000 so that each site contributes in the best possible way to achieving Favourable Conservation Status at the appropriate geographical level within the natural range of the respective species or habitat types.

Where such conservation objectives have been set for a site, the effects must be assessed against these objectives.'

6.37 Further, regulation 37(3) of the Habitats Regulations provides:

'(3) As soon as possible after a site becomes a European marine site, the appropriate nature conservation bodies must advise other relevant authorities as to

–

(a) the conservation objectives for that site...⁴¹

6.38 Therefore, the conservation objectives for a European Site are limited to the qualifying species and habitats (Annex I and Annex II) and are set at or near to the point of designation. The appellant considers that they are not 'at large' and they do not 'evolve'.

6.39 As has been set out above, the only qualifying features of the three SACs which are relevant to this Inquiry are: Atlantic salmon, Twaite shad and Allis shad. The relevant conservation objectives to each of these are:

Severn Estuary SAC

'Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

...The populations of qualifying species...⁴²

River Wye SAC

'Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

...The populations of qualifying species⁴³

River Usk SAC

⁴¹ CD11.2

⁴² CD12.13

⁴³ CD12.14

'The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

'...The population of the feature in the SAC is stable or increasing over the long term.'⁴⁴

- 6.40 Having regard to the conservation objectives and the Commission's 2019 Guidance, the variation application need only be refused if there is a 'significant impact' on one or more of the qualifying features such that the site would not be capable of maintaining or restoring the populations of those qualifying features. The Defra guidance relied upon by the Agency states at p.13-14 (final bullet point under the heading "Test the integrity of the site") that the integrity of a site will be adversely affected if a proposal could 'prevent or disrupt restoration work, or the potential for future restoration, if it undermines the site's conservation objectives'.⁴⁵ The test is not whether some salmon or shad would die or even whether the impact would be contrary to a conservation objective. Rather, the impact on their respective populations must be significant such that the sites no longer maintain those populations or that a conservation objective is undermined.
- 6.41 It is clear that the Agency's AA has used the conservation objectives as a proxy for the integrity test. This is wrong. Article 6(3) of the Habitats Directive states that an AA must be made 'in view of the site's conservation objectives'. This is reflected in Regulation 63(1). It does not however indicate that the test is whether or not the conservation objectives are met or whether or not they are harmed. That will clearly be highly relevant to the AA but they are not a proxy for the ultimate test.
- 6.42 In this regard, the appellant argues that it is relevant to note the opinion of the Advocate General ('AG') in *Sweetman v An Bord Pleanála* (Case C-258/11) [2013] 3 CMLR 16, *Advocate General Sharpston*⁴⁶ where the AG considered how the integrity of a site should be construed. She stated (emphasis again supplied):
- '54. Notwithstanding those linguistic differences, it seems to me that the same point is in issue. It is the essential unity of the site that is relevant. To put it another way, the notion of "integrity" must be understood as referring to the continued wholeness and soundness of the constitutive characteristics of the site concerned.*
- 55. The integrity that is to be preserved must be that "of the site". In the context of a natural habitat site, that means a site which has been designated having regard to the need to maintain the habitat in question at (or to restore it to) a favourable conservation status. That will be particularly important where, as in the present case, the site in question is a priority natural habitat.*
- 56. It follows that the constitutive characteristics of the site that will be relevant are those in respect of which the site was designated and their associated conservation objectives. Thus, in determining whether the integrity of the site is affected the essential question the decision-maker must ask is "why was this*

⁴⁴ CD12.15 section 4.2 p.16 - 17

⁴⁵ Defra, 'Habitats Regulations Assessments: Protecting a European Site', CD12.1

⁴⁶ CD13.2a

particular site designated and what are its conservation objectives?” In the present case, the designation was made, at least in part, because of the presence of limestone pavement on the site – a natural resource in danger of disappearance that, once destroyed, cannot be replaced and which it is therefore essential to conserve.'

6.43 Again, conservation objectives are central to the consideration of the impact upon the European Site. They are not, however, in themselves the test.

6.44 At paragraph 19 of its summary legal submissions⁴⁷ the Agency advanced the following proposition: *'In order to avoid an adverse effect on integrity, the conservation status of a habitat or species must if favourable, be preserved and, if unfavourable, must not be further harmed or rendered more difficult to restore to a favourable conservation status.'*⁴⁸ No authority is given for this proposition and it places an unacceptable gloss on the test which is whether there will be an adverse effect on the integrity of the site. We have set out above the clear guidance in relation to this.

6.45 The Commission Note on Setting Conservation Objectives is relevant in this regard (https://ec.europa.eu/environment/nature/natura2000/management/docs/commission_note/commission_note2_EN.pdf). It states:

'Therefore, in its most general sense a conservation objective is the specification of the overall target for the species and/or habitat types for which a site is designated in order for it to contribute to maintaining or reaching favourable conservation status of the habitats and species concerned, at the national, the biogeographical or the European level. Whereas each site contributes to the attainment of favourable conservation status (FCS) this objective can only be defined and achieved at the level of the natural range of a species or a habitat type.'

A broad conservation objective aiming at achieving FCS can therefore only be considered at an appropriate level, such as for example the national, the biogeographical or the European level.

However, the general objective of achieving FCS for all species and Habitat types listed in Annexes I and II of the Habitats Directive needs to be translated into site level conservation objectives which define the condition to be achieved by species and habitat types within the respective sites in order to maximise the contribution of the sites to achieving FCS at the national, biogeographical or European level.

Therefore identifying the contribution a particular site can make to Member States' achieving favourable conservation status for the habitats and species present on the site provides the basis for setting of site level conservation objectives.'

6.46 The Commission therefore contemplates site level conservation objectives, set on the basis of the contribution that the site makes to FCS of the relevant habitats or species more widely – at the appropriate level for that habitat or species. Note that FCS of the species or habitat at site level is not itself the test:

⁴⁷ CD6.24 p.7 (internal numbering) para.18

⁴⁸ CD6.24 p.7 (internal numbering) para.19

'When adopting conservation objectives for a particular Natura 2000 site, Member States should establish priorities in the light of the importance of the respective site for the maintenance of or the restoration at a favourable conservation status of the habitat types and species of Community interest present on the site and for the coherence of Natura 2000, and in the light of the threats of degradation or destruction to which the site is exposed.'

6.47 The appellant considers that it is worth repeating part of the EC Guidance (2019) definition with the following emphasis:

'The 'integrity of the site' can be usefully defined as the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and / or populations of the species for which the site is designated.'

6.48 The emphasis, therefore, is on the ability of the site to sustain populations of the species for which the site is designated. Clearly, an impact which would prevent any of the designated sites from sustaining, say, the population of Twaite shad for which it is designated would fail the test.

6.49 Taking the Severn Estuary SAC as an example. The Conservation Objectives state:

'Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

...The populations of qualifying species...'⁴⁹

6.50 It is important to understand how FCS is addressed in the Habitats Directive.⁵⁰ There are distinct definitions of FCS for habitats (Article 1(e)) and species (Article 1(i)). These definitions are the same as for the Habitats Regulations⁵¹ by virtue of Regulation 3 (which explicitly notes the different definitions in relation to habitats and species).

6.51 The definition of FCS in relation to species is at Article 1(i), it states (again, emphasis supplied):

"The conservation status will be taken as 'favourable' when:

— population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and

⁴⁹ CD12.13

⁵⁰ CD11.3

⁵¹ CD11.2

– the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and

– there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis”.

6.52 Clearly, it is argued, if a population is sustainable it will also be ‘maintaining itself on a long-term basis as a viable component of its natural habitat’. It is precisely the ability of a site to sustain qualifying habitats, complex of habitats and/or populations of species relevant to the designated site which is at the heart of the integrity test.

6.53 The appellant considers that the Agency’s position comes close to arguing that wherever a species which is a qualifying feature of a European Site is in unfavourable conservation status, any loss of individuals will amount to an adverse effect upon integrity because it will adversely affect the ability of the species to be restored to a FCS. This is in stark contrast to the other decisions relevant to the sites in issue. In particular, the decision of Natural Resource Wales (NRW) to institute by-laws which require catch and release fishing on the Usk and the Wye. In cross-examination Dr Masters accepted that some salmon would die as a result of that policy (in the order of 10%).⁵² He further accepted that his predicted figures were lower than those which could be expected to die from Atlantic salmon fishing on the River Severn, Usk and Wye in 2019. If it were the case that the loss of individuals of a species in an unfavourable conservation status would necessarily amount to an adverse effect upon integrity then, necessarily, NRW could not have allowed the practice to have continued.

6.54 In any event, even if the Agency is right to place the emphasis that it does on the unfavourable conservation status of the species in play, it is clear that, in the appellant’s view, the removal of an AFD at HPC will not prevent the restoration of the FCS of those species. This is addressed further under the separate species headings but was pithily summarised by Mr Goodwin on Day 7 when he stated that these judgments are being made within the context of ‘natural trends’. All animals maintain their populations within a ‘fluctuation’, if the impact fits within that natural range then the integrity of the site will not be affected. If an impact is driving a

⁵² Cross examination of Dr Jerome Masters, Day 4 of Inquiry,

population below that band then you would have to consider whether the species is going towards such a low base that it would not function in the long term.⁵³

The Ramsar Site

6.55 Turning to the Ramsar site, this site is not protected by the Habitats Regulations. It is Government policy that Ramsar sites should be protected in the same way as European Sites.⁵⁴

6.56 The intake and outfall heads are located around 2.5km from the edge of the Ramsar site which is an inshore designation.⁵⁵

6.57 Up until mid-way through the Inquiry, it was the view of the appellant that one reason why the Ramsar site had been designated was for its assemblage of marine species. However, upon further investigation, it has emerged, contrary to the appellant's previous assumption, that in fact the assemblage is not a 'qualifying feature' of the Ramsar site, as was explained in Mr Goodwin's evidence in chief.

6.58 Ramsar sites, which are wetlands of international importance, are designated in a different way to SPAs and SACs. Article 2 of the Ramsar Convention provides:⁵⁶

'1. Each Contracting Party shall designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance, hereinafter referred to as "the List" which is maintained by the bureau established under Article 8. The boundaries of each wetland shall be precisely described and also delimited on a map and they may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands, especially where these have importance as waterfowl habitat.

2. Wetlands should be selected for the List on account of their international significance in terms of ecology, botany, zoology, limnology or hydrology. In the first instance wetlands of international importance to waterfowl at any season should be included.'

6.59 Article 6 of the Ramsar Convention established a 'Conference of Contracting Parties to review and promote the implementation' of the Convention. The seventh meeting of the Conference of the Contracting Parties (10-18 May 1999) developed the 'Strategic framework and guidelines for the future development of the List of Wetlands of International Importance'.⁵⁷ At paragraph 3 the guidelines explain:

'3. Throughout its evolution, the Convention on Wetlands has developed Criteria for the designation of Wetlands of International Importance (Ramsar sites) which have been kept under constant review. It has supplemented these with regularly updated

⁵³ Examination-in-chief of Mr Tim Goodwin, Day 7 of Inquiry,

⁵⁴ NPPF, CD12.18 p.51 para. 181 of July 2021 Framework

⁵⁵ See Figures 1 and 2 appended to the Statement of Common Ground, CD6.5, PDF pages 20 and 21

⁵⁶ CD11.4

⁵⁷ CD12.35

*Guidelines to assist Contracting Parties with their interpretation and application of the Criteria reflecting the development of conservation science.*⁵⁸

6.60 The guidelines set out the 8 criteria under which Ramsar sites may be designated. At paragraph 37 it states:

*'...Contracting Parties are urged to consider all of the Criteria fully when developing a systematic approach. Article 2.2 of the Convention indicates that sites should be considered on the basis of their "ecology, botany, zoology, limnology or hydrology". Under the Ramsar Criteria (see Section V), this is further clarified in terms of wetland type and conservation of biological diversity.'*⁵⁹

6.61 It is material to consider two of the eight criteria which contain reference to fish, Criteria 7 and 8.⁶⁰ They state:

'Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.'

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.'

6.62 It is therefore clear then that Criterion 7 is directed at protecting populations of fish whereas Criterion 8 is dedicated to the protection of their habitat. This is further clear from the Guidelines to each criterion. For example, the Guidelines to Criterion 8 demonstrate that the criterion is limited to habitats with statements such as *'It is important to conserve all those areas that are essential for the completion of a fish's life cycle if the fish species or stock is to be maintained.'*⁶¹

6.63 The Severn Estuary Ramsar site was designated for six criteria. Significantly, in relation to fish, it was designated under Criterion 8 (habitats) and not under Criterion 7 (populations). This is a point overlooked by the Agency and (until recently) by the appellant. The Severn Estuary Ramsar Information sheet explains why the site is designated according to each criterion (it was designated under criteria 1,3,4,5,6 and 8; the potentially relevant ones are set out below):⁶²

- Criterion 1 of the Ramsar convention due to its immense tidal range (second largest in the world) which affects the physical environment and biological

⁵⁸ Page 5

⁵⁹ Page 11

⁶⁰ CD12.35 pages 21 -22, 23

⁶¹ CD12.35 p.23 para.98

⁶² CD6.13g p.243

communities (including the Annex I communities' sandbanks, estuaries, mudflats and sandflats, and Atlantic salt meadows);

- Criterion 3 due to its unusual estuarine communities, reduced diversity and high productivity;
- Criterion 4 for its importance for the run of migratory fish between the sea and the river via the estuary, including for Salmon *Salmo salar*, Sea Trout *Salmo trutta*, Sea Lamprey *Petromyzon marinus*, River Lamprey *Lampetra fluviatilis*, Allis shad *Alosa alosa*, Twaite shad *Alosa fallax*, and Eel *Anguilla anguilla*. It is also of particular importance for migratory birds during spring and autumn;
- Criterion 8 due to the fish of the whole estuarine and river system being one of the most diverse in Britain, with over 110 species recorded, including those listed under Criterion 4, and for its importance as a feeding and nursery ground for many fish species, particularly Allis shad and Twaite shad which feed on mysid shrimps in the salt wedge.

6.64 Section 22 of the Ramsar Information Sheet⁶³ lists 'noteworthy fauna'. It does not list: Atlantic cod, whiting, Atlantic herring or sea bass.

6.65 Therefore, it is clear to the appellant that the assemblage species as species are not to be treated as qualifying features of the Ramsar site. Nor, it is argued, is Criterion 8, under which the Ramsar site was identified, concerned with populations of "assemblage" species as such.

6.66 However, if the appellant is wrong in that contention and even if the assemblage were to be treated as akin to a qualifying feature of the Ramsar site it is clear that none of Atlantic cod, Atlantic herring, sea bass nor whiting are individually denoted as having any particular significance in relation to the Ramsar site. Rather they are simply species which are part of a wider "assemblage". This is important. If the permit variation led to the removal of an entire species from the assemblage, and the assemblage were to be treated as a qualifying feature, then that may be sufficient to amount to an adverse effect on the integrity of the Ramsar site. However, if viable populations of each of the species are maintained in the Ramsar site then there can be no adverse effect upon its integrity, as there would still remain an assemblage with the same number of recorded species.

6.67 The appellant has seen letters from Natural England (NE) and NRW dated 22 June 2021 and has the following comments:

- NE fails to recognise that there is a clear distinction between Criterion 8 which relates to the function of the wetland (which of course is not simply its physical state but also its ecological functioning) and Criterion 7 which attributes the international importance of a wetland to the presence of a significant proportion of indigenous fish species. In that Criterion 8 is plainly the applicable criterion to the listing of the Severn Estuary Ramsar site, the question should be whether the removal of the AFD requirement would affect

⁶³ CD 6.13g p.246

the site's functioning as a spawning ground, nursery or migration path, not whether numbers of indigenous fish species would be affected.⁶⁴

- Mr Goodwin made enquiry of the Ramsar Secretariat on the point. The e-mail from the Secretariat (dated 18 June 2021 13:47, appended to these closing submissions) states:

'Criterion 7 identifies those wetlands important to the maintenance of biodiversity through their support of fish species (which include shellfishes). It emphasizes the different forms that diversity might take, including the number of taxa, different life-history stages, species interactions, and the complexity of interactions between the above taxa and the external environment. In addition, the different ecological roles that species may play at different stages in their life cycles needs to be considered. (Strategic Framework, p. 44, par. 213.

The emphasis of this Criterion [8] is not on the fish themselves (the subject of Criterion 7) but rather on the ecological functions provided by the wetland, notably as a source of food, or as a spawning ground or nursery, or as a migration path. The Criterion notes that the importance of these functions need not just be for fish within the wetland itself but may also be for fish stocks further afield. For example, many coastal wetlands such as estuaries or mangrove swamps are crucially important as nursery areas for fish stocks living in deeper waters offshore. (Strategic Framework, p.47, par. 236)'

- The point about designation prior to Criterion 7 or 8 being drafted is not a valid point. The 1990 Montreux Criteria have been superseded by the Guidelines in Resolution VII.11. The Ramsar Information Sheet produced by the Joint Committee on Nature Conservation in 2008⁶⁵ provides the up to date information on the Site, and clearly lists at Point 13 the relevant criteria, specifically by reference to the Resolution VII.11 Guidelines.

6.68 With regard to the letter of NRW, it is notable that it relies essentially on the Regulation 33 Guidance and thus has fallen into the same error as the Agency. The same error permeates the further comments of NRW discussing Criterion 8.

Other relevant principles

6.69 It is agreed that the precautionary principle applies to the Secretary of State's AA and that there must be no reasonable scientific doubt as to there being no adverse effect upon the integrity of each of the sites. However, this does not mean that the assessment must be so precautionary so as to be 'unrealistic'. Nor does it mean

⁶⁴ For completeness the current guidance on designation of Ramsar sites (Handbook 17 Designating Ramsar sites, 2017, not a CD but available at <https://www.ramsar.org/sites/default/files/documents/pdf/lib/hbk4-17.pdf>) has updated certain of the criteria but not those relevant here.

⁶⁵ CD 6.13g, p. 241

that only quantifiable factors may be taken into account. Qualitative considerations are clearly also material to any judgment.

- 6.70 A recent judgment, *R(Keir) v Natural England* [2021] EWHC 1059 (Admin)⁶⁶ is of direct assistance on this point. In that case the Court considered the grant of a species license (also regulated by the Habitats Directive and Habitats Regulations). The Judge made clear that the relevant consideration in that case, which was the conservation status of a species was a '*multi-factoral judgment*'⁶⁷ and went on to state '*it is relevant for a decision-maker to consider degrees of likelihood or confidence when evaluating these matters...*'⁶⁸. The Judge stated that the relevant test (contained in Regulation 55(9)(b) Habitats Regulations) '*requires an overall judgment to be made comprised of a number of elements, or '...building blocks...'*'
- 6.71 Therefore, although the Secretary of State must be satisfied beyond reasonable scientific doubt that the permit variation will not adversely affect the integrity of a European Site he may consider the likelihood of various matters as part of that overall judgment. In other words, he need not be 'certain' of every single factor which contributes to the overall judgment.
- 6.72 Further, the mere fact that there is uncertainty in an assessment will not mean that a development cannot be permitted. This point has recently been picked up by Mr Justice Jay in *R(Wyatt) v Fareham Borough Council* [2021] EWHC 1434 (Admin) where the Judge stated:
- '45. ... Mr Jones came close to submitting that, because there was scientific uncertainty, no development could properly be permitted because deleterious impacts could not logically be excluded. But that is the whole point of the precautionary principle: the uncertainty is addressed by applying precautionary rates to variables, and in that manner reasonable scientific certainty as to the absence of a predicated adverse outcome will be achieved, the notional burden of proof being on the person advancing the proposal. The application of precautionary values to relevant variables may well have been sufficient, without more; but a further cushion is provided by the application of a precautionary buffer.'*⁶⁹
- 6.73 In that case, the Judge found a flaw in relation to one part of the calculation, which was not held to be precautionary, but found that the other inputs were sufficiently precautionary such that the assessment was precautionary overall (see paras 53-89).
- 6.74 Further, it is clear that the precautionary principle does not permit an assessment of risk based on purely hypothetical considerations and the harm must be '*real and not fanciful*' (*Morge v Hampshire County Council* [2010] EWCA Civ 608 at para.35.⁷⁰ There must be credible evidence of a real, as opposed to a hypothetical risk: see

⁶⁶ CD 13.13

⁶⁷ Page 9 para.40

⁶⁸ Page 9 para.41

⁶⁹ CD 13.21 para.45

⁷⁰ CD 13.3 para. 35

Boggis v. Natural England [2009] EWCA Civ 1061 at para. 37⁷¹ (cited in the Agreed Statement of Legal Principles, para. 15)⁷² .

6.75 The Agency will no doubt argue that significant weight should be given to their judgment as they are a statutory consultee. However, the cases which have addressed this issue have not been in the context of an appeal where there are opposing experts on both sides. Plainly, if a decision maker has accepted the advice of a body such as the Agency, provided it does not contain any clear legal or other error, the decision maker is entitled to place considerable weight on it. That is however completely different to a case where the Secretary of State as decision maker has the function of determining an appeal between the Agency and a party such as the Applicant, where his function is to scrutinise and weigh the competing evidence, including expert evidence. To give more weight to the evidence of the Agency in such circumstances would mean that the impartiality of the appeal process would be compromised. Further, and in any event, it is clear that the advice of the Agency is not binding, nor those of the statutory nature conservation bodies (SNCB), and it does not have to be given significant weight if cogent reasons can be given for departing from it.⁷³ Here, there are such cogent reasons. To this can be added the impact of the errors which the Agency admits it made in its original AA which are addressed below.

6.76 The Agency suggest that the appellant failed to gain the necessary information, and refer to *R (Mynydd y Gwynt Ltd) v Secretary of State for Business, Energy and Industrial Strategy* [2018] P.T.S.R. 1274. This case was not made out in their Statement of Case (SoC) or any PoE. Regarding Mr Crundwells suggestion that he tried to make contact with Cefas to obtain tagging data, he accepted the point that it would be very difficult to sample at HPC to get an equivalent of the RIMP / CIMP data. The Mynydd case was where the Secretary of State had specifically requested data which the applicant failed to respond to, entirely different to the circumstances here.

Points of general principle

Errors which have been made and accepted by the Agency

6.77 During the course of the Inquiry the Agency have accepted a number of errors in their calculations and assessment. Three of these are of particular note: (1) the Agency's treatment of the LVSE intake factor, (2) the uncertainty analysis in relation to Atlantic salmon, and (3) the failure to understand where the intake heads will be located relative to the boundaries of the Ramsar site, these are addressed briefly below. Each of these errors has its own impact upon the credibility of the Agency's case. However, when considered together they reveal that the Agency's opinion in relation to the variation application cannot be given

⁷¹ CD 13.20

⁷² CD 6.21

⁷³ *R (Wealden) v Secretary of State for Communities and Local Government and ors* [2017] EWHC 351 CD 13.15 para. 44(viii)

any special weight by the Secretary of State, given their analysis has been so fundamentally flawed.

- 6.78 The Agency's AA and PoE were written on the basis and at a time when the Agency's position was that there should be an LVSE intake factor of 1.394.⁷⁴ The appellant's consistent position is that it considers that the factor is likely to be less than one but has been prepared to adopt a factor of 1 as a precautionary measure for the purposes of the appeal.⁷⁵
- 6.79 On 4 June 2021 (15:51 PM) the Agency issued a correction note to the appellant which slightly revised its figure of 1.394 to 1.33 and updated all of the figures it relied upon with regards to the predictions of how many fish of relevant species would be impinged.⁷⁶ This had been in response to the rebuttal of Dr O'Donnell dealing with the intake area for HPB.⁷⁷
- 6.80 On 4 June 2021, at 21:33 PM the appellant requested the excel spreadsheets which sat behind the Agency's revised calculation. Upon reviewing these the appellant contacted the Agency and informed it of an error, which included wrongly ascribing data from HPB to HPC. On the morning of the 8 June 2021 the Agency informed the appellant that it agreed that there was an error in its calculations and that the revised factor should in fact be about 1. The Agency then re-issued all of its figures (8 June, 12:50).⁷⁸
- 6.81 As highlighted below, this has impacted upon the case now pursued by the Agency. First, it means that the Agency now accepts that all of the figures it presented as its 'predicted impacts' in its AA were wrong and ought to have been materially lower. This is true of its predicted figures, its mean figures and its uncertainty analyses. The Agency has made no new AA of the revised figures and yet has defended its case regardless.
- 6.82 Further, as a result of this 'correction' the Agency no longer alleges that the impact of HPC without an AFD will be worse than the impact of HPB.⁷⁹
- 6.83 The exchange is set out below for convenience

Mr Moules 'Thank you Sir. That's helpful. The other point is in relation to HPB impact versus HPC to confirm that the Agency is not presenting a case, is not presenting evidence that HPC has a greater impact than HPB in the order of 1.9 which I think is the figure Mr Waugh referred to as a result of the scaling factor

⁷⁴ CD 6.6 p.28 Figure 11

⁷⁵ CD 6.5 p.16 para.5.10

⁷⁶ CD 6.6a and CD 6.6b

⁷⁷ CD 6.20

⁷⁸ CD 6.6c

⁷⁹ Confirmed by counsel for the Agency on 10 June 2021, however the Agency did appear to try and row back from this in some of its cross-examination of Dr Jennings on 16 June 2021

changing that point is no longer being advanced and you'll remember... Sorry Sir. Sir I think you are muted.'

Inspector 'That was me catching up on two notes at the same time. Sorry just repeat that about the 1.9 times scaling factor.'

Mr Moules 'That's not the Agency's case and we won't be advancing evidence on that basis because the scaling factor is now 1.0 we don't argue that HPC has a greater impact than B and you'll recall that Dr Edwards in her evidence made a separate point which is the absence of a baseline monitoring before HPB began and so she didn't accept that it was proven that HPB had not had an impact on the protected site so that is the case we advance...[s]o there won't be new figures, new analysis or anything that hasn't been seen.'

6.84 We address this further below. Suffice it to say at this stage that it is clearly a hugely significant change in position.

6.85 During the course of the Inquiry the Agency also accepted that its uncertainty analysis figure relating to salmon of 255 equivalent adults impinged per year was indefensible. The appellant highlighted a significant error in the calculation which had led to the model taking into account Equivalent Adult Value (EAV) factors which were biologically impossible.⁸⁰ Having accepted its error, the Agency initially revised its figure down to 105 and sought to rely upon it.⁸¹ However, in cross examination Dr Masters accepted that the figure of 105 relates to the original allegation that 17 salmon would be impinged each year.⁸² This has now fallen to 12 as a result of the amended LVSE intake ratio.⁸³ As such, Dr Masters accepted that the figure of 105 should have no weight.

6.86 Also of relevance to the weight to be given to the Agency's case is the fact that it was apparently unaware that the intake heads are to be sited a long way outside of the boundary of the Ramsar site. This came as news to Mr Waugh during cross-examination, who admitted he had made an error.⁸⁴

6.87 It is the case that the appellant alleges that the Agency has made a number of further errors and these are to be determined by the Secretary of State. However, the errors which have hitherto been accepted by the Agency are important. First, the Agency will be likely to submit that their position of statutory consultee or expert decision-maker means that their opinion should be given special weight. That is clearly inappropriate, given the Agency's changed position on a number of matters in its SoC and in the PoE of their witnesses.

6.88 Second, the Agency seeks to rely upon the agreement of NRW and NE with its conclusions.⁸⁵ However, the agreement of those agencies was proffered on the

⁸⁰ See Appellant note 'Effects of HPC impingement on salmon, comment on methods employed in the Agency's uncertainty analysis (paper TB013 CD Ref: 8.12)' 4 June 2021 CD 6.12m

⁸¹ See the Agency's Response to Dr Jennings' note on simulation of Atlantic salmon EAVs 9 June 2021 CD 15.9

⁸² Cross-examination of Dr Jerome Masters, Day 4 of Inquiry, 11 June 2021

⁸³ CD 6.26 (ID12) Comparison table of EA and Cefas values 10 June 2021

⁸⁴ Confirmed in cross-examination of Mr Adam Waugh,

⁸⁵ CD 6.24 (ID 2) p.10 (of legal submissions) paras 27 -28

basis of figures which were advanced by the Agency at the time that they wrote their AA. The Agency has not defended those figures at this Inquiry. The Secretary of State has no response from NRW or NE on the basis of the figures which the Agency now relies upon.

6.89 Finally, on day 2 of the Inquiry (9 June 2021) Dr Edwards explained how the Agency reached its decision not to vary the permit in line with the appellant's application. She described a process where the AA was peer reviewed by senior members of staff. When asked 'who actually took that decision?' Dr Edwards responded that it was the technical specialists in conjunction with a "calibration panel", the project manager and some more senior members of the team. She wasn't clear on who had the authority to take the formal legal decision but posited that it may have gone to the area manager. The Agency's decision to conclude that there would be an adverse effect on the integrity of each of the relevant sites was based upon the information in the AA. That AA contained materially different estimates of fish losses compared to the numbers now pursued by the Agency at this Inquiry. The Agency has not presented any evidence that the Agency's decision would have been the same if the calibration panel, project manager or area manager had been presented with the figures which it now pursues.

Expertise

6.90 The appellant argues that it is not only the errors made by the Agency which mean that their or analyses should not be given any special degree of weight. The appellant has presented evidence from experts whose expertise is not disputed. The Agency's witness Dr Edwards fairly accepted in cross examination⁸⁶ that there was a 'huge amount of expertise on both sides' of the appeal. In particular, Dr Edwards accepted that the fact that the appellant's workings in TR456 had been subject to independent review by Dr C O'Brien, Chief Fisheries Science advisor to Defra and Vice President of the International Council for Exploration of the Sea (ICES) gave a fair indication of the depth of expertise that has gone into the material prepared by the appellant.⁸⁷ Dr Edwards also confirmed that Mr Goodwin (HRA witness for the appellant) is a considerable expert in HRAs. Dr Edwards accepted that the evidence produced by ICES (and relied upon by the appellant) is the best available evidence on fish stocks. As Dr Jennings stated in cross examination you won't 'find a more comprehensive and carefully reviewed and peer reviewed set of information on the status of these populations than you will get from ICES.'⁸⁸

6.91 No one who witnessed the expert evidence given by Dr Jennings and who has read his PoE could come to any other conclusion than that he is a consummate expert. His C.V. and experience demonstrate this to be the case.⁸⁹ Dr Jennings has authored or co-authored over 200 papers and book chapters on marine science topics and has undertaken numerous reviews of marine science programmes and projects. Dr Jennings emphasised that his work was supported by a lot of other

⁸⁶ Cross-examination of Dr Karen Edwards, Day 2 of the Inquiry, 9 June 2021

⁸⁷ CD1.11 p.26

⁸⁸ Cross-examination of Dr Simon Jennings, Day 6 of the Inquiry, 16 June 2021

⁸⁹ CD 6.12 p.2 paras.1.8-1.12

scientists and that he had drawn very widely upon expertise in Cefas.⁹⁰ He also explained that he had requested evidence and information from the other parties and groups, for example the Agency's analysis of the presence or otherwise of Allis shad and also the information from Unlocking the Severn ('UtS').⁹¹

6.92 There is simply no basis for giving the Agency's case or evidence any special degree of weight in this process. The decision should not be based on anything other than a fair assessment of the evidence which has been presented by all parties (and others) to this appeal.

Uncertainty and the Uncertainty analysis

6.93 It is clear that any assessment of a new project will encounter uncertainty. Indeed, as Dr Edwards said in cross examination, in response to a question as to whether the precautionary principle required certainty in relation to every factor of the assessment, *'It couldn't because there is absolute certainty on none of these factors.'*⁹² The precautionary principle is already implicit in the legal requirement that adverse effects must be excluded beyond reasonable scientific doubt.⁹³ It has limits, it does not mean that absolute certainty is required in relation to every single factor.⁹⁴ There must be credible evidence of a real risk as opposed to a hypothetical risk.⁹⁵ Also, the purpose is not to aim for zero risk.⁹⁶

6.94 In its AA, the Agency applied an 'uncertainty analysis' to its predictions and used that to arrive at a prediction of the 99th percentile. It used this to present a figure to the Secretary of State which it states has a 1 in 100 chance of occurring. The Agency accepted⁹⁷ that the prospect of this happening in two consecutive years was 1 in 10,000. The entering into this process and the reporting of such unlikely scenarios is indicative of the Agency's approach which has been so overly precautionary as to arrive at unreal scenarios.

6.95 Now that the Agency has revised all of the predicted figures it relies upon, but has not subjected those figures to an uncertainty analysis, it is clear that the uncertainty analyses undertaken by the Agency on its previous predicted figures should be given no weight. However, the figures still appear in the Agency's AA and it appears were taken into account as part of the decision that the variation application did not meet the requirements of the Habitats Regulations. This is clear from a fair reading of the AA. See for example, on page 55:

'The scale of the predicted impingement of Twaite shad using the best evidence is low but at the 99th percentile could be at a level that would prevent the Severn Estuary/Môr Hafren SAC and Ramsar from achieving favourable status. HPC is

⁹⁰ Cross-examination of Dr Simon Jennings, Day 7 of the Inquiry, 17 June 2021

⁹¹ Cross-examination of Dr Simon Jennings, Day 7 of the Inquiry, 17 June 2021

⁹² Cross-examination of Dr Karen Edwards, Day 2 of the Inquiry, 9 June 2021

⁹³ Accepted by Dr Karen Edwards in cross-examination, Day 2 of the Inquiry, 9 June 2021

⁹⁴ Accepted by Dr Karen Edwards in cross-examination, Day 2 of the Inquiry, 9 June 2021

⁹⁵ Accepted by Dr Karen Edwards in cross-examination, Day 2 of the Inquiry, 9 June 2021

⁹⁶ Accepted by Dr Karen Edwards in cross-examination, Day 2 of the Inquiry, 9 June 2021

⁹⁷ Accepted by Dr Karen Edwards in cross-examination, Day 2 of the Inquiry, 9 June 2021

*scheduled to operate for sixty years therefore any impact that the station has will be long-lasting, and continuous over that period.'*⁹⁸

6.96 When it was put to Dr Edwards in cross-examination that this passage implied that the judgment had been reached on the basis of the 99th percentile impact occurring continuously, Dr Edwards posited that:

'[t]hey could have meant, and again I am, because I didn't write this, you are asking me to think outside the box of what I know, they could have meant, if the 99th percentile happened, with the 99th percentile happening in the first year could then cause such catastrophe that it can't recover after that. I don't know. You are right it says that, it implies that, but it doesn't say anywhere continuous for every year.'

6.97 Thus, the Agency reached its decision on the basis of an AA which at least 'implied' that the judgment in relation to why the impact upon Twaite shad would amount to an adverse effect upon integrity, was based upon a continuous application of the 99th percentile impact. The Agency has now disavowed itself of that position. Dr Edwards stated in cross examination that she could not *'imagine who would make that assumption'*.⁹⁹ However, the reasoning in the AA, which is the reasoning on which the decision was made, does imply that such an assumption was being used. This necessarily undermines the Agency's decision.

6.98 On any view, the Agency's Quantitative Impact Assessment (QIA) is overly precautionary so as to arrive at a simply unrealistic estimate of predicted impact. This is clearest from the evidence of Dr Edwards¹⁰⁰ where it is worth setting out a short exchange in full¹⁰¹:

Dr Edwards (response to previous question): '...with any new project uncertainty is expected, but yes. We never have perfect data we never have perfect information, we always, we deal with uncertainty every day'

Tromans QC: 'And the way to address that is to apply precautionary rates to the variables in your assessment, yes'

Dr Edwards: 'Sorry, the variables in my...'

Tromans QC: 'The variables in your assessment. To put it another way, when you are carrying out the various steps you make conservative assumptions. You take a precautionary approach at each stage.'

Dr Edwards: 'That is one approach, I believe that's what Dr Jennings said he's done. We tried to find the most appropriate parameters, that was our projected, I think we call them predicted, and then we did the assessment around that and created ranges around that.'

⁹⁸ CD4.1 p.55

⁹⁹ Cross-examination of Dr Karen Edwards, Day 2 of the Inquiry, 9 June 2021

¹⁰⁰ Cross-examination of Dr Karen Edwards, Day 2 of the Inquiry, 9 June 2021

¹⁰¹ Cross-examination of Dr Karen Edwards, Day 2 of the Inquiry, 9 June 2021 (at 2:19 of YouTube recording)

Tromans QC: 'But you have applied, you have applied precautionary assumptions haven't you in coming up with those predicted figures?'

Dr Edwards: 'Um, I'm not sure I agree with that, if we had just gone with precautionary assumptions and figures we would have done our TB007, our analysis on the pelagic cap we would have seen that we came up with a factor which was more beneficial and we, if we were being precautionary we could have thrown that away and said, "well we will just use the Appellant's figure because it is higher. We will use TR456". We didn't do that. We stuck with what we thought was the best estimate and created a range around that. '

Tromans QC: 'Ok. But if you do apply precautionary assumptions at each stage in respect of the parameters they will have a cumulative effect won't they?'

Dr Edwards: 'Yes they would. Yes

Tromans QC: 'And you have then added the step of the uncertainty analysis to give you a feel for the likelihood of extreme variance from predictions, yes?'

Dr Edwards: 'That is one of the things I did, yes.'

Tromans QC: 'That you did. And we have agreed I think that in doing that it certainly wouldn't be realistic to apply a 99th percentile approach year on year. We have established that. Yes?'

Dr Edwards: 'Yes'

Tromans QC: 'So, any residual uncertainty left after you have done all that, it is not in itself a reason for refusing the application?'

Dr Edwards: 'No...'

6.99 Therefore, the justification for the uncertainty analysis, as presented by Dr Edwards is that precautionary assumptions had not been made in the Agency's main assessments rather, a 'best estimate' had been arrived at and then the precautionary part of the assessment was in the uncertainty analysis. This is plainly wrong as the evidence given by each of the other Agency's witnesses demonstrates. An example of this is the assessment of the impact upon Atlantic salmon. The Agency has ascribed all of its predicted impingement losses to each of the rivers in turn despite this being a wholly unlikely, indeed fanciful, outcome. It has done the same in relation to Twaite shad.

6.100 It is plainly right that an assessment should adopt precautionary figures so as to ensure there is no room for reasonable scientific doubt when the ultimate test is applied. Dr Jennings explained in his evidence that it is of course right to highlight uncertainty: *'everybody wants to account for uncertainty because nobody wants to give advice that is wrong'*.¹⁰² However, the repeated layering of precaution upon

¹⁰² Examination-in-chief of Dr Simon Jennings, Day 6 of the Inquiry, 16 June 2021

precaution together with the uncertainty analysis means that the scenarios which the Agency has arrived at are simply not credible.

6.101 The correct approach is the one adopted by Dr Jennings which has been to build precaution into his assessments but not to the extent that the results are 'unreal'. At paragraphs 4.172-182 of his PoE Dr Jennings¹⁰³ listed all of the ways in which the Cefas methodology had taken precautionary approaches. It is worth summarising them here:

- The stock assessments deliberately 'sought outputs based on this worst-case approach to allow me to understand whether the risk assessment based on EAV could conceivably lead me to the wrong conclusion about long-term impacts on the fish populations';¹⁰⁴
- in the stock assessments, HPC impingement mortality was taken as the upper confidence interval for unmitigated mortality 'It is extremely unlikely that the upper rate of impingement would occur year-after-year over a 20-year time-series. Further, the rates assumed no mitigation effects from the LVSE and FRR system';¹⁰⁵
- In the stock assessments the impinged 0-group fish were subjected to the 0-group mortality in the assessment as opposed to higher and more realistic rates of mortality which apply when 0-groups are comprised of very young fish;¹⁰⁶
- HPB abstraction was assumed to continue to be ongoing as part of the stock assessments. In practice, it will cease before HPC begins and therefore ameliorate a proportion of the impact;¹⁰⁷
- Fishing mortality has been ignored in the calculation of EAV factors for all species;¹⁰⁸
- The calculations of annual EAV numbers or EAV biomass have been repeated with the upper confidence intervals for impingement rates to indicate a 'worst-case' annual effect;¹⁰⁹
- The EAV analysis of HPC effects does not account for the reduction in net impingement which will result from the closure of HPB;¹¹⁰
- The salmon analysis has been based upon a calculation which includes 100% mortality in the FRR despite providing evidence that survival could exceed 50%;¹¹¹

¹⁰³ CD6.12 p.46-47

¹⁰⁴ Para. 4.173

¹⁰⁵ Para. 4.174

¹⁰⁶ Para. 4.175

¹⁰⁷ Para. 4.176

¹⁰⁸ Para. 4.177

¹⁰⁹ Para. 4.177

¹¹⁰ Para. 4.177

¹¹¹ Para. 4.178 (see also para 3.12)

- The salmon analysis has assumed that the two salmon smolts recorded in the CIMP were caught in the survey year even though they were not and the smallest run size in any river was used as a comparator to calculate the EAV as a proportion of the population size;¹¹²
- For Twaite shad the EAV number has been compared with the smallest population which is that within the Severn;¹¹³
- A conservative estimate for the impact of the intake intercept area (a value of 1) has been used;¹¹⁴
- The FRR estimates which have been agreed are precautionary given improvements in the design of that system;¹¹⁵
- Dr Jennings has used the lower uncertainty intervals for the effects of the intake velocity cap in repeat analyses in his proof to test his conclusions. Further, although the cap is expected to provide benefits for two additional semi-pelagic species (sea bass and whiting) the calculations ascribe no benefit for those species;¹¹⁶

6.102 The case for SEI has also relied upon uncertainty and has further alleged that there should have been more work done and more data gathered. However, as explained by Dr Jennings this application is made 'in a very strong situation' due to the RIMP and CIMP (addressed below) and all of the surveys in the Technical Reports (TR), for example TR083.¹¹⁷ He accepted that there can always be more data but that we are in a good position as we have real world data.¹¹⁸ Much criticism was made of the inability of the appellant to place an acoustic receiver on part of the development. However, as Dr Jennings explained, at the time the request was made, the jetty where researchers wanted to place the receiver was still under construction. The criticisms were simply unfair and unfounded: nor were they mentioned in any of the SEI case or evidence.

6.103 Dr Jennings' assessment has addressed uncertainty through the use of precautionary judgments. This is exactly the approach envisaged in Wyatt¹¹⁹. The precautionary elements of Dr Jennings' work demonstrates that his approach has been highly precautionary and has delivered robust predictions which can give the Secretary of State confidence beyond reasonable scientific doubt that the removal

¹¹² Para. 4.178

¹¹³ Para. 4.178

¹¹⁴ Para. 4.179

¹¹⁵ Para. 4.179

¹¹⁶ Para. 4.180

¹¹⁷ Cross-examination of Dr Simon Jennings by EA, Day 6 of the Inquiry, 16 June 2021

¹¹⁸ Cross-examination of Dr Simon Jennings by SEI, Day 6 of the Inquiry, 16 June 2021

¹¹⁹ CD 13.21 - paragraph 45 of the judgment

of the AFD will not adversely affect the populations of the relevant species or the integrity of any designated site.

The Impact of HPB

6.104 One notable impact of the concession made by the Agency the day before the Inquiry opened with regards to the intake velocity factor is that it significantly amended Figure 13 in Dr Edwards' proof which showed the Agency's predicted impacts of HPC vs HPB (column 5).¹²⁰ Of the species before this Inquiry, that table now shows that the Agency's predicted impact upon Atlantic salmon, Allis shad, Twaite shad, and Atlantic herring is less than the impact which it predicts HPB is currently having (and, as the Inquiry heard, HPB will cease operating and begin defueling no later than July 2022). The Agency subsequently confirmed that they were no longer pursuing a case that the impact of HPC without an AFD would be worse than HPB.

6.105 The implications of this are important. First, as Mr Goodwin notes in his PoE¹²¹ HPB ought properly to be considered part of the cumulative assessment for the impact of HPC. As HPB will cease to operate before HPC starts to extract cooling water from the Severn Estuary, the cessation of HPB effectively leaves headroom for the impact of HPC. Necessarily, where the impact is less, it can confidently be said that there can be no adverse effect on integrity of any European Site if HPB is not having an adverse effect on integrity of any European Site.

6.106 The Agency's position is that there is uncertainty as to whether HPB is having an adverse impact because of the absence of baseline data before HPB operated.¹²² However, it presents no evidence to the Inquiry one way or the other. In 2012 the Secretary of State, in his HRA for the DCO, confirmed that:

*'...Furthermore, the abundance trends by species group from the monitoring programme for HPB showed that it has not had an effect on fish community structure'*¹²³

6.107 The Secretary of State further stated:

*'...it is unlikely that such additive pressures will change the situation, especially since there is no evidence that the operation of HPB has led to adverse impacts on fish populations.'*¹²⁴

6.108 Dr Edwards accepted that there was no evidence before the Inquiry to change the Secretary of State's conclusions in 2012.¹²⁵ Dr Edwards accepted that in reaching his conclusion the Secretary of State was content to rely upon the RIMP data.¹²⁶

¹²⁰ CD6.6 p.39 Figure 13. This was updated by CD6.6c (see adjusted Figure 13, p.5)

¹²¹ CD6.13

¹²² See Proof of Evidence of Dr Karen Edwards CD6.6 at p.36 para 7.2.2. Of course in reality there would have been no completely baseline data before HPB operating, because HPA had been abstracting from the same intake for many years before HPB commenced abstracting.

¹²³ CD 5.8 p.69 para. 6.146

¹²⁴ CD 5.8 p.70 para. 6.151

¹²⁵ Cross-examination of Dr Karen Edwards, Day 2 of the Inquiry, 9 June 2021

¹²⁶ Cross-examination of Dr Karen Edwards, Day 2 of the Inquiry, 9 June 2021

- 6.109 The evidence of Dr Jennings is that the RIMP can in fact be used to provide information regarding trends in the recruitment of juvenile fish to Bridgwater Bay.¹²⁷
- 6.110 The effect of Dr Edwards' concession (which is clearly correct) that there is no evidence to disrupt the findings of the Secretary of State with regards to the impact of HPB together with the fact that the Agency now predict that the impact of HPC will be less than HPB for Atlantic salmon, Allis shad, Twaite shad and Atlantic herring is the complete answer to whether the effect of the removal of the AFD at HPC on those species will result in an adverse effect upon the integrity of any European Site. These of course include the three key species which are actually protected in their own right as qualifying species for which the relevant SACs were designated.
- 6.111 On day 5 of the Inquiry, in cross examination of Dr O'Donnell, counsel for the Agency raised an issue with regards the potential continuing extraction of water by HPB after it has ceased operation no later than 15 July 2022.¹²⁸ This was the first time this issue was raised and the Agency has not indicated that there would be any material impact of the continuing water abstraction from HPB during its decommissioning either in its AA, its SoC, its witness statements or its oral evidence. To deal with this point Dr O'Donnell produced a note for the Inquiry.¹²⁹ That note explains that the defueling process is expected to take 3.5 years from the date of defueling (i.e. 22 July 2022) and that HPB is expected to entirely cease abstracting water at the end of 2025. HPC is due to start commercial operation in June 2026 and therefore it is unlikely that there would be any overlapping period where both are abstracting water. However, in the unlikely event that there were an overlap Dr O'Donnell explains that the level of abstraction at HPB would be 'trivial' in comparison to its operation (around 2%) or around 0.5% of HPC's abstraction and the overlap would on a worst-case-scenario be for one year. Further, only HPC unit 1 will commence operation in June 2026 and therefore the abstraction rate will initially be half that which has been assessed for HPC (which includes units 1 and 2.) Unit 2 is likely to commence operation in 2027.
- 6.112 Therefore, the unlikely potential for any overlap and the minimal abstraction of HPB during de-fuelling if there is a short overlap makes no difference to the assessment. This was confirmed by Dr Jennings in response to a question from the Inspector.¹³⁰ The following records the relevant exchange:
- Inspector: 'Part of your report, Dr Jennings, and this is a simple point, just deals with the assumption that HPB will have closed – we've got new evidence to suggest that it won't close in 2022 but will be run down in terms of abstraction to a later point. Does that in any way effect your evidence that is put forward?'*
- Dr Jennings: 'Not substantially. I mean of course it makes the net benefit argument more convincing in the sense we're absolutely sure there won't be a period of overlap. But otherwise it really doesn't change anything – as I said it just*

¹²⁷ See Appendix H, PoE of Dr Simon Jennings CD 6.12i

¹²⁸ Cross-examination of Dr Manus O'Donnell, Day 5 of the Inquiry, 15 June 2021

¹²⁹ Note from Dr Manus O'Donnell, 'Abstraction associated with HPB defueling operations, CD 6.11e (ID 18)

¹³⁰ Question from Inspector to Dr Simon Jennings, Day 7 of Inquiry, 17 June 2021

reminds us that for example when we did the stock assessments that fact that [HPB]¹³¹ was operating through the period we did the stock assessments, we can now be sure those analyses are extremely conservative because HPB certainly won't be operating alongside HPC.'

The use of the CIMP and RIMP data

- 6.113 The Agency's case in relation to some species (Atlantic salmon in particular) has been founded upon what the Agency termed a 'data deficiency'.¹³² This is a surprising claim particularly as Dr Masters' evidence followed that of his colleague Mr Waugh who, unprompted, described the RIMP and CIMP together as being '*perhaps one of the most powerful data sets of its type, at least in the UK if not in Europe.*'¹³³
- 6.114 The RIMP was designed to assess long term changes in fish populations at Hinkley Point by sampling fishes impinged on the drum screens. Pisces Conservation Ltd collected monthly impingement data at HPB from 1981, this consisted of six 1-h samples on a given day each month, taken at the same point in the tidal cycle. The species and number of fish in each sample are recorded, and length distributions are recorded in some years. Data from the RIMP is available for a 37 year period 1981-2017.¹³⁴
- 6.115 The CIMP program was specifically designed to provide unbiased, high resolution data on impingement over a full year.¹³⁵ It consisted of 40 24hr samples collected on pseudo-randomly selected sampling dates stratified into 10 samples per quarter (960 hours total) from 24 February 2009 – 29 January 2010.¹³⁶ The CIMP

¹³¹ Dr Jennings said "HPC" here, but it was clear from the context that he meant HPB

¹³² As described in a question from Mr Moules to Dr Jerome Masters, Day 3 of Inquiry, 10 June 2021

¹³³ Examination-in-chief of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

¹³⁴ PoE of Dr Simon Jennings, CD 6.12 p.11 paras.3.7-8

¹³⁵ PoE of Dr Simon Jennings CD 6.12 p.10 para. 3.5, reported in SPP112, CD 7.11

¹³⁶ PoE of Dr Simon Jennings CD 6.12 p.10 para. 3.5

recorded species, numbers and length distributions of fish in each sample. It included both daytime and overnight samples.

- 6.116 CIMP sampling then continued from 11 Feb 2010 – 27 May 2010 (a 2.5 month period) with a further 11 samples being collected.¹³⁷ ¹³⁸ On any view the data gathered from the CIMP and the RIMP is profoundly useful in being able to assess the likely impact of HPC upon fish populations.
- 6.117 It is significant that it was primarily on the basis of this data that the Agency and the Secretary of State were able to conclude, beyond reasonable scientific doubt, that the HPC DCO (granted in 2013) would not adversely affect the integrity of any European Site.¹³⁹ Neither the AA by the Agency at that time, nor the AA by the Secretary of State raises any concern whatsoever with regard to there being a 'data deficiency', or that impacts are simply too uncertain to be assessed from the RIMP and CIMP. Further, since the grant of the DCO in 2013 there is four more years of data from the RIMP available. It cannot therefore be argued that the CIMP and RIMP data is somehow unreliable as it is old. In this regard, it can be noted that the Agency's case with regards to Atlantic salmon rests largely on a single returning adult salmon recorded as impinged in a RIMP sample in 2002 despite the fact that since that date, no further adult salmon who had a chance of making a contribution to spawning have been recorded as impinged at HPB.¹⁴⁰
- 6.118 Both the Agency and SEI have sought to argue that there is uncertainty regarding whether the RIMP and CIMP will be representative of the fish which may be impinged at HPC. This was nothing more than a hypothetical concern unsupported by evidence. Dr Jennings highlighted that both intakes are near each other outside of the main tidal streams and with similar substrate types. He highlighted that to the extent that there is dissimilarity this relates to the depth of water available over the HPC intake.¹⁴¹
- 6.119 Neither the Agency nor SEI has produced any evidence to support the supposition that HPC may impinge a materially different composition of fish. However, the available evidence does in fact indicate that the fish species in the vicinity of the HPC intake are similar to those at HPB. Dr Jennings has explained that the issue needs to be considered on a species by species basis. In particular, he highlighted that the risk to Atlantic salmon is likely to be less at HPC given the deeper water and the pelagic cap. In relation to sea bass, the location of HPB nearer the saltmarshes may mean more juvenile bass are impinged at HPB than HPC.¹⁴²

¹³⁷ PoE of Dr Simon Jennings CD 6.12 p.11 para. 3.6

¹³⁸ An issue arose at the Inquiry with regards to whether the Agency had the data from this additional sampling. During cross-examination on day 4 Dr Masters alleged that the Agency was unaware that the additional sampling had recorded 2 salmon smolts until recently. However, this is incorrect. The Agency had access to published summaries of these data and the data itself well in advance of the preparation for the 2020 AA. The appellant's instructions are that the extended CIMP dataset was required by the Agency to complete their seasonal spawning and nursery area assessment (CD 8.31) where the full data was analysed by the Agency. Further the additional period is referenced in the Agency's 2013 AA (CD 5.3 p.136) it was also used in the Agency's assessment for sea bass in the 2020 AA (CD 4.1).

¹³⁹ CD 5.3, CD 5.8

¹⁴⁰ Accepted by Dr Masters in cross-examination, Day 4 of Inquiry, 11 June 2021

¹⁴¹ Cross-examination of Dr Simon Jennings by EA, Day 6 of Inquiry, 16 June 2021

¹⁴² Cross-examination of Dr Simon Jennings by SEI, Day 7 of Inquiry, 17 June 2021

However, although these benefits can be expected as a result of what is known about fish behaviour, Dr Jennings has not factored them into his quantitative analysis.

EAV

6.120 One main issue between the parties is how to assess the impact of the entrapment of largely juvenile fish on the spawning population. As Dr Jennings explains, the younger age classes of fish experience very high mortality in their natural environment '*[I]n practice, this means that most of the entrapped fish would never survive to contribute to the spawning population anyway*'.¹⁴³ For this reason it is necessary to '*express rates of entrapment in terms of projected future losses of adult fish*'.¹⁴⁴ The method employed by the appellant is explained in Dr Jennings' proof as follows:

'3.19 The EAV method employed by Cefas involves forward projection of the numbers of entrapment mortalities, accounting for natural mortality, to give equivalent numbers of fish at the age of maturity that are lost from the spawning population (an EAV number) (Appendix A).

3.20 The EAV method thus converts an annual rate of entrapment to an annual rate of loss of mature fish. It is a straightforward adjustment to reflect the likelihood of entrapped fish reaching maturity and contributing to the spawning population.

3.21 Once an EAV number has been calculated, it may be:

(a) expressed as a percentage of the numbers of mature fish in the whole population;

(b) multiplied by the individual body weight of mature fish in the population to give an EAV biomass, which can then be expressed as a percentage of the biomass of the spawning population; and/or

(c) divided by the number of fish that were entrapped to give an EAV factor. This factor can be multiplied by numbers of entrapped fish to estimate of the number of equivalent adults that are lost.

3.22 An EAV factor can be interpreted as the proportion of entrapped fish that will survive to maturity. So an EAV factor of 0.1 means that one in ten of the entrapped fish would be expected to survive to maturity had they not been entrapped.

*3.23 When annual EAV numbers or EAV biomass are expressed as a percentage of spawning population size, they provide a metric of entrapment risks to the spawning population.'*¹⁴⁵

6.121 The method employed by the appellant is precautionary. As Dr Jennings explains it does not take into account any mortality which may be expected to arise as a result of fishing (this is addressed further below). This means that the figures used

¹⁴³ CD 6.12 p.13 para. 3.18. This is common ground between the main parties.

¹⁴⁴ CD 6.12 p.13 para. 3.18

¹⁴⁵ CD 6.12_p.13

are especially conservative for those species which are directly targeted by commercial fishers¹⁴⁶ but it is also conservative for other species which are caught as bycatches in fisheries for other species.¹⁴⁷

6.122 As Dr Jennings explains, spawning population sizes of fish can be highly variable from year to year and since EAV numbers or EAV biomass are reported as a percentage of the spawning population size the result will depend on the year when spawning population size is estimated.¹⁴⁸ Dr Jennings' assessment recognises that the impingement figures from the 2009 CIMP would not have affected spawning population sizes in 2009. Rather, those fish would influence the spawning population sizes in later years (when they reach maturity). Therefore, Dr Jennings has accounted for this in his assessment and estimated the spawning population size for the year when the majority of young fish impinged at HPC would have joined the spawning population.¹⁴⁹

6.123 The Agency's method differs. It has not taken into account the fact that fish impinged in the 2009 CIMP would not impact the 2009 spawning population. This difference may well be of little moment. However, the significant difference between the appellant and the Agency is the Agency's novel (and unsound) approach in comparing what is termed an 'SPF extension' to an annual spawning stock biomass figure.¹⁵⁰ The Agency claims that this accounts for the loss of fish which would be likely to have gone on to repeat spawn in the future.

6.124 Dr Jennings clearly explained in his oral evidence that there is nothing inherently wrong in performing such a calculation, however the clear error¹⁵¹ relates to how the Agency has used the figures it has arrived at and the conclusions it draws from them.¹⁵² He highlighted that the explanation of what the Agency had done differed as between its counsel's opening submissions¹⁵³ and the oral evidence of Dr Masters but neither were entirely correct¹⁵⁴.

6.125 Dr Jennings helpfully explained that the important thing to stress was that the size of fish populations varies widely from year to year. It changes because spawners are added as fish mature and it is also changing because fish are dying (whether from fishing, predation, disease or senescence). He highlighted that one is looking at a rate 'in' to a population and a rate 'out' of a population. Also, the rate at which fish join the population is joined by a year class strength. That is the number of young progeny produced each year which is an annual rate.¹⁵⁵ When fish population assessments are undertaken, scientists look at rates of annual loss and the advantage of doing this is that one has an idea of the rates of mortality that can be sustained by populations. Dr Jennings used marine fishes as an example

¹⁴⁶ CD 6.12 p.14 para. 3.25

¹⁴⁷ CD 6.12 p.14 para. 3.27

¹⁴⁸ CD 6.12 p.14 para. 3.29

¹⁴⁹ CD 6.12 p.14 para. 3.33

¹⁵⁰ Spawning Production Foregone extension. See Glossary at CD 6.5b.

¹⁵¹ Dr Jennings confirmed it was an 'error', as opposed to a mere difference in judgment, in response to a question of the Inspector on Day 7 of the Inquiry, 17 June 2021

¹⁵² Examination-in-chief and cross-examination of Dr Simon Jennings, Day 6 of the Inquiry, 16 June

¹⁵³ CD 6.24 (ID 2) p.5 paras. 21 and 22

¹⁵⁴ Examination-in-chief of Dr Simon Jennings, Day 6 of the Inquiry, 16 June 2021

¹⁵⁵ Examination-in-chief of Dr Simon Jennings, Day 6 of the Inquiry, 16 June 2021

and explained that the species which are relevant to this Inquiry can sustain annual rates of mortality between 16 and 33% each year. Knowing that, one can also calculate an annual rate of loss to impingement and make a comparison. If the annual rate is around 1% it is 'trivial'.¹⁵⁶

6.126 In evidence in chief¹⁵⁷ and in cross examination¹⁵⁸ Dr Edwards confirmed her view that step eight of the Agency's QIA method was:

*'to compare these entrapment losses to the population units to establish a percentage loss. So the outcome of this is predicted annual proportional losses from HPC total entrapment mortality.'*¹⁵⁹

6.127 The view of Dr Edwards is consistent with what is reported in the Agency's AA (2020) which Dr Jennings highlighted in his evidence in chief.¹⁶⁰ He highlighted, as an example, that on page 34 the AA states:

*'From these probability distributions, a mean uncertainty prediction can be derived, and estimates of annual proportional losses can be made with associated quantitative confidence levels (e.g. we can be X% confident that the annual proportional loss will not exceed Y% in any given year).'*¹⁶¹

6.128 It is therefore clear that the Agency's analysis was predicated on estimating an annual rate. However, this is not what the Agency's methodology has in fact produced. This was, to some extent confirmed by Dr Masters in his evidence in chief. Dr Masters confirmed *'we are not talking about an annual mortality...'*¹⁶² and further stated *'if you really want to know what the impact is going to be then you need to consider all of the fish in any given year that would not be there as a result of the operation of this project over a 60 year period and the way to do that is with the SPF extension.'*¹⁶³

6.129 The problem is that the Agency has applied the output of Dr Masters' calculations as an annual mortality. As a fish can only die once, the Agency's use of the SPF extension as an annual rate of mortality is clearly wrong and has led to a significant overestimate of the impact of HPC upon fish populations.

6.130 Dr Jennings explained in his oral evidence that he has 'no qualms' with the method as it is a reasonable way of predicting the number of fish forward in time but that it is *'no longer an annual rate'* and that the repeat spawners are being counted *'year after year'*.¹⁶⁴ He further explained the mismatch between the losses being calculated by the Agency and the populations they were being compared to. He stated:

¹⁵⁶ Examination-in-chief of Dr Simon Jennings, Day 6 of the Inquiry, 16 June 2021

¹⁵⁷ Day 1 of the Inquiry, 8 June 2021

¹⁵⁸ Day 2 of the Inquiry, 9 June 2021

¹⁵⁹ Examination-in-chief of Dr Karen Edwards, Day 1 of Inquiry, 8 June 2021

¹⁶⁰ Examination-in-chief of Dr Simon Jennings, Day 6 of the Inquiry, 16 June 2021

¹⁶¹ CD4.1 p.34

¹⁶² Examination-in-chief of Dr Jerome Masters, Day 2 of Inquiry, 9 June 2021

¹⁶³ Examination-in-chief of Dr Jerome Masters, Day 2 of Inquiry, 9 June 2021

¹⁶⁴ Examination-in-chief of Dr Jerome Masters, Day 2 of Inquiry, 9 June 2021

*'Obviously if you don't adjust the spawning stock biomass you are comparing a multi-annual rate with the biomass and then linking that to thresholds that apply to annual rates. So that isn't strictly correct. You could recover a rate by adjusting the spawning stock biomass to account for the future spawnings of the fish in the spawning stock but, I mean, to an extent that becomes a self-defeating process because you end up back in the condition where you compare a multi annual rate with a multi annual rate and the consequence of that is an annual rate, which is what Cefas have calculated in the first place.'*¹⁶⁵

6.131 The problem with the Agency's method becomes very clear when it is considered in the context of the Agency's uncertainty analysis. Dr Jennings explained that the way the Agency present their upper percentiles from the uncertainty analysis imply that the figures are a one year in a number of years event. Dr Jennings further explained that it is important that the components going into the model to estimate uncertainty need to be equivalent to the outcome. The outcome is defined by the Agency as an annual rate but, as the Agency has calculated the EAV as a multi-annual value, that 'corrupts' the process in the uncertainty analysis and applies a multiplying factor.¹⁶⁶

6.132 Further, the fact that the Agency has not accounted for fishing mortality (F) in its EAV calculation is compounded by the SPF extension. Dr Jennings explained in-chief that because the Agency approach is to project across repeat spawning it is considering the age of fish which are most exploited by fishing. He explained that the ICES working group data shows that in cases of all the marine species subject to F the highest mortality is in the older age classes.¹⁶⁷ In cross-examination Dr Jennings explained that even during a period of zero catch advice for Atlantic cod, in 2019 there were 1,351 tonnes taken from the relevant stock. He emphasised that fishing is the 'big impact' even during zero catch advice years.¹⁶⁸ Dr Jennings and Cefas have not included F in their assessments. He described this as 'very conservative'. However, he stated that for the Agency's method the bias becomes significantly larger.¹⁶⁹

6.133 The Inspector asked Dr Masters on Day 2 of the Inquiry whether the EAV methods had been peer-reviewed or had documented history. Dr Masters did not draw the Inquiry's attention to any precedent for the SPF extension being used to draw conclusions with regards to annual proportional loss. For all of the reasons set out by Dr Jennings, it is clear that the Agency's use of the SPF extension to derive an annual mortality figure is simply wrong and the figures which it has produced are not robust.

6.134 Further, the Secretary of State can have considerable confidence in the results of Cefas in terms of estimating the impact of HPC upon fish populations. Dr Jennings and Cefas undertook a different method (stock assessment) which is independent of EAV in order to assess the impact. Dr Jennings explains in his proof¹⁷⁰ and also

¹⁶⁵ Examination-in-chief of Dr Jerome Masters, Day 2 of Inquiry, 9 June 2021

¹⁶⁶ Examination-in-chief of Dr Jerome Masters, Day 2 of Inquiry, 9 June 2021

¹⁶⁷ CD 9.20

¹⁶⁸ Cross-examination of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

¹⁶⁹ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

¹⁷⁰ CD 6.12 p.15 para.3.41 and CD 6.12g

explained in his evidence in chief that the purpose of these was to apply a more detailed approach than EAV. He explained that the EAV method was conceived as a simple method of risk assessment. Like most risk assessments in natural resource management the process is that you apply a simple not-data-demanding method to a large number of cases or species and if that indicates a degree of risk you would then elevate the complexity of the process to look at cases where you believe that there is a risk.¹⁷¹

6.135 Dr Jennings explained that the EAV method demonstrated that there weren't high risks and that in many cases the analysis would simply have stopped. But, because an impasse was reached with the Agency he applied a stock assessment method to the relevant species for which the necessary data was available (Atlantic cod, sea bass and whiting).¹⁷² Dr Jennings explained that stock assessments have been used for years to estimate how populations respond to F. They can take account of full ranges of different types of mortality which affect a population over its entire life history. It enabled Cefas to address the EA's concerns with regards to the long term impacts of HPC. He explained that what Cefas did was to introduce the mortality of impingement to the stock assessment and that would show how the population would have changed had HPC been operating for a long period.¹⁷³ He highlighted that this was conservative as it assessed the impacts on top of those of HPB and looked at the trends in abundance in Atlantic cod, sea bass and whiting. He explained that Cefas took the published assessments which were signed off by committee of 20 international experts as part of a rigorous and serious process. Using the same code as ICES, Cefas then introduced impingement estimates which came from the RIMP. Noting concerns about the RIMP, Dr Jennings assumed that for every year impingement mortality at HPC was based upon the upper uncertainty interval of the impingement rate for that year (i.e. a 1 in 40 year event). He also explained that he assumed absolutely no mitigation in the calculation and that mortality was based upon a simple scaling of the volumes of water abstracted at HPB and HPC.^{174 175}

¹⁷¹ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

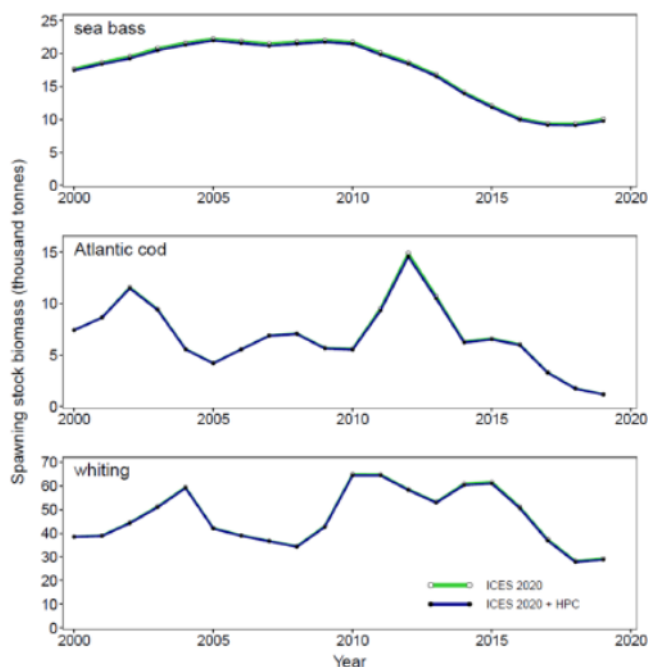
¹⁷² Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

¹⁷³ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

¹⁷⁴ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

¹⁷⁵ Dr Jennings was cross examined on the basis that the RIMP was too 'sparse' to bootstrap. However, as Dr Jennings highlighted, that may have been the case for some species but as cod, sea bass and whiting were relatively abundant in the CIMP it was not the case for those species (Cross-examination by the Agency, Day 6 of Inquiry, 16 June 2021)

6.136 The results of the stock assessments are reported in paragraph 4.32 of Dr Jennings’ proof. They show that in all cases, had HPC abstraction been occurring throughout the assessment then it would have had a very small proportional effect. The timing, magnitude and rate of trends in spawning population size would have effectively been unchanged.¹⁷⁶ This is absolutely clear from Dr Jennings Figure 1¹⁷⁷ which is reproduced here for ease of reference:



6.137 It can be seen from the above figure that the impact of HPC will be negligible on these populations. Dr Jennings explained that what this demonstrates is that fishing and the environment are the ‘overwhelming drivers’ of the trends of these populations. It is the reproductive success of these populations, the progeny that are the young eggs and larvae which are recruiting to Bridgwater Bay and the structuring of the assemblage which is interacting with HPB. He explained that the stock assessments gave ‘considerable reassurance’ as a worst case scenario.¹⁷⁸

LVSE intake factor

6.138 As set out above, a change in the Agency’s position on the eve of the Inquiry has led to a factor of 1 (ratio of the effectiveness of the LVSE intake head design) being agreed between the parties. It is the appellant’s position that the figure of 1 is precautionary and the true figure is likely to be materially lower.¹⁷⁹ The Agency disagrees that a factor of 1 is precautionary but it remains unclear as to why this is so, despite the evidence given by Dr Edwards on this topic. It appears to be

¹⁷⁶ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

¹⁷⁷ CD6.12 p.25 Figure 1

¹⁷⁸ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

¹⁷⁹ CD 6.5 p.16 para. 5.10

another example of the Agency seeking positively to find uncertainty at every possible turn.

6.139 Dr Edwards accepted that the reason why the LVSE intake head was new was that it was designed precisely in order to reduce impingement as compared with previous designs¹⁸⁰ and that in relation to any new development one is going to have to rely upon forecasting and therefore there was nothing novel about HPC in that regard. Dr Edwards further accepted that computational fluid dynamics ('CFD') is an established technique.¹⁸¹ It is exactly this technique which has been used by the appellant to model the performance of the intake heads. In cross-examination counsel for the Agency asked questions of Dr O'Donnell on the basis that the CFD work and report was somehow not robust. However, it is notable that the points made did not appear in the case for the Agency and it gave no evidence to this effect, despite having been in possession of the CFD work since 7 March 2019 and it having been submitted as part of the variation application.¹⁸²

6.140 Dr O'Donnell's oral and written evidence clearly explains the purpose and function of the LVSE heads. At 5.2 onwards of his proof he sets out that the conceptual basis for the LVSE heads is to minimise impingement of fish and is derived from the Agency's 2010 Cooling Water Options Report. He explains at 5.3 that there are three criteria for effective velocity control:

- *the intake velocity should be slow (reducing intake velocities to less than 0.3 metres per second over as much of the length of the intake surface as practical during all tidal states);*
- *reducing vertical abstraction velocities; and*
- *making sure the apertures to the intake head are perpendicular to the current flow ('side entry') so that intake velocities are not added to by current/tidal flow; limiting the exposure of the intake surfaces to the tidal stream will reduce the risk of impingement for fish swimming within it i.e. they reduce the cross-sectional intercept area of the intake presented to the prevailing tidal directions by mounting the head orthogonally to the tidal flow.*¹⁸³

6.141 The 2010 Cooling Options Report includes a basic conceptual design for an LVSE head.¹⁸⁴ The HPC LVSE heads have been designed to follow additional requirements listed at para 5.7 of Dr O'Donnell's proof¹⁸⁵ and the final design is described in detail at paragraphs 5.8 – 5.13.¹⁸⁶

6.142 The performance of the intake heads has been assessed against a series of combinations of tidal levels and current velocities which were chosen to be

¹⁸⁰ Accepted by Dr Edwards in cross-examination, Day 2 of Inquiry, 9 June 2021

¹⁸¹ Accepted by Dr Edwards in cross-examination, Day 2 of Inquiry, 9 June 2021

¹⁸² CD 1.13

¹⁸³ CD 6.11 p.25 para.5.3

¹⁸⁴ CD 9.4 p.114 Figure 6-17

¹⁸⁵ CD 6.11 p.26 para. 5.7

¹⁸⁶ CD 6.11 p.27 – 28 para.5.8-5.13

representative of 'worst case' environmental tidal conditions.¹⁸⁷ The CFD work conducted by HR Wallingford¹⁸⁸ demonstrates that the performance of the LVSE heads will be more effective at preventing the impingement of fish relative to that outlined in the 2010 Guidance. Table 1 of Dr O'Donnell's proof¹⁸⁹ compares the performance of the final design with the heads outlined in the 2010 guidance.¹⁹⁰ It is clear that the performance of the final design will be far superior to what the guidance had envisioned from the head alone.

6.143 In response to the Agency's acceptance of the ratio of '1', Dr O'Donnell issued a note to explain why the figure of 1 is precautionary.¹⁹¹ He clearly explains the difference between the appellant and the Agency. He highlights that it relates to the concept of the geometric area which is presented to the tide. It is worth setting out his explanation in full:

'7... In modelling terms, this represents the area through which fish must pass to enter the zone of influence. The underlying assumption of the geometric intercept area methodology is that there is a physically finite hydrodynamic zone of influence of the LVSE due to the abstraction of water. Particles, whether passive or active (such as swimming fish) follow a streamline path along the principal direction of the tidal currents. For an intake abstracting water, there is a finite streamline corridor in which anything within this corridor would enter the intake and anything outside of this corridor would bypass the intake. The width of this corridor is governed by the state of the tide and alignment of the intake structure to the tidal flow. Conceptually there are three key tidal states that are considered: a) slack tide, b) peak tidal currents aligned with the axis of the intake and c) tidal currents misaligned from the intake. These three states are illustrated in Figure 1.

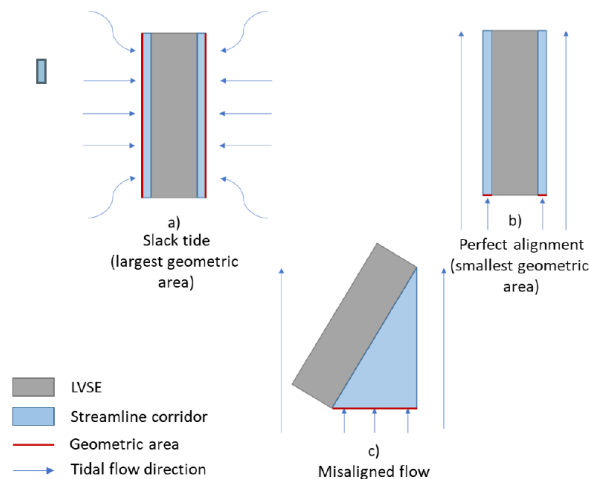


Figure 1: Illustration of the three key tidal states considered using the geometric intercept area methodology: a) slack tide, b) peak tidal currents aligned with the axis of the intake and c) tidal currents misaligned from the intake. The length of the red lines multiplied by the 2 m height represent the geometric projected area.

¹⁸⁷ CD 6.11 p.28 para.5.14

¹⁸⁸ CD 1.13

¹⁸⁹ CD 6.11 p.29-30

¹⁹⁰ CD 9.4

¹⁹¹ CD 6.11d (ID 13) para.7

6.144 Dr O'Donnell explains how the LVSE intake heads operate at slack tide, aligned tide and misaligned tides:¹⁹²

'(a) Slack tide: here the LVSE head abstracts water predominantly horizontally on all sides and is the condition where the LVSE presents its maximum area as the tidal flow can "see" the whole aperture length, through which water is abstracted. This condition occurs for approximately 15% of the tidal cycle. 85% of the time the cases below dominate.

(b) Aligned tide: here the detailed engineering design of the LVSE heads results in no aperture area being presented to the tides. For this condition water is still abstracted through the apertures, of course, it is just that the perspective of this aperture length presented to the tide is zero. Whilst this is true from a geometric perspective, fish can enter the zone of influence through the distance that the intakes have an influence into the tidal flow, the size of this zone of influence is based on where intake velocities fall well below the target of horizontal intake velocity <0.3m/s ... This is conservatively assumed to be ~2m beyond which there is no horizontal draw into the heads.

(c) Misaligned tides: Here the LVSE presents an area between case a) and b) above which is a function of the angle of the tide. Fish abstraction in this condition is assumed to only happen on one side of the intake as the other is sheltered from the tide (this treatment is assumed by both the Appellant and the Agency).'

6.145 The disagreement between the Agency and the appellant relates to the state of 'aligned tide'. The Agency's position is that at perfect alignment there is no benefit to the smallest possible intercept area and therefore applies a ratio of 1. Dr O'Donnell explained in his oral evidence that what the Agency had done was taken the intake area of HPB and used it in lieu of the affected area at HPC.¹⁹³ That approach is clearly incorrect. Any calculation which aims to arrive at the effectiveness of the HPC intake must be based upon the intake dimensions at HPC. As Dr O'Donnell explains it is appropriate to reduce the area of 54.8m² to 32m² based upon the CFD modelling and experimental validation work of the LVSE intake carried out by HR Wallingford. As the height of the structure is 2m and draws water on both sides of the intake the total area of abstraction is 2x2x2x4 which amounts to 32 meters squared.¹⁹⁴ The effect of this, as Dr O'Donnell explained in cross examination, is that the zone where fish could be abstracted over the tidal cycle is much less than that relative to HPB which is why the ratio is less than 1.¹⁹⁵

6.146 Dr O'Donnell's evidence explains that it is conservative to assume a 2m influence of the intake head into the tidal flow over the full length of the apertures.¹⁹⁶ This is the product of both the work by HR Wallingford and also the results of SPP105¹⁹⁷ which indicated that the hydrodynamic influence of the LVSE intakes is only felt

¹⁹² CD 6.11d (ID 13) para.8

¹⁹³ Examination-in-chief of Dr Manus O'Donnell, Day 5 of Inquiry,

¹⁹⁴ CD6.11d (ID 13) para.10

¹⁹⁵ Cross-examination of Dr Manus O'Donnell, Day 5 of Inquiry,

¹⁹⁶ CD6.11 p.30-31 para.5.23

¹⁹⁷ CD7.15_Supplementary Spreadsheet

over a short distance with inward velocities falling to 0.1m/s over a distance of approximately 1.5-2.5m from the intake surfaces and to 0.05m/s at a distance of approximately 3m from the intake surfaces over virtually the full tidal cycle.¹⁹⁸ The range from the intake surface for the inward velocity to fall to the Agency criterion of 0.3 m/s is 0 to 0.68 metres (dependent on the tidal current speed).

6.147 It was put to Dr O'Donnell in cross examination that the intake heads had a hydrodynamic influence up to around 5m.¹⁹⁹ He clearly explained that this was not the case. He showed that any effect beyond 2m was less than he would be able to measure, below 0.05m/s and certainly less than the flow of the slack tide which is 0.1m/s.²⁰⁰

6.148 Dr O' Donnell also explained under cross examination that the 5m influence shown as indicated by the Agency counsel was not the primary flow but secondary 3D flow, an inherent problem of 3D flows being misunderstood in a 2D plot. As flow goes up the hydrodynamic nose cone, it diverts sideways and back down into the main flow. As the figure above shows, flow is actually diverted away from the structure initially before returning parallel to the intake. This secondary flow is different from the primary flow, from which the 1.5-2.5 m horizontal draw to a velocity of 0.1 m/s is derived.

6.149 Counsel for the Agency also cross-examined Dr O'Donnell in relation to historic comments made in a Cefas report which linked the need for a behavioural cue with the low velocity intake heads. That document from 2015²⁰¹ states:

'The target intake velocity of 0.3 m/s was chosen in order to minimise the possibility for fish to be sucked into the intake heads as it is a speed that most fish can escape. However, the use of a low intake velocity is only effective if fish can detect it and consequentially swim away from it. Therefore it is generally recommended to use some form of fish deterrent such as an AFD or a Louvre screen. The primary consideration when implementing a form of fish deterrent must be its ability to repel fish; however consideration must also be given to any impacts on nuclear safety, for example the deterrent may present a threat to the intake heads following a ship collision.'

6.150 However, as Dr O'Donnell explained the AFD will not impact how the LVSE operates in terms of the abstraction of water or its interaction with the tide, there is no correlation between the two, specifically the vertical velocity cap and the low velocity entry. It is therefore incorrect to state that the benefits of the LVSE heads are solely dependent upon the provision of an AFD.

6.151 It is clear that the guidance regarded design changes which secured a low velocity was desirable and effective without an AFD. Neither the Agency's best practice guide²⁰² nor the Agency's Cooling Water Options report²⁰³ indicates that there is no

¹⁹⁸ CD6.11 p.30-31 para.5.23

¹⁹⁹ Cross-examination of Dr Manus O'Donnell, Day 5 of Inquiry,

²⁰⁰ He demonstrated this by reference to CD7.15 p.17

²⁰¹ CD 9.46 p.42 section 5.1.9

²⁰² CD 9.3

²⁰³ CD 9.4

point in seeking to achieve low velocity unless there is an AFD.²⁰⁴ Further, in cross examination, Dr Edwards accepted that the Agency's 'Screening for Intake and Outfalls: a best practice guide'²⁰⁵ lists a number of design changes at Sizewell B²⁰⁶ and that these included, reduction of intake velocities, eliminating vertical flow, elimination of intakes superstructure, locating intakes further off shore and that all of these were considered benefits even though Sizewell B does not have an AFD. She accepted that the guidance indicated that the design changes were desirable and effective without an AFD.²⁰⁷

6.152 Therefore, on the basis of the evidence of Dr O'Donnell and the CFD work the Secretary of State can be confident that the ratio of '1' for the LVSE intake factor is precautionary and it is likely to be a material underestimate of its effectiveness in preventing the impingement of fish.

6.153 Finally under this heading, it is further relevant to highlight the size of the risk of abstraction zone in the context of the Severn Estuary. Dr O'Donnell explained in his proof that the area where fish are at risk of abstraction is 1,136 cubic metres across all four intakes. Outside of this area fish are not at risk.²⁰⁸ To put this in context, at the mean low water spring level, a crude estimate of the cross section of water at the point of the HPC intakes is approximately 235,416 square metres. If that cross sectional area were to be multiplied by the length of the Bristol Channel it is clear that the area would be very significant indeed. The Agency has taken no issue with this calculation. Furthermore, the abstraction volume of HPC is very small compared to the flow through the Bristol Channel. The Bristol Channel has the second largest tidal range in the world and extremely large volumes of marine water flows through it. HPC abstracts a tiny proportion of the instantaneous flow through the estuary. The riverine flow from the River Severn (i.e. the freshwater contribution) is extremely small in comparison and is approximately 120 km from the HPC intake locations. Comparison of abstraction volumes with freshwater riverine flows – as made by some third parties are therefore somewhat misleading. Accordingly the area where fish are at risk of abstraction is very small with respect to the area of the Bristol Channel available to fish.²⁰⁹

Population sizes

6.154 One main issue between the parties with regards to the assemblage species is the population sizes.

6.155 Cefas and Dr Jennings have used ICES estimates of the spawning population sizes of cod, sea bass and whiting. Dr Jennings explains in his proof²¹⁰ and also explained in his oral evidence that ICES conducts science and provides advice on a whole range of marine science topics. It is a major player in advising on fish populations and it is therefore reasonable to draw on the advice which it gives. Dr Jennings underscored in chief that a number of organisations and countries trust ICES to

²⁰⁴ Accepted by Dr Edwards in cross-examination, Day 2 of Inquiry,

²⁰⁵ CD 9.3

²⁰⁶ CD 9.3 p.24 Table 2.2

²⁰⁷ Cross-examination of Dr Edwards, Day 2 of Inquiry,

²⁰⁸ CD6.11 p.31 para.5.24

²⁰⁹ CD6.11 p.31 para. 5.25

²¹⁰ Appendix C of proof of evidence of Dr Simon Jennings, CD6.12d

provide population information, including the European Commission, Iceland, Norway and the UK.²¹¹

- 6.156 In his oral evidence Dr Jennings explained why the ICES population sizes should be used. He explained that when one considers the impingement data from HPB it is predominantly juvenile fish which have been impinged. Those juveniles are not swimming there as part of a migration. They are carried as eggs and larvae into Bridgwater Bay (largely by the wind-driven and tidal currents) and will swim out and recruit to the adult population when older. Therefore, it is the populations of the marine species which are spawning offshore (which will include adults from Bridgwater Bay and elsewhere) and especially off Trevoise Head which determines the number of fish recruited to the nursery areas in Bridgwater Bay and therefore it is entirely right to consider the ICES estimates.²¹²
- 6.157 The Agency argue that adult population sizes are smaller than those calculated by ICES. The Agency reduce each species' population size by multiplying it by a ratio between a stock area assumed by the Agency and the stock area reported by ICES. For example, if the Agency consider the area used by the population to be three times smaller than the ICES stock area, then the Agency reduce the ICES population size by a factor of three.
- 6.158 The Agency's approach is, in the appellant's opinion, significantly flawed. These issues were highlighted by Dr Jennings in his evidence. He highlighted that the Agency's areas do not reflect the biology of the animals across their lifecycle. He highlighted that some of the areas cut across spawning grounds where fish are mixing. He further emphasised that the Agency's re-scaling of the population areas has been done by 'area' but that this is very misleading. The ICES Divisions²¹³ exist for statistical and management processes. They are not 'boxes of biology'. He emphasised that when ICES assign a population or a stock to one or more of these boxes the Expert Group that are making that decision aren't saying this population is evenly spread through the boxes. The boxes are a convenient way of denoting the absolute boundaries of the area used for assessment and management.
- 6.159 Dr Jennings explained that there are very large parts of the ICES stock area boxes where certain populations of fish species will not be found in substantial numbers. He gave Atlantic cod as a good example. He stated that cod don't particularly like to live in water more than 200m deep. However, half the area which ICES uses in denoting the 7e-k cod stock is water more than 200m deep – particularly western areas in 7j and k. Similar considerations apply for whiting. As the Agency has scaled its population using a ratio between the population in the area which ICES uses and the area which the Agency assumes will be used, it is clearly flawed. Dr Jennings explained that the Agency's area for cod as against that of ICES is a 1:4.5 ratio and therefore the Agency reduced their population size by a factor of 4.5 because their area was smaller. However, if you accept that around half the area is

²¹¹ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

²¹² Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

²¹³ CD6.12 p.57 Figure 10

not 'cod friendly' then that changes the scaling factor to 2-2.5. He explained that this is a simple example of why the methodology is biased.

6.160 Mr. Waugh claimed that his areas were based upon an analysis of peer-reviewed literature.²¹⁴ However, it is clear to the appellant that those articles do not support his conclusions and that he had effectively cherry picked sections from them. Dr Jennings confirmed that he had been through the articles comprehensively and concluded that he did not believe that they support Mr Waugh's conclusions. First, he highlighted that none of the articles which are cited argued to re-scale populations on the basis of area alone. He explained that they tended to show things like home ranges of tagged animals but did not claim that these were the population ranges, rather they were the ranges of moving animals. Dr Jennings also highlighted that he himself had cited a number of the same studies in his own proof (Appendix E)²¹⁵ but they had come to different conclusions as set out in his rebuttal.²¹⁶ Ultimately, as Dr Jennings stated the reliance upon one paper or one scientist is *'nothing as powerful as a multistage international process with internal and external peer review that brings together experts in all the biology of those fishes'*. That is why the Secretary of State can have confidence in spawning population size arrived at by ICES.

6.161 Dr Jennings explained that his ultimate concern was not the science in those papers but rather the concern that the Agency had focused upon individual elements of the lifecycle. He accepted that some articles, for example, provide evidence of sea bass summer feeding grounds and that this is not disputed. However, in the context of this Inquiry, the important issue is the populations throughout their lifecycle and that the reason for that is that the fish in Bridgwater Bay are the young of a spawning population predominantly offshore and moving over very large areas. It is wrong to state, for example, that because a small group of bass stay within a bay on the coast of Wales for the summer that this is evidence that the bass population should be treated on a small scale. The population should be treated over its full lifecycle.²¹⁷ Dr Jennings elaborated that to base a view of the population on just one group of fish over one season, when the fundamental basis for the EAV and stock assessment is over several years and the course of the lifecycle and addresses the connections between Bridgwater Bay and the spawning population offshore, *'doesn't really seem the right way to address the question'*.²¹⁸ That, in the appellant's view, is patently correct.

6.162 There is no ICES assessment for Atlantic herring in the Bristol Channel area. Therefore, Dr Jennings relies upon PELTIC survey data, PELTIC being an acoustic survey which determines the abundance of a range of species of fish in the water column. The survey work began in October 2012 and covers a large proportion of areas 7e and 7f annually. He highlighted that the survey uses 4 different acoustic wavelengths which to help discriminate between the different fish species and that

²¹⁴ CD6.8 p.11 para.4.2.7

²¹⁵ CD6.12f

²¹⁶ CD6.19 p.11 para.2.47 onwards

²¹⁷ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

²¹⁸ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

the results are validated using a pelagic trawl net to provide samples of the fish that are actually present.

6.163 In chief, Mr Waugh stated that a PELTIC survey is an ‘excellent’ way to try to identify a biomass of a particular species. He further stated that whilst the Agency agreed that the use of the PELTIC survey is ‘*a much more appropriate assessment, what we would be keen to see is how the appellant has indicated within this PELTIC survey what genetic information and what populations [...] are present within that PELTIC survey*’.²¹⁹ Whilst Mr Waugh had some comments to make, it appears that the Agency does not dispute the robustness of this survey for forming the basis of the abundance assessment for Atlantic herring.

6.164 The Agency has selected Division 7f for its Atlantic herring population. Dr Jennings stated that he did not find evidence for or against this argument. However, significantly, he stated that Cefas estimated that there was about 3,200 tonnes of Atlantic herring in Division 7f. He stated that Cefas conducted an additional analysis where it compared the predicted impingement biomass with the 7f biomass and the results amounted to 0.01% predicted loss of Atlantic herring biomass recorded by the PELTIC survey annually. If there is no mitigation then this would rise to 0.04%. Therefore, whichever population the Secretary of State opts for in relation to Atlantic herring (appellant vs Agency) it would have no outcome on the judgement to be reached, which is that there would be no material impact upon the Atlantic herring population as a result of HPC.

6.165 The population sizes for Atlantic salmon and Twaite shad have been agreed for the purposes of this Inquiry so are not discussed at length here. However, it is worth noting that the Atlantic salmon population of the Severn Estuary is only made up of the sum of the estimates for the Wye, Usk and Severn. It therefore does not take account of any Atlantic salmon not found in those rivers (i.e. in the Tone and Parrett).

Health of the populations and ‘levers’

6.166 Much of the Agency’s case has involved drawing attention to the poor state of some of the species before this Inquiry. Dr Jennings acknowledges these conditions in his evidence.²²⁰

6.167 In his oral evidence, Dr Jennings confirmed the conservation status of the populations in issue. However he emphasised that given the extremely small predicted percentage losses it was ‘inconceivable to see them being major drivers of the populations’. He gave shad as an example. He explained that it was ‘incredibly improbable’ that the predicted mortality figure would halt recovery. He said that the rates of increase and decrease, as driven by other factors, would be considerable in relation to the effects of impingement mortality. That is something which originates in the biology of the species. Because fish have large numbers of eggs, populations can grow rapidly if conditions are right for the species.

²¹⁹ Examination-in-chief of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021.

²²⁰ Proof of Evidence of Dr Simon Jennings CD6.12 in particular at Appendix E (6.12f) and paras 11.25 (sea bass), 11.50 (Atlantic cod), 11.65 (whiting). For Atlantic salmon see the SoCG (CD6.5) at para 4.29

6.168 There is no evidence before this Inquiry that the problems faced by each species have been in any way the result of or exacerbated by the decades of water abstraction at HPB. As Dr Jennings has continually emphasised, the drivers of the population sizes are not water abstraction in Bridgwater Bay. In relation to the marine species, the clear drivers of the population levels are fishing and environmental variation and change. Dr Jennings gave the example that even where 'zero catch' advice was in place for cod, in 2019, 1,351 tonnes were taken from the relevant stock as a result of fishing.²²¹ For the Twaite shad, the clear issue are the weirs and the blocking of rivers which is the problem which the UtS project is seeking to address.²²² In relation to Atlantic salmon, Dr Jennings listed various impacts which were the loss of gravel, agricultural sedimentation, goosander predation and poaching.²²³

6.169 This is relevant for two reasons. First, the abstraction at HPB and the predicted abstraction at HPC is not expected to have anything more than a negligible effect upon the population sizes of the various species. The sizes of the populations and the barrier to their restoration are clearly driven by other factors. Dr Jennings confirmed that all the evidence he had been able to assimilate does not suggest that Hinkley Point is one of the big influences on these populations.²²⁴ Second, the fact this is the case means that there are 'levers' available to relevant authorities in order to assist in the recovery of the various populations. As Mr Goodwin made clear, it is no part of the appellant's case to rely upon these 'levers' to justify its application.²²⁵ Rather, they are a material part of the background against which the appeal is to be decided.

Local depletion

6.170 Although no party has relied upon the potential for 'local depletion' of a particular age class of a species as a result of the project, the issue arose as part of Dr Turnpenny's questions to Dr Jennings. Dr Jennings emphasised that he and Cefas had considered the issue of local depletion. He explained that he looked at the RIMP data and considered a cohort of sea bass who arrived in the bay in one year and then looked at how many were impinged as the '1 group' in the following year. He stated that this exercise was sufficient to satisfy him that impingement was not leading to 'in year depletion' of bass. He emphasised that this local effects exercise had not been neglected but that it was not a core part of the case being presented.

6.171 Dr Jennings' response to Dr Turnpenny demonstrates the thorough nature of the work done by Dr Jennings and his team. No potential population effect has gone unassessed, even where it did not form the subject of dispute between the parties.

²²¹ Cross-examination of Dr Simon Jennings by the EA, Day 6 of the Inquiry, 16 June 2021

²²² Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

²²³ Cross-examination by Dr Turnpenny of Dr Simon Jennings, Day 7 of the Inquiry, 17 June 2021

²²⁴ Cross-examination by Dr Turnpenny of Dr Simon Jennings, Day 7 of the Inquiry, 17 June 2021

²²⁵ Cross-examination by D&S IFCA, of Dr Simon Jennings, Day 7 of the Inquiry, 17 June 2021

Again, this adds to the confidence which the Secretary of State can have in the evidence of Dr Jennings and the considerable work which sits behind it.

The Species in Issue

Marine species (the assemblage)

6.172 As set out above, the appellant considers that the assemblage is not a qualifying feature of any of the SACs. Neither is it a qualifying feature of the Ramsar site when the Ramsar Information Sheet is considered carefully. As such, it is legally irrelevant to the consideration of whether the variation application would have an adverse effect upon the integrity of any of the designated sites.

6.173 However, even if contrary to this submission, it is relevant, it is clear that the impact upon each of the disputed species within the assemblage (Atlantic cod, sea bass, Atlantic herring and whiting) would be negligible as a result of HPC.

6.174 The Agency's case in relation to marine species was presented and defended by Mr Waugh. He confirmed that he was involved in writing relevant parts of the appropriate assessment with regards to the marine species. Following his evidence, it is clear that the Agency's case on this issue cannot be given any real weight.

6.175 During cross examination, Mr Waugh confirmed that he had conducted his analysis and reached his conclusions in relation to the Ramsar site. He confirmed that his assessment did not rest on effects to the integrity of the SAC at all.²²⁶ In order to double check, he was then asked directly: '*So your decision wasn't then based on an adverse effect on integrity of the Severn Estuary special area of conservation (SAC), it was based purely on an effect on the Ramsar site, is that correct?*' Mr Waugh replied: '*That is correct*'.²²⁷ For that reason, the appellant did not ask Mr Waugh any further questions on the SAC. There was an attempt in re-examination to re-establish the Agency's case with regards to impacts on the assemblage being relevant to the Severn Estuary SAC, however, Mr Waugh's clear answer in cross-examination should stand.

6.176 Mr Waugh was clear that he had limited his assessment to Ramsar Criterion 8. Mr Waugh confirmed that none of the species he was concerned with were migratory species and therefore his "key focus" is on the Ramsar site as a 'feeding and nursery ground' for many fish species.²²⁸

6.177 Mr Waugh was then taken to a map²²⁹ which shows the location of the intake heads and the various designated sites. When it was highlighted that the intake heads were 3.3km from the shore of the estuary and well outside the boundary of the Ramsar site, he indicated that he hadn't appreciated that. He was under the misapprehension that the SAC and Ramsar sites were contiguous and that the

²²⁶ Cross examination of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

²²⁷ Cross examination of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

²²⁸ Cross examination of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

²²⁹ CD6.13b

intake heads were within their location. He directly confirmed that his assessment was based upon a misconception that the intakes were within the Ramsar site.²³⁰

6.178 Mr Waugh confirmed in cross examination that annual losses as estimated by the appellant would not '*raise concern*' for any of the assemblage species he was concerned with and that if those were the figures his conclusion would be '*no adverse effect on the abundance of the assemblage*'.²³¹

6.179 The Agency's AA in relation to the variation application states (emphasis supplied):

*'Marine migrants (MM) make up the majority of the species by abundance in the CIMP dataset. It includes, in order of decreasing abundance: European sprat, whiting, Dover sole, Atlantic cod, thin lip grey mullet, flounder, five-bearded rockling, Atlantic herring, snake pipefish and European seabass. There are several diverse species contributing to this group, occupying a variety of habitats. Due to the complexity of this group it is difficult to assess how the removal of any individual species in significant numbers would positively or negatively impact the other species in that estuarine use group. It is unlikely that the MM group as a whole would be impacted by the removal of large number of one species.'*²³²

6.180 Despite this, the Agency has in practice treated each of the relevant marine species to this Inquiry as separately designated features of the European Sites and has failed to recognise that if these species are to have any relevance (the appellant's primary position being that they do not) then it can only be as part of a general assemblage of fish.

6.181 Having addressed the general issues of EAV, population sizes and stock assessments above, we make the following specific comments about each of the assemblage species.

Atlantic Cod

6.182 The stock area used by the Agency is clearly not robust. As Dr Jennings explained in his evidence, it is not consistent with his understanding of what *Neat et al* have done, nor with considering the full life cycle of the population. Further compounding the Agency's error is the use of the SPF extension for Atlantic cod which is a repeat spawner; this has been addressed above.

6.183 The precautionary assessment of Dr Jennings is to be preferred. It is summarised at 4.94-4.101 of his PoE²³³ and in more detail in Appendix F.²³⁴ It is worth emphasising that Atlantic cod is a population with an ICES benchmark, which is where an expert group specifically looked at the arguments for and against the current definition of the stock. He explained that ICES reviewed the stock in 2020 which involved considering the work of *Neat et al* including all other evidence.

²³⁰ Cross examination of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

²³¹ Cross examination of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

²³² CD4.1 p.99

²³³ CD 6.12 p.36-37

²³⁴ CD 6.12g

However, the debate in ICES was not to reduce the area but to extend it to include the range of the Atlantic cod stock.²³⁵

6.184 Dr Jennings' predicted EAV figure is 0.412% of the spawning population size with an upper confidence limit of 0.842%. Dr Jennings concludes that the analysis shows that *'although the impingement at HPC reduces the spawning population size of cod it has an insignificant effect on variation in population size.'*²³⁶ And that, *'[T]he size of the cod spawning population is expected to increase and decrease at the same times and at almost identical rates whether or not HPC impingement were occurring.'*²³⁷

6.185 As stated above, Atlantic cod is one of the species for which Dr Jennings has prepared a stock assessment. This gives further confidence that any impact from HPC will be negligible. As Dr Jennings states, had HPC been operating for the past 20 years it would have had *'no effect on the main trends in spawning biomass'* and *'the size of the spawning population would still have increased and decreased at the same times and at an almost identical rate, whether or not HPC were operating.'*²³⁸

Whiting

6.186 Dr Jennings confirmed that he had not found any specific evidence to support the Agency's stock area. The main understanding of the whiting population in general is that it is *'remarkably genetically homogenous'* and the challenge has been finding any management units on the Western side of the UK. He emphasised that as with Atlantic cod, the discussion about whiting in the Celtic Sea had focussed on whether the ICES stock area was too small as opposed to too large.²³⁹ The Agency's analysis also suffers from the error made in relation to the SPF extension.

6.187 The precautionary analysis of Dr Jennings (summarised at 4.102-108 of his proof)²⁴⁰ is to be preferred. This results in a predicted annual rate of loss of 0.126% of the southern Celtic Seas and western English Channel spawning biomass with an upper confidence limit of 0.188%.

6.188 Dr Jennings concludes that the *'size of the whiting spawning population is expected to increase and decrease at the same times and at almost identical rates whether or not HPC impingement were occurring.'*²⁴¹ As with Atlantic cod, the stock assessment in relation to whiting provides additional confidence that any impact upon the relevant population of whiting will be negligible.

6.189 Finally with regards to whiting it is worth considering a report relied upon by SEI and appended to Dr Colclough's proof of evidence²⁴² entitled 'A long-term study of whiting, *Merlangius merlangus* (L) recruitment and population regulation in the

²³⁵ CD 6.12f p.103, para. 11.28

²³⁶ CD 6.12, p.36, para 4.100

²³⁷ CD 6.12, p.37, para 4.101

²³⁸ CD 6.12, p.23, para 4.42

²³⁹ Examination-in-chief of Dr Simon Jennings, Day 5 of Inquiry, see also ICES Report of the Benchmark Workshop on Celtic Seas Stocks (2014) CD 9.82 p.47 para. 4.1.4

²⁴⁰ Page 37

²⁴¹ CD6.12, p.37, para 4.108

²⁴² CD6.14k

Severn Estuary, UK' analyses the dynamics of whiting in the Bristol Channel. The report notes that '*[P]ower station sampling in this region has generated a unique opportunity to explore the population dynamics of whiting*'.²⁴³ Dr Colclough confirmed that the RIMP survey is '*unique and very worthwhile*'.²⁴⁴ The study considers numerous variables affecting populations and it is notable that the study does not highlight any proven or suspected impact of HPB on whiting populations. The study further highlights the natural variability of whiting populations. It states:

*'It is known that there is considerable temporal variability in recruitment and population size in heavily exploited whiting populations...'*²⁴⁵

6.190 Further, on page 17, the report states:

'While recruitment shows high between-year variation the species shows notable long-term stability. Annual whiting abundance within Bridgwater Bay is highly variable, but varies around a stable mean that has not changed over 40 years.

6.191 This report is entirely consistent with the case presented by the appellant.

Sea bass

6.192 The Agency's approach is, in the appellant's view, clearly unsupportable. It is noticeable that its area used to calculate stock divides a large part of the spawning grounds from which bass recruit. Again, the Agency's assessment of sea bass is not only flawed as a result of the un-evidenced population size but also as a result of the SPF extension.

6.193 Contrary to the Agency's area, the assessment of Dr Jennings was evidenced. His assessment is summarised at 4.88-93 of his proof of evidence²⁴⁶ and demonstrates the extraordinary migrations which adult sea bass make; they range over very wide areas.²⁴⁷ Dr Jennings indicated that he agreed with the Agency that there is some local population structuring in the summer months but once they have overwintered, they come back to spawning areas where they mix, and that is the primary source of the young appearing in the Severn Estuary and the Bristol Channel. He emphasised that because it is the early life stages being affected, we aren't talking about adult bass that have been in Denmark swimming into the Bristol Channel and being subject to impingement. Rather, the emphasis is on what is the population which is contributing to the spawning which produces the young bass that appear in the UK.

6.194 The assessment of Dr Jennings predicts an annual rate of loss of 0.03% of spawning stock biomass for the central and southern North Sea, Irish Sea, English Channel, Bristol Channel and Celtic Sea bass with an upper confidence level of 0.038%. Dr Jennings therefore concluded that the size of the '*spawning population of bass is expected to increase and decrease at the same times and at almost*

²⁴³ CD6.14k p.1 para.1

²⁴⁴ Cross-examination of Mr Steve Colclough, Day 5 of Inquiry, 15 June 2021

²⁴⁵ CD6.14k p.1 para.1

²⁴⁶ CD6.12, pg. 35 -36

²⁴⁷ CD6.12f p.100

identical rates whether or not HPC impingement were occurring.²⁴⁸ Further confidence can be derived from the stock assessment for sea bass which shows a negligible impact upon the population had HPC been operating for the past 20 years.

Atlantic herring

- 6.195 Dr Jennings' assessment is summarised at 4.109-4.121 of his proof.²⁴⁹ He calculated the annual rate of loss to be 0.166% of annual landings of Atlantic herring or 0.274% when assuming the upper confidence limit.
- 6.196 As stated above, in the absence of an ICES stock assessment in ICES Divisions 7e and f, Dr Jennings used PELTIC acoustic survey data in order to estimate the relevant biomass for Atlantic herring. It appeared that the Agency took no in-principle objection to this. Using this alternate approach, Dr Jennings assessed the impact upon the biomass within the Agency's preferred area which was 7f. Using only that area, impingement at HPC would lead to an annual loss of 0.04% with no mitigation.
- 6.197 It is the case that the change in the size of the intake screen mesh does affect Atlantic herring. However, it is clear that in the context of the Inquiry this effect is immaterial. Dr Jennings explained that if one adds that additional mortality one arrives at a figure of 0.05% of the biomass being impinged at HPC with no mitigation.²⁵⁰
- 6.198 The Devon & Severn Inshore Fisheries and Conservation Authority (D&S IFCA) made a statement to the Inquiry which indicated a concern about further sub structuring of Atlantic herring populations within the ICES Division 7f.²⁵¹ Dr Jennings addressed this in his evidence in chief. He explained that it is right that we see pockets of what are spring spawning Atlantic herring using gravel substrates in various locations around the coast but there isn't enough evidence to come to a firm conclusion about population identity or sizes for the Inquiry and that he didn't believe that D&S IFCA was able to come to that conclusion.²⁵² However the Secretary of State can have confidence that if there were smaller substocks of Atlantic herring in the relevant area that would have no material difference to the outcome of Dr Jennings' assessment. Dr Jennings explained that if there were a substock which accounted for one tenth of the PELTIC biomass (i.e. 320 tonnes) and that was the only substock being impinged then one is only talking about increasing percentages to around 0.5%. Dr Jennings explained that he did not believe this would have any significant effect on population trends given what we know about the tolerance of Atlantic herring to F.²⁵³

²⁴⁸ CD6.12, pg. 36, para 4.93

²⁴⁹ CD6.12, p. 37-39

²⁵⁰ CD6.12, p. 38, para 4.119

²⁵¹ CD10.6 (ID 5)

²⁵² Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

²⁵³ Examination-in-chief of Dr Simon Jennings, Day 6 of Inquiry, 16 June 2021

Atlantic salmon

6.199 When considering the potential impact of the variation on Atlantic salmon populations it is necessary to take into account how Atlantic salmon use the estuary and designated sites.²⁵⁴ There was no real difference of opinion between the appellant or the Agency with regard to how salmon can be expected to behave in general. Adult salmon enter the Severn Estuary as part of their journey into the rivers to spawn. In doing so, they use selective tidal transport and will do this close to the sea surface and in mid channel following an olfactory trail to their natal rivers.²⁵⁵ Those salmon are broadly in transit to a number of rivers. Having spawned, the adults return to the sea with a very low likelihood of surviving to spawn again. The salmon fry and parr develop in fresh water²⁵⁶ before undergoing a process of smoltification to adapt to life in the sea. They then start to migrate downstream towards the sea. Once they enter coastal waters they are known as post-smolts. When the post-smolts enter the estuary they are doing so as part of their migration towards the sea. Again, they do this using selective tidal stream transport and descend the river and estuary close to the surface of the main channel in the fastest moving section of the water columns.²⁵⁷ The vast majority of smolts will not survive at sea and become spawning adults.

6.200 The HPC intake heads are over 10km south of the main tidal channel where one expects salmon to be. Dr Masters couldn't bring himself to accept that salmon are not expected to be around the HPC intake head in appreciable numbers. However, it became clear that his concern was with regard to salmon who were not behaving as expected. Dr Jennings' evidence on this point was clear. He explained that the risk of impinging salmon is 'very low'. This is evidenced by the RIMP and CIMP data and also the fact that it is well understood that salmon use selective tidal stream transport. Looking at the tidal flows (where HPC intakes are 10km to the south) it is the appellant's case that it is 'extremely unlikely' that a salmon picking up the scent of its natal river (Wye, Usk or Severn) would have a reason to deviate 10km to the south.²⁵⁸ He explained that if the tide reverses a salmon will look to get out of the tide but it would be logical that it would move to the north as it is the shortest distance to travel. Or it might seek shelter in the deeper water in the vicinity of the channel. It is the appellant's case that it was very unlikely to be found by the HPC intake.²⁵⁹

6.201 The depth of the intake heads are also important. The centre of the intake heads are 2.5m above the seabed where, it is argued, the tide is slower than near the surface.²⁶⁰ Even if one were to put what is known about salmon behaviour to one side, and to pretend that salmon are equally distributed across the estuary, it is

²⁵⁴ Accepted by Dr Masters in cross-examination, Day 4 of Inquiry, 11 June 2021

²⁵⁵ CD6.12f p.125 para.11.135

²⁵⁶ CD6.12f p.124 para.11.129

²⁵⁷ CD6.12f p.126 para.11.138 and CD9.35 Moore 1995

²⁵⁸ Examination-in-chief of Dr Simon Jennings, Day 5 of Inquiry,

²⁵⁹ Examination-in-chief of Dr Simon Jennings, Day 5 of Inquiry,

²⁶⁰ During the mean low water spring tide there will be c.10m of water above the intake head (CD 6.11c Figure 5). The salmon are unlikely to be swimming at 10m below the surface

clearly relevant to consider that the intercept area of 48 square metres is around 10.5 thousand times smaller than the cross-sectional area of the Severn Estuary.²⁶¹

6.202 Dr Masters accepted that the fact that no salmon were recorded as impinged during the CIMP is entirely consistent with what we know about salmon behaviour and the location of the HPB intake heads. He confirmed that the recorded impingement of two smolts in the CIMP between 11 February 2012 and 27 May 2012 was also consistent with what we know about salmon behaviour. Dr Masters further confirmed that the low numbers of salmon recorded as impinged in the RIMP was consistent with what we know about salmon behaviour and the location of the HPB intake heads.²⁶²

6.203 Across the whole 30 year period, only 9 salmon were recorded as impinged in the RIMP.²⁶³ Dr Masters accepted that of those 9 only 5 had a chance of making any contribution to any future stock (two kelts and two smolts) and only one adult had a high chance.²⁶⁴ The last salmon which had any chance of making a contribution to any future stock was recorded as impinged in 2002.

6.204 In 2013, the Agency gave their view as to the likely impact of HPC upon salmon based upon the data in the RIMP and CIMP. Their AA for the original DCO application states:

'Very few ...salmon or smolts have been recorded in impingement data at HPB over the past decade and no salmon were recorded in the long term impingement monitoring programme at HP between 2005-09 or in the CIMP ... likely to be a negligible effect at population level' (penultimate paragraph)

*'In AA Conclusion (2013) p.145: We would, therefore, agree that the impingement impacts from the HPC abstraction will not cause an adverse effect on the salmonid populations designated under the Severn Estuary Ramsar'*²⁶⁵

6.205 So, at that time, the Agency were confident beyond reasonable scientific doubt that based on the RIMP and CIMP data, there would not be a significant adverse effect upon the salmon population. The Agency also stated elsewhere in the report:

*'An analysis of the abundance trends by species group from 1981-2008 ...shows HPB has not had any obvious ...or negative effect on fish structure at HPB'*²⁶⁶

*'Furthermore, we have evidence that the salmon population on the River Tone has substantially increased in the last decade, despite the presence of HPB and this has been linked to water quality improvements in this period of time.'*²⁶⁷

²⁶¹ 372,190 m sq divided by 48 m sq intercept area (CD 6.12 p.35 para.4.81)

²⁶² All accepted in cross examination, Day 4 of Inquiry, 11 June 2021

²⁶³ CD 6.12 p.42 Table 8

²⁶⁴ Accepted in cross examination, Day 4 of Inquiry, 11 June 2021

²⁶⁵ CD 5.3 p.145

²⁶⁶ CD 5.3 p.146

²⁶⁷ CD 5.3 p. 223

6.206 Since the date of that document there is four more years' worth of RIMP data available for HPB. During that time, no salmon were impinged. The subsequent data confirms the Agency's previous judgment.

6.207 Similarly, in 2013 the Secretary of State concluded:

*'6.145 'There were no predictions for salmon and sea trout, since none of these fish species have ever been recovered from HPB intake screens. The estimated impingement losses for migratory fish were therefore considered to be insignificant.'*²⁶⁸

6.208 Again, the data available after that date, confirms rather than conflicts with the Secretary of State's judgment.

6.209 The appellant considers, therefore, that it is striking that the Agency have taken the position which they have at this Inquiry. Neither the AA nor the Agency's proofs take into account the previous judgment of the Agency or the Secretary of State when applying the same data. Dr Masters' position with regards to the reliability of the RIMP and CIMP was particularly striking. It is clearly wholly at odds with the view of the Agency and the Secretary of State in 2013 who used it to found their conclusion for the DCO. Further, Dr Masters' view was plainly at odds with his own colleague Mr Waugh who stated that together the RIMP and CIMP is 'one of the most powerful datasets of its type in Europe'.

6.210 When the Agency conducted its AA it did so on the basis of a predicted value of the impingement of 17 equivalent adult Atlantic salmon which amounted to 0.1% of the Severn Estuary population, 0.3% of the Wye SAC and 0.3% of the Usk SAC.²⁶⁹ It also contended that there was a 99th percentile uncertainty analysis impact of 255 per annum. Whilst the Agency claimed not to have taken account of the 99th percentile in their assessment as being overly conservative and overly precautionary, throughout the AA the 99th percentile is reported, in a way that seeks to lend credence to the result.

6.211 Dr Masters confirmed that the Agency had done no assessment of whether 0.3% annual loss of adult equivalent salmon would alone adversely impact the integrity of any European Site.²⁷⁰ In any event, the Agency now advances a materially lower predicted impact of between 11 and 12 impinged adult equivalents a year and has produced no uncertainty analysis figure which relates to that number.²⁷¹ The Agency's case is now that there is a predicted impact of 0.07% against the Severn Estuary, 0.2% for the Wye SAC and 0.2% for the Usk SAC.

6.212 Dr Masters accepted that it is possible to conduct an assessment which is overly precautionary. On any view, it is argued that his revised figure is heavily inflated above what can be considered a realistic prediction, for the following reasons:

²⁶⁸ CD 5.8 p.69 para.6.145

²⁶⁹ CD 6.7 p.37 Table 2

²⁷⁰ Cross examination of Dr Jerome Masters, Day 4 of Inquiry,. Though Dr Masters sought to give his view on this figure he confirmed that it was not the Agency's position.

²⁷¹ Despite initially inviting the Secretary of State to place weight on a higher figure, Dr Masters confirmed in cross examination on Day 4, that the Agency no longer relied upon that figure as it was not related to the Agency's new predicted number.

- Dr Masters based his evidence on only 21 years of the RIMP data (1997-2017). He accepted that had he taken the full data into account his figure would have been lower. When it was put to him that his figure of 12 salmon would fall to around 6.5 he did not disagree;
- Dr Masters has attributed an EAV of 1.02 to the single adult salmon recorded as impinged in the RIMP (in 2002). This does not factor in any chance of it dying before it reaches the river despite the Agency applying a 10% risk when it considers the salmon population of the estuary;²⁷²
- Dr Masters has also wholly ignored the CIMP data. Dr Masters repeatedly criticised the RIMP (the data-set he chose to base his analysis on) as its samples were only collected in daylight. However, the CIMP included both day and overnight samples. Dr Jennings explained in his evidence that there were 12 valid overnight samples in the period of April May 2009 and April May 2010. Therefore out of 120 days when smolts are most likely to be descending the estuary in relatively large numbers there is data from 12 of those nights. Dr Masters accepted that had he used the CIMP data his predicted figure would have been lower. Indeed, it would have been much lower as the figure of 1.6 predicted equivalent adults which Dr Jennings has derived from the CIMP shows;
- The Agency has attributed predicted mortality in its entirety to the population of each river SAC. Dr Masters accepted in cross-examination that this was unlikely. In fact, it is clearly unrealistic. Dr Masters accepted that salmon in the Severn Estuary were in transit to at least one of five rivers²⁷³, it is plainly extremely precautionary (and indeed unrealistic or fanciful) to assume that every single salmon which is impinged at HPC has its home river as either the Usk or Wye;
- Dr Masters confirmed that the population for the Severn Estuary is conservative on the basis that the figure only includes salmon from the Wye, Usk and Severn. He accepted it did not include salmon which spawn in the Parrett or Tone.

6.213 In the unlikely event that the Agency's figure of 12 equivalent adult salmon per year (from any of the relevant sites) did arise, the appellant says that it is clear that this would not amount to an adverse effect upon integrity. Dr Masters accepted that a figure of 10% was appropriate as a predicted impact from Catch and Release salmon fishing.²⁷⁴ NRW has recently instituted byelaws on the Usk and Wye which implement catch and release fishing which allow for adult salmon to be deliberately targeted despite there being a 10% risk of death. If a 10% mortality rate were applied to the 2019 salmon catches on the rivers Severn, Wye and Usk in 2019 an assumed level of mortality would be 16, 24 and 20 fish respectively as a result of the fishing.²⁷⁵ Had NRW considered that an annual loss of around 24

²⁷² CD 8.16 p.9

²⁷³ Severn, Usk, Wye, Parrett and Tone

²⁷⁴ CD 9.17

²⁷⁵ CD 6.12f p.97 para.11.13, accepted by Dr Masters in Cross-Examination Day 4 11 June 2021

salmon from the Usk was having an adverse effect upon integrity then there would clearly have had to have been a ban on fishing licenses.²⁷⁶

6.214 On any view, the figure of 12 per year is unrealistic and the prediction of Dr Jennings (1.6 adult equivalents per annum with an upper confidence limit of 3.2) is to be preferred. Despite there being no salmon impinged during the CIMP, Dr Jennings has considered the position as if the two impinged after the CIMP year were caught during that year.²⁷⁷ Dr Jennings' assessment is highly precautionary:

- he has assumed 100% mortality from the FRR despite providing evidence that survival could exceed 50%;²⁷⁸
- he has ascribed a highly precautionary EAV to smolts of 0.1 (three times that used by the Agency);²⁷⁹
- he has ascribed every impinged salmon to each river in turn despite this being highly unlikely;
- he has considered his assessment against the river with the smallest salmon population (the Severn) despite this not being designated in and of itself.

6.215 Finally and of fundamental importance is the fact that the impact of HPC upon salmon impingement can be expected, in the appellant's view, to be better than that of HPB. HPC will extract roughly 4x the amount of water at HPB.²⁸⁰ Further, the parties agree that the pelagic cap can be expected to reduce the number of salmon impinged by over four times.²⁸¹ Therefore, the pelagic cap more than cancels out the increased intake as regards the expected effect on salmon. Dr Masters agreed that 'all other things being equal' the HPC impact on salmon would be less than the HPB impact.

6.216 HPC also benefits from an FRR. Neither party has factored any expected benefit from this into its assessment. Dr Masters accepted in cross examination that this was 'precautionary'. There is no evidence that salmon would be more likely to be impinged at HPC than HPB. Rather, the depth of the intake suggests that it is less likely. As stated by Mr Waugh, the fish populations of the Severn Estuary are '*some of the most well studied in the world*',²⁸² further, the RIMP and CIMP give a very good indication of the impact of HPB on relevant fish populations. It is therefore notable that no one has presented any evidence to the Inquiry of HPB having an adverse impact upon salmon populations (or indeed any of the populations in issue in this Inquiry). Any impact it has had or is having is therefore imperceptible and clearly does not amount to an adverse effect on the integrity of any protected site. The appellant argues that as HPC is projected to have less of an impact upon salmon there can be no reasonable scientific doubt that a grant of the variation of

²⁷⁶ Dr Masters accepted that the byelaws were the subject of AA under the Habitats Regulations.

²⁷⁷ CD 6.12 p.44 paras. 4.161-164

²⁷⁸ CD 6.12 p.43-44 paras. 4.160-168, see also 3.12

²⁷⁹ CD 6.12f p.124 para.11.131

²⁸⁰ CD 6.5 p.97 para.3.11, the Agency uses a factor of 3.91 (CD 6.12j p.148, linear relationship agreed CD 6.5 p.12 para.4.16)

²⁸¹ CD 6.5, p.8 Table 1

²⁸² Examination-in-chief of Mr Adam Waugh, Day 3 of Inquiry, 10 June 2021

the permit will not have an impact on salmon such that it amounts to an adverse effect upon integrity.

Twaite shad and Allis shad

6.217 The appellant argues that, as with Atlantic salmon, the impact of HPC without the AFD can, on the Agency's revised figures, be predicted to be better for both species of shad. Again, this is by reason of the pelagic cap more than cancelling out the increase in water abstraction at HPC.

6.218 Also as with Atlantic salmon, despite operating over 4.5 decades no party has produced any evidence of HPB having a materially adverse impact upon shad populations. Indeed, the Secretary of State positively held in 2013 that there was '*no evidence that the operation of HPB has led to adverse impacts on fish populations*'.²⁸³ It is clear from the Agency's own case that the main issue facing shad populations are '*pollution, building of obstructions to migration and over fishing*'.²⁸⁴

6.219 It is plainly the case that the scientific understanding of shad behaviour is developing. Dr Jennings stated that there was now some evidence that shad do not leave the estuary rapidly but may in some cases leave more slowly.²⁸⁵ As the CIMP and RIMP has impinged some Twaite shad, this is unsurprising. This development in understanding in no way undermines Dr Jennings' analysis which is based upon the extrapolation of data from the CIMP. As Dr Jennings explained, all the data shows is that Twaite shad are using the waters in Bridgwater Bay.²⁸⁶ That much was already known from the very dataset used by Dr Jennings (and the Agency) to form the basis of their analysis.

6.220 The appellant argues that the Agency's case with regards to Twaite shad boiled down to an allegation that HPC may impinge more adult shad than HPB. However, it was clear that in reality there was no evidence that this either would or even may be the case. The lack of evidence supporting Mr Crundwell's hypothesis is underlined by the words he uses in his proof. He states that '*I suspect HPC will have a higher chance of entrapment of adult shad...*'²⁸⁷ and that '*I believe juvenile shads are more likely to use areas closer to the shore...adults are more likely to reside and migrate further from the coast...*'²⁸⁸. Clearly, a mere suspicion or belief will not amount to 'reasonable scientific doubt'. The hypothesis, it was argued, has to be supported by credible scientific evidence.

6.221 Mr Crundwell's evidence also contained, in the appellant's view, some bold statements which were unsupported by any evidence produced by him. His rebuttal stated:

²⁸³ CD 5.8

²⁸⁴ CD 6.9 p.8 para. 5.1.1

²⁸⁵ Cross-examination of Dr Simon Jennings by SEI, Day 7 of Inquiry,

²⁸⁶ Cross-examination of Dr Simon Jennings by SEI, Day 7 of Inquiry,

²⁸⁷ CD 6.9 p.13 para.5.4.6

²⁸⁸ CD 6.9 p.14 para.5.4.10

*'The latest acoustic tracking evidence shows that adult shad frequent coastal areas far away from the main channel for prolonged periods, moving in and out of suitable habitat presumably for feeding...'*²⁸⁹

- 6.222 However, under cross examination it became clear that the evidence for this statement was lacking. Dr Jennings highlighted in cross examination that there simply is not the depth of information to make a full analysis.²⁹⁰
- 6.223 Dr Jennings accepted that shad may be 'less directive' than salmon but gave evidence that in April-June, a directed migration is expected and that his expectation is that they would be taking advantage of selective tidal stream transport. He also emphasised that they can be expected to be present in shallow water. The putcher ranks²⁹¹ used to catch 100s and sometimes 1,000s of shad each year and that these are sited in very shallow water.
- 6.224 Dr Jennings directly addressed the emerging data from the UtS Project. He highlighted that it was 'early days' and that the strongest data is that we already have a nearby abstraction point which is not catching significant numbers of adult shad. The acoustic tracking data provided by UtS shows that three Twaite shad were recorded in Bridgwater Bay with 2 being recorded for very brief periods. One was there for almost two months but Dr Jennings explained that given the range of the receivers it may well have shed its tag which is a fairly normal occurrence. It was impossible to tell. He further stated that if the fish was alive and in the vicinity of Bridgwater Bay for 2 months then the risk of impingement is presumably very low.²⁹²
- 6.225 Both the appellant and the Agency have applied their estimates of Twaite shad mortality against each relevant population. As with Atlantic salmon, this is highly precautionary such that it is unrealistic. In practice it means that the figures arrived at by Dr Jennings and the Agency are highly precautionary.
- 6.226 Whether the appellant or the Agency is correct with regards to the likely impact upon Twaite shad, it is clear neither predicted impact figure will materially impact the Twaite shad populations. Mr Crundwell produced two figures which showed the predicted impact of an incremental loss of Twaite shad from the population. Figure 5 of his proof shows that a 0.1% impact is imperceptible. Even a 1% impact shows a small decrease and then the restoration of the population. On any view, the loss of even 1% from the Twaite shad population would not affect the ability of the population to restore itself in the long term.
- 6.227 Dr Jennings explained this further in his oral evidence. He explained that what the model seeks to do is to understand how reductions in egg production in shad affect trends in the population and the graph shows the effect of different levels of additional mortality over time. The line of 0.1% per year shows no detectable effect on the population. He stated that even if the figure was 1% there would be no risk to the population as a result of that source of mortality. The driver of population

²⁸⁹ CD 6.18 p.2 para. 1.1.3

²⁹⁰ Cross-examination by the Agency of Dr Simon Jennings, Day 6 of Inquiry,

²⁹¹ A traditional method for catching salmon and other fish in the Severn Estuary

²⁹² Examination-in-chief of Dr Simon Jennings, Day 5 of Inquiry,

abundance would be factors which lead to much greater levels of mortality. Historically that is the blocking of rivers by the development of weirs. The model produced by Aprahamian is an 'equilibrium model'. Although the line looks stable that is not realistic. He highlighted Graph 7 in TB016²⁹³ to show that the population is varying in abundance from year to year. A variation of 0.1% or 1% against that background of natural variation is not going to have ecological implications which the system is not already adjusted to.²⁹⁴ In cross examination Dr Jennings reiterated that the effects of a rate of 1% additional mortality will simply be 'undetectable in the real world'.²⁹⁵

6.228 Dr Jennings emphasised that the real drivers of population impacts upon shad are the artificial barriers. When it was put to him in cross-examination that there were no such barriers on the rivers Wye and Usk he highlighted that the estimates of population numbers for those rivers are in any case dependent upon the river Severn population estimates.²⁹⁶ It is therefore the case that the population estimates are based upon the River Severn where artificial barriers are still influencing shad migration.

6.229 That is consistent with the Agency's conclusion in 2013.²⁹⁷ In their AA at that time their own expert stated that a 0.3% loss to the UK population would be 'trivial' (p141). The Secretary of State agreed and found that a predicted rate of annual impingement of 0.3% would be 'insignificant'.²⁹⁸

6.230 The appellant's case is that the assessment of Dr Jennings is, in any event, to be preferred in relation to the Twaite shad. His predicted impacts are 0.029% of equivalent adults per year for the Severn Estuary, 0.038% for the River Wye and 0.078% for the River Usk. The main difference between Dr Jennings in relation to the Twaite shad is in respect of the EAV calculation. The appellant has set out above why the Agency's SPF extension method is to be rejected. In the context of the Twaite shad which is a repeat spawner, it has grossly inflated the number of equivalent adults expecting to be impinged without making any account for repeat spawning in the population which the figure is compared against.

6.231 The Agency's case with regards to the Allis shad is that there 'might be' a locally derived Allis shad population.²⁹⁹ Dr Jennings has reviewed each of the studies which have variously been relied upon by the Agency as providing evidence of an Allis shad population.³⁰⁰ Mr Crundwell relied upon only one of these in his proof (*Hardouin et al*³⁰¹). The executive summary of that study states:

'In determining the proportions of A. fallax [Twaite] and A. alosa [Allis], the present study has demonstrated that the DNA markers used were not sufficiently species-specific to provide unequivocal results. Taken with caution, based on the

²⁹³ CD 8.15 p.14

²⁹⁴ Examination-in-chief of Dr Simon Jennings, Day 5 of Inquiry,

²⁹⁵ Cross-examination of Dr Simon Jennings by the Agency, Day 6 of Inquiry,

²⁹⁶ Cross-examination of Dr Simon Jennings by the Agency, Day 6 of Inquiry,

²⁹⁷ CD 5.3

²⁹⁸ CD 5.8 p.69 para. 6.145

²⁹⁹ CD 6.18 p.4 para. 2.2.1

³⁰⁰ CD 6.12f p.122 para.11.120

³⁰¹ CD 9.39, CD 6.9 p.34 para.5.17.5

mitochondrial DNA and nuclear DNA (nif1-nDNA); the proportion of A. fallax in the Wye is 70 % with 1% A. alosa and 29% hybrids. Based on the same markers, the proportion of A. fallax in the Usk is 54% with 46% hybrids and in the Tywi, 28% were identified as A. fallax with 72% identified as hybrids. Additional DNA markers will likely identify a higher percentage of hybrids. Microsatellite loci indicated that the Tywi population is genetically different from the Usk and the Wye, but no population structure was found. A single egg from the lower Wye had only A. alosa markers and is the first recent evidence of spawning of this species in the Wye.'

6.232 Therefore, the appellant argues that the height of the Agency's case with regards to a spawning population of Allis shad appears to be one Allis shad egg having been found in the Wye in 2013 as part of a study which on its own terms says its results should be 'taken with caution'. Evidently, it does not demonstrate that there is a viable spawning population of Allis shad population in the Wye. Plainly, from the historical evidence advanced by Mr Crundwell, Allis shad may have in previous centuries been a common species, and indeed food source in the Severn, Thames and other UK rivers, but that has long since ceased to be the case.

6.233 A conclusion that there is no viable spawning population of Allis shad is consistent with what the Agency concluded in relation to the original DCO application where they stated in their AA: (p140-1)(emphasis added)

'In most respects, the life cycle of the Allis shad is very similar to that of its more common relative the Twaité shad, except that the Allis shad tends to be larger and migrate further upstream during their spawning migration (Bird, 2008). The River Severn has historically had breeding populations of Allis shad, however, there are currently no known spawning populations of these species in the UK, which is why it was recently removed as having SAC status within the Severn Estuary. Even without mitigation in place impingement impacts from HPC alone will not have an adverse effect on the Allis shad.' 'There are no confirmed spawning sites for Allis shad in the UK (Maitland & Lyle 1990)³⁰²

6.234 To this can be added the fact that the Core Management Plan including Conservation Objectives for the Wye SAC (updated 2017) confirms there are 'no recent confirmed records' of Allis shad in the Wye³⁰³ and the fact that the UtS project has been unable to conclude that pure Allis shad persists.³⁰⁴

6.235 As Dr Jennings observes, there will be wandering stray Allis shad that enter the Severn estuary.³⁰⁵ However, that does not amount to a viable spawning population of Allis shad. If no spawning population exists in the relevant rivers then clearly HPC cannot have a material adverse effect on such a population.

6.236 Dr Jennings fairly recognised that he had reached his conclusion of there being no breeding population on the balance of probabilities.³⁰⁶ There is no issue with this. In *Keir* (noted above at paragraph 6.70) the court held that the conclusion of NE

³⁰² CD5.3 p.126

³⁰³ CD6.13d p.61

³⁰⁴ CD6.9 p.34 para.5.17.5

³⁰⁵ Proof of Dr Simon Jennings CD6.12 at para. 4.136

³⁰⁶ Cross-examination of Dr Simon Jennings by the Agency, Day 6 of Inquiry,

that the presence of a barbastelle bat roost was unlikely was not problematic for the purposes of the Habitats Regulations³⁰⁷ and that decision makers can take into account matters of likelihood or unlikelihood in the context of those regulations.

Other species

6.237 The appellant's assessment has not simply limited itself to the seven species in issue between it and the Agency. Below, the alleged potential impact upon sturgeon, as raised by SEI, is addressed. Dr Jennings' proof addresses³⁰⁸ a number of other species which were raised by third parties. In terms of the number of individuals likely to be impinged, sprat is clearly the most abundant. In response to a question from the Inspector, Dr Jennings explained that the assessment demonstrated that the impact on sprat, and its role in the food web, was expected to be 0.1% (mitigated) and 0.5% unmitigated. He emphasised that food webs in the estuary are 'massively dynamic' and that he couldn't conceive that there would be a food web effect as a result of this rate of impingement.³⁰⁹

Other issues

The Case for SEI

6.238 The case for SEI narrowed considerably at the Inquiry. Their statement of case³¹⁰ raised a range of issues, a number of which were not supported by any evidence. The proof of evidence of Mr Colclough was directed in significant part to TR456, which he agreed in cross-examination had been superseded.³¹¹ Mr Colclough accepted that things had moved on since that paper was produced and therefore it wasn't a good use of Inquiry time to scrutinise that document.³¹² The issues which were pursued by SEI at the Inquiry, but not by the Agency, are: the alleged power as opposed to linear relationship between HPB and HPC, the potential impact of climate change and the potential impact of the cooling water abstraction on sturgeon.

6.239 The morning before Mr Colclough gave evidence³¹³, SEI introduced a study by *Bryhn et al* (2013) entitled 'Biomass and number of fish impinged at a nuclear power plant by the Baltic Sea'.³¹⁴ This paper was relied upon by SEI to demonstrate that rather than there being a linear relationship between water volume abstracted and number of fish impinged, it is instead a 'power relationship'. It is notable that page 3 of that report confirms '*[T]he removal of fish by power plants with once-through cooling systems has rarely exerted a demonstrable impact on surrounding fish stock sizes*'.

6.240 The Bryhn study looked at power plants in north west Europe and also in Taiwan and created a regression curve from the data collected from those plants. The clear

³⁰⁷ CD13.13 at paragraph 66 of judgment

³⁰⁸ CD6.12I 17.31 on

³⁰⁹ Dr Simon Jennings in response to question from the Inspector, Day 7 of Inquiry

³¹⁰ CD6.4

³¹¹ Cross-examination of Mr Steve Colclough, Day 5 of Inquiry,

³¹² Cross-examination of Mr Steve Colclough, Day 5 of Inquiry,

³¹³ On 15 June 2021

³¹⁴ CD9.121

issue with this study as articulated by Dr O'Donnell in evidence in chief is that there are a number of complicated factors which make up impingement calculations (that much is clear from the evidence for this Inquiry). He stated that it would be '*rather optimistic*' if impingement could be properly represented with one single dependent variable, i.e. mass flow rate.³¹⁵ In the appellant's view, that is clearly right. Mr Colclough stated that every power station is unique and accepted that we have no idea what the variables are which might have affected the data used by Bryhn et al. He accepted in cross-examination that it may be that for a particular plant there may have been a large increase in impingement simply because there was a big influx of fish. He further accepted that the approach has to be treated with a high degree of caution.³¹⁶

6.241 The Bryhn et al study, along with a number of others (including a paper by Henderson) was reviewed by the Agency as part of TB003, 'The relationship between number of fish impinged and abstraction volume for Power Stations cooling water intakes'.³¹⁷ That analysis concluded:

*'There is no single proposed formula for the variation of power station impingement with abstraction. Data from HPB does not show an increase in impingement with higher pumping rates. In the light of these conflicting indications, we intend to assume a linear variation in impingement with abstraction volume, as used in TR456 Ed2(Table 2). The available evidence does not contradict this approach, or suggest a more valid one'*³¹⁸

6.242 No party to the Inquiry has suggested that this analysis left out of account any valid study or evidence and Mr Colclough accepted that the Agency had considered the issue thoroughly.³¹⁹ It is clear therefore that the Bryhn et al study, and the evidence of SEI does not undermine the agreement of the Agency and the appellant that there is a linear relationship between abstraction volumes.

6.243 SEI has also raised the issue of the potential impact of climate change upon fish impingement by HPC. Mr Colclough accepted in cross-examination that the impacts of climate change were uncertain. He agreed that making any long term predictions is extremely difficult and accepted that climate change may lead to a range of different impacts. For example, higher temperature may have one effect and higher rainfall may have another.³²⁰ He accepted that climate change may have conflicting impacts on the same species.³²¹ It is notable that SEI has not indicated to the Inquiry how climate change should be factored into the assessment.

6.244 Finally, with regards to SEI's case, Dr Colclough alleged that the water extraction may impact upon sturgeon. The first point is that sturgeon is not a qualifying interest feature of any of the designated sites. Therefore, any potential impact upon sturgeon cannot have an adverse effect on the integrity on any designated site. Further, and in any event, the risk to sturgeon is clearly hypothetical as

³¹⁵ Examination-in-chief of Dr Manus O'Donnell, Day 5 of Inquiry,

³¹⁶ Cross-examination of Mr Steve Colclough, Day 5 of Inquiry,

³¹⁷ CD8.28

³¹⁸ CD8.28 p.10

³¹⁹ Cross examination of Mr Steve Colclough, Day 5 of Inquiry

³²⁰ All accepted in cross-examination of Mr Steve Colclough, Day 5 of Inquiry

³²¹ Response of Mr Steve Colclough to question from Inspector, Day 5 of Inquiry

opposed to real. Mr Colclough was clear that there has been no viable spawning population in the UK for around 500 years. He further accepted that there were 16 SACs in Europe which are designated for the protection of sturgeon and that none of them are in the UK. He accepted that it would be relevant for the Inquiry to consider the probability of a sturgeon finding itself in the proximity of the intake heads.³²² It can be noted that Counsel for SEI did not cross examine any appellants witness in relation to sturgeon.

6.245 A new point raised in only in SEI's closing refers to the demise of invertebrates species, but this matter is not made out in any party's case.

Water Framework Directive

6.246 Both the Agency³²³ and SEI³²⁴ have in various places in their documentation referred to the WFD. It appears to be the case that neither party now alleges any breach of the WFD, which is independent of the alleged impacts upon the designated sites. In cross-examination, Mr Colclough accepted that he wasn't presenting any evidence in relation to non-compliance with the WFD³²⁵. However, he stated that if a fish species were lost from the freshwater or transitional water bodies upstream that may cause a '*failure for [the] WFD in terms of its classification status*'. He confirmed that SEI wasn't mounting any separate argument under the WFD to that which is realised under the Habitats Regulations.

6.247 Despite this confirmation from SEI's sole witness, counsel for SEI did seek to cross examine Mr Goodwin on the basis that there might be an issue with regards to water quality. This was surprising. The allegation appeared to be that the entrainment of phytoplankton might lead to an issue. First, it is abundantly clear that phytoplankton do not hear and so the removal of the AFD would make absolutely no difference to water quality as a result of their entrainment.³²⁶ Second, and in any event, any such impacts have been assessed as part of the HPC WFD Assessment (16 October 2020).³²⁷ This concluded:

'In light of the variation to the DCO and the submission of new information and updated predictions of impact, a new screening assessment was made following the Agency's Clearing the Waters for All guidance, to assess how the changes to the proposed design of HPC (i.e. the absence of mitigation via an AFD system) would affect compliance with WFD. It was considered that intake of water into the CWS had the potential to impact on fish and invertebrate assemblages in the vicinity of HPC. In addition, local ecological receptors and water quality parameters had the potential to be impacted as a result of the discharge of material from the fish return and release (FRR) system. For both activities, it was considered that there was potential for impacts on the designated and qualifying features of protected areas.

³²² All accepted in cross-examination of Mr Steve Colclough, Day 5 of Inquiry

³²³ CD 6.5

³²⁴ CD 6.4

³²⁵ Cross-examination of Mr Steve Colclough, Day 5 of Inquiry

³²⁶ Confirmed by Mr Tim Goodwin in re-examination, Day 7 of Inquiry,

³²⁷ CD 8.32

*Assessment of these impacts concluded that there was minimal risk of these activities of compliance with WFD.*³²⁸

6.248 The position of the Agency appears to be that the Habitats Regulations and WFD are interlinked. The SoCG³²⁹ states:

'2.4 The Environment Agency confirms that it has no objection to the variation of the permit aside from its concerns under the Conservation of Habitats and Species Regulations 2017 (and under the Water Environment (Water Framework Directive) Regulations 2017 insofar as they apply to European sites as protected areas). If the Secretary of State is satisfied that the proposal would not adversely affect the integrity of the European sites then the permit variation should be granted.

2.5 For clarification, the Environment Agency's view is that the WFD imports the requirements of the Habitats Directive. The Agency's view is that the Water Framework Directive specifies that areas requiring special protection under other EU Directives (such as the Habitats Directive) are identified as protected areas for the purposes of Article 4.1(c). The Agency's view is that achieving the objectives of SACs is a requirement of WFD because they are Protected Areas for purposes of WFD. As such, the Agency will submit that if there is a breach of the Habitats Directive then there will also be a breach of the WFD.

2.6 However, the Environment Agency raises no separate issue under the WFD. In particular, the Agency does not allege a breach of the WFD water body status and it does not argue, for example, that matters arising from the discharge of moribund biomass will breach the WFD.'

6.249 The appellant does not agree that if there is an impact upon the integrity of a European Site then there will necessarily be a breach of the WFD. However, given no party raises the issue independently of the Habitats Regulations it would not be proportionate to address the legal interrelationship in detail given that it will, in reality, be immaterial to the decision.

Draft South West Marine Plan (SWMP)

6.250 Despite presenting no evidence supporting, or even alleging a breach of the Draft SWMP, now adopted, SEI sought to put the document into the CDs after the evidence had been heard at the Inquiry and indicated that it continued to rely upon it in relation to this appeal. The lack of any evidence on this point calls into question the weight that can be given to any submissions which are made by SEI in relation to this. However, for completeness the matter is addressed here. There is no dispute that relevant policies of the draft plan can be material considerations, the weight to be placed on them being a matter for the decision maker.

6.251 Mr Goodwin's evidence confirmed that he had considered the Draft SWMP and found that the application did not breach it. The policies which SEI relied upon in its SoC are addressed below.

³²⁸ CD 8.32 p.36

³²⁹ CD 6.5 p.2

6.252 Marine Policy SW-MPA-2 states:

'Proposals that may have adverse impacts on an individual marine protected area's ability to adapt to the effects of climate change and so reduce the resilience of the marine protected area network, must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate adverse impacts'

6.253 There is no evidence whatsoever that the proposal may have an adverse impact on the marine protected area's ability to adapt to the effects of climate change and therefore there is no breach of this policy. Indeed the proposal for a new nuclear power station is to a large extent predicated on provision of a secure supply of zero carbon energy, thereby contributing to securing a reduction in greenhouse gas emissions.

6.254 Marine Policy SW-NG-1 states:

'Proposals should deliver environmental net gain for marine or coastal natural capital assets and services. Proposals that may have significant adverse impacts on marine and coastal natural capital assets and services must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate d) compensate for significant adverse impacts and deliver environmental net gain.'

6.255 The benefits of HPC at a national scale in terms of the environment (both terrestrial and marine) in providing a long term and stable zero carbon source of energy and thereby assisting the UK in meeting its greenhouse gas reduction targets are undeniable. In considering this draft policy's reference to "environmental net gain" it needs to be kept in mind that this appeal is concerned not with a new proposal or project, but with the variation of conditions of an already permitted project. Further, the proposed variation will not have 'significant adverse impacts on marine and coastal natural capital assets and services'. As such, there is no breach of this policy.

6.256 Marine Policy SW-BIO-2 states:

'Proposals that may cause significant adverse impacts on native species or habitat adaptation or connectivity, or native species migration must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate significant adverse impacts d) compensate for significant adverse impacts'

6.257 Again, the proposal will not cause significant adverse impacts on native species or habitat adaptation or connectivity or native species migration. As such, there is no breach of this policy.

Overall Assessment on the Integrity of the Designated sites

6.258 The appellant, through the evidence of Tim Goodwin, was the only party to the Inquiry who sought to apply the predicted impacts upon fish populations to the test in Regulation 63 of the Habitats Regulations and to assess in a rigorous manner whether the impacts would result in an adverse effect on the significance of any European Site.

6.259 Taking all of the above into account, the appellant argues that the Secretary of State can be confident beyond reasonable scientific doubt that the permit variation to remove the AFD would not have an adverse effect upon the Severn Estuary SAC, the Wye SAC, the Usk SAC and the Ramsar site.

Severn Estuary SAC

6.260 The relevant qualifying features for the Severn SAC are the Twaite shad, and the Atlantic salmon. The evidence of Dr Jennings demonstrates that whether on the basis of his estimates or that of the Agency's there would be no material adverse impact on the Atlantic salmon or Twaite shad population within the SAC as such, there is no significant adverse effect on either population and none of the conservation objectives are undermined. As such, the appellant's position is that the Secretary of State can be certain beyond reasonable scientific doubt that there will be no adverse effect upon the integrity of the Severn Estuary SAC.

6.261 If the Secretary of State takes the view that the assemblage is relevant to the assessment then, similarly, the assessment of Dr Jennings demonstrates that none of the populations of four species in issue would be materially impacted over the lifetime of the proposal. As such the appellant's position is that the Secretary of State can be certain beyond reasonable scientific doubt that there will be no adverse effect upon the integrity of the Severn Estuary SAC.

Wye SAC

6.262 The qualifying features for this site include the Twaite shad, the Allis shad and the Atlantic salmon. The evidence of Dr Jennings demonstrates that whether on the basis of his estimates or that of the Agency's there would be no material adverse impact on the Atlantic salmon or Twaite shad population within the SAC as such, there is no significant adverse effect on either population and none of the conservation objectives are undermined. Further, there is no evidence of a viable spawning population of Allis shad. As such, the appellant's position is that the Secretary of State can be certain beyond reasonable scientific doubt that there will be no adverse effect upon the integrity of the River Wye SAC.

Usk SAC

6.263 The qualifying features for this site include the Twaite shad, the Atlantic salmon and the Allis shad. The evidence of Dr Jennings demonstrates that whether on the basis of his estimates or that of the Agency's there would be no material adverse impact on the Atlantic salmon or Twaite shad population within the SAC as such, there is no significant adverse effect on either population and none of the conservation objectives are undermined. Further, there is no evidence of a viable spawning population of Allis shad. As such, the appellant's position is that the Secretary of State can be certain beyond reasonable scientific doubt that there will be no adverse effect upon the integrity of the River Usk SAC.

Severn Estuary Ramsar Site

6.264 As set out above, the Ramsar site has not been designated for its fish populations under Criterion 7. The relevant criterion for selection, Criterion 8, is concerned not with fish populations but with the ecological functions of the wetland. Criterion 4

recognises the importance of the site for the run of migratory fish. As such, its integrity cannot be adversely affected through an impact upon fish populations in itself. However, if the Secretary of State did treat the assemblage (together with Atlantic salmon) as qualifying features then there would, in any event, be no adverse effect upon integrity. The evidence of Dr Jennings demonstrates that there will be no material adverse impact on the populations of those species. As such, the appellant's position is that the integrity of the site cannot and will not be adversely affected.

Conclusion

- 6.265 In conclusion, the appellant has advanced the proposed variation for reasons of safety, which have been thoroughly tested by the appellant with the help of experts, and which are not contested by the Agency. The only reason for refusing the application for variation would be the inability to conclude that, without the AFD, operation of the cooling water system would not have an adverse effect on the integrity of the relevant sites. The appellant accepts that this needs to be determined to a high standard of certainty, and that it is relevant that HPC will operate for 60 years during which period it will require a continuous cooling water supply. However, the appellant submits that the approach of Cefas in assessing the effect of the intakes on populations of the relevant fish species provides a clear and robust assessment of predicted effects and their consequences, using conservative and precautionary assumptions in an appropriate manner, and providing a basis for appropriate assessment beyond reasonable scientific doubt and based on the best available evidence, scientific knowledge, and expert interpretation.
- 6.266 Further, the evidence of Mr Tim Goodwin has applied that assessment in a rigorous manner to the legal and policy framework for AA. His evidence has highlighted the vital importance keeping centrally in mind the test of integrity, of identifying clearly the relevant qualifying features and conservation objectives for the SACs, and distinguishing these from policy guidance. The same applies to the legal criteria for identifying the Ramsar site as being of international importance as a wetland. He has also clarified the correct approach to uncertainty and application of the precautionary principle.
- 6.267 By contrast, unfortunately, the appellant considers that the Agency and the SNCB as consultees, have failed to take this principled approach and have fallen into error as a result. They have relied on hypothetical and unreal assumed risks, and have overplayed the uncertainties inherent in any new project.
- 6.268 It is also relevant for the Secretary of State to have in mind that HPB has operated for decades, generating 37 years of data on impingement and that (as was clearly recognised by both the Agency and Secretary of State at the stage of the DCO) it has not led to adverse impacts on fish populations. The LVSE intakes at HPC, even without an AFD, will, as a result of the pelagic cap, give rise to a lower impact on the three qualifying species of Atlantic salmon, Twaite shad and Allis shad (as well as Atlantic herring) which is a powerful factor giving confidence that there will not be an adverse effect on integrity.
- 6.269 As indicated in opening submissions, the appellant would much have preferred to install an AFD, had safety concerns not precluded this. It is however completely satisfied that without the AFD, the intakes for cooling water will not adversely affect

the integrity of the SACs and Ramsar site. It believes that the evidence presented to this Inquiry has enabled the Secretary of State to reach the same conclusion to the very high standards of certainty which the law requires, and on that basis respectfully asks that this appeal against deemed refusal be allowed.

7. THE CASE FOR THE ENVIRONMENT AGENCY

7.1 The full submission made by the Agency can be found at CD 6.27; the material points are as follows:

Introduction

7.2 HPC will abstract huge volumes of water continuously for its lifespan of 60+ years. In doing so, it will impinge and entrain many fish. When he granted the DCO, the Secretary of State considered it necessary to impose conditions requiring the appellant to provide an AFD. An AFD is designed to create an auditory behavioural cue to deter fish from swimming close to the intake and thereby reduce the risk of impingement. The Agency considers the AFD to be an essential piece of mitigation; in fact the AFD is the most important piece of mitigation for hearing species which make up the majority of the biomass in most seasons.

7.3 The focus of this appeal is the environmental consequence of constructing HPC without an AFD. It is common ground that the appellant's permit variation application may only be granted if the Secretary of State is certain that the project without an AFD 'will not adversely affect the integrity of' any designated sites: Regulation 63(5) of the Habitats Regulations.

7.4 The Agency has set out its submissions on the meaning of "integrity" in Opening. Additional key points to note are that:

- In cross-examination Mr Goodwin agreed with the proposition that "*taking each qualifying feature in turn, if the conservation objectives for a feature will be undermined, site integrity is necessarily affected*";
- Recent Defra guidance³³⁰ lists relevant factors to consider when applying the integrity test. In particular, it is highly relevant to consider the current conservation status of the site's designated features that might be affected by the proposal³³¹;
- The guidance emphasises the need to consider "*each potential effect... and how they might impact on the site's conservation objectives*" reaffirming the correctness of the Agency's legal submission on the role of the conservation objectives in the integrity test³³²; and
- The guidance confirms the need to consider the "*extent, timing, duration, reversibility and likelihood of potential effects*"³³³. In that regard, it is pertinent that this is a large scale infrastructure project with a 60+ year lifespan whose effects are not easily reversed.

7.5 It must be emphasised that the appellant has not argued, let alone demonstrated, that the AFD would not provide effective mitigation. Rather, the appellant says the

³³⁰ CD 12.1, p14 'how to assess effects on site integrity'

³³¹ Ibid, 1st bullet point.

³³² Ibid, 2nd bullet point.

³³³ Ibid, 3rd bullet point.

AFD would be difficult to install and maintain. As Dr Jennings agreed, the real question for the Secretary of State is what is the consequence of constructing HPC without an AFD?

- 7.6 The Agency, in agreement with NE and NRW considers that it is not possible to be certain that the project minus an AFD will not adversely affect the integrity of the Severn Estuary SAC, the Severn Estuary Ramsar site, the River Wye SAC and the River Usk SAC. This is due to the effect on seven species of concern, namely: Twaite shad, Allis shad, Atlantic salmon, Atlantic cod, European sea bass, Atlantic herring and whiting³³⁴.
- 7.7 That does not mean that HPC cannot proceed. The lawful way to reconcile the requirements of health and safety, the public benefits of the project and the need for environmental protection, is to use the derogation procedure specifically provided for in the Habitats Regulations. This would ensure that adequate compensatory measures are provided for the environmental harm that the project will cause. If the Secretary of State agrees with the Agency, mindful of the appellant's proposed construction timetable³³⁵, it is open to the Secretary of State to issue a "minded to refuse" letter and to allow the appellant to advance a case for a derogation without the need for a fresh variation application.

Uncertainty and qualitative considerations

- 7.8 It should be recognised at the outset that both parties agree that there is uncertainty within the derivation of many of the parameters used within the quantitative assessment of impacts, and that *"where appropriate and quantitatively predicted, the effects of these uncertainties should be considered in the analysis"*.³³⁶
- 7.9 Uncertainty in and of itself is not a reason for refusal. Indeed, the Agency has been able to conclude that the project would not adversely affect the integrity of the designated sites in relation to many species (109 out of 117). Nevertheless, it is fundamental to the overall judgment, and the degree of precaution applied, that there remains considerable unquantifiable uncertainty about the likely entrapment impacts of HPC.
- 7.10 Firstly, there are significant uncertainties arising from the use of the RIMP and CIMP data sets to predict impingement losses associated with HPC. In terms of the RIMP, this involved³³⁷:
- 6 hours of continuous sampling, from 2 out of 4 drum screens, on one day each month;

³³⁴ It is common ground that this Inquiry does not need to consider European eel (CD 6.5 SoCG, para 4.2). The Agency's AA concluded that an adverse effect on the integrity of the protected sites could not be ruled out in relation to impacts on eel. That issue will be addressed if necessary through other regulatory processes.

³³⁵ CD6.11 Dr O'Donnell says that retrofitting an AFD would have to be done by the end of 2021 and that if NNB lost this appeal it is his view that NNB "would need to seek alternative legal routes e.g. derogation": O'Donnell's proof, para 8.17.

³³⁶ CD6.5 SoCG, para 4.24.

³³⁷ CD1.11, p39, para 4.1.

- Samples were collected during daylight on the ebb tide³³⁸;
- That resulted in 72 hours of sampling from 2 pumps per annum;
- Thus, the sampling equates to only 0.41% of HPB’s full abstraction volume over a year³³⁹.

7.11 Dr Masters explained that such infrequent sampling is likely to underestimate the effect of HPC on e.g. Atlantic salmon because salmon smolts migrate seasonally and in pulses, often at night. Migration may peak at particular points of the season in response to environmental conditions, and consequently there is every chance that the once monthly six hour daytime sample will not accurately represent the position. Plainly the RIMP was not designed to sample for salmon and Dr Masters rightly likened it to the RSPB Big Garden Birdwatch being conducted by asking one street to look at half of their garden at night for only a few minutes in order to estimate the bird population in a town.

7.12 The appellant has also recognised this significant limitation of the RIMP data set. TR456 stated that³⁴⁰:

"The sampling frequency at 6 hours per month means that the RIMP survey under samples changes that happen over short periods of time e.g. the waves of sprat migration into and out of the Bristol Channel in November-January".

7.13 That logic, the Agency argues, applies with equal, if not greater force, in relation to Atlantic salmon.

7.14 Stepping back, it is also significant that the appellant commissioned the CIMP specifically because the RIMP was not a high enough resolution data set³⁴¹:

"Whilst the RIMP programme has provided a useful dataset for interannual trend analysis, the CIMP survey was designed to provide an unbiased, high resolution dataset which would enable the seasonal fish community to be analysed in detail even for rare species".

7.15 In terms of the CIMP survey undertaken over a 14-month period between 2009 and 2010, this involved³⁴²:

- Forty x 24 hour samples in a year;
- Sampling occurred 10 times each quarter;
- The sampling consisted of an 18 hour bulk sample, and six x 1 hour samples sorted independently;

³³⁸ NB the Appellant proposed an ebb tide bias in TR456 (CD 1.11), but it is agreed that there is no evidence to support an ebb tide bias when estimating impingement: see CD 6.5 SoCG, para 4.12.

³³⁹ C6.10 Dr Masters’ proof (salmon) para 6.2.4.

³⁴⁰ CD1.11, p40.

³⁴¹ CD1.11 (TR456), p44, para 4.2.

³⁴² CD7.1, pp3-4.

- 7 of the 18hr bulk samples were not carried out due to a crane malfunction or miscommunication between station staff, and so the data from the 6 hourly samples acquired on those dates was extrapolated to create a 24 hour sample figure; and
- The sampling equates to less than 11% of the volume of water abstracted by HPB in a year.

7.16 The CIMP is now 11 years old and (save for continuing the RIMP until 2017) the appellant has not collected any more recent, or higher resolution, data to inform this AA. That is particularly significant given the next major uncertainty.

7.17 Secondly, the HPB and HPC intakes are in different locations and it is necessary to make assumptions about the fish communities near each intake. As the Agency's AA explained³⁴³:

"A key assumption in using the HPB information is that the HPC will entrain similar numbers of fish to HPB by volume of cooling water abstracted. This is actually unknown where there have been no site specific HPC surveys conducted."

7.18 The Agency, SEI and other third parties have argued that more adults of some species might be present near the HPC intake, whereas Dr Jennings argues that fish using selective tidal transport are unlikely to encounter the HPC intake. Dr Jennings agreed that this is a known unknown and that opponents of the appeal were not merely speculating, but rather relying on scientific/ecological reasons why the fish population at HPC might differ from that at HPB³⁴⁴. In other words, there is reasonable scientific doubt about this issue.

7.19 This is not a case where opponents are relying on hypothetical risks. There is a clear and obvious issue on which the scientists reasonably differ. But we must not forget that the only reason there is scientific doubt is because the appellant has refused to commission any surveys or monitoring to resolve the doubt. In particular:

- Cefas have been advising the appellant since before the original DCO application, Cefas has experts in fish tagging and monitoring, and yet the appellant has never instructed Cefas to undertake any tagging or other studies to discover what type of fish use the area around the HPC intake, or how and when fish use that area;
- The appellant has even declined to support relevant investigations proposed by others. Mr Crundwell explained that Cefas lent the UtS Project 11 acoustic receivers in 2018 to help ground truth a Bristol Array of receivers, but subsequently Cefas took them back and deployed them in the north of England. He also explained that the appellant refused to allow a receiver to be positioned near the proposed HPC intake location. Dr Jennings' suggestion that this was due to jetty construction was no answer because he agreed

³⁴³ CD 4.1, p24. There was a beam trawl survey, but this was flawed because a beam trawl is only a few feet off the seabed and not sampling the section of the water column that HPC will draw from.

³⁴⁴ As set out below, in the case of shad there is new empirical data that supports the EA's position.

that acoustic receivers are small pieces of equipment that are commonly attached to buoys. Indeed, Dr O'Donnell said he wasn't aware of any engineering reason why an acoustic receiver could not have been deployed at the site of the HPC intake;

- The provision of RIMP survey data ended in 2017 despite Dr O'Donnell explaining that the design optioneering for the AFD had concluded in 2017 that it was not feasible to install and maintain an AFD. It is remarkable that the RIMP study should cease shortly before this variation application was made.

7.20 The fact is there is no good reason why monitoring studies could not have been carried out to support this application. That would have provided the best scientific evidence to replace a very important, and yet unproven, assumption. The legal relevance of this is as follows: although there is no legal burden of proof in an AA, the default position is that an application should be refused unless there is sufficient information to convince the competent authority that it would not have an adverse effect on the integrity of the designated sites. It is therefore in an applicant's interest to ensure that the competent authority has sufficient information to be able to reach the required level of certainty. As Peter Jackson LJ held in *R (Mynydd y Gwynt Ltd) v Secretary of State for Business, Energy and Industrial Strategy* [2018] P.T.S.R. 1274³⁴⁵:

31. I agree that the use of the expression "burden of proof" in this context is not helpful. The task of the decision-maker is to make an assessment on the basis of all the available information, applying the appropriate legal test. In the present case, there was a default position by virtue of regulation 61(5). But that is not the same thing as a legal burden of proof weighing upon one party to the process. It means no more than that it is in the interests of the applicant, who will self-evidently want the application to succeed, to provide the information necessary to enable a favourable decision to be made. It is clear that the judge did not mislead himself in this respect, because he described the "burden of proof" upon the applicant in this way: "In effect, the burden upon him is to ensure that the competent authority is provided with sufficient information to convince the authority."

7.21 The Agency submits that the appellant has failed to provide sufficient information to convince the Secretary of State that HPC without an AFD would not adversely affect the integrity of the designated sites. The appellant's complaints about the Agency and SNCBs being too precautionary should not be allowed to distract from the fundamental problem in this case: there is great uncertainty in the data sets, the appellant is forced to rely on assumptions in relation to key issues, and all because it has not taken the many opportunities available to carry out monitoring and sampling to resolve the obvious uncertainties. It is quite wrong for the appellant to portray the Agency as having been hyper-cautious in its assessment. The Agency has merely refused to assume or wish away the obvious uncertainties that the appellant has failed to resolve.

7.22 Thirdly, the project is a novel design and there are no data from similar infrastructure operating in the real world, so predictions are based on theoretical

³⁴⁵ CD13.22

modelling. In and of itself that is not uncommon, but the point is that it particularly compounds the other uncertainties. The data sets give rise to considerable uncertainty, an unproven assumption is relied on about the quantities and life-stages of fish near the HPC intake which is the foundation of the whole QIA process, and yet there is no working, real world, comparator which could be used to give reassurance that the QIA predictions are realistic.

- 7.23 Fourthly, the project will have a continuous effect for 60 years in circumstances where there are no adaptive management options to respond to changes in environmental circumstances because continuous water abstraction is required for nuclear safety reasons. It is submitted that this ought to affect the Secretary of State's approach to uncertainty and risk. It is one thing to consent a short term project which can be amended or halted if initial ecological predictions prove to be incorrect, but it is quite another to give the green light to a 60 year impact on 4 designated sites which cannot easily be reduced if predictions based on data deficiency and assumptions prove to be an underestimate.
- 7.24 Finally, it should be noted that the Agency has used the best scientific methods available in order to try to account for these uncertainties. Dr Edwards explained that the Agency's formal uncertainty analysis was a more scientifically robust method of accounting for the recognised uncertainties than the appellant's approach of making so-called "*conservative*" assumptions, many of which (as set out below) the Agency disagrees are in fact conservative³⁴⁶.
- 7.25 Dr Edwards explained that the Agency had not, contrary to Dr Jennings' suggestion, assumed that an extreme upper value of annual percentage loss to entrapment calculated for one year will be repeated in all other years³⁴⁷. Instead, the uncertainty analysis has simply been used to reflect the level of quantifiable uncertainty within the QIA. Together with the qualitative analysis, the uncertainty analysis, it informed the overall judgment about whether it was possible to conclude beyond reasonable scientific doubt that there would not be an adverse effect on the integrity of the designated sites.
- 7.26 Nevertheless, it is important to appreciate that the uncertainty analysis is still based upon the CIMP data and the assumption that the difference in HPC location does not affect the likely nature and scale of impingement losses. If the CIMP data is not representative of circumstances at the HPC intake then the actual impact will differ from the prediction and may well be outside the range of possible values in the uncertainty analysis. In other words, there is no guarantee that the uncertainty analysis represents the maximum possible impact.

LVSE intake factor

Introduction

- 7.27 Before dealing with the areas of dispute, the position in relation to the LVSE intake factor, which also forms part of the QIA, needs to be addressed.

³⁴⁶ CD6.15 Edwards' rebuttal, section 2.1.

³⁴⁷ CD6.12 Jennings' proof, paras 6.64 to 6.81, and Edwards rebuttal, section 2.2.

- 7.28 The QIA process begins by estimating the number of fish likely to be impinged at HPB and then scaling that up to account for the much greater volume of water that HPC will abstract. The parties agree that the correct number to scale by is close to 4.³⁴⁸
- 7.29 Next, the parties agree it is necessary to apply certain intake design factors to account for the different intake design at HPC. There are two factors: the pelagic cap factor (which represents the benefit of the HPC capped intake that reduces entrapment by vertical currents); and the intake intercept area factor (which accounts for the performance of the low velocity side intake design).
- 7.30 The appellant has agreed the Agency's calculation of the pelagic cap factors for the species of concern³⁴⁹. In the case of pelagic species (which will be protected by the capped intake from entrapment by vertical currents) the factor is 0.23 (range 0.18-0.28) which has the effect of reducing predicted entrapment to around a quarter of what it otherwise would have been. The Agency thereby gives considerable credit for the performance of the capped intake. Indeed, the Agency's pelagic cap factor gives a greater benefit to the capped intake which again indicates that the Agency has not been overly precautionary in its assessment.

The agreed intake intercept area factor of 1.0 is not conservative as the Appellant claims

- 7.31 The parties disagreed about the intake intercept area factor. The intake intercept area factor represents the interaction of the HPC intake with the tidal stream relative to the HPB intake i.e. it is a ratio of the cross-section/effective area that each of the intakes presents to the tide.
- 7.32 In the absence of agreement, the appellant proposed a factor of 1.0 i.e. no effect, which it argues is "conservative". The Agency had proposed a factor of 1.394, but having considered the calculation error identified by the appellant, and the additional data/information provided, it now accepts that it is appropriate to use a factor of 1.0³⁵⁰.
- 7.33 The remaining issue is whether the intake intercept area factor of 1.0 is "conservative" as the appellant claims. By claiming that the factor of 1.0 is "conservative" what the appellant means is that the Secretary of State can be certain that the intake intercept area is less than 1.0.
- 7.34 The Agency contends that the factor of 1.0 has not been proven to be "conservative" and that use of a factor of 1.0 should not be regarded as a precautionary assumption.
- 7.35 The starting point is that the LVSE intakes proposed for HPC are the first of this kind to be constructed anywhere in the world³⁵¹. Consequently, because of the novel design of the LVSE intakes, there are no empirical data to confirm how the

³⁴⁸ SoCG (CD 6.5) paragraph 3.11.

³⁴⁹ See table 1 at p.8 of the SoCG (CD 6.5).

³⁵⁰ CD 6.6c.

³⁵¹ CD6.11 O'Donnell's proof, para 5.6.

intakes actually perform in the real world. The predicted performance of the intakes therefore relies upon theoretical modelling.

7.36 The appellant's argument that a factor of 1.0 is "conservative" is based upon Dr O'Donnell's analysis of the geometric area that is presented to the tide.³⁵² Briefly, Dr O'Donnell argues that there is a 'streamline corridor' either side of each LVSE head and that the 'geometric area' extends out 2m from the intake face because that is the 'zone of influence' of the intake heads. The total 'geometric projected area' for HPC is 32m² i.e. 2m (assumed zone of influence each intake face) x 2m (height of each intake face) x 2 (sides to each intake head) x 4 (number of intake heads). The effective area of HPB is agreed to be 54.8m² and so using the effective area for HPC of 32m² Dr O'Donnell calculates the ratio of HPB:HPC effective area to be 0.6.

7.37 The validity of that calculation crucially depends upon the 2m 'zone of influence' being correct. It is therefore important to be clear where that figure comes from and how and why it was produced. Dr O'Donnell explains that the 2m distance represents an area "beyond which there is no horizontal draw into the heads".³⁵³ He further explains that the 2m distance is "based upon interpretation of the CFD modelling and experimental validation work of the LVSE intake carried out by HR Wallingford, specifically the 2m draw"³⁵⁴. In cross-examination he confirmed that the only modelling work he relied on was the 2013 HR Wallingford document,³⁵⁵ and modelling relating to Sizewell C in SPP105.³⁵⁶ It is therefore necessary to scrutinize whether that modelling demonstrates that the LVSE intakes certainly have no effect on fish beyond 2m.

7.38 The HR Wallingford report was concerned solely with 'Task 1' that EDF had commissioned i.e. it described the results and conclusions of the physical model investigation carried out to assess flows at the intake heads.³⁵⁷ Importantly, the report pre-dated the design optioneering for the AFD (which took place from 2014-2017) and so HR Wallingford were clearly proceeding on the basis that an AFD would be installed. Indeed, they made recommendations about the final selection of the system for mounting the AFD.³⁵⁸ It was not part of HR Wallingford's brief to examine how the LVSE intakes would affect fish, especially not how they would affect fish in the absence of an AFD.

7.39 In terms of the physical modelling work undertaken by HR Wallingford, it is relevant to note that:

- They built a model at a scale of 1:25.3 which meant that the 35.5m real life intake was about 1.4m long in the model.³⁵⁹ At that scale, a distance of 2m would be 79mm;

³⁵² See CD6.11d, figure 1.

³⁵³ CD6.11d, para 8(b).

³⁵⁴ CD6.11d, para 10.

³⁵⁵ CD1.13.

³⁵⁶ CD7.15.

³⁵⁷ CD1.13, p7.

³⁵⁸ CD1.13, p52, section 13.

³⁵⁹ CD1.13, p16, section 8.1.

- They observed “*flow patterns approaching and passing inside the intake head*” and their visual observation was “*aided using injected dye tracker*”;³⁶⁰
- The “*example observed flow patterns*” were illustrated in Figures 10.1-10.8, and Figures 10.1, 10.3 and 10.5 show “*distance to undisturbed flow approximately 2m*”;³⁶¹ and
- They said that “*the typical distance from the intake entrance to the “undisturbed” ambient flow stream was estimated at approximately 2m*”.³⁶²

7.40 Accordingly, the figure of 2m was an estimate (not a measurement), it was based on visual observations of dye movement at a scale of 1:25.3, and it was obtained when carrying out ‘*Task 1*’ which was not concerned with measuring the affected distance for fish from the intake head, or assessing the effect of the LVSE heads minus an AFD. Based on the physical model report, it is impossible to conclude beyond reasonable scientific doubt that the LVSE heads would not have any effect on fish beyond 2m.

7.41 Section 11 of the HR Wallingford report also compared the results of the physical model to flow distributions and velocity magnitudes predicted by the CFD model. That section looked at the inward velocities very close to the entrance opening screens in order to ascertain whether they remained below the 0.3m/s target.³⁶³ Dr O’Donnell relies on figure 11.3,³⁶⁴ but that does not show the LVSE heads have no effect at all beyond 2m. Instead:

- The top image of the figure shows an intake head sliced in half lengthways. The width of the intake in the image is 5m (i.e. half of the full width of 10m);
- The tide is moving left to right and the arrows or vectors show the direction and magnitude of the flow;
- Where the arrows are horizontal and aligned to the intake heads they are showing an undisturbed flow;
- There is no Y-axis to measure distance from the intake heads, but using the 5m width of the intake as a guide, it is clear that the flow is disturbed up to around 5m from the intake face.

7.42 It is unsurprising that there is no Y-axis to measure distance from the intake heads because HR Wallingford were not assessing the affected distance/zone of influence of the intake heads. Instead, they were focused solely on the inward velocities very close to the entrance opening screens. In cross-examination Dr O’Donnell said that the CFD modelling showed that inward velocities dropped off considerably only a short distance from the intake face, but that does not answer to point. The fact is that the CFD modelling shows the intakes have an effect on flows beyond 2m and yet nobody has ever investigated whether, and if so how, that could affect fish. In

³⁶⁰ CD1.13, p19, section 8.3. See e.g. photograph B18 on p80.

³⁶¹ CD 1.13, pp21, 23 and 25.

³⁶² CD 1.13 p34, section 10.1.2.

³⁶³ See CD 1.13, section 11.1

³⁶⁴ Reproduced as his Figure 10 to his proof and again as figure 2 to his note at CD 6.11d.

those circumstances, it is not possible to conclude beyond reasonable scientific doubt that the zone of influence of the intake heads is no greater than 2m.

7.43 The Sizewell C modelling in SPP105 confirms that the intake heads do have an effect beyond 2m.³⁶⁵ Figure 2 of that document shows the variation in inward velocity with distance from the LVSE intake surfaces at different tidal current speeds.³⁶⁶ At all tidal current speeds the intakes are predicted to create an inward velocity at least up to 5m away. Again, it is beside the point simply to say that the inward velocity is predicted to be small because crucially the appellant has never sought to understand what effect such small inward velocities might have on the fish species that are likely to encounter the intake head, which in many cases will be small themselves.

7.44 Against that background, it is clear that the appellant's argument that a factor of 1.0 is "conservative" is not based on the best scientific evidence. Instead, it is merely based on a 'zone of influence' of 2m which is assumed to represent the distance beyond which the intakes do not affect fish. Such an assumption is unwarranted given that the modelling shows the intakes create inward velocities up to 5m away and given that nobody has ever carried out any assessment of how small inward velocities affect fish.

7.45 It should be emphasised that the Agency is not merely speculating about risk here. Until this variation application, the appellant itself was absolutely crystal clear that LVSE intake heads needed to be combined with an AFD in order to be effective. In TR148, written in 2011 in support of the original permit determination, Cefas said:³⁶⁷

"because of the usual high water turbidity at Hinkley Point and the consequent absence of visual clues, any mitigating effect of the low-velocity intake is only likely to be realised if it is combined with some form of artificial stimulus (e.g. an acoustic fish deterrent) to induce fish to swim away from the intake structure. Equally however, an acoustic fish deterrent is unlikely to be fully effective on its own if the intake velocity exceeds the swimming capabilities of the fish. For these reasons low-velocity intake and AFD need to be considered as a combined mitigation measure"

7.46 In 2015, after the 2013 HR Wallingford report, the appellant still maintained that LVSE heads needed an AFD to be effective:³⁶⁸

"The target intake velocity of 0.3m/s was chosen in order to minimise the possibility for fish to be sucked into the intake heads as it is a speed that most fish can escape. However, the use of a low intake velocity is only effective if fish can detect it and consequently swim away from it. Therefore it is generally recommended to use some form of fish deterrent such as an AFD or a Louvre screen"

³⁶⁵ CD 7.15.

³⁶⁶ CD 7.15, p17

³⁶⁷ CD 7.2, p19, section 3.1.

³⁶⁸ CD 9.46, p42, section 5.1.9.

- 7.47 The need for an artificial stimulus to deter fish from the intake heads is unsurprising given that this part of the Bristol Channel is agreed to have near zero visibility sub-surface due to the heavy sediment load.³⁶⁹
- 7.48 Now by contrast, in suggesting that the intake intercept area factor is 0.6 (based on an HPC effective area of 32m²) the appellant is saying that an LVSE intake without an AFD will be effective on its own in reducing entrapment by 40% compared to HPB. Yet since the appellant made the clear statements quoted above, it has not undertaken any investigation or study to test whether LVSE intakes will be effective without an AFD, nor has it sought to understand how the inward velocities revealed by modelling undertaken for other purposes will actually affect fish. Nor has the appellant undertaken any work to ascertain the extent to which the LVSE intake heads might actually attract fish in the manner of an artificial reef, which is a relevant risk identified in the scientific literature and raised by Mr Waugh, Mr Colclough and a number of third parties.³⁷⁰
- 7.49 The appellant's own documents themselves underscore that there is reasonable scientific doubt and that the Secretary of State cannot be certain that an intake intercept area factor of 1.0 is "*conservative*". There is therefore no proper basis for concluding that using a factor of 1.0 overestimates the predicted impact of HPC.

Equivalent Adult Values (EAVs)

- 7.50 Because many fish species produce large numbers of offspring, mortality of larval and juvenile fish will not have the same effect on a population as removing the same number of adults would, due to the fact that many of the larvae and juveniles would never have survived to contribute to the spawning population. Consequently, the parties agree that it is appropriate to express numbers of impinged fish in terms of an equivalent number of adults, in order to contextualise the losses of fish of all ages in terms of the equivalent number of adult fish that they represent.³⁷¹ This is the EAV.
- 7.51 The dispute in relation to EAVs turns on how the EAV factors are used and what they represent as opposed to the technical detail of how they are calculated.
- 7.52 There are some important preliminary points. First, as Dr Masters explained, published guidance is not prescriptive about the method by which EAVs should be calculated, there is little peer reviewed scientific literature on the topic, and that the choice of methodology depends on expert judgment.
- 7.53 Secondly, each different method may define an 'adult' in different ways, so a hundred equivalent adults calculated by one method is not necessarily the same thing as a hundred equivalent adults calculated by another method.
- 7.54 Thirdly, EAVs are a contextualisation or a first approximation of impacts. Calculations take place in what Dr Masters described as an "EAV bubble" i.e. on an

³⁶⁹ CD6.11 Dr O'Donnell's proof, para 3.5.

³⁷⁰ CD 9.51 (Turnpenny, 1988), pp 2 & 24; CD 9.4 (EA Cooling Water Options, 2000) p73; and CD 6.14I (SEI 30, Seaby 2020) pp 24, 48-51.

³⁷¹ CD 6.5 SoCG, para 4.17.

assumption that impingement (number, length and age) and population do not change such that losses in one year do not affect population or recruitment in future years.

The Cefas EAV method:

7.55 In its variation application the appellant proposed a method which was based on comparing the numbers of fish predicted to be impinged at HPC that would otherwise have survived to become first time spawners, to 2009 adult populations. Importantly, the Cefas method does not consider survival of fish past maturity. Once a fish has become an adult, it is counted as one adult in that year, but its potential to spawn again in future years is not counted. However, the potential number of first time spawners were compared to estimates of the number/biomass of all adult fish in the spawning population (first-time and repeat spawners).

The Agency's EAV SPF extension:

7.56 The Agency considers that the Cefas method undervalues repeat spawning and so it applies a SPF extension. The purpose of the SPF extension is to predict the full impact of the project, that is, how many mature fish would have been in the spawning population but for the project, taking into account first-time spawners as well as fish which survive after first spawning to spawn again in successive years (repeat spawners). After all, it is the full impact of the project that is relevant when undertaking an AA, not merely the number of first-time spawners missing from the population due to impingement in any given year.

The EAV SPF extension is being used correctly:

7.57 Dr Jennings does not dispute the actual calculation of the EAV SPF extension. In his proof he said the SPF extension is a "*technically appropriate way to project the numbers of fish in year class forward through time*",³⁷² and in evidence in chief he said he had "*no qualms*" about the way in which the Agency has carried out the calculation. Rather, he argues that the "*EAV SPF rates are incorrectly used because they are expressed as a percentage of spawning population size*".³⁷³

7.58 Dr Jennings agreed with the description of the EAV SPF extension given in the Agency's opening at paragraph 21-22.³⁷⁴ The key point is that "*the SPF extension counts the fish that would form part of the population but for the operation of HPC. Since it counts 'what is missing' in any given year, it is correct to compare that figure to an annual SSB (i.e. what 'remains'). Comparison between the two reveals the full impact of HPC*".

7.59 The appellant's disagreement with the SPF extension is that the output of the SPF extension calculation cannot reasonably be compared to an annual spawning stock biomass (SSB) for the population. That contention is wrong:

³⁷² CD6.12 Dr Jennings' proof, para 5.10.

³⁷³ CD6.19 Dr Jennings' rebuttal, para 3.3.

³⁷⁴ CD 6.24.

- As Dr Masters explained, the only difference between the Cefas method and the EAV SPF extension is that the Agency finished the calculation and counted all of the fish that would be missing in any given year as a result of HPC. All of the underlying assumptions are the same. The EAV SPF extension merely counts the missing repeat spawners as well as the missing first-time spawners;
- If the Cefas method reveals an annual loss, so does the EAV SPF extension. The only difference is that it is expressing an annual loss of first time and repeat spawners as opposed to only first-time spawners;
- It is true that the results of the Cefas method cannot be compared directly to the results of the EAV SPF extension because they define adults differently (Cefas counts first time spawners whereas the Agency counts first time and repeat spawners), but the EAV SPF extension is nevertheless expressing an annual loss of first-time and repeat spawners;
- The EAV SPF extension can validly be compared with the total SSB and with indicative thresholds for annual losses because it expresses the total number of spawners that would be missing in any given year as a result of prior impingement; and
- Ultimately what matters for HRA purposes is understanding what the total impact of the project on the fish population is. Only the EAV SPF extension is able to reveal the total or true loss to the spawning population.

7.60 It is notable that when advising NRW in relation to Tidal Lagoon Swansea Bay, Cefas said that it was helpful to look at more than simply a percentage annual mortality, and additionally to consider the cumulative mortality over each lifestage for a number of years.³⁷⁵ That reinforces the Agency's position that the EAV SPF extension is a valid and more useful form of analysis than a simple percentage of first time spawners lost in any given year.

7.61 In answer to the Inspector's question, Dr Jennings said that the dispute about EAVs was one where there was a right and wrong answer as opposed to a difference of reasonable scientific judgements. The Agency agrees. The appellant cannot show that the technically correct EAV SPF calculation is not a valid and useful consideration when carrying out a HRA. It plainly is because it tells the competent authority how many spawning fish would be in the population but for their having been killed by the project under consideration.

The EAV SPF extension does not need to be applied to the 'baseline' as the Appellant claims.

7.62 Dr Masters explained why it would be wrong to apply the SPF extension to the baseline by reference to Figures 6 and 7 in his proof.³⁷⁶ He demonstrated that the EAV SPF extension should be applied to the impinged fish in order to represent all spawners that would have formed part of the spawning population but for the

³⁷⁵ CD9.118, sections 2 and 4.

³⁷⁶ CD6.7 Dr Masters' proof, section 6.3.

operation of HPC. He also demonstrated that it would be wrong to apply the EAV SPF extension to the actual population against which HPC losses are compared. In the worked example in Figure 7 he showed that the actual population would be extinct in year 3, yet if the SPF extension were applied to the baseline it would incorrectly suggest that the impact of HPC was only 66% as opposed to 100%.

The EAV SPF extension correctly omits fishing mortality

- 7.63 The appellant has criticised the omission of F from the EAV SPF calculation, and argued that it overvalues older fish which are targeted by the fishing industry.³⁷⁷ As Dr Masters explained, however, it is right in principle to omit F because zero catch advice is a reasonable worst case scenario and because it is impossible to include a robust figure for F which would be applicable over the 60 year duration of the project.³⁷⁸
- 7.64 When commercial fishing is taking place, there is additional mortality on top of natural mortality. This additional F means that fish generally will not live as long and consequently the EAV will be lower than if there is no F. As Dr Masters explained, it is difficult to select a value for F because it varies over time and with geographic area.³⁷⁹ He illustrated the problems caused by temporal variations in F by reference to the example that Cefas used in SPP102³⁸⁰ which relied on Sizewell C data relating to sea bass impingement.³⁸¹ Cefas used the mean value for F over the years for which they had collected impingement data, but as Dr Masters explained the mean value of F was considerably higher than F was from 2018 onwards. Consequently, by using the mean value of F, Cefas would underestimate the power station's current impact. Incidentally, selecting the lowest historic value of F instead of the mean does not provide the answer because there is no guarantee that F will not be lower in the future. In any event, even if high values of F are taken into account, the EAV SPF factor is still more than twice the appellant's proposed EAV factor.³⁸²
- 7.65 In terms of geographic variation in F, the fishing and mortality rates used by ICES are calculated for the entire stock area and yet fishing effort is not uniform across the whole of this area.³⁸³ The published value of F may not be representative of fishing mortality on the local sub-population that is being impacted by entrapment by HPC.
- 7.66 Irrespective of these difficulties in estimating F, assuming that zero fishing mortality may occur over the 60+ year operational life of HPC is a reasonable worst case scenario which should be adopted as a matter of principle given the status of the fish stocks and current fisheries advice.

³⁷⁷ See e.g. CD 7.8 (SPP102).

³⁷⁸ CD6.7 Dr Masters' proof, section 6.4. See also CD 8.9 (TB010, Appendix E).

³⁷⁹ CD6.7 Dr Master's proof, section 6.5 and 6.6.

³⁸⁰ CD 7.8.

³⁸¹ CD6.7 Dr Masters' proof, section 6.5 and figure 8.

³⁸² CD6.7 Dr Masters' proof, para 6.5.3.

³⁸³ CD6.7 Dr Masters' proof, para 6.6.1.

7.67 For example, in relation to Atlantic cod, in 2020 ICES again recommended that “*there should be zero catch in 2021*” in divisions 7.e-k (western English Channel and southern Celtic Seas).³⁸⁴ Notably, the ICES 2020 Benchmark Workshop on Celtic Sea Stocks considered the overall conclusion of the benchmark assessment to be that “*the stock is at its lowest SSB and that F has been way too high historically*”.³⁸⁵ Moreover, Dr Jennings agreed that the benchmark workshop had advised on a precautionary basis that a new benchmark assessment would be required before they would feel confident departing from zero catch advice:

*“The new SAM stock assessment model for cod estimates the stock to be in a poor condition, with SSB well below all biomass reference points. This situation is likely to lead to a very low or zero catch advice and is unlikely to change in the near future. Providing non-zero catch advice in the short term based on the suggested forecast procedure of the benchmark might be possible when ICES guidelines are blindly followed but are likely caused by overestimating productivity of the stock. The stock assessment can be considered the best available science (when using a data-rich stock assessment); however, the low stock size, low catches and the corresponding limited availability of data and samples, in combination with the considerable retrospective uncertainty, cast doubt on the appropriateness of the model for providing catch advice different from zero. Should the stock start to recover and exceed biomass limit reference points, effectively leading to non-zero catch advice, the stock assessment model might have to be revisited to ensure this does not lead to the application of a model on autopilot which has been conditioned on the current situation without considering new developments”.*³⁸⁶

7.68 Similarly, ICES advice in 2019 for herring in the Irish Sea, Celtic Sea and Southwest of Ireland was that “*there should be zero catch in 2020*”.³⁸⁷

7.69 The current status of whiting and European sea bass stocks is also such that it is reasonable to assume zero fishing mortality may occur over the sixty year operational life of HPC.³⁸⁸

7.70 There is no commercial fishery targeting Twait and Allis shad, which are also listed in schedule 5 of the Wildlife and Countryside Act 1981 meaning that it is an offence to kill, injure or take them. Again, assuming zero fishing mortality is a reasonable worst case scenario when assessing the predicted entrapment impacts on those species.

Dr Jennings’ revised EAV method still fails properly to account for repeat spawning.

7.71 Dr Jennings’ proof presented a revised EAV method that differed from the original Cefas method in two main respects. First, Dr Jennings changed many of the parameters used in the calculation of the EAV factor.³⁸⁹ Secondly, Dr Jennings also

³⁸⁴ CD 9.13.

³⁸⁵ CD 9.22, para 2.1.4, p.3.

³⁸⁶ CD9.22, p.6.

³⁸⁷ CD9.47.

³⁸⁸ CD6.7 Dr Masters’ proof paras 6.7.5 to 6.7.6.

³⁸⁹ Dr Masters explained that he would not necessarily disagree with the changes, but he had not had sufficient time to review all of the changes (some of which were updates following revisions made by ICES and some of which were changes in response to TB010, CD8.9).

changed the 'reference year' i.e. the year's population against which the HPC predicted impingement (expressed as equivalent adults) is compared to in order to give an impact value. Instead of comparing all impacts to the population in 2009, Dr Jennings has chosen a different reference year for each species. This has led to the predicted impacts changing because, for example, the mean weight of an adult fish varies from year to year as does the number/biomass of adult fish in the spawning population (SSB). The choice of reference year significantly affects the predicted impact and in evidence in chief Dr Masters explained that important questions about Dr Jennings' selection of reference year remain unanswered.

7.72 Despite these changes, the fundamental problem still remains because Dr Jennings' approach still only counts first time spawners and not all the fish that will be missing from the population as a result of prior impingement. Dr Masters explained that it is still necessary to apply the EAV SPF extension to Dr Jennings' new EAV factors, and that this would result in EAV factor values approximately 2.6 times higher for Atlantic cod, 1.6 times higher for whiting, 4.4 times higher for European sea bass, 4.9 times higher for Atlantic herring and 3.6 times higher for Twaite shad.³⁹⁰

EAV conclusions

7.73 The Agency argue that the appellant's EAV method does not show the true impact of HPC because it only considers some of the fish that would have been missing from the population in any given year (the first time spawners). Accordingly, the Agency's EAV SPF extension ought to be used to predict the real/full impact of HPC.

7.74 Turning then to the species of concern.

Shads

Designations and conservation objectives

7.75 The following designated sites are relevant in relation to shad:

- Severn Estuary SAC: Twaite shad is an Annex II qualifying feature and also part of the notable estuarine assemblage relevant to the "Estuaries" habitat qualifying feature
- River Usk SAC: Twaite shad is an Annex II qualifying feature
- River Wye SAC: Twaite shad and Allis shad are Annex II qualifying features
- Severn Estuary Ramsar: Twaite shad and Allis shad are covered by Criterion 4 and Criterion 8.

³⁹⁰ Consequently, the EAV factors in Table B of CD6.26 (ID12) are not directly comparable. The Cefas column shows Dr Jennings' new EAV factors, whereas the EA column shows the EAV SPF extension of the Cefas application EAV factors. To compare like with like, Dr Jennings' EAV factors would need to be extended using the EAV SPF extension.

7.76 The conservation objectives all require that the shad population be maintained or restored. To quote just one, the conservation objective for Twaite shad and for Allis shad for the River Wye SAC is to:³⁹¹

"ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

...

the populations of qualifying species"

7.77 The standard data forms for the SACs each recognise that the SACs are "*considered to be one of the best areas in the United Kingdom*" for Twaite shad.³⁹²

7.78 Now that the UK has left the EU, UK SACs and Ramsar sites form part of the NSN sites of National Importance rather than the EU's Natura 2000 network. Within the NSN there are six SACs designated due to the presence of Twaite shad, including the Wye, Usk and Severn. Accordingly, the three SACs relevant to this Inquiry for Twaite shad constitute half of the Twaite shad sites within the NSN. Additionally, as Mr Crundwell explained, those three SACs host three out of the four Twaite shad spawning populations in the UK. This is relevant when approaching the risks and uncertainties in this case because what is at stake is the integrity of a substantial part of the NSN relevant to Twaite shad.

Conservation status

7.79 The latest condition assessment for the Severn Estuary SAC shows that the shad feature is in unfavourable condition and that NRW has "*high confidence*" in that assessment.³⁹³

Population of Twaite shad

7.80 The appellant's variation application used the population estimate for shad taken from a Severn Tidal Power report produced by APEM in 2010.³⁹⁴ Mr Crundwell's evidence explains how the Agency replaced many of the assumptions in that 2010 report with publicly available empirical data that has since resulted from the UtS Project.³⁹⁵ The appellant's theoretical modelled population was almost double (166,000) that of the Agency's improved model (86,696).³⁹⁶ The appellant now agrees that the Agency's improved model should be used to provide estimates of Twaite shad population size for the purposes of this Inquiry.³⁹⁷

³⁹¹ CD12.14.

³⁹² CD12.31, p5 (River Usk SAC), CD12.33, p5 (River Wye SAC), and CD12.30, p5 (Severn Estuary SAC).

³⁹³ CD12.28, p27, para 3.8.

³⁹⁴ CD9.108.

³⁹⁵ CD6.9 Mr Crundwell's proof, sections 5.10 to 5.11.

³⁹⁶ CD6.9 Mr Crundwell's proof, para 5.11.2.

³⁹⁷ CD6.5 Statement of Common Ground, para 4.28.2.

Population of Allis shad

- 7.81 In relation to Allis shad, a key point of difference between the parties is whether the Secretary of State should assume on a precautionary basis that there is a spawning population capable of being affected by HPC.
- 7.82 Dr Jennings argues that³⁹⁸ *"in the absence of evidence for ongoing spawning in the Rivers Severn, Wye or Usk, the few Allis shad recorded in the Severn Estuary are therefore expected to be stray fish rather than part of a self-sustaining Severn, Wye or Usk population"*
- 7.83 He agreed in cross-examination that he had approached the question by asking if there is *"positive evidence"* of a spawning population of Allis shad, as opposed to asking whether he could be certain that there was not a spawning population. The Agency submits that is the wrong approach to take when conducting a HRA. Where, as here, Allis shad are a designated Annex II qualifying feature of SACs affected by a project, the precautionary principle requires the competent authority to assume that a spawning population persists unless it has been proven beyond all reasonable scientific doubt that there is no spawning population.
- 7.84 Mr Crundwell explained that he considered it probable that Allis shad do persist in the River Wye and Severn.³⁹⁹
- Allis shad are a qualifying feature of the River Wye SAC because at the time of designation there was a presumed spawning population. Furthermore, the designation remains in place;
 - Sub-adult Allis shad do roam at sea, but it is unlikely that shad from distant populations would migrate so far upstream into the Severn Estuary which is effectively a dead end to migration;
 - There is evidence of Allis shad of a breeding size, at the correct time of the year and in breeding condition captured from Bristol Channel commercial salmon fisheries;
 - Allis shad genetics persist in the River Wye and Severn shad runs;
 - Anglers, commercial netmen and photographs collected as part of the UtS Project report that very large shad are still present, far in excess of the normal size of the Twaite shad that are observed;
 - eDNA analysis of the River Severn shows that a small proportion of shad still penetrate further upstream than the barriers to migration at Worcester which stop Twaite shad migration. These are more likely to be large Allis shad which have improved swimming speeds and capabilities and can penetrate the catchment further than the Twaite shad;

³⁹⁸ CD6.12 Dr Jennings' proof, 11.113 (Appendix E, p121).

³⁹⁹ CD6.9 Mr Crundwell's proof, section 5.13 and Crundwell's rebuttal, section 2.2.

- Historically the River Severn was a renowned Allis shad fishery and it is perfectly possible that a residual population persists.

7.85 In evidence in chief, Mr Crundwell explained that there is no Allis shad life cycle model, or independent run estimate, and so in order to estimate the Severn Estuary Allis shad population the Agency used the best genetic evidence available and concluded that as a precautionary estimate 1% of the total river Wye shad run could be Allis shad, and 3% of the Severn run could be. He explained that there was uncertainty around those figures, but that was the best estimate using the available scientific techniques and data.

There is also a reasonable scientific basis for concluding that more adult shad are likely to be present near the HPC intake compared to the HPB intake.

7.86 The parties' quantitative impact assessment predictions are based on the assumption that the proportion of adult shad near the HPC intake will be the same as the proportion near the HPB intake. Both parties have questioned that assumption, but whereas the appellant speculates that fewer adults will be present near the HPC intake, the Agency has provided evidence that amounts to a reasonable scientific basis for concluding that more adult shad are likely to be present near the HPC intake. A greater number of adult fish may mean that the impact of HPC is underestimated as the EAV currently being used is based on HPB impingement.

7.87 The appellant's basis for questioning the assumption is Dr Jennings' hypothesis that *"owing to the location of the main tidal flows, diadromous fish associated with the Wye, Usk and Severn and using selective tidal stream transport are highly unlikely to be swimming close to the HPC intake"*.⁴⁰⁰ But in cross-examination Dr Jennings agreed that he was not able to point to any evidence to demonstrate that was in fact the case because the appellant has never undertaken any empirical studies to test whether or not the assumption holds true.

7.88 By contrast, Mr Crundwell was able to point to significant new information concerning Twaite shad behaviour which has been obtained from the UtS Project using the best scientific methods available.⁴⁰¹ In his evidence in chief, Mr Crundwell explained that the new shad science covers the following areas relevant to this Inquiry:

- It provides an independent run estimate of the shad population;
- It provides new evidence about the freshwater distribution of shad and their behaviour;
- It provides new information about the freshwater survival of shad each spawning year;

⁴⁰⁰ CD6.12 Dr Jennings' proof, para 4.75.

⁴⁰¹ See CD6.9 Mr Crundwell's proof, section 5.7 for a summary of the new evidence and scientific techniques used.

- It provides the first evidence of shad movements in the Severn Estuary and the sea via acoustic tracking data;
- It provides new evidence about spawning, sea survival between years and site fidelity; and
- It provides evidence of hybridization rates, and eDNA distribution.

7.89 Although the new evidence constitutes the early results of a project that is due to run until 2025, Mr Crundwell explained that the acoustic tagging results of over 200 fish indicate that:

- Shad enter freshwater for only about 30 days;
- Shad are present in the Severn Estuary during most months of the year, except December, January and February;
- Geographically, they appear to use the whole of the Severn Estuary -not just the main channel, but also the bays. Indeed, they use both the English and Welsh coastlines and make migrations from open water to bays frequently. Some shad appear to be semi-resident in bays for many weeks or months and migrate in and out, sometimes daily;
- Migration to spawning rivers is not continuous, but instead it is controlled by water temperature and tide;
- Shad using selective tidal transport do not move quickly through the estuary sticking to the main channel, but instead make many movements throughout the estuary for feeding, migration and shelter. In fact, migration to spawning rivers is not accomplished on just a few tides, but instead it takes place over many weeks; and
- Survival at sea between years is high (around 60%) and adult shad can return 5 or more times to spawn.

7.90 Mr Crundwell emphasised how significant this new evidence is. Prior to the use of acoustic tagging of shad through the UtS Project, it had been impossible to track movements of adult shad in coastal waters. Instead, it had been necessary to rely on bycatch data to give an indication of the temporal and spatial distribution of shad. The new evidence represents a massive leap forward in our understanding of shad behaviour.

7.91 There is nothing at all in the new data to support the appellant's speculation that fewer shad are likely to be present near the HPC intake. On the contrary, the work of Davies et al,⁴⁰² provides a reasonable scientific basis for believing that shad are more likely to be found near the HPC intake because the results of the tagging study "*suggest year round use of estuarine and nearshore habitats by at least a subset of the Twaite shad population during the marine phase*".⁴⁰³

⁴⁰² CD 9.36.

⁴⁰³ CD 9.36, abstract point 3.

- 7.92 The appellant sought to cast doubt on the value of the three detections of shad in Bridgwater Bay, but those results are in keeping with the results demonstrating the use that shad make of Swansea Bay.⁴⁰⁴ The Swansea Bay results show that shad move around the bay and can visit multiple times. There is no good reason why shad would not use other bays, such as Bridgwater Bay, in a similar manner.
- 7.93 The appellant also sought to suggest that one of the shad detected in Bridgwater Bay might have died or shed its tag. Dr Jennings agreed in cross-examination that this was speculation. An acoustic tag has a range of approximately 200m and it is highly unlikely that a dead fish would remain within range to be detected for 3 months by a single receiver in an estuary which has a very large tidal range. It is far more likely that a dead fish or shed tag would be swept out of range or buried in the high sediment load, and thus cease to be detected. Whatever the fate of this single shad, the wider results support Mr Crundwell's view that shad are likely to be using bays like Bridgwater Bay for most of the year and that they make multiple movements around the full extent of the bays for purposes such as feeding and shelter.
- 7.94 There are significant differences between the location of the HPB and HPC intakes. HPB is near-shore, whereas HPC is 3km out into the Severn Estuary. The CIMP data shows that it is predominantly juvenile shad that are entrapped at HPB which Mr Crundwell explained was to be expected because small fish are more likely to use near-shore habitats because they warm up quicker, have abundant food, and there is less tidal energy meaning the smaller fish with poor swimming speeds can remain there feeding for longer. Additionally, the tidal cycle is likely to push these smaller fish to the margins. By contrast the initial tracking results suggest that adult shad are likely to be in the vicinity of the HPC intake for prolonged periods.
- 7.95 Accordingly, there is a reasonable scientific basis for concluding that shad may be more likely to be impinged at HPC than at HPB. If that is the case then the predicted impacts are likely to underestimate the true impact of HPC. The appellant is wrong, it was argued, to contend that the Agency has adopted too many precautionary layers in its assessment. The Agency's precautionary assumptions are not only warranted when considered in isolation, but also warranted when viewed collectively because there is such considerable uncertainty about this central assumption of the whole quantitative impact assessment.
- 7.96 Finally, it is important to note that shad have exceptional hearing and the AFD was the most important mitigation for shad in the whole intake system. The appellant's own predictions of the efficacy of an AFD in its DCO application indicated that an AFD would be likely to deter 88% of shad from entering the intakes.⁴⁰⁵ Removal of the AFD puts the most valuable component of the shad stock i.e. adult shad, at far greater risk of entrapment (and if they are entrapped, FRR is agreed to result in 100% mortality for shad).⁴⁰⁶

It is a reasonable worst case scenario to assess predicted impacts of HPC against each river stock separately.

⁴⁰⁴ CD6.9 Mr Crundwell's proof, appendix 1, p45-46.

⁴⁰⁵ See CD1.11, table 19, p66.

⁴⁰⁶ See e.g. CD6.26 (ID12), table A.

7.97 The Agency has assessed the impacts of HPC on each of the rivers designated for shad individually in line with the advice received from NRW.⁴⁰⁷ Mr Crundwell acknowledged that it is unlikely that HPC would have an impact only on shad from a single stock. Nevertheless, he explained that there is no reasonable alternative in the absence of any evidence to show the proportions in which the different stocks would be impacted. The reason there is no evidence is because no genetic evaluation was carried out as part of the RIMP or CIMP to attribute impingement losses to a particular river and because the appellant has not carried out any other assessment work capable of enabling losses to be apportioned between the rivers.

7.98 Even if there were a genetic study of the juveniles entrapped at HPB, it is likely that the proportions of the different stocks entrapped each year would vary based on the prevailing environmental conditions. Consequently, a long term study would be required to make a reliable estimate of the proportion of each stock likely to be entrapped. In the absence of such data, the Agency’s decision to follow the advice of the SNCBs is, it is argued, the only logical and precautionary option. Anything else would be guesswork with no reasonable scientific basis. Tellingly, the appellant criticises the Agency’s approach but does not suggest a workable alternative.

It is not possible to conclude that the project will not adversely affect the integrity of the designated sites.

7.99 The starting point is that the population of shad in the Severn Estuary and contributing rivers is classed as “unfavourable” and the conservation objectives require the population to be restored. The Agency submits that the long term impact of HPC on the shad population would undermine that conservation objective by hindering restoration and thus adversely affect the integrity of the designated sites.

7.100 The Agency’s quantitative analysis predicts the following level of impact on the shad population:

Severn Estuary SAC & Ramsar (Twaite shad)	0.1%
River Wye SAC (Twaite shad)	0.2%
River Usk SAC (Twaite shad)	0.4%
Severn Estuary SAC & Ramsar (Allis shad)	0.6%
River Wye SAC (Allis shad)	0.4%

7.101 Of course, those figures are based on the assumption that similar numbers of adult shad will be entrapped at HPC compared to HPB. If, as Mr Crundwell considers likely, more adult shad will be entrapped at HPC, then the EAV factor may be higher and the impacts may be greater.

⁴⁰⁷ CD6.10 Dr Masters’ proof (salmon), Appendix 4, p.53.

7.102 Although the modelled impacts appear to be small, the crucial point is that even this level of continuous downward pressure for 60 years will undermine the conservation objectives by hindering, or preventing, restoration of the shad population to a favourable conservation status. Mr Crundwell explained this by reference to the model of Aprahamian.⁴⁰⁸ The blue line (showing a 0.1% increase in mortality) demonstrates that the long term effect of the predicted impacts will be to cause a slight decline in the shad population. It is no answer to say that the decline will be small. The point is that it unquestionably is a decline in circumstances where the conservation objective requires the restoration of the shad population. An additional long term pressure that has the opposite effect to that required by the conservation objectives does undermine the conservation objectives and it necessarily constitutes an adverse effect on the integrity of the designated sites.

7.103 The Agency's reasoning is neatly encapsulated in the following extract from its AA:⁴⁰⁹

"This pressure might be acceptable if the stock status was sufficient to allow a surplus to be cropped but for a species like the Twaite shad that is already in "unfavourable" condition and well below historic levels any level of additional cropping is going to, over the long term, suppress the population further and prevent the recovery of the stock therefore preventing a favourable condition assessment to be made."

7.104 In an attempt to escape the logic of this analysis, the appellant sought to rely upon other initiatives being undertaken with respect to shad⁴¹⁰. The suggestion appeared to be that artificial barriers to migration were the real obstacle to restoring the shad population and that the impact of HPC was slight in comparison.

7.105 The appellant's argument fails, in the Agency's assessment, on the facts because it is clear that the Rivers Usk and Wye are not currently affected by artificial barriers to migration, and the UtS Project restoration works are directed only at the River Severn. This is confirmed by the latest NRW condition assessment which notes that the River Wye has "*no significant artificial barriers to migration*" and that the only limitations in the River Usk are the footings of Crickhowell Bridge and (in low flows) the footings of Llanfoist Bridge.⁴¹¹ Indeed, the designation for the River Wye recognises the shad migrate "*over 100km upstream*" through "*an unobstructed main channel*".⁴¹²

7.106 It is only in relation to the River Severn that "*the situation could be significantly altered by the restoration project on the River Severn*".⁴¹³ Nevertheless in cross-examination Dr Jennings suggested that improvements to the River Severn would reduce impacts on the other designations because the impact on the other rivers is

⁴⁰⁸ CD 9.115, figure 5A.

⁴⁰⁹ CD 4.1, p53.

⁴¹⁰ In relation to other initiatives, NRW's advice was that "outcomes of [UtS Project] are yet unrealised and therefore irrelevant to conclusions of the current 'alone' assessment, even as context": see Masters' proof (salmon) CD 6.10 p46.

⁴¹¹ CD 12.28, p28.

⁴¹² CD 12.32, p1.

⁴¹³ CD 12.28, p28.

modelled using the River Severn run estimate. But that argument confuses the modelling exercise with what would happen in the real world. Modelling the impact on the Rivers Wye and Usk against an increased River Severn run estimate in the future would give the appearance of a benefit to the populations of the Wye and the Usk (the impact would appear lower because the population that impingement numbers were compared to would be larger). Yet, there is no evidence that restoration works to the River Severn would actually result in any benefits for the shad populations in the Rivers Wye and Usk. The modelling would show an apparent benefit that is not realised in the real world.

7.107 Accordingly, the impact of HPC in relation to the River Wye and the River Usk SACs cannot be justified by reference to restoration works relating to the River Severn. There are no secured restoration initiatives relating to the Wye and the Usk that can be relied upon to show that the conservation objectives can be met notwithstanding the additional downward pressure on the shad population caused by HPC.

Atlantic salmon

Designations and conservation objectives

7.108 The following designated sites are relevant in relation to Atlantic salmon:

- Severn Estuary SAC: Atlantic salmon is part of the notable estuarine assemblage relevant to the Annex I qualifying habitat “H1130: Estuaries”;
- River Usk SAC: Atlantic salmon is an Annex II qualifying feature;
- River Wye SAC: Atlantic salmon is an Annex II qualifying feature;
- Severn Estuary Ramsar: Atlantic salmon is covered by Criterion 4 and Criterion 8.

7.109 The conservation objectives are set out in Table 1 of Dr Masters’ proof.⁴¹⁴ The essential points are that: (i) the conservation objectives all require that the population be maintained or increased and sustainable in the long term; and (ii) because the populations are currently in unfavourable condition the objective is to restore them, not merely to prevent further harm.

Conservation status

7.110 The Secretary of State, George Eustice, has recently said that across its range, Atlantic salmon populations are in a “*serious, perilous state*”.⁴¹⁵ Numbers are also described as being “*at crisis levels*” by the North Atlantic Salmon Conservation Organisation.⁴¹⁶ Dr Masters explained that the latest stock published assessments for the principal salmon river tributaries of the Severn Estuary show that the River Severn, River Wye and River Usk stocks are all ‘probably at risk’.⁴¹⁷ Egg deposition

⁴¹⁴ CD6.10 Dr Masters’ proof (salmon), p8, table 1.

⁴¹⁵ CD6.10 Dr Masters’ proof (salmon), para 5.1.1.

⁴¹⁶ Ibid

⁴¹⁷ CD6.10 Dr Masters’ proof (salmon), section 5.2. See also CD 6.5 SoCG, para 4.29.1.

in 2019 was 51% of the river Severn’s conservation limit, 31% of the River Wye’s conservation limit, and 70% of the River Usk’s conservation limit, putting the Severn and the Wye close to being “at risk”.⁴¹⁸ The 2020 figures are still provisional and not published, but Dr Masters said the three rivers are expected at least still to be “probably at risk”. Moreover, it is agreed that the rivers are projected to be “probably at risk” in 2024.⁴¹⁹

7.111 It is important to note the significance of the current unfavourable population status of Atlantic salmon. Dr Masters agreed with the evidence of Mr Ian Russell of Cefas given on behalf of NRW at the Wales Rod and Line (Salmon and Sea Trout) Byelaws 2017 Inquiry to the effect that “[i]t’s important to note that any additions to the spawning stock are particularly valuable when stocks are at low levels. Even relatively small numbers of fish are crucial to recover stocks in as short a time as possible”.⁴²⁰ Thus Cefas has previously accepted that the unfavourable population status of Atlantic salmon provides a powerful justification for preventing even relatively small levels of additional mortality.

Population of Atlantic salmon

7.112 The population sizes against which Atlantic salmon losses should be compared for the AA for the River Severn, River Wye and River Usk SACs are agreed.⁴²¹ Dr Masters explained that the agreed figures are based on the mean run size between 1997 and 2017 i.e. the period for which we have run size estimates for the principal salmon rivers and impingement records from the RIMP data set. Importantly, he explained that the agreed figures are higher than those used by the appellant in its variation application.⁴²² The fact that the Agency has used the best scientific methods to arrive at a higher population estimate than the appellant substantially undermines the appellant’s complaint that the Agency has generally been too precautionary in its assessment. Instead, it is argued that this indicates that the Agency has consistently made its judgments on the best available evidence without any predetermined view as to the outcome.

There is significant uncertainty in relation to the predicted impact of HPC on Atlantic salmon because of the data deficiency.

7.113 Dr Masters explained that there is significant uncertainty in the predicted impact of HPC on Atlantic salmon because of the data deficiency. It is therefore important to look at what the available data shows and why it is difficult to make any reliable predictions of the impact of HPC on Atlantic salmon.

7.114 The appellant proposed a method for predicting salmon impingement in TR456 that was based on using the RIMP data.⁴²³ Dr Masters explained that there were three main flaws in that approach:

⁴¹⁸ CD6.10 Dr Masters’ proof (salmon), para 5.2.7.

⁴¹⁹ CD 6.5 SoCG, para 4.29.1.

⁴²⁰ CD6.10 Dr Masters’ proof (salmon), para 7.1.6.

⁴²¹ CD 6.5 SoCG, paras 4.29.5 to 4.29.8.

⁴²² CD 1.11, p75. The Appellant’s mean then was 15,883 compared to the agreed mean now of 17,616.

⁴²³ CD 1.11, p76. On which see CD6.10 Dr Masters’ proof (salmon), section 6.3.

- The appellant’s analysis totally discounted any juvenile salmon and only considered kelts (the 2002 returning adult having been mistakenly identified as a kelt in TR456);
- The analysis was based on an annual average density which took no account of the possibility that salmon may have been impinged outside the 0.41% of HPB flows that were monitored by the RIMP; and
- The analysis assumed that kelts will only be caught on an ebb tide at HPC because they were caught on ebb tides in the RIMP (which of course only sampled ebb tides).

7.115 The Agency instead used a similar method to that used to analyse the CIMP data for other species. It used 21 years of RIMP data for which it also had population data available.⁴²⁴ The result of this analysis is a prediction of 12 equivalent adults impinged each year by HPC.⁴²⁵

7.116 As with shad, the Agency has followed the advice of the SNCBs⁴²⁶ and on a precautionary basis assessed HPC losses against each SAC population individually because it is impossible to predict what proportion of impinged salmon will originate from which SAC. In recognition of the precaution involved in that assumption, the Agency has judged it would be inappropriate additionally to use uncertainty analysis when assessing the impact on Atlantic salmon from the river SACs.

7.117 Dr Jennings’ proof contains a new assessment based on two smolts that were caught in the CIMP outside the time period that Cefas used for the analysis in TR456.⁴²⁷ He raises the two smolts impinged at HPB to an impingement prediction for HPC of 16 smolts per annum which he then equates to 1.6 returning adults per annum. As Dr Masters explained, this new analysis still ignores the evidence of the RIMP which showed that kelts and a returning adult have previously been impinged at HPB (despite the infrequent sampling). He also noted that Dr Jennings’ estimate is a minimum because it is not clear that all four pumps were operating at full capacity when the smolts were caught.

7.118 The fundamental difficulty in relation to predicting the impact of HPC on Atlantic salmon though is the data deficiency discussed above. In short, the RIMP and the CIMP were not designed to provide a robust estimate of salmon impingement and their low sampling frequency means that it is unsafe to draw firm conclusions about the level of salmon impingement at HPB. As NE said, the data deficiency arising from the fact that “*RIMP & CIMP methods are ineffective in detecting smolt impingement (seasonal, nocturnal)*” provides “*a strong justification to take a precautionary approach*”.⁴²⁸

7.119 Against that background of data deficiency, it would be wrong to fall into the trap of accepting the appellant’s argument that impingement of salmon at HPC will be a

⁴²⁴ At this point the Agency had not seen records of salmon being caught in the CIMP outside the sampling period used by the Appellant, hence why the Agency used the RIMP data.

⁴²⁵ CD 6.26 (ID 12), table C.

⁴²⁶ CD6.10 Dr Masters’ proof (salmon), Appendix 4

⁴²⁷ CD6.12 Dr Jennings’ proof, paras 4.161 to 4.163.

⁴²⁸ CD6.10 Dr Masters’ proof (salmon), Appendix 2.

rare event because the CIMP / RIMP data shows few salmon were impinged at HPB. As Dr Masters explained, even the very limited daytime RIMP sampling managed to record impingement of every possible life stage of salmon. That does not show that salmon impingement must be rare, but instead it is a salutary warning that the considerable data deficiency could be masking a greater impact on salmon. Put simply, low numbers of recorded impinged salmon during infrequent, non-targeted monitoring, does not necessarily mean that low numbers of salmon are actually impinged at HPB.

7.120 For completeness it should be noted that the doubts raised by Dr Jennings about the status of some of the salmon recorded in the data do not substantially affect the predicted impacts. Dr Jennings argues that fish recorded as parr or smolts in TR456,⁴²⁹ appear to have been caught in the autumn and so are likely to have been autumn wash-outs that would have died anyway. Dr Masters agreed that may be the case, but he pointed out that it has only a slight effect on the Agency's RIMP-based prediction due to the effect of the recorded returning adult on the EAV calculation.

There is no reasonable scientific basis for concluding that fewer salmon are likely to be present near the HPC intake compared to the HPB intake

7.121 Just as with shad, there is a disagreement about whether it is right to assume that impingement data at HPB accurately reflects the fish that are likely to be encountered near the intake of HPC.

7.122 Dr Jennings argues that salmon are less likely to be impinged at HPC because the intake is in deeper water where pelagic smolts are less likely to encounter them.⁴³⁰ But as Dr Masters pointed out, the HPC intake is also 3km further offshore and closer to the main channel which is likely to increase the likelihood of salmon encountering the HPC intake. Furthermore, the Agency's calculation of predicted impingement for Atlantic salmon already includes the effect of the pelagic cap (with an agreed factor of 0.23).

7.123 Salmon using selective tidal transport will not just use the main channel. They are likely to use the whole estuary. Dr Jennings agreed that there were putcher ranks previously on the River Severn which fished for salmon in the intertidal zone of the estuary. The fact that people fished for salmon in the intertidal zone itself suggests that salmon are commonly encountered on the margins of the estuary away from the main channel.

7.124 In the absence of any survey or monitoring directed at answering this particular question, it really is speculation for the appellant to suggest that HPC will be likely to impinge fewer salmon than HPB.

There is no reasonable scientific basis for assuming FRR mortality of less than 100%

⁴²⁹ CD 1.11, p41, table 6.

⁴³⁰ CD6.12 Dr Jennings proof, para 4.151.

7.125 Dr Jennings' evidence suggested that, based on experiments conducted at Oldbury Power Station in 1970,⁴³¹ "it would be a reasonable assumption that 50% of healthy salmon smolts would survive impingement at HPC".⁴³² In cross-examination he agreed, however, that the Secretary of State should make his assessment on the basis of 100% salmon smolt mortality in the FRR.

7.126 There is no reliable basis for departing from an FRR mortality rate of 100% and, in any event, the point is not a significant one in the overall assessment of the impact on Atlantic salmon:

- As Dr Masters explains in his rebuttal, the Oldbury study does not explain how long smolts were held for after impingement and it is questionable whether delayed mortality was properly accounted for;⁴³³
- There are significant differences between Oldbury and HPC, including the fact that at HPC the intake tunnels are 33m below the bed of the channel giving rise to pressure change/barotrauma and the smolts will be transported for 3km through the intake tunnels before going through the FRR; and
- In any event, whatever the FRR mortality of salmon smolts, the FRR mortality of adult salmon and salmon kelts will be 100% and so the overall prediction will not be significantly affected.

The Appellant's comparison with salmon mortality related to catch and release fishing merely underscores the absence of adaptive management available in relation to HPC

7.127 The appellant sought to suggest that some level of salmon mortality should be regarded as acceptable because catch and release fishing remains possible in the designated rivers and that has an incidental mortality risk associated with it. But as Dr Masters explained, comparison with F merely underscores the particular risks associated with the 60 year HPC project:

- All intentional killing of salmon is prohibited on the Rivers Usk and Wye;
- Rod licences are not sold for particular rivers and there is no HRA for the issuing of rod licences. Instead, regulatory action takes the form of byelaws which have to be proportionate i.e. the restrictions imposed must be no more than necessary to achieve the objective;
- The evidence shows that regulatory controls have gradually been imposed on salmon fishing over the last fifty years with the result that there has been a significant fall in the number of licences and fishing days available;⁴³⁴
- Such adaptive management to protect salmon is not available in respect of HPC because once HPC is commissioned it will be a continuous impingement pressure for six decades.

⁴³¹ CD 9.53.

⁴³² CD6.12 Dr Jennings proof, para 3.12.

⁴³³ CD6.16 Dr Masters rebuttal, para 6.51.

⁴³⁴ See e.g. CD 9.50, p10 and p16 Table 6, and p19 Figures 2 & 3.

It is not possible to conclude that the project will not adversely affect the integrity of the designated sites

7.128 The crucial starting point is that the populations of Atlantic salmon in the principal salmon rivers are “*probably at risk*” and the conservation objectives require their restoration. As with shad, the Agency submits that the long term impact of HPC on the Atlantic salmon population would undermine those conservation objectives by hindering restoration and thus adversely affect the integrity of the designated sites.

7.129 The Agency’s quantitative analysis predicts the following level of impact on the Atlantic salmon population:

Severn Estuary SAC & Ramsar	0.07%
River Wye SAC	0.2%
River Usk SAC	0.2%

7.130 Again, those numbers appear small at first blush, but it is important to appreciate the high level of unquantifiable uncertainty surrounding the modelled impacts due to the data deficiency. RIMP monitoring of 0.41% of HBP’s flows, on ebb tides only, in daylight only, still managed to detect the impingement of every possible life stage of Atlantic salmon. There is a very real prospect that more representative sampling would show HPB to be having a greater effect on Atlantic salmon which would in turn lead to a greater predicted impact for HPC.

7.131 This is not a case where one party is merely speculating and pointing to imaginary or hypothetical risks. The data deficiency is plain and obvious. It is recognised by the SNCBs and it goes directly to the heart of the QIA process. If the impact of HPB is not accurately revealed by the 0.41% of flows sampled by the RIMP then when HPB impacts are scaled up to predict HPC losses the underestimate will be magnified and the resulting prediction for HPC could be wildly out.

7.132 The only reason the Agency are in the position of having to work with such a major data deficiency is that the appellant has not undertaken any further monitoring or assessment, despite having the considerable resources and expertise of Cefas available to it since before its DCO application nearly a decade ago.

7.133 Given the ‘*probably at risk*’ status of the salmon stocks, the considerable uncertainty caused by the data deficiency, and the long-term nature of the project Dr Masters was correct to say he could not be certain that HPC would not undermine the conservation objectives for the designated sites by hindering restoration of the salmon population.

The Marine Assemblage

Designations and conservation objectives

7.134 There are two preliminary legal issues in relation to the marine assemblage. First, the appellant argues that the ‘Notable estuarine assemblage’ is not protected by the Severn Estuary SAC designation. Secondly, the appellant argues that Ramsar

Criterion 8 protects physical habitat and not the marine assemblage fish themselves. The Agency submits that the appellant is incorrect and that the AA is required to consider the impact of the project on the marine fish assemblage.

- 7.135 In terms of the SAC, the Agency's submissions were set out in its opening legal submissions.⁴³⁵ In short, the SAC was designated for, among other things, the qualifying Annex I habitat "H1130: Estuaries". The conservation objectives for that qualifying feature includes maintaining or restoring "*the structure and function (including typical species) of qualifying habitats*". The marine assemblage (including Atlantic cod, European sea bass, whiting and Atlantic herring) are typical species of the qualifying habitat and so the conservation objective for the qualifying habitat requires that the structure and function of those typical species be maintained.
- 7.136 There is nothing surprising or unusual about that analysis. It is supported by both NE and NRW.⁴³⁶ Furthermore, it reflects the way in which the Secretary of State conducted his HRA when granting the DCO.⁴³⁷ Indeed, the appellant's own shadow HRA to support this variation application also considered effects on the marine assemblage and whether they would undermine the conservation objectives for the "Estuaries" qualifying feature of the SAC.⁴³⁸ Accordingly, it is submitted that it is legally correct to include the marine assemblage in the AA and to ask whether HPC could affect the structure and function of the typical species so as to undermine the conservation objective for the "Estuaries" qualifying feature and thereby give rise to an adverse effect on the integrity of the site.
- 7.137 In terms of Ramsar Criterion 8, the appellant's new argument is that this criterion protects physical habitat as opposed to fish. Both NE and NRW have written to oppose that argument,⁴³⁹ and the Agency submits that the appellant is incorrect.
- 7.138 Read fairly and as a whole, it is clear that Ramsar Criterion 8 covers the functions that fish perform within wetland sites and not the physical habitat of the wetland sites themselves. As NRW has observed "*the guidelines for Ramsar Criterion 8 do not concern themselves with the physical habitat, rather they relate to the biological functions which fish populations within or outside the wetland site rely upon to complete their life cycles*".
- 7.139 The fish performing the specific biological functions (i.e. feeding, spawning, juvenile residency and growth and migration) are an essential part of the wetland's qualifying interest. As NE explains "*[t]his is not solely a physical habitat-specific criterion, but a criterion that relates to a wetland site that performs specific functions for fish e.g. feeding, spawning, migration etc., of which the fish themselves are manifestly a critical element*".
- 7.140 In the case of the Severn Estuary Ramsar site, the site is designated under Ramsar Criterion 8 for "*the fish of the whole estuarine and river system*" because those fish perform functions that the wetland site is important for. Alteration of the

⁴³⁵ CD 6.24, para 6 to 14.

⁴³⁶ CD 14.8.

⁴³⁷ CD 5.8, para 6.147.

⁴³⁸ CD 1.9, section 6.4.

⁴³⁹ CD 14.9 and CD 14.10

structure of the fish populations could affect the functions that the fish perform within the wetland site and consequently adversely affect the importance of the wetland site for those functions. For these reasons, it is right to consider the fish assemblage in the AA in relation to the Ramsar site (as the Secretary of State did when granting the DCO).

7.141 Finally, in relation Ramsar sites, it is agreed that national policy affords them the same protection as SACs.⁴⁴⁰ Of course Ramsar sites do not have formal conservation objectives, so it is necessary to derive conservation objectives in order to apply the integrity test. The Agency submits that the Secretary of State adopted the correct approach when granting the DCO by using the conservation objectives of the Severn Estuary SAC because the designations are “*contiguous and the qualifying features for the SAC broadly align with the Ramsar*”.⁴⁴¹

Conservation status

7.142 The conservation status of the four marine assemblage species is agreed:

- Atlantic cod has been below a biologically safe limit since 2004 in ICES areas VIIe-k (except 2011-2012), and ICES advise zero catch in 2020 in areas VIIe-k to allow the species to recover;⁴⁴²
- The SSB for European sea bass has been declining since 2009 and is currently only just above a biologically safe limit and it is below precautionary biomass limits;⁴⁴³
- The SSB for whiting has decreased since 2010 and is estimated to have been below a biologically safe limit since 2018;⁴⁴⁴ and
- Celtic sea herring is undergoing a period of recovery following a stock collapse in 2004, and the status of the stock in the Bristol Channel is uncertain⁴⁴⁵.

The Appellant has not proved beyond reasonable scientific doubt that it is right to compare predicted impacts of HPC to the large ICES stock areas that it suggests contain the relevant populations

7.143 A key area of disagreement concerns the appropriate population against which to compare predicted losses of the marine assemblage species. The Agency submits that the appellant has not proved beyond reasonable scientific doubt that the large ICES stock areas it proposes contain the relevant population of European sea bass, Atlantic cod and whiting appropriate for conducting a HRA within the Severn Estuary. Comparison with such large populations inappropriately dilutes the predicted impacts of HPC and fails properly to consider the impact on the integrity of the designated sites in question.

⁴⁴⁰ See NPPF para 176 (now para 181 of July 2021 NPPF) and CD 12.1 Defra Guidance on HRA, p.5.

⁴⁴¹ CD5.8, para 4.11.

⁴⁴² See para 4.3.8 CD6.8 Mr Waugh’s proof.

⁴⁴³ See para 4.3.12 CD6.8 Mr Waugh’s proof.

⁴⁴⁴ See para 4.3.12 CD6.8 Mr Waugh’s proof.

⁴⁴⁵ See para 4.3.13 CD6.8 Mr Waugh’s proof.

7.144 In answer to the Inspector’s question, Dr Jennings said that identification of the appropriate population size involved scientific judgment. He very much appeared to acknowledge that there is reasonable scientific doubt as to the size of the appropriate populations. That conclusion is supported by the following reasons.

7.145 First, ICES stock assessments were primarily designed in order to give advice on sustainable fishing. They were not designed for the purpose of HRA of plans or projects, and they do not relate to the particular designated SACs and Ramsar sites that are the subject of this AA.

7.146 Secondly, the appellant’s reliance on the international credentials of ICES,⁴⁴⁶ overlooks the fact that the Secretary of State has not made ICES a statutory consultee in the UK when approval is sought for a plan or project. Moreover, there is no guidance of the Secretary of State (or indeed anyone else) to suggest the use of ICES stock assessments for the purposes of assessing the impact of plans or projects under the Habitat Regulations. In those circumstances, it would be quite wrong to treat ICES stock assessments as somehow representing the default position and requiring justification for taking a different approach.

7.147 In answer to the Inspector’s questions, Dr Jennings said he “*believed strongly in deferring to ICES*”. His approach ignores the legal requirement to ask whether there is reasonable scientific doubt and replaces it with a strong presumption that ICES has all the answers, despite ICES existing to answer different questions to those facing competent authorities.

7.148 Even ICES itself has made pronouncements that sound a note of caution. For example, in 2021 the ICES Stock Identification Method Working Group (SIMWG) recognised the potential mismatch between traditional stock subdivisions and true biological stocks:⁴⁴⁷

“traditionally, exploited stocks have been assessed and managed according to geographical features and ICES stock subdivisions. As more research is conducted though, it is evident that only a fraction of stocks are organized according to such subdivisions. In reality, they are far more dynamic and complex. SIMWG’s work is aimed at minimizing mismatches between true biological stocks and traditional management areas. It plays a significant role in forming improved approaches to define stock units and promote evidence-based management approaches.”

7.149 Thirdly, the appellant is unable to point to any previous example where a competent authority in the UK assessed impacts of a proposed plan or project by comparing those impacts to ICES stock assessments extending over vast areas. The novelty of what the appellant is proposing is significant and it would set a precedent for the consideration of other plans and projects affecting marine species.

7.150 Fourthly, the appellant and Cefas have previously taken a very different approach to that now urged on the Secretary of State. The appellant did not compare predicted losses from HPC to ICES stock assessments in its original DCO

⁴⁴⁶ CD6.12 Dr Jennings’ proof, Appendix C.

⁴⁴⁷ CD9.72

application.⁴⁴⁸ Instead, it concluded that for all marine finfish except for blue whiting, the populations were limited to the Bristol Channel and eastern Celtic Sea, with relatively little mixing. Similarly, Cefas did not recommend comparison with much larger ICES stock areas when advising NRW in 2017 in relation to the Swansea Tidal Lagoon project.⁴⁴⁹

7.151 Fifthly, Dr Jennings' own evidence demonstrates that the populations advanced by the appellant are too large:

- Dr Jennings said that what matters is "*where the adult populations spawn, the populations of which they are part, and the transport of their progeny as eggs and larvae*".⁴⁵⁰ On that basis we need to look at where the eggs and larvae come from that are transported to Bridgwater Bay and which fish lay those eggs and larvae;
- The appellant's evidence does not, however, establish that all the fish making up the SSB figures it proposes in fact have an actual (or even potential) connection to Bridgwater Bay;
- Taking European sea bass as an example, Dr Jennings accepted in cross-examination that sea bass in ICES Division 4b (which covers the North sea as far as Norway and Denmark) do not contribute to eggs and larvae that end up in Bridgwater Bay, yet those sea bass are included as part of the SSB against which the appellant compares predicted HPC impingement losses;
- It is no answer to say, as Dr Jennings did, that the SSB is unevenly distributed over ICES stock areas and that relatively few sea bass live in Division 4b. The fact is that there is no evidence of the percentage distribution of the SSB between divisions, no evidence of precisely where the eggs and larvae that enter Bridgwater Bay each year come from or which fish lay those eggs. All we have is an admission that the appellant's SSB includes fish that have no connection with Bridgwater Bay and which are therefore irrelevant for the purposes of assessing the impact of HPC. This underlines the problem of using ICES stock areas created for fisheries management purposes for the entirely different purpose of conducting an AA. For fisheries management purposes it is unnecessary to establish a connection between a particular designated site and the spawning population. By contrast, in an AA it is absolutely essential to know how big the population is that contributes to the eggs, larvae and juvenile fishes in Bridgwater Bay. In the Agency's view, the appellant's evidence does not answer that question.

7.152 Sixthly, in relation to Atlantic herring, the appellant's PELTIC survey does not provide a reliable identification of the relevant population for undertaking an AA of the impact of HPC on herring. The work of Dr Clarke,⁴⁵¹ and the representations by the D&S IFCA,⁴⁵² show that it is highly likely that herring in the Bristol

⁴⁴⁸ See CD 7.2 (TR148) and CD6.8 Mr Waugh's proof, para 4.4.9.

⁴⁴⁹ CD 9.118 and CD6.17 Mr Waugh's rebuttal, para 2.1.1C.

⁴⁵⁰ CD6.19 Dr Jennings' rebuttal, para 2.21.

⁴⁵¹ CD 9.114 and see also Waugh's proof, para 4.7.4ff.

⁴⁵² CD 10.1.

Channel/Severn Estuary have some degree of separation or subpopulation/metapopulation structure and that the relevant population is smaller than ICES Division 7f.⁴⁵³ The PELTIC survey merely estimated the total number of herring in ICES Division 7f, but it did not involve any genetic work and so it cannot tell us the size of the subpopulation(s) of herring likely to be affected by HPC.

7.153 Dr Jennings' response to that objection was unpersuasive. He explained a "*simple calculation*" that he had "*done in [his] head*" whereby he assumed that 10% of the herring biomass from Division 7f came from one subpopulation stock, and then concluded that the predicted rates of impingement would not be a concern because impingement levels would not be the driver of population dynamics. That 'analysis' is flawed because we do not know the size or distribution of the sub-population(s) that are likely to be impacted by HPC. Dr Jennings' guess that the sub-population might constitute 10% of the total biomass of Division 7f is just that - a guess. Dr Clarke's work suggests that there is a spawning population at nearby Minehead.⁴⁵⁴ It is not clear if herring in Bridgwater Bay constitute 100% of that spawning population or some smaller percentage. Dr Jennings' "*simple calculation*" is not informed by any data or assessment and he even said he had not reviewed Dr Clarke's study in any detail. All of this points to the fact that there is an obvious concern that HPC will adversely affect a smaller sub-population of herring and yet the appellant has provided no actual evidence capable of removing reasonable scientific doubt as to the nature and extent of that adverse effect.

7.154 Where that leaves us is that the appellant's population figures are demonstrably too large for Atlantic cod, whiting and European sea bass and inappropriate for use in an AA. The lack of recognition of strong evidence to support fine scale herring populations very close to the intake, coupled with inadequate herring surveys undertaken by the appellant, also means that the Atlantic herring population proposed by the appellant is, it is argued, unreliable. Mr Waugh by contrast has conducted a thorough literature review and arrived at population figures that are greater than the appellant proposed in its DCO application, and greater than Cefas proposed for the assessment of Tidal Lagoon Swansea Bay only 30 miles away. It cannot be said that Mr Waugh has been excessively precautionary. The appellant's suggestion that sea bass from outside his population areas may spawn and their eggs reach Bridgwater Bay in some years does not invalidate his assessment. Taken at its highest, the appellant's criticism merely shows that Mr Waugh's assessment is precautionary. But that comes nowhere close to saying that the relevant population is as large as the appellant's proposed ICES stock areas.

7.155 Another important point flows from this: if the appellant's population figures are demonstrably too large then it follows that Dr Jennings' stock assessment carried out on those population figures is also flawed. His stock assessments are also not precautionary because their input is the RIMP data which carries considerable uncertainty with it. No doubt that is why no such stock assessment was attempted in support of the original DCO, and why the variation application did not include one.

⁴⁵³ CD 10.1.

⁴⁵⁴ CD6.8 Mr Waugh's proof, Figure 1.

Predicted impact on the assemblage species

7.156 It is important to recall that the pelagic cap is agreed not to have a benefit for European sea bass, Atlantic cod and whiting (and so the factor is 1.0).⁴⁵⁵ Consequently, the AFD was to be the principal form of mitigation for those species. Although the agreed pelagic cap factor for herring is 0.23, it is notable that in its DCO application the appellant predicted that the AFD would deflect 95% of herring from the intakes.⁴⁵⁶ Consequently, the loss of the AFD will result in a significant increase in impingement of all four marine assemblage species.

7.157 The Agency predicts the following impacts on the marine assemblage species as a percentage of spawning population size:⁴⁵⁷

European sea bass	2.1
Atlantic cod	15.7
Whiting	6.5
Atlantic herring	4.0

7.158 Mr Waugh explained that impacts of that magnitude could adversely affect the structure and function of these typical species of the marine assemblage and thereby undermine the conservation objective for the “Estuaries” feature, giving rise to an adverse effect on the integrity of the SAC and the Ramsar site.⁴⁵⁸

HPB (and HPA) versus HPC

7.159 In SPP106,⁴⁵⁹ the appellant sought to calculate the impact of HPC relative to HPB and HPA. It argued that:

- the reduction in impingement mortality associated with the closure of HPB will exceed the increase in impingement mortality at HPC for Atlantic herring, Allis shad and Twaite shad; and
- the impingement mortality of HPC will be less for all species (apart from salmon and sea trout) than it was between 1976 and 1999 when HPA and HPB were operating.

7.160 The appellant’s argument that closing HPB creates “headroom” for HPC to operate is beguilingly simple, but it does not withstand scrutiny.

7.161 First, there is no evidence that HPB (or indeed HPA) has not adversely affected the fish of the SACs/Ramsar site, in particular because there was no baseline study

⁴⁵⁵ CD 6.5 Statement of Common Ground, table 1.

⁴⁵⁶ CD 1.11, table 19.

⁴⁵⁷ CD 6.26 (ID 12), Table C.

⁴⁵⁸ CD6.8 Mr Waugh’s proof, section 6.2.

⁴⁵⁹ CD7.9.

before those projects began operating, nor any control or impact monitoring.⁴⁶⁰ The appellant's underlying assumption of no adverse effect from HPA/HPB is unprovable as there is no data prior to their opening upon which to make a comparison.

7.162 In evidence in chief, Mr Goodwin referred to the Court of Appeal of Northern Ireland's decision in *An application by Friends of the Earth Limited for Judicial Review* [2017] NICA 41.⁴⁶¹ The case concerned a challenge to the Minister's refusal to issue a Stop Notice to the owners of the bed of Lough Neagh and a number of businesses involved in sand extraction from Lough Neagh (an SPA and Ramsar site). The Minister's reasons included that "*it would not be a proportionate response in a situation where there is no evidence that the dredging, which has been going on since long before the site's designations, is having any impact on the environmental features of the lough.*" Mr Goodwin gave this case as an example of the court having to grapple with a situation in which there is no established baseline against which to judge the effect of a long-standing project.

7.163 The important point that emerges from the judgment (consistently with Mr Goodwin's explanation in evidence in chief) is that the precautionary principle means that the absence of evidence of harm should not be equated with the absence of harm. Instead, it must be shown by positive evidence that the project is not causing an adverse effect; unless that is demonstrated the decision-maker must proceed on the assumption that there is an absence of evidence that the project is not having an unacceptable impact:

"[34] We return to the decision under challenge and the statement of the Minister in the decision letter that there is "no evidence that the dredging ... is having any impact on the environmental features of the lough". This is the wrong approach. It is acknowledged by the Department that these operations are likely to have a significant effect on the environment. It is not known what that effect will be. The precautionary principle applies. It operates on the basis that there should be no planning permission until it is established that there is no unacceptable impact on the environment. The Minister's decision proceeds on the basis that there is an absence of evidence of an unacceptable impact on the environment. The proper approach is to proceed on the basis that there is an absence of evidence that the operations are not having an unacceptable impact on the environment. (emphasis in original)

...

[37] Given the repeated finding that the operations are likely to have significant impact on the environment the decision maker cannot simply put in the balance the absence of evidence of harm. It is not considered a sufficient response to the content of the decision letter to refer to the options and the references to the precautionary principle in the briefings to the Minister. What has been disregarded in the letter of decision, where it deals with the Stop Notice, is that these operations are considered likely to have significant impact, that the nature and extent of that impact has not been established, that prior to the grant of permission

⁴⁶⁰ CD6.6 Dr Edwards' proof, section 7.2.

⁴⁶¹ CD13.23.

is the requirement to establish that there will be no significant impact and that it is imperative that the precautionary principle be applied. What must be put in the balance is the absence of evidence that there is no harm. To approach the matter with a requirement for evidence of harm is the negation of the precautionary principle.”

7.164 Mr Goodwin argued that there is positive evidence that HPB has not had an adverse effect on any of the designated sites. To see whether that is the case, it is necessary to look now at what, if anything, the RIMP data can tell us about HPB’s effect.

7.165 Second, the RIMP data cannot be used to ascertain the impact of HPB (or indeed HPA) on fish of the SACs/Ramsar site. The appellant has sought to identify trends in the 37 years of RIMP data, but as the Agency explained in TB019,⁴⁶² there are such large uncertainties in the data set it is not possible to identify any trends with confidence. In particular:

- The Agency’s AA concluded that the change in overall fish abundance (all species combined) over time is too weak to conclude whether overall fish abundance has increased or decreased between 1981 and 2017, and that it may not be possible for the RIMP to detect a reduction in fish abundance smaller than 50% due to substantial variability within the data;⁴⁶³
- That accords with the views of NRW as expressed in the latest feature condition assessment for the Severn Estuary SAC.⁴⁶⁴ NRW said that the “*trend assessment [for Twaite shad] is based on the long term data set from the HP power station*” and it considered that a “*low degree of confidence*” should be attached to the trend assessment based on the RIMP;
- The highest Dr Jennings put it was that there are “*signals*” from the data one can detect if the RIMP data is “*disentangled by sub-setting and focusing on specific age classes*”;⁴⁶⁵
- Even that disentangling exercise has its limitations because Dr Jennings recognises that “*there is weak evidence of autocorrelation in the time-series of numbers at age, so the strength of some correlations may be slightly overestimated*”;⁴⁶⁶
- Dr Jennings also recognises that reductions in population will first occur in areas of lower habitat suitability.⁴⁶⁷ If as, for example, Mr Waugh, Mr Colclough and Dr Stewart (D&S IFCA) argue, the Severn Estuary is an area of high habitat suitability, the RIMP will not be likely to reflect changes occurring in the wider population.

⁴⁶² CD8.18.

⁴⁶³ CD4.1, p35, section 2.4.

⁴⁶⁴ CD12.28, p28.

⁴⁶⁵ CD6.12 Dr Jennings’ proof, Appendix D, para 10.15.

⁴⁶⁶ CD6.12 Dr Jennings’ proof, Appendix H, para 14.4.

⁴⁶⁷ CD6.12 Dr Jennings’ proof, Appendix H, para 14.8.

7.166 Thirdly, even if it were possible to ascertain a trend in the RIMP data, that does not demonstrate that HPB has not adversely affected the designated sites because the 37 year RIMP study coincides with a significant decrease in water abstraction from the Severn Estuary making it impossible to attribute any positive trend in the RIMP data to HPB not having an effect as opposed to a reduction in abstraction generally. This is illustrated in Figure 4 in Dr Edwards' proof which shows that the RIMP study began in 1981 when water abstraction in the Bristol Channel was just below its historic peak.⁴⁶⁸ The steady decline in the volume of water abstracted during the 37 year RIMP study to nearly 50% of its peak is likely to have masked any impact of HPB that might otherwise have been detectable in the RIMP data.

7.167 Fourthly, even the appellant's comparisons between the impact of HPB and HPC do not demonstrate that closure of HPB⁴⁶⁹ will certainly create "headroom" for HPC to operate in.

7.168 The analysis in SPP106 sought to compare HPB to HPC by comparing their relative abstraction rates alone i.e. the simple comparison of abstraction rates does not try to calculate numbers of equivalent adults likely to be impinged or compare predictions of equivalent adults to the population to estimate the percentage impact on the population. As Dr Edwards explains, the calculation is simply: HPC equivalent cumecs with LVSE intakes = HPB abstraction rate x LVSE intake head factor x HPC pelagic cap (where applicable).⁴⁷⁰

7.169 Even this simplified comparison calculation is highly sensitive to the parameter used for the intake intercept area factor:

- The figures in Table 5 of SPP106⁴⁷¹ are derived from a calculation using the appellant's figure for the intake intercept area factor stated in SPP105 i.e. 0.726;⁴⁷²
- The figures in Dr Edwards revised figure 13,⁴⁷³ are based on the same calculation but using the agreed factor of 1.0 for the intake intercept area factor;
- Making that single change significantly affects the comparison and shows HPC performing worse than HPB in relation to whiting, cod and bass.

7.170 The calculation is also highly sensitive to the figure used for the pelagic cap. This can be demonstrated with reference to Table 6 in Dr Jennings' proof which sets out the ratio mortality of HPC to HPB in the final column.⁴⁷⁴ A number greater than 1 in that column indicates higher mortality at HPC than HPB. The calculation is flow ratio (3.836) x intake intercept area factor (1.0) x intake velocity cap (the figures for

⁴⁶⁸ CD6.6 Dr Edwards' proof, p15.

⁴⁶⁹ The continuing abstraction associated with HPB's defueling operations and the absence of any fixed date for the total cessation of water abstraction is explained in Dr O'Donnell's note: CD 6.11e (ID18).

⁴⁷⁰ CD6.6 Dr Edwards' proof, para 7.2.3.

⁴⁷¹ CD 7.9, p22.

⁴⁷² NB the appellant originally used a figure of 0.827, but changed it to 0.726 in SPP105.

⁴⁷³ CD 6.6c. NB the original figure 13 in her proof used the figure of 1.394 which has since been superseded by the agreed factor of 1.0.

⁴⁷⁴ CD6.12 Dr Jennings' proof, p30.

which are agreed)⁴⁷⁵ x FRR mortality. For shad and herring, Dr Jennings predicts lower mortality associated with HPC than HPB (0.88). But Dr Jennings agreed in cross-examination that if the agreed upper confidence figure for the pelagic cap (0.28) is used in the calculation instead of the factor of 0.23, then the comparison shows HPC has a greater effect than HPB (1.074).

7.171 Given the sensitivity of this simple comparison exercise to the inputs, the fact that the simple comparison excludes consideration of EAVs and comparisons with the population, and the absence of evidence to show HPB has not adversely affected the designated sites, it is not possible to be certain that closure of HPB would create “headroom” for HPC to operate.

Conclusion

7.172 The Agency invites you to recommend that the Secretary of State dismiss the appeal on the basis that he cannot be certain that the project would not adversely affect the integrity of the designated sites.

⁴⁷⁵ CD 6.5 SoCG, table 1.

8. THE CASE FOR THE SEVERN ESTUARY INTERESTS

- 8.1 The full submission made by SEI can be found at CD 6.29 with comment on the SWMP at CD 12.36; the material points are as follows:
- 8.2 HPC is a multi-billion pound project that is going to have an ongoing and massive impact on the Severn Estuary for the 60 years of its operation.
- 8.3 The cooling water system alone will abstract 130 cumecs, greater than all of the rivers contributing to the Severn Estuary in summer months, and a larger flow than the River Severn itself, the biggest river in the UK.
- 8.4 SEI has made it clear throughout these proceedings that there is no intention to interrupt the development of HPC. The sole purpose behind the intervention is to ensure that the damaging impacts of the development are monitored and that proportionate compensation be put in place to mitigate the harmful effects of operation. This is nothing new. It is exactly this approach that underpins Government environmental policy.
- 8.5 The reason underlying the appeal, the apparent 'discovery' by the appellant of various issues in relation to the operation of the AFD, after the original application was made on the basis that the combination of LVSE abstraction chambers with AFD and a FRR was achievable, feasible and best practice in accordance with Environment Agency 2010 guidelines.
- 8.6 Having heard the explanation for the apparent discovery of difficulties it remains problematic to fully understand how what are now advanced as difficulties came as a revelation to anyone?
- 8.7 Dr O'Donnell's explanation was that the factors that changed the appellant's position were a high tidal range, high levels of sedimentation, that there were winter storms in this part of the country and that the presence of maintenance staff would pose a shipping hazard.
- 8.8 These things should not come as a novelty to the appellant after they had gone through the previous application and DCO process. It belies a staggering inability to see the obvious and a lack of critical thinking behind the initial application, if true.
- 8.9 So far as the three aspects of the water intake, the LVSE structure is a completely new and untried design. It was developed in part as a response to the failure of the Sizewell B design in operation. It has never been used before at any site anywhere in the world.
- 8.10 The FRR system has only been partially tried before. No-one has built an intake 3.3km offshore and the barometric trauma impact on fish and other estuarine life is acknowledged as likely to be extreme, even before the abstracted life forms reach the FRR and mesh screens.
- 8.11 The consequence of the appeal is that the Secretary of State is now faced with a request to remove the only element of the 'best practice' system that has been tried and tested.

- 8.12 The SEI have always maintained⁴⁷⁶ that the development is liable to three sets of regulation:
- 8.13 Firstly the area is designated a SAC and subject to the Habitats Regulations (and Ramsar sites that are to be treated the same way); secondly the intake area covers the Bridgwater Bay water body designated under the WFD and subject to the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, and finally the area is subject to the provisions of the SWMP for planning purposes.
- 8.14 The proposed project alteration has been assessed by the statutory bodies and consultees – the Agency, NRW, NE and D&S IFCA. All have rejected the proposed alterations on environmental grounds.
- 8.15 The proposed alterations have been considered by environmental Non-Governmental Organisations (NGOs) such as the Blue Marine Foundation, the Somerset Wildlife Trust, the Wildfowl and Wetlands Trust, the Severn Rivers Trust and local angling bodies. All these organisations have a practical knowledge of the ecology and operation of the Severn Estuary. All have rejected the proposed alteration.
- 8.16 Additionally, and unusually, the Inquiry has heard from a body of significant scientific experience in this field, people that had been involved with and learned the lessons from previous power station designs and practical implementation and that had been involved in both developing the guidance and, in some cases, also involved in the actual design of the system subject to this appeal. All of these concerned people raise serious, tangible and scientifically literate concerns.
- 8.17 Faced against that array, the appellant on a scientific basis has sought advice from Cefas as consultants, with Dr Jennings saying that when he joined the appellant's team relatively recently that he was asked by EDF to look at the effect on population, and told that he was not to comment on the Habitats Regulations impacts. Also more recently introduced to the appellant's team, Mr Goodwin, was brought in to comment on the application of the regulatory framework.
- 8.18 It is clear that by way of background to this appeal, from issues that relate to the technology available to deploy and maintain the AFD, to the absence of any proper ecological investigation around the abstraction and outfall systems, that the appellant was reluctant to conduct their own research, or support others, in order to increase the ecological knowledge within the estuary. There has been no 'call for evidence' from local bodies – the D&S IFCA, UtS, no apparent consideration of the research findings from the Swansea tidal project, evidence from local universities or even to consider local fishing records to help inform additional research.
- 8.19 It is an agreed legal proposition⁴⁷⁷ that "*Any decision should be based upon the best scientific knowledge in the field, and the information required should be up to date.*" That is precisely to remove the need to speculate and to replace assumption with reasonable certainty.

⁴⁷⁶ CD 6.4 – paras 23 to 39

⁴⁷⁷ para 10 CD 6.21

8.20 The Secretary of State can only grant the permit variation if he decides that it will not adversely affect the integrity of each of the designated sites. The Secretary of State must apply the precautionary principle and must be satisfied beyond reasonable scientific doubt.

8.21 The appeal raises a number of legal issues including the:

- Habitats Directive and Regulations and Ramsar – as with the representations of NRW and NE, SEI agree with Agency interpretation of the law in relation to this Directive and Regulations made pursuant to it;
- WFD and Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The SEI position remains that this is a mandatory legal requirement with duties placed upon the Secretary of State to prevent the deterioration of surface water quality and otherwise to support the achievement of the environmental objectives set for a body of water;

Both of the above have derogation powers that permit an imperative reasons of overriding public interest (IROPI) course to be followed; and

- The SWMP, which was adopted as of 12pm on the 23 June 2021. It is a material consideration and sets out the approach to marine planning. The plan deals with (para 5.17) 'Water quality' and (para 5.22) 'Marine protected areas' (including SW-MPA2, SW-BIO-2 and Marine Policy SW-NG-1 'Net gain') that remain unchanged from the draft plan. A decision-making hierarchy is set out in relation to Marine Protected Areas.

8.22 In relation to the Habitats Directive and Ramsar considerations the Secretary of State, as the Appropriate Authority will need to make determinations based upon the evidence given in these proceedings.

8.23 In SEI's submission, the appellant has failed to discharge the requirements. There are numerous factors that were directly raised by the Agency during their cross examination of witnesses that are adopted – for example the challenge to the use of large ICES areas for fish stock populations.

8.24 That example underlines fundamental erroneous assumptions that have been made by the appellant in setting out their case.

8.25 A central assumption that seems to follow through many of the assertions is that in TR456 (CD 1.11) in which it is asserted "*there is no such thing as a biological population at the estuary level.*" Clearly this was refuted by the evidence of Charles Crundwell in relation to shad. Following the credible evidence advanced this assertion must either be entirely wrong, or such that it must create real scientific doubt as to what is happening. It follows that reliance on those assumptions to calculate risk to passing fish will need to be properly re-assessed.

8.26 Consider the assertions, or better described, assumptions, of Dr Jennings in relation to shad. He said:⁴⁷⁸ "*Atlantic salmon and Twaite shad use selective tidal stream*

⁴⁷⁸ CD 6.12 para 4.71

transport during parts of their life-cycle to move through the estuary (Appendix F). Selective tidal stream transport reduces energy costs during migration, as the fish use the force of tidal currents to help them travel rapidly over long distances while using less of their energy reserves.”

8.27 That assertion is simply wrong in relation to shad.

8.28 Contrast that statement with the recently obtained evidence advanced by Charles Crundwell, a man that has actually studied the species in question⁴⁷⁹ *“The ground breaking acoustic tagging of 209 adult shad started in 2017 and will continue until 2022. This has allowed new knowledge on shad to be gained. Of particular relevance to this Inquiry is the new data on freshwater behaviour (spatial and temporal), movements through the Bristol Channel and coastal waters, survival between years, site fidelity, genetics, run size and population structure. Many of these results are new to shad science and are freely available to interested parties. Much of this new data has helped to inform our HRA.”*

8.29 We now know that there is significant site fidelity, there are relatively high sea and spawning survival rates and, as per Charles Crundwell, *“Passage through the estuary - We now know that shad spent prolonged periods in the Severn Estuary/Bristol Channel on returning to sea post spawning (July-November) and on their returning spawning migration through the Bristol Channel (Feb to May) to reach their river can take several weeks. In fact adult shad only appear to be mainly absent from the Bristol Channel in December and January)”*.⁴⁸⁰

8.30 Of direct relevance to the removal of the AFD⁴⁸¹, *“It is my opinion that it is reasonable to assume that adult shad will not just pass the location of HPC once on migration swept along by the tide, but are more likely to pass many multiple times. It is also probable that post spawning shad will reside for prolonged periods within the vicinity of HPC abstraction.”*

8.31 There are only four known breeding populations of Twaite shad in the UK. All are in the Severn or rivers that flow into its estuary.

8.32 Twaite shad populations need to be restored and proceeding without an AFD would mean that it is unlikely that the populations will be maintained.⁴⁸²

8.33 There is little margin of error in relation to this species – even less with the allis Shad.

8.34 There is no disagreement that these ‘hearing specialist’ Annex II species are relevant features of SACs that stand to be directly affected by the removal of the AFD. The extinction of either population, in itself would also result in the loss of WFD status in any waters that are affected.

⁴⁷⁹ CD 6.9 para 1.1.7

⁴⁸⁰ CD 6.9 5.7.11

⁴⁸¹ CD 6.9 5.12.4, Charles Crundwell

⁴⁸² Mr Crundwell in cross examination

- 8.35 Another significant and incorrect assumption made by the parties in this case is in relation to the assumption that there is a linear rather than power ratio for the impingement and entrainment of fish.
- 8.36 The power ratio is potentially hugely significant in any quantitative assessment even if the very lowest power ratio example is used. No-one has demonstrated any error in Dr Henderson's work at HPB⁴⁸³ and elsewhere, or that his following conclusions are wrong: "*on a large scale, the relationship between the rate of water extraction and impingement can be approximated by a power relationship. This is important as it indicates that large intakes such as that proposed for Hinkley C Nuclear Power Station will be considerably more damaging to fish stocks than would be anticipated by a simple pro-rata calculation based upon data from the working B stations which have considerably lower cooling water requirements*".
- 8.37 At HPB⁴⁸⁴ an increase in pumping rate of 33% resulted in an average increase in fish impinged of 147%.
- 8.38 The results of this scientific research by Dr Henderson, a leading international expert on the impingement and entrainment of fish at power stations, a senior researcher at Oxford University publishing his findings in peer reviewed papers, and the leading scientist behind the RIMP data, produce a significant impact on the quantitative assessments.
- 8.39 Credible, and arguably the best scientific evidence available in this field, is that there is a real, as opposed to hypothetical risk. That evidence has gone unanswered.
- 8.40 A party alleging that there was a risk that cannot be excluded on the basis of objective information must produce credible evidence that there was a real, as opposed to hypothetical risk, that must have been considered: *Boggis v. Natural England* [2009] EWCA Civ 1061 at 37⁴⁸⁵. The corollary is, of course, that once such credible evidence has been advanced of a real risk, then it should be dealt with properly. Nothing has been advanced by any other party in respect of the power ratio, and it would be surprising if anyone could advance contrary evidence based primarily on power stations across Northwest Europe.
- 8.41 In relation to barometric trauma, it seems that no research has been conducted into the effect of the novel 3.3km journey with fluctuating and extreme bar readings prior to the FRR and 5mm screens.
- 8.42 In applying the test under the Habitats Regulations, courts have confirmed that '*no reasonable scientific doubt should remain*' about the absence of adverse effects on the day the decision is made⁴⁸⁶ and that the assessment "*must not have lacunae and must contain complete, precise and definitive findings and conclusions...*".⁴⁸⁷

⁴⁸³ Table 4 CD10.3

⁴⁸⁴ Table 3 CD10.3

⁴⁸⁵ CD13.20

⁴⁸⁶ *Waddenzee*, CD6.4 [29]

⁴⁸⁷ *Sweetman*, CD6.4 [29]

- 8.43 Witnesses have confirmed the conclusion of the Agency’s AA⁴⁸⁸ that it was not possible to conclude no adverse effect on the integrity of the Severn Estuary SAC and Ramsar site, River Usk SAC and River Wye SAC.
- 8.44 Turning to the WFD assessment, it is apparent that the appellant has failed to properly understand and address the requirements of the WFD and of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.
- 8.45 The body of water most closely associated with HPC is the Bridgwater Bay water body. Its ecological status was only moderate, ie below the ‘good’ status required based upon Invertebrate Quality Index (IQI), Dissolved inorganic nitrogen (DIN) and two other criteria. Undoubtedly the operation of HPC will have a negative impact on both IQI (through invertebrate entrainment) and DIN (from dead fish like sprat that might otherwise be deterred by the AFD).
- 8.46 Within the WFD assessment⁴⁸⁹ the following was given in relation to invertebrates:

4.1.1.2. Invertebrates

No population-level assessments on the impacts of entrainment, impingement and entrapment within the CWS has been conducted with respect to populations of invertebrate taxa in the vicinity of HPC. The most impacted invertebrate taxon is likely to be the brown shrimp Crangon crangon and this species represents a potentially important component of marine ecology in the vicinity of HPC.

The TR456 assessment (Cefas 2019a), as updated by Agency & APEM’s (2020b) review, has predicted losses in the region of 3.5ty-1 of this species as a result of impingement mortality. Brown shrimp reproduce almost continuously throughout the year and have large dispersal potential.

As such, despite the potentially high levels of shrimp mortality associated with HPC, it is considered, as described in Section 6.11 of the Marine Assemblage FIAT (EA2020a), that this species will be highly resilient to these losses. It is therefore considered that impacts arising from the impingement, entrainment and entrapment of benthic invertebrates will not jeopardise compliance with WFD.

It was considered that intake of water into the CWS had the potential to impact on fish and invertebrate assemblages in the vicinity of HPC. In addition, local ecological receptors and water quality parameters had the potential to be impacted as a result of the discharge of material from the fish return and release (FRR) system. For both activities, it was considered that there was potential for impacts on the designated and qualifying features of protected areas.

Assessment of these impacts concluded that there was minimal risk of these activities of compliance with WFD.

⁴⁸⁸ CD4.1, p.218

⁴⁸⁹ CD8.32

8.47 It is apparent that the legal test applied in both examples above is wrong when applying reg 3(2)(b) of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

8.48 The legal test within Regulation 3 of the Water Framework Regulations is:

3 Duties on ministers and regulators

(1) The Secretary of State, the Welsh Ministers, the Agency and NRW must exercise their relevant functions so as to secure compliance with the requirements of the WFD, the EQSD and the GWD.

(2) Without prejudice to the generality of paragraph (1), the Secretary of State, the Welsh Ministers, the Agency and NRW must determine an authorisation so as, in particular—

(a) to prevent deterioration of the surface water status or groundwater status of a body of water (subject to the application of regulations 18 and 19), and

(b) otherwise to support the achievement of the environmental objectives set for a body of water (subject to the application of regulations 16 to 19).

8.49 There is a positive duty to determine an authorisation of a permit so as to otherwise support the achievement of the environmental objectives set for these protected bodies of water. It is clear, subject to the derogation within the Regulations, that any application that is going to adversely impact the achievement of the environmental objectives should not be supported.

8.50 It is notable that uncontested evidence was given by Stephen Colclough, the former UK and Irish representative to the EU that led European WFD transitional waters sampling methodology and fish classification, that the demise of any species of fish would result in the reduction of status of any relevant body of water.

8.51 The SWMP was adopted yesterday, 23 June 2021. The plan, coupled with the current Planning and Environment Bills before Parliament and recent Regulation such as the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 sets a clear direction of policy in environmental protection. Should it prove impossible to avoid or mitigate the adverse impacts, in order to protect the protected areas, compensation measures should be considered.

8.52 Apart from setting out specific policy guidance, the plan also sets out a decision-making hierarchy:

"Para 1121 - Proposals must first demonstrate that they have avoided adverse impacts by altering the proposal so that it no longer exerts a pressure on the features of marine protected areas. Avoidance is the preferred measure due to the difficulty of mitigating impacts in the marine environment. Where adverse impacts cannot be avoided, proposals must demonstrate that they have minimised adverse impacts at source by altering the proposal to reduce the pressures placed on features of marine protected areas. Where adverse impacts cannot be minimised at source, proposals must demonstrate that they will mitigate the impacts caused. Proposals will likely apply a mixture of measures to avoid, minimise and mitigate

adverse impacts. Advice should be sought from the statutory nature conservation bodies on the suitability of mitigation measures. Proposals must demonstrate how they have satisfied a) before moving to b), and so on.'

8.53 *Para 1122 - Where proposals cannot avoid, minimise and mitigate adverse impacts, this policy does not remove the provisions for derogations that are present in primary legislation and regulations. Where a proposal cannot avoid, minimise and mitigate adverse impacts on sites protected by The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Marine Habitats and Species Regulations 2017 and where an overall adverse impact on site integrity cannot be ruled out, SW-MPA-1 does not remove the provision for derogation set out under the aforementioned regulations. Proposals wishing to proceed down the derogation route must do so in accordance with the process set out under the regulations, with advice from the relevant decision-maker and the statutory nature conservation body. This may be the case for navigational aids."*

8.54 It is self-evident that the effect of this appeal will add to, rather than diminish the pressures on the features of the Marine Protected Areas. The proposed removal of the AFD will cause additional fish impingement and entrainment, including of Annex II species and will aggravate rather than minimise the harm. Where proposals cannot be minimised at source, the next step is to consider mitigation of the proposal. This is clearly impracticable since no additional mitigation has been advanced. The SWMP reflects the position advanced by both the Agency and SEI, that the correct route for this application is to seek a derogation.

8.55 The SWMP now also includes 'net gain' provisions that should be properly applied to the application:

In relation to SW-NG-1, SW-NG-1 encourages proposals to apply the evolving net gain approach to development that aims to leave the natural environment in a measurably better state than beforehand. The policy also protects marine and coastal natural capital assets and services by ensuring that proposals which are likely to cause harm take measures to prevent, reduce or mitigate significant adverse impacts, with compensation strategies being encouraged to deliver environmental net gain. Proposals that cannot avoid, minimise and mitigate, or as a last resort compensate for significant adverse impacts, will not be supported.

8.56 Beyond cursory remarks from Mr Goodwin⁴⁹⁰ it is clear that the appellant has not dealt with marine planning in this application which is a material consideration and has conflated the tests and procedures set out above with their own, very narrow, interpretation of procedures under the Habitats Regulations.⁴⁹¹ Such a fundamental mistake potentially has the effect of making the application defective.

8.57 Not only does SEI say that there remains significant uncertainty on the propositions advanced by the appellant, but there also remains significant doubt that the application is warranted.

⁴⁹⁰ CD 6.13 para 8.5

⁴⁹¹ as evidenced by Mr Goodwin in cross examination

- 8.58 At the outset of the Inquiry we were treated to witnessing the criticisms of Dr Turnpenny and Dr Lambert, imputing that they had some personal financial motivation for giving the evidence in the way that they have to this Inquiry. Their evidence was that the AFD system was practicable and effective. This is exactly the same position that both have advanced for many years before this Inquiry. Dr Turnpenny, as the Inquiry has already heard, was part of the team that designed the LVSE – it is not Dr Turnpenny’s and Dr Lambert’s position that had changed.
- 8.59 Any interested bystander might have half-expected some follow-up questions to deal with Dr Turnpenny and Dr Lambert’s assertion that the appellant has failed to get in touch with them to consider the latest technological options, with information from other suppliers of such equipment acquired as part of the appellant’s thorough investigation of this issue. There was nothing other than an acceptance by Dr O’Donnell that since 2017 he had spoken to one company and an unnamed person that worked in the sector who told him that there would be difficulties. It doesn’t appear that any serious and diligent attempt has been made to overcome the alleged technical problems.
- 8.60 The simple fact behind those criticisms of these two Doctors, both of whom are scientists, and many of whose papers are relied on in the appellant’s own case, is that Dr Lambert’s company is one of a number of suppliers of this type of technology. They were not guaranteed to gain from adopting this stance at the Inquiry, a stance that is consistent with their research and writing over many years. If one is to level charges of financial gain, ironically the only party guaranteed to have a financial benefit from not supplying and maintaining the AFD equipment over the 60-year period of operation of HPC is the appellant.
- 8.61 What is also apparent is that the appellant has chosen not to conduct proper research to support their application. They have then criticised the Agency’s best efforts to work with the paltry offerings, relying on the lack of detail and uncertainty that creates to try and support their own position. The appropriate authority has a legal duty to base the decision on up-to-date information. Where there is insufficient information and uncertainty, a proper application of the tests means that the proposal should be rejected.
- 8.62 SEI’s case as set out in their opening statement, if there is any credibility in the appellant’s reason for applying to vary the condition then we would not be here today had there not been a complete failure of the most basic scrutiny at the initial stage. No-one has suggested that as an engineering problem, there has been any change to conditions in the Severn since 2013.
- 8.63 Ignoring the power relationship for fish impingement and entrainment is a similarly glaring error. This appeal is not about whether HPC will proceed. It will. The opposition to this appeal is about mitigating and compensating for the harm that will be caused by the removal of a layer of environmental protection put in place to help protect a sensitive marine nursery area from a massive project that will impact the area for over half a century.
- 8.64 This Government has consistently championed policies aimed at biodiversity gain. It has consistently championed the principal that where environmental harm has to be caused, that such harm is offset by compensation for the harm. In the context of a

project like HPC, such compensation could readily be identified and implemented, just as has been done in relation to the Swansea tidal project.

- 8.65 The route to get to that place can either be via IROPI – and compensation being applied under the Habitats Regulations provisions (Reg 64), or via implementation of Regulations 16 to 19 of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 to a similar end, or both together, and through the net gain policies in the SWMP.
- 8.66 This is not an Inquiry where there has been a simple split in scientific opinion. The Agency, NRW, NE, D&S IFCA, SEI and present and past scientists engaged in nuclear infrastructure – all agree that the appeal and the removal of the environmental protection the AFD affords, is wholly misplaced. It was one of the pillars supporting the introduction of novel technology.
- 8.67 SEI advocates the importance of adaptive management. There are huge uncertainties contained within the development itself. We know that there is the uncertainty of climate change to be dealt with. There is evidence that it is likely that before HPC is operational, that sturgeon are likely to be visiting the estuary. These highlight the issues that will need to be addressed in the very near future. A structured adaptive management approach, of the kind operating at Swansea, is the kind of modern approach that ought to be taken to dealing with the uncertainties of the next 70 years of construction, operation and decommissioning of the plant, climate change and the different stresses that will be placed on the Severn Estuary habitats.
- 8.68 This Inquiry started on World Oceans Day. On that same day Environment Secretary George Eustice said:
- "The UK is a global leader in marine protection, and we are leading the way internationally to deliver healthy and sustainable seas. We must strike a balance in supporting sustainable industries while increasing protections for our seas to ensure a healthy, resilient and diverse marine ecosystem and we will work with others as we develop future protections."*
- 8.69 Environment Minister Rebecca Pow said:
- "It is clear people feel a strong connection with our beautiful ocean and coastlines. This is not only really welcome it is also so important if we are to tackle the impacts of climate change, biodiversity loss and preserve our marine environment for future generations to enjoy."*
- The UK is a global leader in marine protection. We have already established a 'blue belt' of marine protection extending across 38% of UK waters and are using our COP26 and G7 Presidencies to put ocean recovery at the heart of international action. "*
- 8.70 That blue belt of marine protection, and the Government's commitment to protecting marine biodiversity lies at the heart of this appeal. No-one is seeking to stop the HPC development. Virtually everyone is seeking the recognition that such development comes with a serious environmental cost to the marine environment, and steps should be taken to compensate for that cost in a meaningful way.

8.71 The appeal should be refused, and the appellant invited to pursue an IROPI application with appropriate compensation being advanced under an adaptive monitoring scheme.

9. THE CASE FOR OTHER OBJECTORS

Statement by Katherine Attwater (CD 10.5).

- 9.1 Stop Hinkley (SH) have been involved with the HPC site since 1984 when the first version of HPC was rejected for not being financially viable. They have engaged with EDF, the appellant, throughout the process of them getting their Preparatory Works and DCO applications. The points raised are regarding the appellant's general behaviour and ethics over this period.
- 9.2 First, in 2011, at the start of preliminary works, SH pleaded with them not to cut down the trees and hedgerows during the nesting season, and the importance of the pasture for the skylark's nests. They insisted they couldn't afford to wait for three months, this was unreasonable given they are now four years behind schedule.
- 9.3 Secondly, the appellant has never given a specific reason why they have decided not to comply with this part of the DCO agreement, other than suggesting it would not make any difference and ignoring the Agency's condition.
- 9.4 Thirdly, they have suggested that diver safety is an issue. Conditions in the Bristol Channel have not changed since the DCO and the possible supplier involved in this inquiry is totally confident that they successfully operate in these conditions elsewhere.
- 9.5 Fourthly, SH consider that there is a potential conflict of interest where the appellant are paying the commercial arm of Cefas to provide their evidence that the AFD is not necessary.
- 9.6 Finally, SH believe that this is a common practice of the appellant where they appear to comply with environmental conditions but have no environmental ethics.

Statement by David Bunt (CD 10.7).

- 9.7 He has been Managing Director of an Environmental Consultancy⁴⁹² for the past 5 years. He is Chairman of the Institute of Fisheries Management the UK's professional body for fisheries managers, and he is also Director of Conservation for the Sustainable Eel Group, a leading European conservation organisation seeking to reverse the decline of the European eel. Previously he held a number of positions, over 30 years, in fisheries and environmental management with the Agency and its predecessor, the National Rivers Authority. He holds a Bachelor's degree in Environmental Biology and a Masters in Aquatic Resource Management; he is a Chartered Environmentalist, and a fellow of the Institute of Fisheries Management.
- 9.8 He is not going to seek to provide complicated scientific evidence in support of this submission. The Inquiry will hear from better qualified and informed colleagues such as the D&S IFCA, Charles Crundwell of the Agency, Steve Colclough of the SEI

⁴⁹² Morpheus Environmental Consulting

and Andy Turnpenny of Fish Guidance Systems. He is just going to present a few facts and common sense in support of this submission.

- 9.9 The Severn Estuary is home to one of the most important and diverse array of fish populations in the British Isles, and it has numerous conservation designations as a result. Those designations are too many to list, but they include being a Ramsar site and a SAC.
- 9.10 It is home, a nursery area or a migratory route for a wide diversity of over 100 fish species, some common, some rare and vulnerable. Rare species include the migratory Allis shad, Twaite shad, sturgeon, the declining Atlantic salmon and the critically endangered European eel. All of these pass through and have the potential to be impacted by the intake for the cooling water to HPC, as they are already for HPB. For the European eel, his specialist area, the Severn Estuary is the migration route for the highest numbers of this fish in the British Isles. The European eel is classified by the International Union for Conservation of Nature as critically endangered, and its numbers have declined by as much as 90 – 95% over the past 40 years. It needs and indeed deserves all the help it can get to help its recovery.
- 9.11 HPC is the first nuclear build in the UK for many years, and is part of the UK's strategy for low carbon energy generation. However, low carbon energy generation is not necessarily green or environmentally friendly. Notwithstanding the risks of nuclear power, rather like hydropower, huge water pumps and intakes suck in and kill huge numbers of fish. However, because we can't see them, being under water, not many people know or care. If they were birds or mammals there would be a public outcry if we could see these pumps sucking in and macerating our wildlife, whether designated under any specific conservation legislation or not. The Agency rightly specified that there should be a first class, state-of-the-art screen to minimise the impact on any fish species. We have heard that the pumping rate of the intake will be 132 cubic meters per second (cumecs). To put that in perspective, that is over twice the average flow of the River Thames' 60 cumecs, and higher than the average flow of the River Severn's 107 cumecs. But those are average flows – highly skewed by wet weather events. It is greater than the normal dry weather flows of all the rivers that drain into the Bristol channel, the Severn, Parrett, Avon, Wye, Usk and Taff combined.
- 9.12 HPC is and will be a 'state-of-the-art' development, investing in the future energy security of the UK. We, as environmental specialists, and on behalf of the citizens of the UK, should expect a state-of-the-art fish screen to match that development, to minimise the impact on any fish species, and particularly those that are rare or vulnerable. If the appeal is to save the appellant money, well the saving is a pittance compared to the total cost of the development. If that small additional cost is ultimately passed on to its customers, then he is positive that the majority of our fellow citizens would be prepared to pay a few extra pence per year, to protect the wildlife of this country.

Statement by Dr Paul Naylor (CD 10.8).

9.13 Alongside the clear danger of adverse effects on the designated sites from removal of the AFD, he believes it is important for this Inquiry to also consider that the arguments made by the appellant to support their application to vary the permit are fundamentally wrong.

9.14 In essence, they make three arguments, that:

- Removal of the AFD will not make much difference.
- Good fish protection measures will remain in the absence of AFD.
- Fitting and maintaining an AFD at HPC is too difficult and dangerous.

9.15 Argument 1 is wrong. Removal of AFD will increase the number of the most numerous fish killed at the intake by a factor of more than 8. This represents millions of sentient vertebrates killed unnecessarily every year, over several decades of the power station's operation. That is a massive difference and a precautionary approach to assessing its impact is essential, particularly as there is no potential for adaptive management.

9.16 Argument 2 is wrong. Without a behavioural prompt such as AFD, the second protection mechanism of a low velocity intake will not help fish. The low velocity only works by allowing fish to swim away once they are prompted to do so. The third mechanism, the FRR, will offer no protection to the vast majority of fish that encounter the HPC intakes, because they are too fragile to survive it.

9.17 Argument 3 is wrong. The assertion that fitting and maintaining an AFD at Hinkley C is too difficult and dangerous is based on inaccurate and out of date information.

9.18 In conclusion, NNB GenCo's arguments for varying the permit and removing AFD are erroneous and misleading, so their appeal must be dismissed.

Statement by Dr David Lambert (CD 10.4, CD 10.9, CD 10.12).

9.19 He is an Environmental Scientist, a Chartered Water and Environmental Manager and the Managing Director of Fish Guidance Systems (FGS), a company that has been designing, manufacturing and installing fish deterrents around the world for over 27 years.

9.20 The position put forward today, that an AFD is required and should be installed at HPC, is not just the position of a single commercial entity but as you have already heard, is also the position of numerous independent experts and organisations across the UK, including an advisory panel to the Welsh government.

9.21 At this stage he will simply concentrate on the facts of the case. The appellant is proposing to remove the AFD for three unfounded reasons

- It is too difficult and dangerous to install
- It is too difficult and dangerous to maintain
- It is not required from a fisheries conservation point of view.

- 9.22 Dr Andy Turnpenny, FGS’s Fisheries Advisor will make a number of points relating to the fisheries issues, and you will be listening to a number of experts over the next two weeks who will debate the fisheries side of things in a lot more detail, but it is necessary to emphasise a few points before commenting on the engineering and safety aspects that the appellant has highlighted.
- 9.23 It is important to stress that the vast majority of fish can hear, and do respond to an AFD. Hearing is not limited to a few special species of fish and as a result, while an AFD can deflect 90% of the fragile hearing specialists, such as herring, sprat, and shad, it will also reduce the total number of fish entering a cooling water system by around 60% across all species. This therefore benefits the whole species assemblage, and in turn the internationally important populations of marine-associated birds that rely on a fish diet in the vicinity of Hinkley.
- 9.24 The Agency’s Best Practice Guides state that, in order to prevent fish from being drawn into cooling water systems, and being damaged or killed, an AFD should be installed in combination with a fish return, and in the case of the new nuclear sites, including here at HPC, in combination with low velocity intake heads.
- 9.25 The implementation of all of these techniques is fundamental to Best Practice, and is the basis for accepting direct seawater cooling as Best Available Technology for the new nuclear plants around our coast.
- 9.26 In addition, we need to bear in mind, as already noted by the Agency, the LVSE are new and their ability to provide any mitigation is unproven. Their predicted reduction in fish entering the cooling water system is just theoretical. Associated with this, even Cefas, which has been supporting the appellant throughout this removal process, has concluded in one of its own reports, *“Because of the usual high water turbidity at Hinkley Point and the consequent absence of visual clues, any mitigating effect of the low-velocity intake is only likely to be realised if it is combined with some form of artificial stimulus (e.g. an acoustic fish deterrent) to induce fish to swim away from the intake structure.”*. ...and the report goes on to say... *“For these reasons low-velocity intake and AFD need to be considered as a combined mitigation measure.”*
- 9.27 The appellant has stated in its submissions that it was committed to the AFD when it was applying for the DCO, but the optioneering phase concluded that the final system to be installed was significantly larger than it was expecting. This brings him onto the real reason for this whole process.
- 9.28 The appellant states its concerns are safety driven but also acknowledges in its submissions that there have been multiple concerns about the cost, which implies a commercial decision. If money isn’t the issue, why doesn’t the appellant commit to working to best practice, and use its expertise to resolve the safety concerns?
- 9.29 The appellant has stated in its submissions that its strong preference was to overcome the Health and Safety concerns regarding the installation and maintenance of an AFD, and the appellant has their own R&D Department, with 60 full time researchers, 24 PhD students and 15 different nationalities.
- 9.30 It states on its website “Research, development and innovation are at the heart of EDF”, yet the appellant has not used any of its researchers, or collaborated with

any expert suppliers, to innovate and solve the eminently solvable problems to overcome the Health & Safety concerns. The appellant has stated it is hazardous to run cables out to the intakes 3km offshore, and yet it has multiple off shore wind farms in the UK and elsewhere that are significantly further offshore, Saint Nazaire in France is more than 12 km from the shore. It can run out cables to these facilities, which cover a far greater area than the proposed intake heads, and yet implies it can't be done at Hinkley.

- 9.31 The appellant repeatedly raises the issue of danger to divers working on the installation and maintenance of the AFD system. We are all committed to minimising the risks associated with work offshore. FGS works with all of its clients to minimise any risks that may be associated with its systems. But the appellant has maintained that the only way to carry out the work is by using divers. From its testimony it claims there are no suitable ROVs (Remotely Operated Vehicles). However, FGS have been advised by independent ROV engineers that ROV units are already available that work in similar high velocity conditions. Zero visibility can be overcome with augmented reality systems, something that he understands the ROV industry is confident it can achieve, and a technology that the appellant's own R&D engineers are seen to be wearing in the photograph on its own website.
- 9.32 Even if the appellant doesn't consider that a suitable ROV is currently available, if it is truly committed to innovation and environmental protection it should be able to work with experts to develop a suitable ROV that would answer the vast majority of the safety concerns and could not only support Hinkley, but also at Sizewell and any other sites that the appellant chooses to develop.
- 9.33 FGS would also rebut another comment that flows through the statements, that AFD systems are novel. As said during the introduction, FGS has been manufacturing and installing AFD systems at sites around the world for over 27 years. They were installed on Doel Nuclear Power Plant's water intake when the technology was just a few years old, but Electrabel, the owners and operators of the plant at that time, saw the benefit the system would bring, even though at that stage they could have been considered novel. After 25 years deployment at that site, 27 years continual development by FGS, they are now proven technology.
- 9.34 FGS do acknowledge the concern that an AFD system hasn't been deployed 3km offshore before, but the appellant rejected the offer to work with FGS and demonstrate its suitability 4 years ago. However, even without the engagement of the appellant, FGS has continued to develop and improve its systems over the last four years, developing the Active Pressure Compensation Unit, which is already in use in another project and is ideally suited for deployment at these offshore intakes, with the potential to significantly increase the service interval beyond the required 18 months stated by the appellant, and thereby reduce the time, the cost and risk associated with the maintenance of the systems.
- 9.35 The AFD system available from FGS meets all the requirements that the appellant has published for the AFD. There would be a need to carry out further detailed design, to incorporate any requirements that the Agency / MMO or other regulators require on redundancy. But this can be done. FGS note the appellant's requirement to retrofit the intake heads for the AFD needs to be completed by the end of this year, ready for the installation next summer, and FGS can confirm that they would

be committed to working with the appellant to meet this requirement. There would be a huge amount to do, in what is now a very small amount of time, but FGS is willing and able to play its part.

9.36 The UK Government is holding itself aloft on the world stage on its commitment to upholding environmental standards, and the introduction of the Animal Welfare Sentience Bill in the Queen's speech a few weeks ago means government departments will need to give full consideration to the welfare of animals, including fish, in their future measures and policies. That is not just today, but over the next 60-year life span of the plant.

9.37 We trust over the next few weeks the Inquiry will conclude in line with all the other independent experts who have reviewed the requirements for an AFD, that an AFD must be installed at HPC.

Statement of Dr Andrew Turnpenny (CD 10.2, CD 10.10).

9.38 A fisheries biologist and Fellow of the Royal Society of Biology, speaking as a scientific adviser to FGS, a company which he co-founded in 1994 but from which he retired in 2015 and in which he stressed he no longer has any financial interest.

9.39 He has been a specialist in the subject of fish entrapment in cooling water intakes from the day he joined the Research Division of the Electricity Generating Board some 44 years ago in August 1977. Since that time he has authored many well-known scientific papers and reports on the subject, including the Agency's Best Practice guidance on fish screening in 2005 (known as Science Report SC030231) and the Agency's key 2010 Evidence Document on Cooling Water Options for the New Generation of Nuclear Power Stations in the UK (SC070015/SR3).

9.40 In 2007 he was appointed to the British Energy Estuarine & Marine Studies (BEEMS) Expert Panel, which was set up to advise on Marine Ecology issues for the Nuclear Build programme and served on the Panel until its disbandment in 2018, with particular focus, along with colleagues Steve Colclough of the Agency and Prof Mike Elliot of Hull University, was on fish protection. Subsequently he was appointed as an expert adviser to EDF's Cooling Water System Working Group for HPC, attending multiple meetings in Paris and London. In both these roles, he worked harmoniously with the Appellant for over 10 years to ensure that the Agency's Best Practice guidance was followed on all their NNB projects. In particular, he was a leading figure in development of the fish protection strategy for HPC. When he retired from BEEMS, he felt satisfied that the progress in fish protection developed over a lifetime's scientific work and international experience, was properly represented in the approved design for HPC's cooling water system as specified under the DCO.

9.41 He is therefore at this point utterly dismayed at the appellant's proposed withdrawal from the Permitted design as per the subject of this Public Inquiry. To clarify his position, it is his view that the appellant should fully acknowledge during the course of this Inquiry the following eight points:

1. That their intention not to use an AFD at HPC will result in a non-BAT compliant development. LVSE+FRR without AFD does not constitute Best Practice.

2. Again, acknowledge as they did in their earlier technical reports, that the proposed use of an LVSE intake design without an AFD system would not be effective in waters with the near-zero visibility found at Hinkley, as fish will fail to react to an unseen threat.

3. Acknowledge that they have not used exhaustive efforts to keep up to date on technical advances with AFD technology and diverless underwater servicing technology.

4. That the majority of fish (56%: Table 18, TR456⁴⁹³) expected to be drawn into the HPC intakes are fragile species such as shads, herring and sprat, for which AFD has been proven up to 95% effective, whereas by their own predictions, near 100% mortality can be expected for these fish in the FRR and therefore no protection will be provided for these fish.

5. That the frameworks for fish stock assessment and management in which Cefas excel are wholly inappropriate when assessing impacts at the local level. The former MAFF Fisheries Laboratory acknowledged and acted on this as far back as the Sizewell B Inquiry in the 1980s by adopting a smaller framework for local assessment. As the Agency and SEI will demonstrate in the course of this Inquiry, a plethora of more recent evidence only strengthens the need for these more locally framed assessments.

6. That while they are predicting fish kills at HPC entirely on the basis of historical HPB station catch rates, there remains considerable uncertainty when extrapolating this to an intake 3km offshore and of a completely different design and depth setting.

7. That past catch records from the Hinkley stations cannot provide a reliable guide to what will happen over the next 60 years, given the marked year-on-year changes in fish communities that are occurring as a result of climate change and warming. This is particularly true for example for shad, a highly protected species under UK law which favours warm-water, and which also has the potential to become more prominent in the Severn basin as a result of ongoing efforts by the Agency and conservation bodies to restore connectivity and habitats in its rivers.

8. Finally, the appellant should acknowledge that as a result of their intention not to fully implement Best Practice at Hinkley, their use of direct seawater cooling may not be considered BAT. The only logical alternative would be to follow the US Environmental Protection Agency model and install cooling towers instead. The reasons for this are fully set out in the Agency's 2010 Cooling Water Evidence Report No. SC070015/SR3. To ignore this advice puts in jeopardy the BAT status of direct seawater cooling at any future UK sites.

9.42 In view of the considerable uncertainties in the appellant's fish prediction and assessment methods, and of future changes in fish community composition within the Severn Estuary and Bristol Channel, a precautionary approach is needed and he would urge the Inquiry NOT to find in favour of the appellant.

⁴⁹³ CD1.11

Statement by Dr James Stewart (CD 10.1, CD 10.6, including Appendix 1, Irish and Celtic Sea Herring Project – Preliminary Report, and CD 12.36).

Introduction:

- 9.43 He represent the D&S IFCA. The Inshore Fisheries and Conservation Authorities (IFCAs), including D&S IFCA, are statutory regulators. D&S IFCA's District includes waters from baselines to six nautical miles on the south and north coasts of Devon and North Somerset, and the waters of the Severn Estuary out to the median line with Wales.
- 9.44 D&S IFCA's Authority is comprised of Local Authority representatives, local stakeholders with marine and fisheries expertise, and nominees from NE, the Agency and the MMO. The ten regional IFCAs have a shared vision: *"Inshore Fisheries and Conservation Authorities will lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry."*
- 9.45 The powers and duties of the IFCAs are provided by the Marine and Coastal Access Act (2009; the Act). The IFCAs' main legal duties are described in section 153 of the Act. They must manage the exploitation of sea fisheries resources in their Districts, balancing the social and economic benefits of exploiting the resources of sea fisheries in their Districts with the need to protect the marine environment, or help it recover from past exploitation.
- 9.46 Under section 154 of the Act, IFCAs must seek to ensure the conservation objectives of any Marine Conservation Zones in the District are furthered. IFCAs are also deemed Relevant Authorities for marine areas and European Marine Sites (EMS), under the Conservation of Habitats and Species Regulations 2017. D&S IFCA is therefore a Relevant Authority, for example, for the Severn Estuary SAC.
- 9.47 This representation highlights the concerns that D&S IFCA has regarding the present appeal, specifically the potential for harm to the fish features. The estuarine fish assemblage is a qualifying feature of the Severn Estuary Ramsar site and a sub feature of the 'Estuaries' feature of the Severn Estuary SAC.
- 9.48 In accordance with the precautionary nature of the Habitats Directive and European case law, for the appeal proposal to be allowed, it will be necessary for the competent authority to be certain beyond reasonable scientific doubt about the absence of adverse effects upon the integrity of European sites.
- 9.49 European Case law supports the assertion that, on the date that the decision is made by the competent authority, there must be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site. The appellant must therefore put forward an assessment that contains complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt as to the effects of the proposed works on the protected area concerned. With regard to the HRA specifically, they agree with the Agency's contention that the appellant's/Cefas' assessment is neither suitably precautionary nor robustly evidenced enough. Detail on this can be found in the Agency's SoC. Additional Case law outlines that, for a breach of Article 6(2), it is sufficient "to

establish the existence of a probability or risk that that operation might cause significant disturbances for that species”.

9.50 On the balance of the considerable evidence available to date, including that highlighted by the appellant and the Agency, D&S IFCA is of the opinion that substantial evidence exists of potential harm to the integrity of European sites and that, where this potential harm cannot be clearly demonstrated, there remains a high degree of reasonable scientific doubt as to the absence of such effects.

9.51 It is therefore D&S IFCA’s position:

a. to support the case presented by the Agency. That is, that the Water Discharge Activity permit variation should be refused on the basis that it cannot be concluded, beyond reasonable scientific doubt, that there would not be an adverse effect on the integrity of the relevant sites.

b. that the appeal should not be upheld, and

c. that the variation to the Water Discharge Activity (WDA) environmental permit should be refused.

9.52 D&S IFCA’s support for the Agency’s position is broad but in this Representation focusses specifically on four main areas:

Issue 1: The Scale of Assessment

9.53 The appellant’s case considers impacts on fish species by comparing estimates of impingement to estimates of the size of the populations from which the impinged fish have come. For these comparisons, the appellant relies heavily on the use of SSB estimates for ICES stock units, or fisheries landings relating to broad ICES areas.

9.54 Stock-level SSBs are useful for management of commercial stocks, but are not necessarily appropriate for assessing impact to fish assemblages at a scale that relates to the Severn Estuary SAC, of which they are a feature. Similarly, whilst comparisons with landings in the absence of SSB data (e.g. for herring) may be more precautionary than using SSB, these data are typically international landings related to the commercial SSB in question, so may still underestimate impacts at the level of more local populations.

9.55 The suggestion in SPP106⁴⁹⁴ and elsewhere that *‘fish stock identities are decided after critical review of all the scientific evidence and are subject to regular peer review when new evidence becomes available’* is an oversimplification of the limitations of ICES management units and the processes and procedures used to change those boundaries. In a recent paper (published in the ICES Journal of Marine Science) led by Lisa Kerr (a former Chair of the ICES Stock Identification Methods Working Group) the authors state that: *“depending on the geographic location, there may be political, legal, cultural, and social pressures that prevent revision of stock boundaries or adding complexity to stock assessments. For*

⁴⁹⁴ CD7.9

example, in Europe, sampling units and intensities are currently fixed by regulation through the relatively inflexible data collection framework, which creates financial consequences for member states when sampling methodology is altered to accommodate a new stock area design.” (Kerr et al., 2017)⁴⁹⁵.

- 9.56 Kerr et al. go on to discuss how, despite increased recognition of complex population structure and stock mixing, disparities between population structure and current management units have therefore not been reconciled.
- 9.57 For some commercial species (outlined in D&S IFCA’s previous representation, and in greater detail in the evidence gathered by the Agency) there is considerable evidence that there may be finer-scale population structuring that is extremely relevant to fish in the Bristol Channel and Severn Estuary.
- 9.58 On this basis, D&S IFCA disagrees with the size and relevance of the population sizes used by the appellant. This disagreement is based on the existence of good evidence from the appellant’s previous assessments (TR148⁴⁹⁶), Cefas’ current population size assessments for Tidal Lagoon Project Swansea⁴⁹⁷, ICES stock reviews and an extensive literature review by the EA for the permit variation application to support much smaller and more relevant population sizes (TB011⁴⁹⁸).
- 9.59 The Agency’s technical briefs, SoC and Adam Waugh’s proofs of evidence summarise this evidence, and robustly support their definition of the appropriate scale of assessment for each species considered.
- 9.60 Ultimately, the Agency has used more appropriate scales of assessment, and thereby refined the population sizes for many species. This has led to the Agency’s conclusion that it is not possible to conclude no adverse effect for four marine species, Atlantic cod, whiting, Atlantic herring and European sea bass. D&S IFCA also present additional evidence to support smaller and more relevant population sizes for Atlantic herring (*Clupea harengus*).

Issue 1.1 The Scale of Assessment for Atlantic Herring (Clupea harengus)

- 9.61 D&S IFCA was involved in the Marine Pioneer programme, which was run by Defra and the MMO to trial innovative, pioneering methods of delivering the Government’s 25 Year Environment Plan, sitting on the Steering Group and Marine Working Group of the Marine Pioneer. Through the Marine Pioneer, D&S IFCA collaborated with scientists from Swansea University on a project known as the Bristol Channel Herring Project, which investigated herring populations in the Bristol Channel.
- 9.62 The Bristol Channel Herring Project is part of a larger research collaboration between Swansea University, the Irish Marine Institute and Uppsala University (Sweden) investigating herring in the Irish and Celtic Seas. The work at Swansea University was led by Dr David Clarke. Dr Clarke is a recognised fisheries science

⁴⁹⁵ CD9.67

⁴⁹⁶ CD 7.2

⁴⁹⁷ CD 9.118

⁴⁹⁸ CD 8.10

and management expert, who has worked on herring since completing his PhD on the Milford Haven herring population in the 1980s, and has worked in academic and regulatory roles including previously as Head of Fisheries at the Agency.

- 9.63 The research is ongoing, but an interim report has been produced for D&S IFCA by the teams from Swansea, Ireland and Sweden. This interim report focussed on the sampling and results relevant to the Bristol Channel, and is attached as Appendix 1⁴⁹⁹ to this Representation.
- 9.64 The interim report describes morphological and genetic sampling of Atlantic Herring (*C. harengus*) in the Bristol Channel and south west Wales areas. The data presented were collected in 2018 and 2019, and comprise analyses of 2,876 fish from 9 locations (summarised in Figure 1, excluding Pembroke Power Station). Data collected included morphology (length, weight, spawning condition, sex, age (from scales and otoliths) and fin clips for genetic analysis).

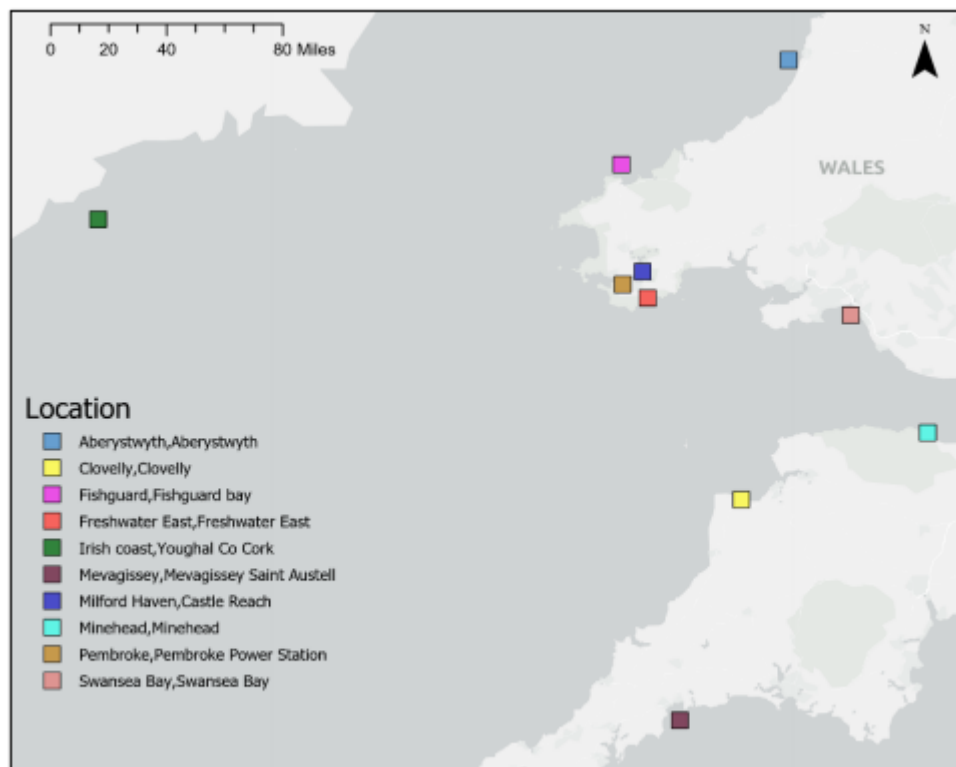


Figure 1. Sampling locations for the Bristol Channel Herring Project.

- 9.65 The report focusses on spawning distribution and stock structure. The main conclusions are:

a. There are a number of spawning locations, including the North Devon Coast (Minehead to Clovelly), the south west and west Wales (around Freshwater East and Milford Haven), and in Cardigan Bay (Fishguard and Aberystwyth). These areas are those where fishing occurs and the research team have been able to obtain samples. It is possible that spawning occurs elsewhere within the Bristol Channel.

⁴⁹⁹ CD 10.6

b. Morphological and genetic analysis has identified at least 3 separate spawning populations. Two of these are spring spawning – one which spawns in low salinity in Milford Haven and one which appears to spawn in fully salt water in the Freshwater East Bay area. Although these spawn in the same general area at the same time of year, they appear genetically discrete from each other and from autumn and winter spawning groups.

c. The autumn spawning samples appear to share genetic characteristics with each other and the wider Celtic sea spawners. However even within these groups there is indication of genetic structuring. Both samples from Aberystwyth and Clovelly (October 2018) show a degree of genetic distinctness and in the case of the Clovelly samples within-spawning season temporal genetic structuring.

9.66 The authors of the interim report conclude: *"It is clear that while further work is needed to fully understand stock structures in the area, Atlantic Herring populations in the area are not a single population unit and should not be treated as such for management purposes."*

9.67 This draft report has not yet been through a typical peer-review process, but is currently being prepared for submission to an academic journal. The research was conducted by an international consortium of researchers with relevant expertise in population genetics, the biology of Atlantic herring, and fisheries science. The study makes good use of standard approaches to morphological and genetic analyses, based on data (including microsatellites and Single Nucleotide Polymorphisms) derived from whole genome sequencing and marker identification studies through international collaborations. The analysis uses a range of techniques to ensure that theoretical assumptions of genetic analyses (assumptions of Hardy-Weinberg and linkage equilibrium) are not violated. The results are therefore robust, and provide a clear refutation of the idea that Atlantic herring form a single panmictic population in the study area.

9.68 This report also supports a range of previous evidence that herring population structure is best described with the metapopulation concept, in which an array of local populations may be linked by varying degrees of gene flow (McQuinn 1997). Such local populations have been reported historically in Milford Haven (Clarke and King 1985).

9.69 Impacts from HPC are unlikely to be evenly distributed across the entire metapopulation and consideration of potential effects on local populations would be more appropriate. The conservation of local populations is essential for the preservation of spawning potential and for the viability of coastal fisheries which, in the Severn Estuary itself, are very small-scale. D&S IFCA is in talks to further investigate the local nature of herring populations, including their spawning grounds, and the sustainability of fishing.

9.70 Overall, this example provides robust evidence of recently-discovered fine-scale population structure in marine fish. This is likely to be of concern for other species which have not been so well-studied, and would lead the appellant's assessments to underestimate the impacts to species and to site integrity.

Issue 2: Equivalent Adult Values

- 9.71 The appellant and the Agency rely on the use of EAVs to contextualise entrapment losses by converting entrapment data to an equivalent number of adult fish. This is because the mortality of a number of juvenile fish will not have the same effect on the population as the mortality of the same number of adults. However, there is more than one method for calculating EAVs (as summarised clearly in the Agency's documents), and it is clear from the case documentation that the EAV method applied by the appellant cannot be said to be precautionary because it typically underestimates the EAV.
- 9.72 To account for the weaknesses of the appellant's approach (the 'core approach') to calculating EAVs, the Agency has adopted an 'extended approach' that accounts for SPF. The calculation of the Agency's extended approach follows the same method and relies on the same assumptions as the appellant's core approach, except that repeat spawners are included in the Agency's calculation.
- 9.73 The use of the SPF extension contributed to the Agency being unable to conclude no adverse effect on site integrity for the estuarine fish assemblage of the Severn Estuary SAC and Ramsar, with Atlantic cod, whiting, European sea bass and Atlantic herring being the species of concern.
- 9.74 The appellant disputes the inclusion of repeat spawners in the EAV calculation. The appellant has raised concerns that this extended approach provides values that would not be comparable with estimates of population size based on SSB. However, following a review of the evidence, D&S IFCA's position is that these concerns are misplaced, as is clearly evidenced in the documents provided by the Agency (in particular TB010⁵⁰⁰ and Dr Masters' Proof of Evidence⁵⁰¹).
- 9.75 The Agency's extended approach provides a better comparison to measures of population size than does the appellant's method, because the extended approach compares losses of first-time and repeat spawners to a spawning population, which is made up of first-time and repeat spawners. The extended approach counts all the adult fish that would have been present in the population had they not been impinged in previous years. The appellant's method only counts some of them, ignoring fish that have spawned in previous years but that would have still been alive and part of the population. If not impinged, these fish that are not counted by the appellant would still form part of the SSB against which they would seek to compare their impingement estimate.
- 9.76 Based on a review of the available methods and evidence, the SPF method is considered by D&S IFCA to be the most appropriate to use to assess the entrapment losses at HPC over the operational lifetime of the station. It addresses many of the factors of relevance in the valuation of lost fish by incorporating natural mortality rates, proportional maturity rates, and repeat spawning potential, without assuming that individual fish live to their maximum lifespan. The SPF method takes into account the value of repeat spawning fish, and produces numbers of equivalent adults which are directly comparable to SSB.

⁵⁰⁰ CD 8.8

⁵⁰¹ CD 6.7

Issue 2.1: Equivalent Adult Values and Fishing Mortality

- 9.77 The appellant states that the Agency have made an error in 'the omission of F from the SPF EAV calculation'⁵⁰². The Agency have, in D&S IFCA's view, adequately countered this statement in their case documentation (e.g. section 6.4 – 6.7 of Dr Masters' Proof of Evidence⁵⁰³).
- 9.78 D&S IFCA's position is that, by calculating EAVs without including F, the Agency is representing reasonable worst-case scenarios for Atlantic cod, whiting, European sea bass, Atlantic herring, and the shad species, as required when taking the necessary precautionary approach to this assessment of an impact that will be continuous for sixty years. There are substantial difficulties associated with incorporating F in the EAV calculations, either for the core or extended approach. The principal difficulty is that F is not constant but varies from year to year, due to a range of factors including management interventions.
- 9.79 The reason for using an EAV is to contextualise impingement losses over the whole operational life of the power station, which is expected to be around 60 years. Applying a fixed level of F to the EAV calculation may result in impacts being overestimated in some years and underestimated in others. In terms of HRA, a method which underestimates impacts in some years would not be consistent with the precautionary principle.
- 9.80 F is controlled by fishery managers, such that when stocks are declining, targeted fishing pressure can be reduced or even removed. For example, ICES have recommended zero catch of cod in 2020 in the western English Channel and southern Celtic Seas to allow the species to recover. When these conditions occur, HPC impacts will continue unchanged and so we need to understand the effect that the station has under conditions of zero catch for commercial species. As such, the extended method EAV calculated using natural mortality alone, is a relevant figure to refer to in assessing the potential impact of entrapment, particularly so within the context of HRA, as low or zero F will occur as a result of management action taken when stocks are below levels where sustainable commercial fishery exploitation could be achieved.
- 9.81 In addition to difficulties in choosing an appropriate temporal range from which to draw an estimate of F, there are difficulties with regard to determining F for an appropriate geographic area. Many marine fish stocks exhibit a complex, meta-population structure with species showing little population structure being the exception rather than the rule (*Kerr et al.*, 2017) - a topic the Agency explored in depth in TB010⁵⁰⁴. F rates used by ICES are calculated for the entire stock area and fishing effort (and thus F) might not be uniform across the whole of this area. If fishing effort is concentrated in an area distant from the power station under consideration, then the published value of F may not be representative of F on the local sub population that is being impacted by entrapment. F across the Bristol Channel and Celtic Sea is not uniform with fishing pressure being lower in Division 7f compared to other areas of the Celtic Sea, Irish Sea and North East Atlantic.

⁵⁰² CD 6.3

⁵⁰³ CD 6.7

⁵⁰⁴ CD 8.8

Fishing effort in the Severn Estuary SAC in particular is very low. F rates used for ICES stock assessments are drawn from across the whole of the stock unit, so for example from across the Irish Sea, Celtic Sea and North Sea for European sea bass. Therefore, F rates cannot be used directly from ICES stock assessments.

9.82 In summary, D&S IFCA acknowledges that F is a relevant factor for predicting the entrapment effects of NNB power stations. However, the complexities of predicting F over the operational life of the power station, the selection of a geographically relevant value for F, and potential issues of accuracy over any fishing mortality values that may be obtained, mean that practically incorporating F is extremely challenging. Incorporating inappropriate estimates of F into the calculation of EAVs would add increased uncertainty to estimates.

9.83 F varies from year to year and can be controlled by fishery management, with low, or zero, F being required when fish stocks are recognised as being fished at unsustainable rates. Consequently, EAVs calculated without including F need to be considered when taking a precautionary approach to assessing the potential impact of a new power station over the course of its operational life.

9.84 D&S IFCA has a further point to make about the use of EAVs and the ecosystem approach to the management of the marine environment, which is relevant to the precautionary nature of the approach required in this case.

9.85 Although EAVs can be used to estimate the EAV lost to entrapment, this does not account for what would have happened to the eggs, larvae and juveniles should they not have been taken into the cooling water system or survived to adulthood. These individuals are not only lost to the population but are lost as a food source to those species that consume them. This interferes with the food web and with the density dependence of the population dynamics of many species.

9.86 In paragraph 8.50 in the Appendices of his Proof of Evidence⁵⁰⁵, Dr Jennings discusses compensation in fish populations driven by density-dependent processes. Essentially, Dr Jennings makes the point that a reduction in the overall number of a certain species (as a result of entrapment by HPC) will be compensated for because the remaining individuals of those species will have fewer competitors and better access to the available food resources. However, this point is misleading.

Issue 2.2: Equivalent Adult Values Ecosystem Function of Non-Adult Life Stages

9.87 Fish eggs, larvae and juveniles are key food sources for larval and juvenile fish in the Severn Estuary. However, these life stages are subject to high levels of entrapment which will remove, modify and redistribute them. These life stages will therefore be less available as food to the remaining fish that do not suffer from entrapment. This process will therefore interrupt the usual density-dependent processes and reduce the capacity for compensation.

9.88 This highlights another critical issue; that EAV is not the only value of an egg/larva/juvenile fish. These other ecosystem functions (e.g. as food sources) have not been given due regard through this process. This represents a key

⁵⁰⁵ CD6.12c

uncertainty in the impacts of HPC on the fish assemblage, and in the impact on the structure and functioning of the Estuaries feature of the SAC.

Issue 3: The Fish Assemblage of the Severn Estuary SAC

9.89 The definition of the estuarine fish assemblage as a sub-feature of the SAC Estuaries feature is consistent with section 2.1 of the Regulation 33 advice package for the Severn Estuary SAC⁵⁰⁶.

9.90 The fish assemblage comprises over 110 species and has specific conservation objectives. The European Commission guidance on the provisions of Article 6 of the Habitats Directive ('the guidance') confirms that when concluding an AA any effects from the proposal must be assessed against the site's conservation objectives⁵⁰⁷ and that Site Integrity relates to these objectives⁵⁰⁸.

9.91 The guidance is also clear that if just one of the habitats or species for which the site has been designated is significantly affected, taking into account the site's conservation objectives, then site integrity is necessarily adversely affected⁵⁰⁹.

9.92 Furthermore, the interactions of the species in the fish assemblage and the way they interact with each other, the designated migratory fish species and designated habitats of the Severn Estuary SAC and SPA are of primary importance to the functioning of the Severn Estuary and the consideration of site integrity. The guidance states that "*the integrity of the site involves its constitutive characteristics and ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the habitats and species for which the site has been designated and the site's conservation objectives*". The species that form this assemblage should therefore be subject to AA in their own right and are highly relevant to the conclusion of the HRA.

9.93 It is the view of D&S IFCA that, in the case of the Severn Estuary SAC, it would not be possible to assess the implications of the appeal proposal for the estuary feature or site integrity as a whole without also understanding the impacts upon its sub-features. An assessment of these sub-features, including the estuarine fish assemblage, is therefore needed to fulfil the requirements of the Habitats Regulations. This view is consistent with NE's published advice.

9.94 It is on this basis, and in line with NE's advice, that D&S IFCA has completed HRAs for relevant fisheries activities in relation to the fish assemblage sub-feature of the Severn Estuary SAC.

Issue 4: Adaptive Management

9.95 In the Addendum to the SoCG, it is stated that the appellant does not consider it appropriate to place a limit on the mass of moribund biota (dead fish) discharged from the FRR as "*in reality they cannot be controlled*". Herein lies the problem –

⁵⁰⁶ CD 12.16

⁵⁰⁷ CD 12.2

⁵⁰⁸ CD 12.2

⁵⁰⁹ CD 12.2

once the cooling water system is started without AFD, the fish kill cannot be controlled without shutting down the reactors and cooling system.

9.96 The nature of an operational power station, with a 60 year life time, does not allow the same degree of adaptive management as exercised by a fishery manager. As outlined previously, and in the proofs submitted by the Agency, fishery managers can place effort and landings limits on fisheries in order to safeguard stocks, including restrictive measures such as zero Total Allowable Catch. This management is adaptive in the sense that it is able to change in response to new evidence. Power station cooling systems cannot be adaptive in this way. Therefore, a precautionary approach, as taken by the Agency, and by NE and NRW as statutory consultees, is justifiable.

South West Marine Plan

9.97 In a further submission D&S IFCA consider that the SWMP is a material consideration and the responsibility is on the appellant to appropriately consider each of the policies in the plan and their relevance to the project.

9.98 Furthermore, the SWMP itself is clear that *"Applicants, those developing a proposal, and third parties, such as advisors, as well as public authorities, should consider the South West Marine Plan where relevant. It is the responsibility of the user to determine whether and to what extent the policies are relevant, and to apply them to a proposal in the context of their own processes and current practice"* (SWMP, paragraph 35). SWMP paragraph 48 goes on to state that *"Whilst public authorities will apply the South West Marine Plan to decisions they take, those introducing proposals that require the decision, sometimes in the form of an application for an authorisation, will need to take relevant account of the plan. To maximise benefits the South West Marine Plan should be used throughout the development of proposals and in all stages of decision-making, in line with current best practice"*.

9.99 The SWMP should be read as a whole but D&S IFCA would highlight one further policy in addition to those highlighted by SEI, Policy MPA-1, which specifies that *"Proposals that support the objectives of marine protected areas and the ecological coherence of the marine protected area network will be supported. Proposals that may have adverse impacts on the objectives of marine protected areas **must** demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate adverse impacts, with due regard given to statutory advice on an ecologically coherent network[emphasis added]"*.

9.100 Some Policies in the SWMP allow compensation as a last resort: an option (d) for cases in which adverse effects cannot be avoided, minimised, or mitigated. However, there is no such provision for MPA-1. Policy MPA-1 is clear that *"proposals that cannot avoid, minimise and mitigate adverse impacts to marine protected areas [(including European sites)] **will not be supported** [emphasis added]"*. The use of strong language here (e.g. 'must') is outlined in the SWMP to be consistent with that used in the Marine Policy Statement.

9.101 In the interests of transparency, D&S IFCA will highlight that the Technical Annex to the SWMP does state that *"This policy [MPA-1] does not remove the provisions for derogations that are present in primary legislation and regulations"*. D&S IFCA's

understanding of this statement is that it potentially includes the IROPI route under Section 64 of The Conservation of Habitats and Species Regulations 2017. D&S IFCA is not well-placed to determine whether Section 64 provides a relevant derogation in this case. D&S IFCA would suggest that such an approach may be against the spirit of MPA-1, but also that a project deemed to have an adverse effect on an Marine Protected Area may have to re-consider appropriate mitigation (in this case the AFD), or the IROPI route for continuation with appropriate compensation. On the issue of compensation, the Managing Natura Sites guidance document defines Compensatory Measures *sensu stricto*: "*they are intended to compensate for the effects on a habitat affected negatively by the plan or project. For example, general tree-planting to soften a landscape impact does not compensate for the destruction of a wooded habitat with quite specific characteristics*".

9.102 This latter caveat will have broad implications for the ability to compensate in a complex and dynamic marine environment. It should also be noted that Policies MPA-1 and NG-1 (the latter raised by the SEI), are highlighted in Table 3 of the SWMP as among those Policies that apply to all proposals.

Conclusions

9.103 D&S IFCA considers that that the documentation provided by the Agency is the product of sound scientific judgement and accounts for the best available evidence. On balance, D&S IFCA supports all of the judgments made by the Agency in their SoC. Therefore, having considered the available evidence, D&S IFCA finds that the Agency's conclusions regarding site integrity are justified and sound.

9.104 In summary, and in addition to the points made in D&S IFCA's previous written representation⁵¹⁰, D&S IFCA:

- a. Supports the adjusted scale of assessment applied by the Agency to the fish species of concern; this approach is preferable in scientific and ecological terms to the ICES stock areas and SSBs suggested by the appellant.
- b. Supports the Agency's extended approach to determining EAV. Applying the SPF EAV method, without accounting for uncertain mortality due to fishing, is an appropriately precautionary assessment for this proposal.
- c. Supports the full consideration in AA of the estuarine fish assemblage as a sub-feature of the Estuaries feature of the Severn Estuary SAC.
- d. Considers that the inability to apply adaptive management to the proposed activities necessitates a precautionary approach to all stages of assessment of potential effects on Site Integrity.

⁵¹⁰ CD 10.1

10. WRITTEN REPRESENTATIONS

- 10.1 In addition to those who made representations at the Inquiry there were some 63 written submissions in response to notification of the event. These included those from the statutory authorities, including NE and NRW, who also provided further comment to the Inquiry (ID21 and 22 (CD 14.9 and 14.10)), as well as other representative bodies and individuals, such as the Bristol Avon River Trust, Severn River Trust and the Westcountry Rivers Trust, Bristol Channel Sea Anglers, Bristol Naturalist Society, Friends of the Earth, Somerset and Warwickshire Wildlife Trusts, the Wildfowl and Wetland Trust, the Bristol Avon Catchment Partnership and West of England Nature Partnership, the Hinkley Point C Stakeholder Reference Group, Ilston and Llandough Community Councils and Yatton Parish Council and the Welsh Anti-nuclear Alliance.
- 10.2 These responses were generally supportive of the Agency’s position of opposition to the proposed variation of the permit and retention of the AFD as part of the three stage mitigation process. Some suggested that the situation regarding marine and environmental protection status of the estuary had changed to the effect that alternative cooling options should be considered, and even that the relevant permits should be revisited and revoked for the scheme as a whole. Notwithstanding this, throughout the preparations for and delivery of the Inquiry event, it was made clear what the parameters of this Inquiry were.

11. INSPECTOR'S CONCLUSIONS

11.1 Taking account of the evidence in this case, including the submissions and representations on which I have reported above, I have reached the following conclusions. References in square brackets [] are to earlier paragraphs in this report.

Background and Main Issue

- 11.2 HPC power station is a large, nationally important infrastructure project that will go ahead. It is a considerable way through its construction period and will start to produce electricity once completed.
- 11.3 The LVSE heads are constructed and tunnels bored out towards the intake and discharge points. The operators have the relevant licences, permits and consent orders to operate the cooling system with an AFD.
- 11.4 That there will be fish mortality associated with this system, and indeed has been with cooling systems associated with HPB and HPA, is an accepted fact. The assessments carried out up to 2013 considered this in significant detail and reached a conclusion on the acceptability of the proposal, which at that time included an AFD system.
- 11.5 Those assessments relied on an AA of likely significant effects as part of a HRA and consideration of whether the integrity of relevant designated sites, their habitats and their identified species, would be maintained. There were HRAs for both the Environmental Permit and the DCO. A further HRA was carried out by the Agency, as the competent authority, as part of the variation application now before this Inquiry.
- 11.6 Notwithstanding the transfer of designated sites into the NSN, following the separation of the United Kingdom from Europe, the transposition of EU Directives into domestic legislation and the Conservation of Habitats and Species Regulations 2017 continue to have effect. Ramsar sites, although not part of the NSN, continue to benefit from the same level of protection as these designated sites.
- 11.7 The appellant has stated that their preference would have been to deliver the project with an AFD installed but that their comprehensive review of diver and operator safety, both for construction and maintenance operations, was such that they felt it would be irresponsible to do so. Consequently, they commissioned Cefas to review the effects without the AFD system. Risks to the health and safety of operators and divers is obviously an issue of significant importance and weight. However, it is not directly relevant to the matter before this appeal, which is whether there would be adverse effects on the integrity of the relevant sites. Consequently, while this risk may have been the cause of the review that led to the variation application and this appeal, it is relevant only if an AFD system is shown to be necessary, when matters of alternatives need be considered. [6.13]
- 11.8 The appellant has sought variation of the permit to remove the requirement for an AFD, arguing that this would not undermine the conclusions of the initial HRAs that

there would be no adverse effect on the integrity of the sites. They are not seeking to rely on the consideration of alternatives or submissions in relation to IROPI.

11.9 Accordingly, I set out at the start of the appeal process, that the main issue was the necessary AA to be carried out by the Secretary of State, as the Competent Authority, to ascertain whether the variation to remove the AFD would not adversely affect the integrity of the designated, or Ramsar, sites.

11.10 The integrity of a site is a function of its constituent characteristics and the habitats and species for which the sites are designated. This Report is therefore structured to inform the assessment against these characteristics. I will address the previous findings of the HRAs and the best practice approach to cooling water systems, consider the identification of relevant designated sites, including their conservation objectives and identified features, as well as the objectives of the Ramsar site.

11.11 The Report will then set out an initial review of the likely significant effects, analysis of the parties' findings, addressing uncertainties and the context, in terms of the status of the populations of the relevant species, and finally, consider an overall assessment of effects to inform the Secretary of State's AA, overall HRA as well as consideration of other legislation.

Previous Assessments

11.12 Assessments directly relevant to the cooling water system, carried out by the Agency in relation to the 2013 Environmental Permit application, the Secretary of State for the DCO, and the Agency, in 2020, for the variation of the permit, now subject of this appeal, all recognised that the proposed development may affect applicable SACs, SPAs and Ramsar sites. Under Regulation 63 of the Habitats Regulations, the relevant competent body must make an AA of the implications for the site in view of the site's conservation objectives.

11.13 The Agency's AA, completed in 2013, considered that findings for the Severn Estuary/Môr Hafren SAC, SPA and Ramsar sites would also cover any potential impacts on associated sites, including the River Usk/Afon Wysg SAC; River Wye/Afon Gwy SAC and River Tywi/Afon Tywi SAC. It found that:

"With the site operating alone with the preventative measures of a fish recovery and return system, and an acoustic deterrent system in the design of the intake for the proposed HPC site in place, we believe that there will be no adverse effect on fish.

However, given the complex nature of the estuary and the reliance on these proposed measures, the final designs should be tested at the commissioning stage of the set up, well in advance of the full operation of HPC to allow maximum performance."

11.14 The SoS's AA in relation to the DCO, also in 2013, took a similar position in relation to the associated designated sites and found that:

"The Secretary of State is aware of the fact that HPC will require up to 134m³/s for direct cooling that will be abstracted from the seabed, meaning that organisms present in the sea water will be drawn into water intakes. Larger organisms will be

impinged on the cooling water intake screens, whilst smaller organisms, such as plankton, fish eggs and Sabellaria larvae will be entrained through the cooling water system. He has considered the extent of these impingement/entrainment effects and considers that, with the acoustic fish deterrent and fish recovery system in place, there will be no adverse effect on the integrity of the Severn Estuary SAC/Ramsar. He notes the concerns expressed by the NE, CCW and others on the operational effectiveness of these systems and accepts the importance of optimising the performance of these systems in situ, prior to the full operation of HPC. The Secretary of State considers that the mitigation measures set out in the DCO, together with the EA's environmental permits and their enforcement, will ensure no adverse effects on the features of the Severn Estuary SAC/Ramsar sites."

- 11.15 Both assessments concluded that the mitigation, provided through the intake design, fish recovery system, the FRR and the AFD, would ensure that there would be no adverse effects, albeit the novel elements of the mitigation design required testing and optimisation to ensure their performance.
- 11.16 The appellant notes that the 2013 assessments did not identify that the cooling water requirements for HPB have had an effect on the integrity of the relevant sites, the SoS's AA stating that "*there is no evidence that the operation of HPB has led to adverse impacts on fish populations*" and the Agency that the analysis of the abundance trends from the long-term impingement modelling programme shows that HPB had not had any "*.. obvious positive or negative effect on the fish community structure at Hinkley Point.*" [6.8, 6.10]
- 11.17 The design of the intake heads and operational measures, including the AFD are the outcome of considerable scientific research, building on monitoring and assessment of previous cooling water approaches, including reports from the Agency, from the appellant and their consultant advisors and from the advisory expert panel, BEEMS.
- 11.18 At the time of the DCO application, an AFD was considered best practice for cooling water systems. In 2010 the Agency published a report⁵¹¹ that found that, in coastal locations, direct cooling would be the preferred option provided that abstraction impacts are acceptable. It went on to review intake design and referred to the Best Practice Guide for the Screening of Intakes and Outfalls⁵¹² and that best practice includes a combination of AFD and FRR.
- 11.19 There is no question that, at that time, reviews by all parties, including the operating company for HPC, EDF, found that the circumstances prevailing at Hinkley Point indicated that direct cooling with AFD and FRR was best practice and accorded with BAT, as initially established by the IPPC BAT reference document on Industrial Cooling Waters. A discussion paper produced by EDF⁵¹³ clearly sets this out.

⁵¹¹ CD 9.4

⁵¹² CD 9.3

⁵¹³ CD 5.7

- 11.20 Consequently, the proposal, at that time, included a LVSE, a design of intake promoted to reduce flow velocities to a target of 0.3m/s, by presenting a large cross sectional area parallel to predominant tidal flows with a cap to ensure a horizontal flow into the head, a FRR, with adaptation to recover eels specifically, and an AFD. AFD was chosen as a review of options for exclusion or deflection techniques had found that the low visibility and high tidal currents meant other techniques were not suitable.
- 11.21 A further review⁵¹⁴ carried out as part of the design process in 2015, considered these proposed elements of the design, noting that the LVSE target velocity of 0.3m/s is only effective if fish can detect the intake and consequently swim away from it, a particularly pertinent requirement in the high turbidity environment of the intake head location. Although it acknowledged that the final option for an AFD system had not been chosen, it confirmed that such a system is required to meet environmental requirements. Overall, the review concluded that the proposed intake and outfall head design, including AFD, was BAT.
- 11.22 The final AA was carried out by the Agency in 2020 in response to the appellant's application to vary the environmental permit. This drew on the most recent scientific assessments and considered the cooling water system comprising only the LVSE and the FRR, with no AFD. The Agency accepted at the Inquiry that there were some errors in their calculations, as set out in my introduction and in the main parties' cases, and that a revised AA had not been carried out nor subject of consultation with the SNCBs, NE and NRW. Nonetheless, the Agency stand by the overall conclusion which was: [6.78, 6.77, 6.80, 6.85, 7.32]

"... that it was not possible to conclude no adverse effect on the integrity of the Severn Estuary / Môr Hafren SAC and Ramsar site, the River Usk / Afon Wysg SAC and the River Wye / Afon Gwy SAC from the variation for the removal of the requirement for an AFD at HPC alone.

... and although there is uncertainty, given the modelled effects, it cannot be certain that there are no adverse effects on the integrity of the designated fish species (listed above) of the Severn Estuary / Môr Hafren SAC and Ramsar site, the River Usk / Afon Wysg SAC and the River Wye / Afon Gwy SAC and that no reasonable scientific doubt about the absence of effects remains...."

Relevant Designated Sites and Interest Features

- 11.23 There was some agreement between the Agency and the appellant as to the sites and interest features relevant to the appeal, although this position did change following the SoCG. For simplicity I have reproduced the tables from the SoCG but updated to reflect the positions put at the Inquiry. While I note SEIs concerns regarding climate change effects introducing additional protected species, I address this in my Other Species section below.

⁵¹⁴ CD9.46 HPC Intake and Outfall Heads ALARP and BAT Review (2015)

Table 1A - agreed

Interest Feature	Relevant NSN Site
Twaite shad	Severn Estuary SAC Annex II qualifying species
Atlantic salmon Allis shad Twaite shad	Severn Estuary Ramsar Criterion 4
Atlantic salmon Twaite shad	River Usk SAC Annex II qualifying species. River Usk SAC Annex II qualifying species.
Atlantic salmon Twaite shad Allis shad	River Wye SAC Annex II qualifying species. River Wye SAC Annex II qualifying species. River Wye SAC (present but not a primary reason for site selection)

11.24 The appellant argues that the ‘notable estuarine assemblage’ of fish species do not form part of the Severn Estuary Qualifying Habitat and at the Inquiry, extended that position relevant to Ramsar Criterion 8. The position, if such fish assemblages do form part of these features, is that it is agreed that only the following species are relevant to the appeal. [6.20, 6.26, 6.57, 6.65, 6.172-6.181]

Table 1B – not agreed

Interest Feature	Relevant Site
Estuaries – Notable estuarine assemblages: Atlantic salmon Allis shad Twaite shad Atlantic cod European sea bass Atlantic herring Whiting	Severn Estuary SAC Annex I qualifying habitat
Atlantic Cod European Sea bass Atlantic Herring Whiting	Severn Estuary Ramsar Criterion 8

11.25 Before considering any adverse effects on the integrity of the relevant sites, it is necessary to determine what are the qualifying interest features, notably Annex I habitats or Annex II species, that must be considered. It is important to note that the relationship between qualifying interest features, the conservation objectives, or Criteria for a Ramsar site, and their role in determining the integrity of the site is a complex one.

11.26 I deal first with the Severn Estuary SAC Annex I Habitat: Estuaries. The appellant argues that, irrespective of any later guidance, the integrity of a site should only be assessed against the specific habitats or species for which it is designated. In terms of the marine assemblage, it was argued that it cannot be elevated to the status of a qualifying species, no matter what the conservation objectives or guidance says. [6.26]

- 11.27 The test for integrity is not defined in the legislation, but the integrity of a site is set out in guidance, the most recent of which is the EC Guidance on Art.6 of the Habitats Directive (2019)⁵¹⁵. This explains that the integrity of a site relates to its conservation objectives, and confirms that *“if none of the habitat types or species for which the site has been designated is significantly affected then the site’s integrity cannot be considered to be adversely affected.”* The same guidance confirms that the conservation objectives should be based on the ecological requirements of the species and habitats present and should define the desired conservation conditions of these species and habitats.
- 11.28 The appellant and the Agency present a set of agreed legal principles⁵¹⁶, which defines the integrity of the site as *“the coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”*
- 11.29 For the Severn Estuary SAC, the relevant qualifying feature listed is not the fish assemblage, but Estuaries, one of five qualifying Annex I habitats. The only Annex II listed species, as agreed relevant to this appeal, is the Twaite shad. Nonetheless, the integrity of a site must be related to its conservation objectives. In this case, the conservation objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the FCS of its qualifying features, by maintaining or restoring a range of specified elements including those associated with qualifying habitats and species distributions and populations, but also *“the structure and function (including typical species) of qualifying natural habitats”*.⁵¹⁷ [6.22, 7.135, 7.136]
- 11.30 The Estuaries feature is an overarching one, and in the case of the Severn Estuary, acknowledged as representing a wide diversity of habitats, some of which are Annex I habitats in their own right. It is considered almost unique in Britain with its classic funnel shape and exceptional tidal range. It is acknowledged to have a diverse geological setting and a wide range of geomorphological features, and, in the SAC citation⁵¹⁸, that its overall interest depends on its large size and on the processes and interrelationships between the intertidal and marine habitats and its fauna.
- 11.31 Consequently, to understand the complexity of the estuary feature and the risks and pressures that could compromise the objective to maintain or restore it, it is necessary to consider the advice given by the SNCBs. In this case, it is in relation to the EMS comprising the Severn Estuary/Môr Hafren SAC, SPA and Ramsar site⁵¹⁹. This guidance provides advice under Regulation 33(2), and confirms that FCS of a natural habitat includes the long-term survival of its typical species. It then outlines in its summary of notified features that migratory fish, including the salmon and Allis shad, and the assemblage of fish species are part of the notable species sub-feature of the estuary feature for both the SAC and the Ramsar site. It

⁵¹⁵ CD 12.2

⁵¹⁶ CD 6.21

⁵¹⁷ CD 12.13

⁵¹⁸ CD 12.29

⁵¹⁹ CD 12.16

explicitly notes that the notable estuarine assemblages, which includes the fish species, are an intrinsic part of the estuary ecosystem and are therefore covered by the Estuaries feature.

- 11.32 Previous Agency assessments have discounted harm from the project to a large number of the species that are included within the marine assemblage. It is a fact that of the species now confirmed to be relevant or at risk by the Agency, the Atlantic salmon, Allis shad, Twaite shad, Atlantic cod, European sea bass, Atlantic herring and whiting, only the Twaite shad is specifically listed as an Annex II species for the SAC. It is a legitimate argument that these unlisted species are not ones for which the site is designated and therefore not ones whose status can affect its integrity.
- 11.33 However, this narrow approach does not align, in my view, with the need to address the conservation objective of maintaining or restoring the estuary habitat. This overarching feature cannot realistically be affected in terms of its basic physical form or geomorphology, and its listing is clearly established as a product of the interaction of the physical environment with its ecological functions. The 'health' of the estuary feature can only realistically be assessed through the maintenance or restoration of its habitats, which are a function of that geomorphology, and its ecology, of which a notable sub-feature is identified as the assemblage of typical species, many of whom are uniquely suited as migratory or marine species to this particular environment. This view is not mandated by the Regulation 33(2) advice, albeit that does assist in formulating the approach to applying the relevant test.
- 11.34 This approach is supported when considering the principle that the conservation objectives of a site are seeking to maintain or restore habitats of importance at FCS. FCS is defined in Article 1 of the Directive, which sets out that:
- "the conservative (sic) status of a natural habitat will be taken as 'favourable' when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable as defined in (i)" (my emphasis)*
- 11.35 The conservation status is further defined and includes when the population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats.
- 11.36 This does not mean that, in relation to the fish assemblage, any level of harm to one individual species should be considered as sufficient to result in compromised integrity of the estuary feature, albeit a total loss of a species would. A balanced judgement should be reached on the resulting populations, distributions and interrelationships of the assemblage as a whole and whether any losses represent a failure to maintain or restore the range of species and the structure and function of the estuary habitat. In this, I consider that it differs from the assessment that must be made against a designated Annex II species, such as the Twaite shad in the case of this SAC, where an impact resulting in a significant effect, such as failure to maintain a favourable conservation status, would, on its own, result in an adverse effect on the integrity of the SAC.

11.37 I note that the original HRA report for the DCO considered that the fish assemblage was relevant to Criterion 8 of the Ramsar, which I address below, but was not included in the SAC as a qualifying feature, albeit the conclusions of that report did address the fish assemblage against the SAC, and it was clearly part of the assessment when considering the conservation objectives⁵²⁰. As I have set out above, the assemblage is not a qualifying feature in its own right, and I note this report considered the boundaries of the SAC and Ramsar designations as being contiguous. In absence of arguments to the contrary, it may have adopted a simple approach of accepting alignment in the qualifying features of the two.

11.38 Nonetheless, in light of my considerations above, I conclude on this matter that it is necessary to consider the identified species within the fish assemblage as part of any assessment of integrity of the Severn Estuary SAC. In this matter, I note that the position is supported by the SNCBs⁵²¹.

11.39 Turning to the Ramsar site, there is no argument that the Ramsar Criterion 4 includes the assemblage of specified migratory fish, albeit the appellant suggests that this purpose relates to the run of migration fish and not the fish themselves. However, the appellant argues that on their reading of Criterion 8, which the Secretary of State in the previous HRA found to include the fish assemblage, does not, in fact, address species at all but just the habitat elements in relation to food, spawning grounds, nursery grounds or migration paths. [6.63, 6.264, 7.75]

11.40 This position was a new one, presented at the Inquiry, and it must be noted that the PoE, SoCG, previous HRAs and the appellant's own supporting evidence all considered the fish assemblage to form part of Criterion 8 of the Ramsar site. [6.57]

11.41 It is necessary to set out the relevant Criterion before considering the opposing views on interpretation. In this case, the appellant argues that if the Ramsar met the relevant criteria in relation to fish, then it is Criterion 7 that should have been included, not 8. The criteria are:

Specific criteria based on fish

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

⁵²⁰ CD5.8 Annex A, Table A1

⁵²¹ CD14.4, CD14.6 and CD14.8, CD14.9, CD14.10

- 11.42 In response to this revised position, I allowed specific responses from the SNCBs, who had supported the Agency’s position previously on the inclusion of the fish assemblage as relevant to Criterion 8⁵²².
- 11.43 The Agency consider that alteration of the fish populations could affect the functions that those fish would perform within the wetland site and consequently adversely affect the importance of the wetland site for those functions. This position is supported by NRW and by NE, who further argue that the Ramsar site was designated before the introduction of these criteria and the citation confirms that fish interests were in the selection of Criterion 2c at the time. Together they set out that guidelines for Criteria 8 support functions critical to fish life cycles and therefore are not related to the physical habitat but the biological functions of the fish population. The structure and function of the wetland site may therefore be affected through effects in the fish assemblage. [7.134, 7.137, 7.138]
- 11.44 The Ramsar information sheet, in relation to Criterion 8, sets out that the fish of the whole estuarine and river system are one of the most diverse in Britain, with over 110 species recorded. However, it specifically identifies migratory species and the importance of the wetland as a key migration route and as a feeding and nursery ground; it particularly notes Allis and Twaite shad.
- 11.45 The argument that the distinction between Criterion 7 and Criterion 8 is between fish species and the habitats to support such species is borne out, to an extent, by the response from the Ramsar Secretariate⁵²³. This confirms that the emphasis of Criterion 8 is not on the fish themselves but rather on the ecological functions. There is a logic to this, Ramsar sites are wetlands and in the case of a coastal wetland with a significant tidal range are unlikely to directly support a large adult population of fish, but are a vital component in the provision of suitable nursery or spawning areas, feeding areas or migratory routes. I consider that the SNCBs and the Agency rightly believe that the Ramsar plays a critical role in the lifecycle of many of the notable fish species in the estuary, and I also consider it likely that this was thought to have been captured in the original citation for this site.
- 11.46 Nonetheless, the criteria would now appear to draw a distinction between the wetland’s role as a nursery or spawning area, feeding site or migratory route (8) and its role as a supporting habitat for a diverse array of fish species and the necessary ecological interrelationships within that ecosystem (7). Notwithstanding the approach taken in previous HRAs, I would caution the Secretary of State in this case and would recommend that the agreed species of relevance, Atlantic cod, European sea bass, Atlantic herring and whiting, are not species to take into account when considering impacts on the Ramsar site. In my view, this does not alter the position that the migratory species, Atlantic salmon, Allis shad and Twaite shad, are relevant features for assessment against Criterion 4. With the Ramsar site near Bridgwater Bay within the boundaries of the SAC, this finding does not remove the non-migratory fish assemblage from consideration, other than in relation to the Ramsar specifically.

⁵²² CD 14.9 and 14.10

⁵²³ CD 6.28

Likely Significant Effects

11.47 It is common ground that unmitigated abstraction and discharge of cooling waters of this scale, in this sensitive location would be likely to have a significant effect on the relevant designated sites. It is also agreed by the Agency, in accordance with the existing Environmental Permit and the DCO, that mitigation in the form of the LVSE with AFD and a FRR would represent sufficient mitigation to ensure that there would not be an adverse effect on the integrity of the designated sites. While there would still be fish mortality associated with the process of entrapment through entrainment and direct impingement losses, these were assessed as being within acceptable levels to maintain or restore fish populations in the estuary and migratory species in the surrounding estuaries and rivers.

11.48 The AA before the Secretary of State now therefore, concerns the effects on the designated sites of the removal of the AFD. Consequently there is no need to consider the effect on non-hearing species, such as eels, and the focus of any consideration of the effects on the integrity of the sites must be on those species I have concluded above are relevant. For clarity, while I note the appellant’s comments regarding the Allis shad not being a primary reason for the River Wye SAC designation, I consider this has no practical implications in any assessment. Consequently, the following table represents my conclusions of the relevant sites and species.

Table 1C

Designated NSN Site	Relevant Conservation Objectives / Criteria	Qualifying Interest features
Severn Estuary/ Môr Hafren SAC	<p>Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the FCS of its Qualifying Features, by maintaining or restoring;</p> <ul style="list-style-type: none"> • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats • The structure and function of the habitats of qualifying species • The supporting processes on which qualifying natural habitats and habitats of qualifying species rely • The populations of qualifying species, and, • The distribution of qualifying species within the site 	<p>Twaite shad</p> <p>Estuaries – including Fish Assemblage: Atlantic salmon Twaite shad Allis shad Atlantic cod European sea bass Atlantic herring whiting</p>
River Usk / Afon Wysg SAC*	The vision for this feature is for it to be in a FCS, where all of the following conditions are satisfied:	<p>Atlantic salmon Twaite shad</p>

	<ul style="list-style-type: none"> The population of the feature in the SAC is stable or increasing over the long term. 	
River Wye/ Afon Gwy SAC	<p>Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the FCS of its Qualifying Features, by maintaining or restoring;</p> <ul style="list-style-type: none"> The populations of qualifying species, and, The distribution of qualifying species within the site. 	<p>Atlantic salmon Twaite shad Allis shad</p>
Severn Estuary / Môr Hafren Ramsar	<p>Criterion 4 - A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions - qualifies as it is important for the run of migratory fish between sea and river via estuary.</p>	<p>Atlantic salmon Twaite shad Allis shad</p>
<p>*Although the Allis shad is a designated species for the River Usk, the Agency’s AA found no record of a population in the river and concluded no adverse effect on this species.</p>		

11.49 Before addressing my recommendations in respect of any adverse effects on integrity in relation to these interest features, it is necessary to set out the assessment criteria, the areas of scientific disagreement between the parties, including uncertainties, and the current conservation status of the relevant species. This is required, as the relevant test, as agreed by the main parties, is that the Secretary of State in carrying out the AA must be satisfied that the Regulation 63(5)⁵²⁴ test is met ‘beyond reasonable scientific doubt’. This includes the application of the relevant precautionary approach in any AA. [6.69, 6.71, 6.93, 7.25, 8.42]

11.50 There is considerable guidance issued on the methodology to assess the effects on a site’s integrity. The most recent, a combined publication from Defra, Welsh Government, NE and NRW from 2021, sets out the tests for integrity and what an assessment requires. In terms of integrity, it sets out, among other tests, that it can be affected if a proposal destroys, damages or significantly changes a designated habitat, significantly disturbs the population of a designated species or prevents or disrupts restoration work, or the potential for future restoration, if it undermines the conservation objectives. In this case, the conservation objectives, although expressed slightly differently across the range of sites, are, in simple terms, to maintain or restore a site’s contribution to achieving the FCS of its qualifying features.

⁵²⁴ Conservation of Habitats and Species Regulations 2017 – Regulation 63(5) - the competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site

11.51 In terms of assessing effects, these include, among other matters, consideration of the conservation objectives and the current conservation status of the site's designated features as well as the scale, extent, timing, duration, reversibility and likelihood of the potential effects. [7.4]

Key Areas of Disagreement

11.52 The Directive, Regulations and associated guidance seeks that decisions are made on the basis of the best scientific knowledge in the field and that information should be up-to-date⁵²⁵. There is considerable scientific evidence submitted as part of this appeal, including work from some of the most recognised researchers or scientific bodies in the country. What is clear is that there remain significant questions over a number of matters, a situation which is not surprising in light of the fact that the assessments before the appeal are trying to ascertain whether the structure and function of species are affected by the proposal, which itself is promoting a novel solution to large scale water abstraction. Such assessments involve species with potentially significant ranges, whose life-cycles are acknowledged, in some cases, to be little understood, and even for those species who have been central to research over many years, the unforgiving obscuration of the environment in which they live obviously limits the accessibility to fine grained data.

11.53 The main parties have taken very different approaches to the parameters informing their respective quantitative assessments and in understanding the uncertainty or levels of precautionary approaches appropriate to consider in any qualitative assessment. Accordingly, I will review the principal data sources and then consider in more detail the key areas of disagreement between the main parties.

The RIMP and CIMP

11.54 Despite a number of divergent approaches, for the key steps of assessment, in the case of the Agency in their QIA, and the appellant with their assessment of entrapment rates, the starting point has been the data collected from HPB. There are two distinct sources, the RIMP and the CIMP. Detail on these monitoring programmes are set out in evidence, but it may be helpful to provide a simple overview.

11.55 The RIMP was a 37 year programme that ended in 2017, designed to assess long term changes in fish populations. It surveyed samples taken in daylight from two of the four drum screens. The samples were taken once per month over a six hour period, midway between spring and neap tide cycles from high water on the ebb tide. [6.114, 7.10]

11.56 The CIMP programme was set up to provide higher resolution data and comprised 24 hour sampling done over the period of a year, predominantly in 2009. Some 40 samples were collected comprising 10 randomly chosen dates, or those operationally closest to the chosen dates, although a series of 11 further samples

⁵²⁵ CD12.2

were taken in 2010. Generally, a bulk sample was taken overnight followed by six one-hour samples during the day. [6.115, 6.116, 7.15]

11.57 The sampling from each programme had various correction factors applied to account for screen and pump operations, indicative of the flow conditions. For the CIMP data a statistical 'bootstrapping' approach was applied to estimate mean annual impingement.

11.58 There is no question that having data of this type is highly advantageous to understand the potential impacts of the project. The appellant noted that this data had informed the DCO and Agency permit assessment in 2013 and that a number of researchers and the Agency's own witnesses had referred to it as an important and powerful data set; I concur. However, the key issue is whether it can fully inform the decision taking in this case and any associated uncertainties that need to be considered. [6.205, 6.207]

11.59 The Agency, while accepting the benefits of the programmes for long term monitoring, highlight that the RIMP sampled approximately 0.41% of the full abstraction volume of HPB, and inevitably was highly constrained by the limited period and timing of sampling; in daylight and generally on ebb flows. They also noted that the CIMP programme had some very low numbers of rarer species recorded on which to base estimates of impingement, had a number of compromised data sets associated with operational issues and equipment malfunctions and represented less than 11% of the total volume of water abstracted. The Agency's position is in line with concerns expressed in the 2013 AA and developed in the 2020 AA, in particular regarding the scaling up of infrequently caught species. I address the Agency's conclusions on the implications of this for the relevant species below. [7.10-7.16]

Areas of Disagreement

11.60 Before considering in detail the assessment of effects on the relevant features, I address the areas of distinct disagreement between the parties on general matters relating to these tests: EAV and the LVSE factor, as well as those matters raised by SEI and others. Further matters of disagreement include the population sizes for each species and the application of species loss to individual SAC rivers, which I address under the specific species conclusions below, as well as the extent to which the uncertainties I have addressed are taken into account, which is found in my overall assessment below.

Equivalent Adult Value

11.61 EAV is a methodology whereby the loss of fish of all ages, particularly juveniles, can be assessed to more accurately represent an equivalent number of adult fish. It is accepted by the main parties that the majority of fish entrapped at HPB are juveniles. Consequently, an EAV approach has been used by both main parties, albeit the methodology used for shad species was different, and the appellant presents an alternative methodology utilising stock assessments for Atlantic cod, sea bass and whiting, which I address under the specific species assessments below.

- 11.62 I have noted the very significant concerns of a number of interest groups and interested parties regarding the scale of fish loss associated with the abstractions, but it is relevant and important to note that the loss of juveniles does not have the same effect on a population as the loss of adult fish. This is an agreed position of the main parties⁵²⁶, who consider that, of the large numbers of larvae and juveniles produced by fish species many would never have survived to contribute to the spawning population. [6.120, 6.156, 7.50]
- 11.63 A calculation of EAV is an approach that contextualises the number of juveniles into equivalent numbers of adults lost. However, despite similar methods having been used by researchers previously there is no standard approach, and in this case, the approach favoured by the appellant differs to that promoted by the Agency; both parties contesting that the other's approach is incorrect. In response to my direct questions it was confirmed that neither approach had been peer reviewed. [6.120, 7.56, 7.61]
- 11.64 The appellant's approach involves a forward projection of the number of entrapment losses to give an equivalent number of mature fish that are lost from the spawning population, which can then be expressed as a percentage of mature fish within the population, multiplied by body weight to give a percentage of biomass of the spawning population or divided by the number of fish entrapped to then be used to estimate the number of adults lost from HPC. Since spawning populations naturally vary from year to year and EAV numbers are reported as a percentage of that population, the result will depend on the year when spawning populations size is estimated. [6.101]
- 11.65 The actual methodology between the two is similar, but the Agency, having reviewed the appellant's EAV approach with their consultants⁵²⁷, identified, in their view, a number of weakness. These they addressed through the adjustment of some underlying parameters, relating mostly to the different screen sizes between HPB (10mm) and HPC (5mm), but particularly in adding a step in the assessment to account for repeat spawners, a SPF extension. The Agency argue that the appellant's EAV only assigns value to a single mature fish without taking any multiple spawning opportunities into account. This added step to include repeat spawners results in a higher EAV factor and therefore a higher predicted impact. [7.50, 9.72]
- 11.66 While the APEM review, and the Agency's subsequent evidence to the Inquiry accepted that F, may overvalue mature fish, it explicitly considered the appellant's concerns and confirmed that the use of the SPF extension provided numbers directly comparable to the SSB. This position was supported by the SNCBs and, at the Inquiry, by the D&S IFCA. [9.76]
- 11.67 Contrary to this position, the appellant argued that the Agency's EAV-SPF approach cannot provide an annual rate of loss as it essentially considers the effect of one year's entrapment over several years of consequence. This was initially set out in a report⁵²⁸ and restated in written and oral evidence to the Inquiry. While the

⁵²⁶ CD6.5 p4.17

⁵²⁷ CD8.9

⁵²⁸ CD7.8

appellant accepted that the EAV-SPF approach could legitimately be used to project the number of fish in year classes forwards through time, they did not accept it can be used to estimate entrapment impacts in the Agency's QIA framework. When that loss is compared with an annual estimate of spawning population size it must, it was argued, give an inflated estimate of annual loss. [6.124, 6.129, 6.130]

- 11.68 The SSB is defined as the total weight of all sexually mature fish, an annual assessment comprising not only fish entering the stock for the first time and those leaving through mortality, but mature fish which potentially spawn in multiple years.
- 11.69 The calculation of EAV, while considered a useful tool to estimate future fish losses, is a theoretical one, described by the Agency as taking place within an 'EAV bubble'. It relies on running the calculation under the assumption of consistent impingement numbers and consistent SSB, and over multiple years of operation until the number of individuals that would otherwise reach maturity settles at a constant rate, a population in equilibrium. Both EAV approaches run through to this equilibrium point. The difference is that without the SPF extension, in all years after an impinged fish would have reached maturity, the spawning potential of that fish is not considered. [7.54, 9.75]
- 11.70 Pre-eminent fisheries consultants, scientist and regulatory bodies take opposing views on this matter. On the basis of the evidence before me, it appears that without taking account of the future spawning potential of lost fish there is a risk that future SSB would be overestimated. The SPF extension method can only be used in an approach that retains a consistent age class range for impingement, as fish represented in a specific age class in future years include those that would not, in fact, be present due to their earlier impingement. Quite clearly, to have any veracity, this method must also take account of the different potential of specific species to spawn across multiple years, in the case of Semelparous species, which spawn only once, the methodologies should produce essentially the same result. On the evidence before me, it would appear that the Agency's methodology allows for this and includes an end point on maturity. Although fish may survive beyond such an end point, the likelihood of the presence of older fish within the vicinity of the intakes is not supported by survey data. [7.58]
- 11.71 Consequently, while it is accepted that this is an issue that continues to divide the scientists involved in this appeal, on the evidence I have seen and read, I consider that the EAV-SPF methodology of the Agency provides a more appropriate and precautionary representation of real world impacts.
- 11.72 Nonetheless, there remains one matter that, irrespective of the methodology, the appellant argues is an important factor and that is F. While the appellant's EAV approach does not include F, this is argued as being highly conservative, and a matter for consideration even for fish species not targeted, due to their inclusion in bycatches. This conservatism would be magnified in the Agency's SPF extension methodology, they argue, because it is mature fish that are targeted by fisheries. [6.132, 6.135]
- 11.73 The Agency accept there is some risk of over-valuing older fish, which in part they address through the species specific end point for the age classes, but they also argue that F varies significantly every year and indeed by location and projecting

the actual levels over the lifetime of the project would be possible on available evidence. In recent years there has been increasingly tighter restrictions on catch numbers to the extent that the Agency, supported by the SNCBs, consider it an appropriate worst-case scenario to assume zero F. For the relevant species, ICES advises zero catch in 2021 for Atlantic cod and whiting has fallen below the safe biological limit, for sea bass the SSB has been declining since 2009, for Atlantic herring SSB has been below the safe biological limit since 2017 and ICES advice in 2019 was that there should be zero catch in 2020; there is no targeted fishery for Twaite or Allis shad. [7.63-7.67, 9.80]

11.74 The project will extend for 60 years, nonetheless, under the current environmental conditions and the stock strength of the relevant species, it is undoubtedly precautionary, but in my view necessary, to assume zero F.

Low Velocity Intake Head Scaling Factor

11.75 As set out in my introduction, the Agency accepted at the Inquiry that they were prepared to accept a scaling factor of 1 for the LVSE intake heads but not that it represented a precautionary figure⁵²⁹. The disagreement with the appellant on this matter is around the performance of the intake heads during 'aligned tide' conditions, that is when the tidal flow aligns perfectly with the intake structure. This matter has relevance in informing the overall assessment of uncertainty and how precautionary the parties' assessment of effects are. [7.32, 7.34]

11.76 In effect, the appellant argues that the zone within which fish would be drawn towards the intakes as a result of horizontal flow conditions is proportionately less than that relative to HPB, that is that the 54.8m² of HPB should be reduced to only 32m² equivalent at HPC. This is made up of a 2m intake height, a 2m plane outwards from the face of the intake multiplied by the 2 sides of the 4 intakes, 2x2x2x4, 32m². The appellant argues that this 2m plane is conservative in its own right and consequently the intake head, despite the considerably increased scale, would perform better than the HPB intake in terms of potential entrapment, albeit they continue to use a factor of 1 in their assessments. The appellant further argues that using this 2m extent of influence, the abstraction volume, where fish may be drawn towards the intake, is some 284m³ per head, 1,136m³ overall, which they then compare in scale to the Bristol Channel, implying a very insignificant scale to the water intake. [6.143-6.145, 6.153]

11.77 The Agency argue that this remains a novel intake design that has only been modelled theoretically or by use of model testing, carried out by HR Wallingford in 2013 or for Sizewell C, which is proposing a similar size and scale of intake⁵³⁰. They point out that the model testing was to assess inward velocities at the screens and not to assess a zone of influence, and that, at the scale used, the visual observations and limited dye tracing represented an actual distance of some 79mm and at best offered only an estimate of 2m. [7.38-7.40]

11.78 If, in reality, a point 2m from the face of the intakes experienced such a level of flow as to have no influence on fish, and that perfectly aligned flow was achieved,

⁵²⁹ CD6.6c, CD6.11d

⁵³⁰ CD1.13, CD7.15

then I can understand the appellant's arguments regarding the intercept area, and note particularly that it should not be considered as a simple comparison to the 132m³/sec flow that is expected to be required. However, the calculation presented appears unrealistically simple to me. In reality there will be turbulent effects as flows pass the intakes, there will be some asymmetry in tides and potentially changes in tidal alignments between springs and neaps, so irrespective of the accuracy of head position, greater component effects of slack water and misaligned tide are likely to be more realistic than the theoretically assessed aligned tide. Within the abstraction volume that will be moving in towards the intakes, fish will be active and their direction of movement cannot be considered to be solely aligned with the tidal flow, especially over such a long length of intake head.

11.79 Although limited evidence was presented at the Inquiry, similar structures or even the hulks of ships have been placed on the sea bed to establish artificial reefs. Their aim is to establish an ecosystem to offer both food and shelter and specifically attract more fish to that area. [7.48]

11.80 Nonetheless, there is no question that, in comparison to HPB, which is a cylindrical structure with one fixed sector facing southeast, the proposed design for the LVSE head will have benefits in terms of the potential for entrapment, as will the addition of a cap to reduce vertical currents. However, I cannot accept that the overt simplicity of the proposed reduction in intake area is properly reflective of real world conditions and I remain concerned that the conclusion of 2m has been drawn from theoretical modelling at a scale where small visually observed changes contribute to much larger real world effects. Overall, I would recommend that the LVSE factor of 1 should not be viewed as precautionary.

Additional Areas of Uncertainty

11.81 The Agency and the appellant reached consensus on the factors to be used to establish the difference between the intake at HPB and that proposed at HPC to account for the increased flows and mitigation associated with the LVSE head and the pelagic cap. Put simply, an approximately four-fold increase in flows, with associated four-fold increase in entrapment, was considered by the two main parties as being addressed through the benefits for some species ascribed to the pelagic cap. These figures are shown in CD6.26.

11.82 SEI challenge the assumption that a four-fold increase of flows would result in only a four-fold increase in entrapment, arguing instead that there would be a power relationship. This they argue by reference to the position of Dr Henderson⁵³¹, a leading scientist in this area directly involved in the RIMP programme, and to studies by Bryhn et al⁵³². [8.35-8.38]

11.83 The Bryhn et al study looked at a wide range of power plants and associated fish impingement in a study that was looking specifically at the number of impinged fish at a plant in Sweden. Regression curves were fitted to data sets from Europe and from Taiwan. Such non-linear relationships are reflected in the views of Dr

⁵³¹ CD10.3

⁵³² CD9.121

Henderson. However, it is clear that there is significant variability in the findings across individual plants.

- 11.84 The Agency carried out a review of this relationship⁵³³, which included the Bryhn study and Dr Henderson’s paper. This found no strong evidence to contradict their approach in taking a linear relationship between flow and entrapment. [6.241]
- 11.85 Having reviewed the SEI case, it is apparent that there is a large variety in the identified relationships between flow and entrapment across the range of plants studied. This is unsurprising as the numbers of fish entrapped must be the result of many more variables than just flow, including, but not limited to, the presence or absence of fish near the intake, the design and scale of the intake and its flow velocity characteristics. It is not clear to me how such variables are accounted for in the Bryhn study. [6.246]
- 11.86 I note that Dr Henderson focussed on HPB and hypothesised that a larger area of intake may entrap proportionately more fish than a simple linear relationship simply because they do not detect it as a threat until they have entered and cannot retreat. The absence of a sensory cue, such as an AFD, would potentially compound this issue. However, in my view, such an effect leading to a non-linear relationship may well be realised for intake structures of similar form in similar locations. Here the structures would be very different with a number of specific elements of the LVSE designed to limit fish entrapment, such as the height above the bed, lower velocities, and the alignment with tidal flows.
- 11.87 While I do not find evidence sufficient to outweigh the arguments of the appellant and the findings of the Agency in relation to the adoption of a linear relationship, the significant variability of findings from other stations lend some credence to the argument that adoption of such a relationship is not a conservative approach. To my mind, it can be considered a practical one for quantitative assessment purposes, although some uncertainty must be accounted for in terms of potential real-world performance of an intake operating at such significantly higher flows.
- 11.88 Dr Henderson and others also challenged whether the factor, ascribed by the Agency as benefit to pelagic species from the horizontal cap, is correct in light of the actual functioning of the HPB intake. The assessment of the intake presented in CD10.3 suggests that at low water the structure, because of the substantial horizontal concrete bar screens, would act like a capped intake, and like a partially capped intake at other states of the tide.
- 11.89 The effect of the cap was addressed in a Technical Brief.⁵³⁴ This considered the nature of the two intakes and refers to the presence of the top face horizontal screens and the exposure of the intake at low water. While I note the assumptions made which informed a range of values, the factor was found to be 0.23, with a range of 0.18 to 0.28. This gives considerable benefit to the provision of a pelagic cap. The brief does compare this finding with other studies and draws some confirmation from that, but I also note that it presents a rather better performance

⁵³³ CD8.28,

⁵³⁴ CD8.5

in relation to reduced effects on pelagic species than is promoted by Dr Henderson, but also better than the appellant's original findings. [7.30]

11.90 I have limited evidence to support deviation from the agreed factor for the benefit of a pelagic cap at HPC. However, the Agency do promote a potential range of uncertainty to this value. I consider that this is an important and relevant precautionary approach, especially as it is clear that the level of entrapment for these pelagic species is very sensitive to relatively small changes in this factor. Such uncertainty should be accounted for in the overall assessment of impacts.

Quantitative Assessment of Interest Features

11.91 Turning to the specific species of concern, there are two initial points to address. While focus has been on those species which are either specifically listed as Annex II species of the relevant sites or part of the migratory assemblage or wider fish assemblage, it is important to note that these species are not solely chosen because there are no other impacts from the proposal. There is significant concerns expressed by many environmental and interest bodies regarding the total impacts on a wide range of fish species, as well as on the eggs and larvae that are entrained. The AA carried out by the Agency in 2020 addressed, in addition to the diadromous migratory species, some 117 species within the full fish assemblage. Some were excluded because there was no record of them within the HPB datasets, or because they were rare or species considered to be stragglers from freshwater or marine environments removed from the site. Some 24 species were studied in detail, including those considered as suitable proxy for other species of potential concern. [7.9]

11.92 The final quantitative assessment carried out by the Agency was for seven of these assemblage species and it is now common ground between the parties that despite large numbers of losses for other species, the migratory species, the Atlantic salmon and shads, and the four species within the marine assemblage, the Atlantic cod, Atlantic herring, European sea bass and whiting, are those that remained as being of concern. In response to specific questions at the Inquiry, it was accepted by the main parties that for a species such as the European sprat, which are the most abundant species in the local area and the most likely species to be impinged or entrained, the estimated overall entrapment mortality was found to be so low as a percentage of the SSB, in light of the status of the population that it was considered inconsequential. [6.237]

11.93 As a result of the revisions made by parties in relation to their quantitative assessments in the run up to, and during the Inquiry, I asked for a comparison set of species impacts to be presented; this can be found at CD6.26.

Twaite Shad

11.94 The Twaite shad is one of two shad species, along with the Allis shad. It is protected as an interest feature and as part of the estuary fish and migratory assemblage for the SACs and Ramsar in the area. The Twaite shad has only four confirmed breeding populations in the UK, all are rivers of the Severn Estuary, and the local populations are therefore of national importance, albeit these populations have shown significant decline. There is agreement that the principal cause of the Twaite, and Allis, shad decline was the introduction of navigation weirs on the

Severn, which effectively cut off half of the available spawning habitat. One outcome has been that Allis shad, a species that is generally larger but difficult to differentiate other than through genetic analysis or from the number of gill rakers, have been held back in lower reaches of the river where hybridisation between the species is accepted to have taken place. [6.168, 6.227, 8.31]

- 11.95 Despite significant changes in population pressures and efforts to support the species, including reduced abstractions, the phasing out of the putcher rank fishery, Salmon Byelaws that reduced the bycatch of shad, improvements in screening requirement and the reduction in angling, this population decline has continued⁵³⁵. [6.223]
- 11.96 The Twaite shad is acknowledged to be a species for which hearing is an important sense for predator detection and avoidance and is thus likely to display an avoidance response to an AFD. However, they are highly susceptible to pressure changes and sheer stresses and it is accepted that there would be 100% mortality following impingement, even with the FRR. [7.96, 8.34, 9.23]
- 11.97 The latest indicative assessment of status of the Twaite shad is 'unfavourable'. [7.79, 7.99]
- 11.98 The appellant argues that despite the almost four-fold increase in abstraction at HPC, the introduction of the pelagic cap will effectively negate that increase in terms of potential impacts. Consequently, the pressure on the Twaite shad population is, they argue, water quality and weirs on the rivers themselves and not historic or future water abstraction. [6.168]
- 11.99 They consider that, even on the Agency's figures, and the taking of an unreasonable approach of assigning impacts to each river's sub-populations, impacts of between 0.1 and 1% of a population cannot be considered to have ecological implications and would be undetectable, even over the long-term.
- 11.100 The Agency acknowledge that their quantitative assessment results in figures of less than 1% impact on the populations. However, they note considerable uncertainty in those figures and that there is emerging evidence associated with the UtS project, that supports that risks are potentially higher than shown by the proportionate calculations based on the RIMP or CIMP data. [7.80, 7.88-7.90]
- 11.101 The UtS project is seeking to reverse the decline of the shad populations with enhanced scientific assessment and direct intervention in terms of providing fish passes to allow increased access to spawning grounds on the River Severn, as well as extensive public engagement and education. The project has included empirical validation of shad population models, acoustic fish tagging and genetic studies of adults and eggs. The data is, in some cases still being analysed, but it nonetheless gives some important emerging evidence of the behaviour of shad in the estuary.

⁵³⁵ CD6.9 p26 Figure 1

11.102 With the direct support of the SNCBs, the Agency have assigned potential losses to each SAC, an approach which the appellant argues is unreasonable as the possibility of impingement of fish relating solely to one river is unlikely. While acknowledged as an unlikely scenario by the Agency, there is no evidence to identify from which population the historic impingement of shad came. With known fidelity and fish potentially leaving and returning from their freshwater phase triggered by water temperatures and tides, it is not inconceivable that fish from one sub-population may be predominantly found within Bridgwater Bay. In essence, without the evidence, the reasonable worst case scenario has been chosen to apply the modelled loss against each river in turn. I accept this is a precautionary approach but reasonable in these circumstances and I note that the Agency have not applied the 99th percentile impacts in this case. [6.99, 6.225, 7.97-7.98]

11.103 Consequently, the Agency's findings, based on their quantitative assessment and my earlier conclusions supporting these figures, are a 0.1% impact on populations of the Severn SAC and Ramsar, 0.2% for the River Wye SAC and 0.4% for the River Usk SAC. These are levels generally considered acceptable at the time of the earlier AAs. However, the Agency now point to more recent and emerging evidence indicating that their qualitative analysis would suggest impacts could exceed this and that the pressure on the populations, already in unfavourable and declining condition would be such that the Twaite shad would be subjected to continuing downward pressure and could not maintain or achieve FCS. [7.100-7.103]

11.104 These findings are centred around recent research that shows a much longer residence time within the bays of the estuary by shad indicating that they are not using selective tidal transport to move quickly through the estuary. The Agency rely on evidence from Davies et al⁵³⁶ and others, who concluded that there is near year round use of estuarine and near shore habitats and a strong element of fidelity and survival through their marine phase. The Agency suggest that these conclusions support that adult shad are more likely to be found near the proposed location of the HPC intake. [7.91]

11.105 Some caution must be expressed because of the relatively limited sampling frequency for Bridgwater Bay, although, in my view, it is reasonable to note that the behavioural response of shad here is likely to reflect that of the findings from Swansea Bay. Undoubtedly shad historically were present in large numbers close to shore, the bycatch of the putcher rank fishery supports that. However, it is a reasonable conclusion to consider that juvenile fish will be more associated with the near shore and intertidal habitats; typical nursery areas for such fish. [6.224, 7.92]

11.106 This new evidence suggests that shad are not a species that transits quickly through the estuary, but one that spends a considerable part of the year in and around areas such as Bridgwater Bay. While I accept that the centre of the channel is located approximately 10km to the north of the proposed site for the intake, tidal streams are not limited to the main channel, albeit they may be at their maximum there. Any fish utilising selective tidal stream transport will enter and exit that flow, utilising both areas nearer the bed and shallower water to limit the opposing flow. Coupled with the more recent evidence of fish remaining within the bay areas, there would appear to be growing evidence to support the principle of shad

⁵³⁶ CD9.36

being exposed to potential impingement for much of the year, and on balance I favour the Agency's concern that the locational differences, with the HPC intake located further offshore in deeper water, would favour a higher proportion of adult fish at risk. This has significant implications in terms of the modelled numbers from the quantitative assessment.

11.107 While, impacts would be, on the face of it, very low, and it is a finely balanced decision, in my view, quantitative assessment findings of less than 1% is not sufficient to ensure that there will be no harm to the Twaite shad populations. This is a species at risk, whose population has been in decline for a considerable period despite efforts to reverse it. The model presenting the impact of mortality on the size of a baseline populations⁵³⁷ is indicative of how even very low level impacts can negatively affect the population over the long term. I note the appellant's concern that this is an equilibrium model and fully accept that the population will be variable and will respond to other environmental triggers. However, there is very limited evidence to suggest that this is currently a sustainable population, indeed the trend appears to be one in decline and is already in unfavourable status. [6.227, 7.102]

11.108 I cannot accept the argument that even if the losses associated with HPC are negative they would be more than outweighed by the benefits to accrue from projects such as UtS. That project is due to finish in 2022 and the outcome of the opening up of upstream spawning grounds cannot yet be fully quantified and can, in any case only be realised for the sub-population associated with the River Severn. Furthermore, increased numbers of shad migrating through the estuary, if they are realised by the project, would represent increased potential for entrapment and the impacts of that cannot be estimated and have not been addressed in evidence. [6.168, 7.104-7.107]

11.109 Consequently, Twaite shad is an important species for which there has been significant declines in population. It is a species that would benefit significantly from the presence of an AFD, and which, on impingement, would be likely to experience 100% mortality within the FRR. The modelled impacts are low, but significant uncertainty has been demonstrated in relation to the potential impacts. I consider the appropriate level of precaution and uncertainties below before concluding on the effect on the Twaite shad populations and the implications for the integrity of the relevant sites in line with their conservation status. [7.96]

Allis Shad.

11.110 The Allis shad population, despite its ubiquity and importance as a commercial fish species prior to the weir construction on the River Severn, is now in a highly degraded state. Hybridisation is extensive because of those barriers to spawning grounds, once the sole domain of this larger and stronger swimming member of the shad family. The Agency's own witness confirms that it is now difficult to identify 'pure' Allis shad genetics within the combined populations. The appellant goes so far as to suggest that there is now no spawning populations of Allis shad, although this is contradicted by the Agency, who present a number of indicators suggesting a small population with predominantly Allis shad genetics are

⁵³⁷ CD9.115 Arahamian et al

still present. These indicators include photographic and fishery records of large shad, in excess of the typical size of the Twaite, the persistence of Allis shad genetics as well as fish spawning at grounds beyond the expected range of the Twaite shad. [6.231, 6.233, 7.84]

11.111 There is also more recent studies utilising genetic information, both eDNA⁵³⁸ and egg analysis⁵³⁹, supporting a proportion of the overall shad population as being Allis shad in the River Severn and River Wye, albeit only very limited evidence of dominant Allis shad genes, being found in only one egg sampled from the River Wye. [6.232, 7.85]

11.112 To my mind, there is considerable evidence of significant historical populations, but only very limited evidence of a spawning population now. Likely numbers of Allis shad are indicative of only a small proportion of the overall shad population. However, it remains an interest feature of the River Wye SAC and part of the estuary and migratory assemblage of the Severn Estuary SAC and Ramsar. I consider that the varying levels of hybridisation confirms that the genetic presence of the Allis shad remains and is potentially viable for restoration.

11.113 While the population levels are much lower than that of the Twaite shad, my conclusions regarding the appropriate quantitative assessment are the same. I therefore favour the Agency's conclusions regarding modelled impacts of 0.6% of the Severn Estuary SAC and Ramsar population and 0.4% of the River Wye SAC.

11.114 Again, these figures, on the face of it, are very low but I also consider there are the same uncertainties implied by the proposed intake design and location and the emerging evidence on migratory behaviour. Overall, this is an interest feature of the relevant designated sites, a species that would be likely to display a significant avoidance response to a behavioural cue such as AFD and with a population in decline against which even limited impacts could have long-term implications in terms of the maintenance or restoration of the species. I consider the appropriate level of precaution and uncertainties below before concluding on the effect on the Allis shad populations and the implications for the integrity of the relevant sites in line with their conservation status.

Atlantic Salmon

11.115 Salmon are a migratory species which spawns in freshwater, where the fry remain close to the spawning site before moving down river as parr. These then move, as smolts from freshwater into the sea, where they may travel extensively. The salmon return after one or more years, almost invariably to the same river to spawn, following which, as kelts, they return to sea, although mortality rates are relatively high. The Atlantic salmon is an interest feature both as an Annex II listed species of the Rivers Usk and Wye and as part of the migratory and estuary assemblage of the Severn Estuary SAC and Ramsar.

11.116 Salmon populations have been recorded as declining over the years; there are many potential reasons, including through marine fishery loss, reduction in

⁵³⁸ CD8.15

⁵³⁹ CD9.39

spawning due to obstructions preventing access to spawning grounds, water quality impacts and sedimentation effecting the spawning gravels. There have been many active measures taken to address this including Byelaws to reduce catch, the cessation of the putcher rank fishery, increasingly tighter commercial and recreational catch limits and subsequently mandatory catch and release.

Notwithstanding this, the relevant sites are all considered to be 'probably at risk' and are likely to continue to remain that way with egg deposits recorded as being significantly below conservation limits in 2019. [7.110-7.111]

11.117 The RIMP programme recorded some nine salmon up to 2004 with only two salmon recorded as impinged during the CIMP programme, with both being outside of the one year programme period. Nonetheless, the Agency argue strongly that these programmes significantly undervalue potential salmon impingement, not only because of their low sampling frequency but, in the case of the RIMP, the sample timing. [7.113, 7.118]

11.118 Salmon are likely to move in pulses on their transit between the freshwater and sea, driven by environmental cues and, according to the Agency, often at night. Despite the RIMP programme recording all stages of the migratory part of the life cycle, such pulses are very likely to have been missed in the RIMP surveys and potentially in the CIMP, albeit this did include higher frequency and overnight bulk sampling. [7.118]

11.119 The quantitative assessments which relied on an agreed population but a disputed EAV approach was based on the CIMP findings by the appellant and the RIMP by the Agency. I have set out above the acceptability of the approach assigning impacts to individual rivers and note that the Agency had a bespoke approach to EAV factors in this case. I am concerned that the Agency approach focussed on the RIMP data to 2004 and not the entire sequence to 2017. Despite this, the actual levels of impingement recorded were very low and potentially cast doubt on the quantitative conclusions, which, for the Agency, was a 0.07% impact on the Severn Estuary and a 0.2% impact on the Rivers Wye and Usk; these figures take account of the corrections made at the Inquiry. While this is greater than the appellant's findings, both parties argue qualitative factors that they regard as making the assessments either precautionary or subject to significant uncertainty. [7.116]

11.120 The appellant concludes that entrapment of salmon is highly unlikely, and if it did occur, would involve individual fish that would not be expected to contribute to the spawning potential. Their precautionary arguments included, in addition to the EAV approach and individual river assessment, an expectation that salmon would not be expected to be outside of the main channel in any significant numbers and that if they were impinged, then the expectation of 100% mortality through the FRR was excessive. Their conclusions overall being that only a limited number of fish may be impinged, of those, only a few would contribute to the spawning potential of the species and even those may survive the impingement. [6.202-6.203]

11.121 Against this, the Agency challenge any conclusion that the low numbers recorded in the RIMP and CIMP programmes are indicative of the likelihood of actual impingement levels, emphasising that, in their view, neither programme was designed to sample for this species. They further argue that there is no evidence

to support that salmon would not typically be found within Bridgwater Bay and that an FRR mortality of 100% is a suitably precautionary approach.

11.122 Atlantic salmon are not a species that would be expected to be present year round within the estuary, indeed, their presence is likely to show significant fine scale variations as they transit the estuary between their marine phase and spawning in freshwater. As a result, the RIMP programme, with its limited sampling frequency and daylight sampling on ebb flows cannot be considered a robust estimate of impingement risk. The lack of recorded impingement from the CIMP data could be taken as an indicator of limited risk, but the two salmon, potentially smolts albeit taken very early in the year, to my mind, confound this data somewhat. With a maximum of 11% of the abstraction being sampled by the CIMP, coupled with the variability of the likely passage of salmon, significant doubt must remain over the robustness of the base data on which the quantitative assessments are based.

11.123 Turning to the more qualitative matters, I find little reassurance in the suggestion that salmon would be limited to the main channel, 10kms north of the proposed intake site. While the association with selective tidal stream transport may be more closely correlated than with shad, in light of the longer residence times of shad within the estuary, the fact that traditional salmon fisheries, both lave nets and particularly putcher rank fisheries targeted fish within the intertidal areas suggest that salmon are likely to utilise much of the estuary. [6.200, 7.122-7.123]

11.124 Were salmon to be impinged, the appellant refers to other sources, such as the studies at Oldbury, to conclude that mortality through the FRR is likely to be less than 100%. A review of the evidence leads me to the conclusion that circumstances of the FRR associated with Oldbury and that proposed at HPC are very different. Undoubtedly, based on ongoing research and development the structures are likely to be improved, but fish would still experience draw down to some 30m below the sea bed, a transfer distance of over 3kms within the tunnels and then passage through the Archimedes screw to the discharge point. I have no reason to question the Agency's views that salmon smolts in the estuary are very sensitive to scale loss, nor that kelts are generally weakened. While I would accept that returning adults may be more robust, they will be still be subject to relatively unknown effects of barotrauma; a figure of 100% must be considered appropriate, albeit conservative. [6.19, 6.101, 7.126, 8.10, 8.41]

11.125 While the appellant notes the findings of no adverse effect on the salmon population recorded in the 2013 AAs, the DCO AA records that there were no predictions for salmon because no fish had been recovered from the HPB intake screens, which is clearly incorrect. The Agency's AA found very limited evidence of impingements, but their conclusions at that stage assumed the presence of an AFD.

11.126 Before concluding, I must address one further matter raised by the appellant who suggests that even were there to be some loss of salmon, the figures would be insignificant and below that even associated with the catch and release programmes now mandatory for the recreational fisheries within the SACs. Catch and release is one of the adaptive management responses available to the regulatory bodies to try to maintain or restore the populations. The fact that over recent years such controls have had to be imposed is indicative of the parlous state

of the populations. The Agency conceded that catch and release is not perfect and some fish will still be taken or will die after release, but this does not suggest that the Agency and the SNCBs have been unreasonable in considering the potential loss of salmon associated with the proposal. [6.53, 6.213, 7.127]

11.127 Recreational fisheries are not subject to HRA, as licences are granted irrespective of locations, and reliance is therefore on byelaws to promote good adaptive management. Coupled to this, many salmon fisheries organisations are partners with the regulatory bodies on habitat protection and fishery enforcement, a level of support that lies alongside maintenance of recreational fisheries. I note another Inspector dealing with the recent imposition of catch and release byelaws, and addressing arguments that they would make little difference, commented on the evidence that even relatively small numbers are crucial to stock recovery, and that where catch and release had been introduced there had been evidence of a cessation in decline of running spring salmon stock and an increase in abundance⁵⁴⁰. [7.127]

11.128 In conclusion, Atlantic salmon are an iconic species, they have been well studied in the area and there is evidence that a wide range of pressures, both in the marine and freshwater environment have led to a gradual decline, despite active management methods. Overall, the species status within the SACs and Ramsar is considered to be probably at risk and the expectation is that they should be maintained or restored to FCS.

11.129 However, this does not mean that the population would fail to be maintained by even the loss of one salmon, for example, although the status of the species means that even very small losses, particularly on adults returning to spawn, could have very significant impacts on the restoration of the populations. On the evidence before me, the short, defined periods when there would be salmon within the estuary, suggest that empirical data from the RIMP or CIMP may well underestimate the likely levels of impingement. However, this same low level of exposure, coupled with the location out of the main channel, albeit still within areas likely to experience salmon, suggests that levels of impingement are likely to be relatively low. I consider the appropriate level of precaution and uncertainties below before concluding on the effect on the Atlantic salmon populations and the implications for the integrity of the relevant sites in line with their conservation status.

Fish Assemblage

11.130 I have found that the fish assemblage, including the migratory species I have addressed above, are an important component of the Estuaries Habitat feature of the Severn Estuary SAC. Consequently, I turn then to the four marine species that were agreed to be relevant in such circumstances.

11.131 Evidence from the Agency at the Inquiry itself appeared to suggest that their concerns related only to the Ramsar site, which perhaps mistakenly was considered analogous to the SAC. This position does not concur with the Agency's position in written evidence, nor their position in either of the AAs or as set out in

⁵⁴⁰ CD9.49

the SoCG. I see no disadvantage to the appellant in dealing with this matter as it is addressed in the written evidence, and indeed oral evidence as it pertained to the population assessments and effects, as the Agency's conclusions on harm to the marine assemblage are the same whether applied to the Ramsar or the SAC, and have been fully addressed by the appellant in their evidence and witness contributions. [6.32]

11.132 For the marine assemblage species, it was generally accepted that the majority of fish present within the area, and impinged at HPB are juveniles. However, only herring are considered to benefit from mitigation from the pelagic cap. Consequently, there is likely to be a significantly greater impingement of the other three species at HPC as a direct result of the increased abstraction rate, notwithstanding some benefits associated with the FRR, as detailed in the SoCG. Nonetheless, the appellant still argues that the impacts would be negligible.

11.133 There are two key differences in the assessments, the EAV, which I have addressed above, and particularly population sizes. Clearly the larger the population size chosen, the lower the impacts of a fixed loss of individuals would be. Population estimates for the appellant are generally based on ICES stock areas and for herring on PELTIC surveys.

11.134 ICES stock areas are argued by the appellant as reflecting the best available evidence of populations, considered over whole life cycles and geographical areas. ICES population estimates are derived from an open, transparent and peer reviewed body that has an international representation and reputation. Their use is appropriate, they argue, as the juveniles found near the intake would predominantly be from offshore spawning grounds, typically off Trevoise Head, and the product of extensive mixing of populations across a wide geographic area. [6.155, 6.156]

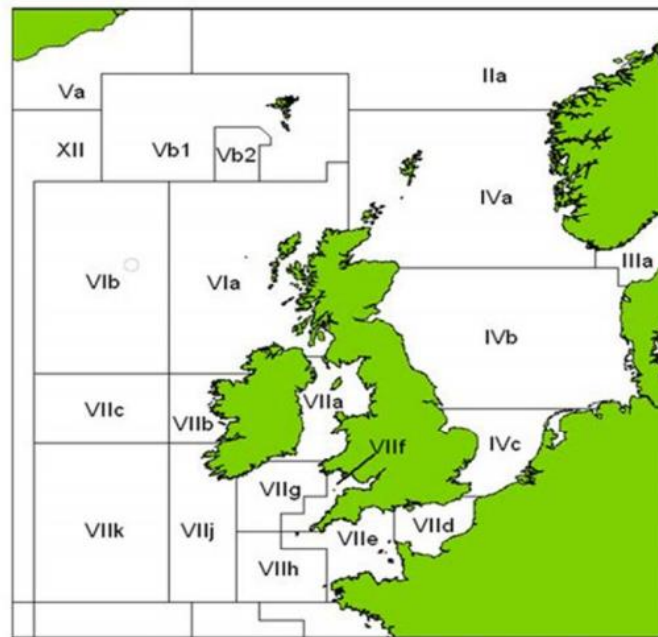
11.135 The Agency argues that these are not a true reflection of the populations or sub-populations that would be affected by the proposal, and disputes the use of such large scale population units, suggesting that this represents a significant step away from Cefas' approach during the original DCO application. They accept that there will be some mixing offshore but that there are distinct sub-populations, some genetically distinct or with acknowledged fidelity to the Severn Estuary, wider Bristol Channel or Celtic Sea areas. The Agency considered the appellant's approach in a literature review⁵⁴¹, which sought to understand the latest research on species population structure, including fish tag surveys and genetic studies. Direct support for the Agency's approach is found in the concerns expressed by the SNCBs to the population sizes chosen by the appellant, and from D&S IFCA, who presented further evidence to the Inquiry, most notably in relation to herring. [7.143-149, 9.58]

11.136 I tested the differences between the parties on this matter at the Inquiry and both agreed that this is a matter of judgement informed by an understanding of the population dynamics of the species. [7.61]

⁵⁴¹ CD8.10

11.137 I have considered the Agency’s review and evidence, and the appellant’s response and submission made at the Inquiry. It strikes me that there are issues with the approach of both parties. Put in simple terms, I consider that the ICES stock areas are geographically derived management units, effective in understanding the broad swathe of impacts that can occur associated, for example, with commercial fishing, and which operate over relatively large scales or geographical areas. I do not question the science behind these estimates at all, but consider they are not reflective of the more localised sub-populations which, where there is species fidelity to an area and/or limited mixing, are more relevant to considering impacts, especially when related to an AA focussed on a defined area such as the Severn Estuary SAC.

11.138 However, it is apparent that the Agency have in part used a proportional approach to assess these more localised populations, scaling down from the ICES assessments. This is not, in my view, properly reflective of the likely variability of stock across the wider areas, dictated by environmental factors, geography or water depths for example. The ICES areas are large, but it must be the distribution of stock within those areas, their mixing with neighbouring populations and their fidelity to specific areas that should determine the relevant population size. [6.159]I note a 2017 paper⁵⁴² and a recent comment from ICES regarding their Stock Identification Working Group⁵⁴³, that bears out the Agency’s view that the stock areas are not reflective of the biological populations. Kerr et al clearly set out that recent research is increasingly identifying and delineating biologically discrete fish populations, and as a result there are misalignments between biological and management units. This is reflective of the clear statement from ICES, that only a fraction of stocks are organised according to ICES subdivisions and in reality they are far more dynamic than that. [7.148, 9.55] In the following sections I address each species in turn applying my own review of the appropriate approach. To assist, the following figure shows the ICES Stock areas.



⁵⁴² CD9.67

⁵⁴³ CD9.72

Atlantic cod

- 11.139 Atlantic cod are an important commercial species, whose levels have declined very significantly as a result of fishery pressure. Their current status, agreed between the main parties, is that fishing rates have been considered unsustainable with full SSB well below the limit reference point (B_{lim}), with ICES advice being for zero catch in 2021⁵⁴⁴. [7.142]
- 11.140 The appellant argues that ICES stock areas VIIe-k, often referred to as 7.e-k, should be used⁵⁴⁵, while the Agency's chosen population range is defined more locally to the spawning grounds off north Cornwall, the Bristol Channel and part of the coast off the southwest part of the UK.
- 11.141 The Agency argue that marine fish population structures are increasingly being shown as highly complex, although much of the research they reference is from North Sea cod stocks. However, I note the ICES 2020 cod stock annex⁵⁴⁶, which, while finding minimal mixing outside of 7.e-k, did also indicate that there was minimal mixing between 7.g and 7.a south and 7.f and 7.e. The annex notes show that the ICES stock area had been increased over a number of years to encompass 7.e-k, and recently it had been considered whether inclusion of 7.b and 7.c would increase consistency. This was rejected, but it is clear that this increase in areas, and rejection of a further increase, was in response to fisheries management and landings.
- 11.142 In terms of population structures, thus finding on mixing within the stock area would concur with the findings of Neat et al⁵⁴⁷, who assessed implications for finer scale stock management of Atlantic cod. This included the tagging of cod from points around the British Isles, including within the Bristol Channel, off the Cornish coast and within the Celtic Sea to the south of Ireland. The Agency presented a population range analogous to that of the Western Channel assessment in this report, which perhaps confusingly is interrupted by the land mass of Cornwall. [6.183]
- 11.143 Quite clearly the interpretation of the results from Neat et al and other research studies that suggest that cod are migratory species but do show some levels of sedentary behaviour and homing response to return to spawning and feeding areas, is a judgement. My own review of the evidence supports the recent and emerging studies that indicate that within the large stock area there are sub-populations with limited mixing, but still home ranges extending into the Western Channel and the Celtic Sea. Kerr et al's findings of increased finer scale populations are also supported by research, notably in the North Sea, of sedentary and homing behaviours. [7.148]
- 11.144 The appellant refers to other tagging studies,⁵⁴⁸ which they suggest demonstrate extensive migration patterns of adult cod, and potentially a bias in

⁵⁴⁴ CD9.60

⁵⁴⁵ For clarity, I have retained the numerical 4 or 7 for the stock areas rather than the Roman IV or VII.

⁵⁴⁶ CD9.54

⁵⁴⁷ CD9.58

⁵⁴⁸ CD9.16 Bendall et al

research studies relying on catch data due to the limited catch frequency in areas 7.j and 7.k. This demonstrates a further interpretation of an accepted position that some cod show migratory patterns that potentially include the Celtic Sea and Western Channel area. I accept that this does indicate mixing, but also that the study found an average travel distance of only 56km and that juvenile cod recaptures remained close to the coast near their release sites and generally remained so over time. Adults ranged more widely but showed strong fidelity to their spawning sites. In fact, the extent of movement indicated in this study for cod released within 7.f, roughly equivalent to the Bristol Channel and Cornish Coasts does show the movements closely related to the areas the Agency promote as suitable for the population, albeit this does not take into account matters of relative abundance across the areas when attempting to proportionally apply a mean number or biomass to that area.

11.145 As a result, I consider that the appellant's area is too large, determined essentially on the basis of fishery management, with populations likely to be of such a level as to mask some of the impact that would be experienced by the loss of juveniles and potentially adults that have a sedentary or homing lifestyle. However, there must be a proportionate level of mixing associated with eggs and larvae transported by wind and tides from the spawning area and with cod dispersal and migration. To my mind, the area drawn by the Agency based on the studies by Neat et al, should realistically be considered as the minimum scale of population in this area.

11.146 I note that alternative assessments carried out for the Swansea Tidal Lagoon found a population based on the Bristol Channel reflective of the juvenile stages using the area as a nursery, but noted that adults would move offshore into the Celtic Sea before returning during the winter. It concluded that the Bristol Channel would likely represent an overestimate of assessment given some exchange between other nursery and overwintering grounds in the Celtic Sea. I therefore conclude that the Agency projected impact of 15.7% of the spawning population represents the very upper limit of likely impact. However, even were that to be considered an over-estimation, it is still, to my mind indicative of significant potential effect on a stock that is in an acknowledged poor state.

European Sea Bass

11.147 The sea bass is a migrant marine species, which is accepted to demonstrate quite considerable movements around the coastal area of the UK.

11.148 The SSB for sea bass has been declining since 2009 and is currently just above B_{lim} . Recruitment is currently considered low and fluctuating without trend since 2008.

11.149 The appellant argues that the current ICES stock area for sea bass should be used which comprises 4.b-c, 7.a and 7.d-h, noting that the latest ICES review found that sea bass showed a '*remarkable homogeneous genetic structure*'.⁵⁴⁹ Against this the Agency argue that more recent studies are starting to show distinct

⁵⁴⁹ CD9.21

populations with strong site fidelity to nursery and feeding areas; they suggest that the population area should be restricted to 7f alone.

- 11.150 The sea bass life cycle comprises juvenile fish that, having moved from spawning areas to inshore bays and estuarine nursery areas, remain there for up to two years before overwintering in deeper water and returning to the coasts to feed in the summer. Beyond the age of five they adopt an adult pattern between winter pre-spawning areas, spawning areas and summer feeding grounds. By reference to the C-Bass project, amongst others, the appellant argues that sea bass can be shown to make considerable migrations on a seasonal basis.
- 11.151 There is little supporting evidence for the figures referred to in CD6.12f, which would appear to represent four separately tagged fish which show very little correlation in either the locational ranges or the timings of their migration. Nor do they appear to correlate with the findings of an alternative tagging study presented by the appellant⁵⁵⁰, which found migrations of some distance within the Celtic Sea and Bristol Channel areas, but also demonstrated levels of site fidelity and possible offshore interaction areas. It must be noted that these represented single tagged fish, with low numbers and confounding factors such as early tag release. They can only be indicators, nonetheless, they are suggestive that sea bass do travel considerable distances and possibly undertake 'random migrations', which could support the appellant's contention of wholesale mixing across the ICES stock area. However, to my mind, neither suggest that there is a regular interaction between fish within North Sea stock and fish within Celtic Sea stocks, nor do they necessarily clearly show that there is a lack of site fidelity or significant levels of mixing across the very large, proposed stock area.
- 11.152 The Agency refer to other tagging or genetic studies. These too are generally inclusive of low sample numbers over limited study areas. Nonetheless, there would appear to be evidence of some localisation associated with specific age classes, for example, the 2016 study into stable isotope signatures in sea bass,⁵⁵¹ which appears to show distinct regional differences between three areas on the Welsh coast. The suggestion is that adult fish show fidelity to relatively small scale feeding grounds, but is linked only to one part of their life cycle. It postulates that these grounds would be linked to specific spawning areas, including Trevoise Head, and that these relatively defined migratory routes would support local/regional management rather than the present single stock approach.
- 11.153 A 2007 study⁵⁵² had earlier looked at migration and management units of sea bass through a review of widespread tagging. This identified migratory movements and putative stock assessment units, despite noting the likely genetical homogeneity of the sea bass. In this study, the finding was of a biological stock associated with the southwest coast, Wales and the northwest coasts of England, with the North Sea and possibly the population around the coast of Ireland, being proposed as separate management units. This, they argue, is a more likely representation of sub populations or biological stock, as opposed to the large stock assessment and management units currently used. Overall, my reading of this

⁵⁵⁰ CD9.12

⁵⁵¹ CD9.59

⁵⁵² CD9.95

study is suggestive of a population associated with 7.a, 7.f and 7.g, which correlates to an extent with the studies referred to by the appellant, including O’Neil et al, albeit this suggests some greater implied mixing with fish from the Irish Coast.

11.154 Despite the considerable levels of tagging and other studies into sea bass, I have presented levels of contradiction in terms of the nature and lateral extent of fish movements. Nonetheless, there would appear to be increasingly robust evidence that despite some long distance migratory patterns, there are more typical patterns of inshore juveniles adopting an adult migration pattern with site fidelity to both feeding and spawning areas. To that extent, I consider that the inclusion of North Sea populations in the ICES stock area into the appellant’s calculations is likely to result in a significant underestimation of impacts. However I cannot conclude that the Agency’s approach of a population associated solely with 7.f properly reflects the migratory patterns of this species. Sea bass may be shown to return reliably to feed in similar areas, and Bridgwater Bay may well be included in this, and as a result impingement would result in direct losses of juveniles that could have contributed to the spawning population.

11.155 However, the evidence does point to significant mixing associated with the larger spawning areas, including Trevoise Head, from where direct impacts on juvenile recruitment would be mitigated, to an extent, by the presence of fish from other areas, although the sea bass is a relatively long-lived fish that will spawn over multiple years.

11.156 I therefore conclude that the Agency’s projected impact of 2.1% of the spawning population represents a likely overestimation of impact. Actual impacts are likely to be smaller, associated with the larger population associated with 7.a, 7.f and 7.g, evidence for which is not available. However, while I have accepted that there is not a simple proportionate calculation because of diversity of stock distribution across the larger areas, the relevant population will be significantly less than is proposed by the appellant. It can only be a coarse estimation, but even were the population to be doubled to account for the larger area, impacts would still exceed 1% and to my mind, a potential material effect on a stock that is in an acknowledged poor state.

Whiting

11.157 Whiting is a commercially fished species, often part of a mixed fishery with haddock and cod. It is one of the most abundant fish found in the estuary and is reported to have important food web relationships with the brown shrimp, but also juvenile fish and small whiting are an important food fish for others within the local area. The SSB has decreased since 2010 and is estimated to have been below B_{lim} since 2018, with recruitment, other than in 2013, also relatively low. [7.142]

11.158 The appellant reports that they have considered the evidence on stock structure and conclude that they are quite genetically homogeneous and see no reason to modify their conclusions that the population assessment should be against 7.b-c and 7.e-k. [6.186]

11.159 The Agency argue that there is strong evidence of biological subpopulation structuring in the species, supported by studies in the North Sea, and that historic

tagging surveys in the Western Channel showed little indication of migration. Based on a review of these studies and a comparative approach based on the Agency's consideration of cod distribution, they promote an area comprising all of 7.f and parts of 7.g and 7.h.

- 11.160 I have reviewed the evidence, including the 2014 ICES report⁵⁵³, which found little evidence of emigration out of the Celtic Sea area and some genetic differences between the western coasts, the Bay of Biscay and three possible distinct populations in the North Sea. Nonetheless, this report still found no reason to depart from a stock assessment area of 7.e-k and to include 7.b-c noting that transport routes, particularly density driven currents are the most significant contributor to shelf retention and transport and consequently implications for stock isolation/mixing.
- 11.161 Similarly to cod and sea bass, juveniles are thought to be recruited into the estuary from spawning grounds offshore. Some detailed studies, such as the 2019 Henderson Study⁵⁵⁴, detail their fate as part of an extensive food web of prey and predation resulting in significant variability in recruitment. This study considered that adults continue to make regular seasonal migrations between Trevoze Head and the feeding grounds within the Bristol Channel, and concurs with findings of earlier studies, such as Potter et al⁵⁵⁵. Studies, such as Ellis et al⁵⁵⁶ would suggest that as whiting are serial spawners, and many studies reflect on a series of larval recruitments into the estuary, the spawning areas may be larger than reported. Nonetheless, with limited evidence presented that whiting emigrate beyond the Celtic Sea, I consider the Agency's approach to be precautionary, but potentially underestimating the level of mixing that there would be associated with the wider Trevoze Head spawning grounds.
- 11.162 Many studies comment on the highly variable nature of recruitment and stock levels, a product potentially of the complex interactions with environmental and predation factors within the estuary nursery and feeding grounds. The appellant reports the SSB in 2010, their chosen reference year, as 64,934 tonnes, but ICES reports 2019 SSB as 29,290 tonnes, with a lower confidence interval of 21,195 tonnes. Commercial landings in that year were reported as 5,542 tonnes and ICES reports fishing mortality below the maximum sustainable yield (MSY) and advises catches of 4,458-5,261 tonnes in 2021. As set out above this is a declining stock with relatively low recruitment. [6.189-6.190]
- 11.163 I therefore conclude that the Agency assessed impact on the population of 6.5% is likely to be an overestimation, but, taking into account all factors, indicative of a far greater impact than the 0.126% proposed by the appellant. Taken at the Agency's level and when compared to proposed catches, this represents over 3% of projected catch levels. Again, it can only be a coarse estimation, but even were the population to be considered to receive some replenishment through mixing, it is reasonable to consider that impacts may still

⁵⁵³ CD9.82

⁵⁵⁴ CD6.14k

⁵⁵⁵ CD9.87

⁵⁵⁶ CD9.5

exceed 1% of the population. To my mind, this would represent a material effect on a stock that is variable but presently acknowledged to be in a poor state.

Atlantic herring

11.164 ICES reports indicated that the SSB has been decreasing significantly since 2011 and has been below B_{lim} since 2017, with recruitment below average since 2013. Their advice was for zero catch in 2020. It is noted that herring stocks are reported to have collapsed across the Celtic Sea in 2004 but staged a recovery by 2012.

11.165 There is no direct ICES stock assessment area for herring in the Bristol Channel and the appellant has calculated a percentage loss against landings, as has the Agency. The appellant has also relied on PELTIC surveys. PELTIC surveys utilise acoustic response at various wavelengths to differentiate fish types, which are confirmed by pelagic trawl. The value of such surveys is accepted by the Agency but they question their use in an AA. [6.162, 6.163, 7.152]

11.166 While the appellant has considered populations across areas 7.e-f, the Agency consider that there is evidence of local spawning grounds within the Bristol Channel as well as genetically differentiated sub-populations, and have chosen to use 7.f only, in what they consider to be a conservative approach. The appellant argues that their assessment, even including the revised mesh size and addressing 7.f only, would still indicate an insignificant impact based on biomass from the PELTIC surveys. Although admitting to it being an estimate, they further suggest that even if a sub-population was of the order of 10% of that, the effects would still be minimal. [6.198, 7.152]

11.167 Herring is clearly a stock that shows significant variability and studies have indicated there may be local recruitment and distinct sub-populations within the Bristol Channel and Welsh Coast area. The latest research, referred to by both the Agency and D&S IFCA, Clarke et al 2021⁵⁵⁷, is showing strong indications in the preliminary results of a number of distinct genetic populations, linked to location and to spring and autumn spawning, and proposes that it is possible, if not likely, that there are more discrete herring populations in the Bristol Channel and around Wales. This would accord with studies such as Ruzzante et al⁵⁵⁸, whose research, although from outside this area, nonetheless found that even with some mixing of populations, strong natal homing behaviour supported population differentiation. [7.153, 9.70]

11.168 In terms of considering an AA focussed on a point source impact, the presence of distinct sub-populations, with localised full life cycles is critical. While the research base is developing, there is strong evidence that such populations are a feature of the Bristol Channel. As such, I consider that the broader scale approach taken by the appellant in this case potentially significantly underestimates effects from a continuing and non-adaptive impact. I therefore prefer the Agency's approach, whose findings of a 4% impact on the spawning population size is indicative of a significant effect on a stock of known vulnerability.

⁵⁵⁷ CD9.114

⁵⁵⁸ CD9.93

Alternative Approaches – Stock Assessments

11.169 The appellant presents a broader scale alternative approach considering the stock assessment trends for three species, Atlantic cod, sea bass and whiting over the last 20 years. To this the appellant has overlain HPC impacts, which they argue to be conservative for a number of reasons, including that they are taken as unmitigated numbers with the assumption of HPB continuing to operate. The resulting graphs indicate very limited proportional effects on the spawning biomass. This they argue helps to check and validate the conclusions drawn from the comparisons of EAV and spawning population size for species. [6.134, 6.136]

11.170 To my mind, there are a number of problems with this approach; it would appear to rely on RIMP data but particularly on the large scale populations drawn from ICES stock assessment areas, which I have generally found above to significantly underestimate the potential impacts when applied to predicted effects. It is not a methodology that has been used previously in any assessment regarding this proposal, and for all these reasons I give it little weight. [7.155]

Conclusion on the Marine Assemblage

11.171 Contrary to the appellant's findings, I have found that the Agency's approach to considering smaller population sizes more reflective of existing and emerging research identifying complexities in population structures and the presence of distinct genetic populations, linked to site fidelity, closely related spawning and feeding areas or natal homing responses. I do not doubt that the ICES figures, based on long term, accepted approaches to calculating SSBs, can be considered robust when assessing necessary management responses to wider scale impacts, such as fishing, on the broader populations defined. However, for the purposes of assessing a point source impact, and one that will be effectively continuous with no immediate adaptation responses, this reinforces my concerns that finer scale populations estimates are more reflective of actual effects.

11.172 Ultimately the scale of these populations is a judgment, and for some species, I consider that the Agency have been too precautionary. Nonetheless, even allowing for some inherent inaccuracy, due to the limited data associated with populations in specific Agency identified areas, their conclusions are considered preferable to the extent set out in the individual assessments above.

11.173 As a result, and taking a precautionary approach based on the best scientific data within the evidence presented to this Inquiry, I have found percentage impacts against spawning populations of up to 15% for Atlantic cod, 1-2% for sea bass, 1-6% for whiting and up to 4% for herring.

Other Species

Sturgeon

11.174 SEI note that climate change is likely to lead to a gradual change in species range and numbers. This, they suggest could potentially introduce more protected fish species into the estuary and at risk of impacts associated with the proposal, specifically they provided evidence on sturgeon, which they say may be present even prior to the proposal beginning to operate. [8.67]

- 11.175 Realistically this point cannot be pursued as a matter effecting the integrity of the designated sites in the area as none refer to sturgeon as either a listed species or a component of any habitats. However, it would appear that SEI's case referred to the adaptability of the proposal to respond to the presence of such species, or indeed the changes to existing species in the area. [6.244, 8.67]
- 11.176 While it is true that a species such as shad, which here is considered to be at its northernmost extent of its range, may benefit from increased water temperatures, and others may experience increased pressures, there is no quantification of such impacts against which to assess long term change, or the effect that the proposal would have. It is nonetheless true that there is no immediate adaptation response that can be considered as a result of the imperative of maintaining cooling water to the plant; this is a point around precaution rather than a species specific point. Consequently, no weight, in relation to the integrity of the relevant sites and their associated habitats and species, can realistically be given to the AA before the Secretary of State on this matter.

Precautionary Approaches and Uncertainty

- 11.177 Before drawing together final recommendations of the implications for the integrity of the relevant sites, it is necessary to deal with the arguments put that the appellant's quantitative assessments were precautionary, relying on conservative approaches, set against the Agency's arguments that there are significant uncertainties that must be accounted for in any assessment. [6.265, 7.9]
- 11.178 The appellant sets out in evidence the precautionary approaches taken. I have dealt with the stock assessment approach, the approach taken to F and the performance of the FRR in relation to salmon. The matter of whether the LVSE factor of 1 is a conservative one has also been addressed. I note the adoption of no benefits from the pelagic cap for the semi-pelagic sea bass and whiting, but have little evidence on which to assess whether this is truly conservative for the species concerned and the stage of life cycle at which the majority would be present around the intake head. [6.101]
- 11.179 Further, the appellant considers that the Agency have carried out uncertainty analysis at 95 and 99th percentile, which they have then incorrectly applied on a repeated annual basis. This is disputed by the Agency who set out that upper value percentage levels were only used as a method of quantifying uncertainty. In reality, the alterations in the Agency's quantitative assessments have not been correlated with an updated series of uncertainty assessments, instead their case relates to concerns over unquantifiable uncertainty. [6.94-6.99, 7.25]
- 11.180 The appellant's view is summed up in their evidence⁵⁵⁹, that the Agency overestimates the effects of the project through: inflated estimates of annual percentage losses to entrapment; using smaller population sizes; extreme upper value annual percentage loss, implied as being repeated in subsequent years; and assuming very low losses will lead to decline in spawning population sizes. Whereas the appellant's own view is that any losses are well within the natural

⁵⁵⁹ CD6.12 pp1.40

variability of a species showing that the populations would be able to successfully maintain their status.

11.181 Both parties accept that there are uncertainties in the approaches used to quantitatively predict effect from the proposed project. The appellant's approach of utilising conservative assumptions so as to arrive at a precautionary assessment is noted, but many of their approaches have not stood up to the scrutiny of the Inquiry process, or are questioned in light of the uncertainties. This is in part because of a level of data deficiency. Such a deficiency is not unusual for marine projects, I have referred above to the particular difficulties associated with quantifying and assessing species with such wide ranges, complex population structures and subject to differing environmental conditions. However, it is accepted that there is at least some base data on which to base assessments on, that of the RIMP and CIMP.

11.182 While I have dealt with this above, it is worth noting that the CIMP was from 2009/10, and the RIMP ran only to 2017. Most importantly, neither provided a comprehensive review of species composition and impingement levels, the RIMP, in particular lacked resolution to provide a robust estimate of species that migrate through the estuary, and even the CIMP represented only about 11% of the abstraction volume. [7.10]

11.183 There are some key areas of uncertainty that have underpinned the Agency's concerns as well others that they have taken a pragmatic stand on, that other interested parties consider represent further challenges to the quantitative prediction; some of these I have dealt with in my reasoning above. In essence, for the Agency, these include the data deficiencies, the locational differences, particularly in terms of age and distribution of fish, between HPB and HPC, the real world performance of novel mitigation methods and the lack of adaptive management options once the project begins. I have dealt with these issues above. For other parties, these include the assumed linear relationships between flow and impingement and the pelagic cap factor, not allowing for the partially capped nature of the HPB intake structure, also addressed above. [7.17, 7.18, 8.35]

11.184 Considering that the appellant would have worked on the principle of operating without the AFD from a period at or shortly before the 2017/8 safety review⁵⁶⁰, some of these uncertainties could have been addressed. There is extensive research going on into fish populations in the Bristol Channel, some of which have been referred to in evidence to this Inquiry. However, there does not appear to be any request for data, targeted surveys or other approaches by the appellant associated with the location of the HPC intake, nor any records of surveys of distribution or age class assessments for species found close to the proposed intake structure, studies that would have assisted in informing at least one of the key uncertainties. [7.19, 7.20]

11.185 Nonetheless, uncertainty on its own is not sufficient to discount a proposal. In accordance with common approaches to the precautionary principle, most recently addressed in *R(oao Wyatt) v Fareham Borough Council [2021] EWHC 1434 (Admin)*, uncertainty should be addressed where practicable through applying

⁵⁶⁰ CD6.11

precautionary rates to variables. I have reviewed the precautionary approach and conservative measures taken by the appellant, and have noted where the Agency have taken pragmatic approaches and sought to quantify the uncertainty. I have not found that the concerns raised by the Agency are fanciful, or of a level that makes them unrealistic.

11.186 In general, despite identifying some areas where I have found the Agency to be overly conservative, I have found little to dispel the Agency's concerns around uncertainties, and as a result have included them within my own overall assessments of effects on the relevant species and habitats.

Overall Assessment of Effects on Relevant Habitats and Species

11.187 Before considering in more detail the outcome of the assessments I have made above on the integrity of each of the relevant sites in light of the relevant conservation objectives, I must deal with three simple propositions.

11.188 Firstly, that considerable research was carried out to define the BAT for direct cooling water systems for power stations and that this is a combination of three distinct mitigations, a LVSE with AFD and a FRR, with the first two being interdependent. In absence of the AFD, the LVSE benefits would be reduced and the proposal would not now reflect BAT. It was argued that, in accordance with the acknowledged best practice approach to Environmental Permitting, the proposal should be refused or, in this case, the appeal dismissed. To continue without achieving BAT should result in a consideration of alternatives, such as onshore cooling towers, and I was referred to such approaches in the United States as an example, or, in lieu of alternatives, an argument should be made for IROPI and compensation. [7.45, 7.46, 8.65, 8.66, 9.15, 9.16, 9.41]

11.189 There is no question that the environmental permitting has an expectation of the adoption of BAT to minimise effects, be they emission limits or direct effects. However, implementation of BAT implies a balanced judgment of the benefit derived from a measure and the cost or effort of its introduction, and the permitting process allows for the proposal of alternative techniques that provide a level of environmental protection that is at least equivalent to BAT. I do not accept that removal of the AFD in and of itself is sufficient to dismiss the appeal, a full assessment of the effects resulting from such removal is required.

11.190 Secondly, the appellant presents a simple argument that the Agency's concession that the effects of HPC would be no worse than that of HPB, while noting that no harm had been attributed to HPB, can be considered to have resolved this matter. [6.8-6.11]

11.191 However, this proposition does not, in my view, fully reflect on the requirement for any assessment to utilise the best and most recent scientific knowledge. While the Agency have pragmatically chosen to accept an LVSE factor of 1 and a pelagic cap factor of 0.23, the novel, untried nature of the proposed measures and, to a more limited extent, the concerns raised regarding the actual flow to impingement ratio and performance of the pelagic cap, introduce uncertainty into the robustness of the initial quantitative assessments. The assessment at this level is highly sensitive to the LVSE factor, which I have concluded cannot be considered to be conservative, and to the pelagic cap factor.

The Agency presented a range for this factor and if the upper limit is applied on a precautionary basis, then HPC is shown to have a greater effect than HPB on this simple calculation. Coupled with the uncertainty associated with the potential for different species and age structures associated with the different location, I do not accept that this proposition holds true. [7.169, 7.170]

11.192 Thirdly, that HPB will stop abstracting and, in absence of any harm from HPB, this would provide 'headroom' to allow for any increased effects at HPC. [6.105]

11.193 I accept that the assessments carried out in 2013 generally accepted that there was no evidence such as to suggest that HPB was having an adverse impact on fish populations, nor that abundance trends from the RIMP supported a positive or negative impact from the operation of HPB. However, the Agency argue that in fact, there is no effective baseline data to prove this. [7.161]

11.194 I am satisfied that HPB will cease abstraction, or be reduced to a very minor comparative rate, prior to the operations at HPC starting⁵⁶¹. However, a conclusion that HPB itself has not had a detrimental impact on species generally, or on those specifically before this Inquiry, is difficult to assess. If all other variables were equal, the long term RIMP programme could have shown whether populations local to the intake were being affected. However, this is not the situation, as the RIMP surveyed over a period when, amongst other significant changes, power station cooling water abstraction levels declined significantly in the wider estuary. Although the appellant refers to 'signals' in the data, to my mind, the consensus is that there is little by way of robust trend data to reach such a conclusion from the RIMP. It is also accepted that the estuarine habitat here, both as a nursery and feeding ground, is a high quality one, which may mask losses of abundance in less suitable habitats.

11.195 It is an unavoidable fact that, despite significant reductions in cooling water abstraction and active management measures across the estuary and rivers in the area to reduce pressures on many fish stocks, a number of those of particular interest have shown declining trends through the period, albeit with some measure of variability. I do not suggest that HPB is necessarily the cause of this, there is no direct evidence of that, but equally HPB may be a component part of the wider anthropogenic or environmental effects contributing to such declines. The evidence available to this Inquiry does not support that the reduction and cessation of abstraction at HPB would necessarily result in sufficient headroom to mask effects from the proposed abstraction to the integrity of relevant sites. [7.161, 7.165, 7.166]

11.196 Turning then to the assessments of effects.

Severn Estuary/ Môr Hafren Ramsar

11.197 I have set out above that I consider that Criterion 4 is relevant to the run of migratory fish, including the Atlantic salmon, Allis and Twaite shad. The conservation objective is to maintain the feature in favourable condition as defined by conditions, including that the size of the populations of the assemblage species

⁵⁶¹ CD6.11e

in the Severn Estuary are at least maintained and is at a level that is sustainable in the long term.

- 11.198 The Agency's quantitative assessment found that there would be a 0.07% impact on the Atlantic salmon population, 0.6% on the Allis shad populations and 0.1% on the Twaite shad population. Despite these very low figures, I have accepted the Agency's concerns regarding the potential data deficiency of the RIMP and CIMP and the latest scientific evidence on shad presence. Two questions must be asked to conclude whether this represents harm to the populations so as to result in a failure to secure the conservation objectives. Firstly, if these uncertainties imply that impacts are significant, what implications does that have for the populations, and secondly, as an assemblage, does a decline in any one species effect the overall assemblage?
- 11.199 On the first matter, I have set out above that all three species have been declining and are considered in a poor state. Evidence suggests that even low level impacts on a population at risk can be significant. Assessing both the quantitative finding and the qualitative uncertainties would lead me to conclude that there could be significant effects for all three species. Significance is not just a function of the percentage loss to the population, but also the capacity of the stock to accept negative change. These populations are clearly under considerable pressure and the continuing and unadaptable impacts, albeit relatively low level, represented by the proposal would potentially undermine the opportunity for maintenance or recovery of the stocks to sustainable levels.
- 11.200 On the second matter, while the quantitative assessments suggest a greater potential impact on shad, even the decline in a single species of this assemblage would represent a failure to meet the conditions set out as indicative of a feature in favourable condition. Furthermore, there is strong evidence of an ecosystem link between the migratory fish and other species associated with the Ramsar, for example with predation of mysids and copepods. Through such links, there are potentially wider effects associated with individual species decline.
- 11.201 Such a finding is not that the loss of any fish from the population would be harmful, but that the level of uncertainties makes it impossible to rule out a significant effect. With an AFD system, which I note is not a novel technology but has been employed on many sites, previous reviews indicate deterrence of up to 74% of salmon and 88% of shad. The inclusion of such further mitigation would still mean there would be the potential for fish loss, but on the basis of the evidence before me, the effects would fall below the level of significance where the populations retain capacity to manage such negative change. As a result, I see nothing in the new or emerging evidence that would lead to a difference in the findings of the 2013 AAs, that, with an AFD, the effects on the migratory fish assemblage can be considered acceptable.
- 11.202 I consequently consider that it has not been demonstrated that the conservation objective for Criterion 4 of the Ramsar site can be met and adverse effects on the integrity of the site cannot be excluded beyond reasonable scientific doubt.

Severn Estuary/ Môr Hafren SAC

11.203 The relevant interest features are the Annex I Estuaries feature and the Annex II Twaite shad.

Estuaries Feature

11.204 The conservation objective is to ensure the integrity of the site is maintained or restored and that the site achieves FCS by maintaining or restoring the structure and function, including typical species, of the qualifying habitats. The FCS of a habitat is defined as including ecological elements, and I have set out above that I consider the inclusion of the status of the typical fish assemblage is relevant to understand whether that conservation objective can be met.

11.205 The fish assemblage includes the migratory fish, Atlantic salmon, Twaite and Allis shad, as well as the marine migrant assemblage, the Atlantic cod, European sea bass, whiting and herring. The migratory assemblage I have addressed above and found that significant effects on the assemblage cannot be ruled out. In relation to the marine assemblage, I have found percentage impacts against spawning populations of up to 15% for Atlantic cod, 1-2% for sea bass, 1-6% for whiting and up to 4% for herring. These species have relatively large populations, which I have found in some cases include population mixing associated with shared spawning areas. While I consider that this makes them more resilient to low-level negative changes, these precautionary findings, in all cases in excess of a 1% impact, are significant.

11.206 The marine assemblage forms part of a much wider fish assemblage in the estuary, in excess of 100 species. The Agency's assessments have found for many of these species that there will be no significant effect. This conclusion is either because of the limited effect of the proposal or as a result of comparison of effect against the robustness or sustainable nature of the populations. As an example, the Dover sole, where predicted impacts of 7.4% were identified but the fishery stock was shown to be harvested sustainably and demonstrating an increasing trend. Based on populations impacts, the Agency considered this species not to be of concern.

11.207 The relevant question having identified impacts of significance to the populations of the four species of interest, is whether that has implications for the assemblage as a whole and its role in assessing the FCS of the Estuaries feature. It is important to note that the Agency were conscious of this further scale of assessment, and I note from their 2020 AA that they considered that removal of a large number of one of the species was unlikely to impact on the marine migrant group as a whole. What is clear is that the fish species, of which these four species make up a large constituent part, particularly in their juvenile form within this locality, are an important component of a much larger interaction between predators and prey species.

11.208 While the reduction in one piscivorous species may result in replacement by another similar species, the findings I have made cannot rule out reduced

populations across four of the major species in this group. In such circumstances wider effects may be realised through changes to the structure of predator and prey relationships. On this basis, I have little evidence to contradict the findings of the Agency's 2020 AA that a proportional change in the species mean that it is not possible to rule out an effect on the overall structure of that assemblage.

11.209 Proportionate losses to a population cannot be considered in isolation of an understanding of the stability or sustainability of their populations, and 'any' loss cannot be considered sufficient to demonstrate impacts on integrity. The use of an AFD in other situations has demonstrated approximate levels of deterrence of 55% for Atlantic cod and whiting, 38% for sea bass and up to 95% for whiting. Consequently, there would still be fish losses of these particular species, but at levels well below those identified without this level of mitigation. On the basis of the evidence before me, I have no reason to challenge the conclusions of the 2013 AAs, that the harm would not be significant with adoption of this additional mitigation.

11.210 I consequently consider that at the levels identified it cannot be demonstrated that the FCS can be maintained or restored and the conservation objective of the estuary habitat feature be met. Adverse effects on the integrity of the site cannot be excluded beyond reasonable scientific doubt.

Twaite Shad

11.211 I have set out above my findings on the Twaite shad and the uncertainties that led me to find that the proposal potentially represents a significant effect on the population. This is a population which has shown levels of decline and against which evidence indicates that relatively low levels of loss can still have long-term population impacts.

11.212 The most recent condition assessments found that the Twaite shad, in both the freshwater and marine habitat was in unfavourable condition. The relevant conservation objective is to maintain the feature in a favourable condition where the size of the population is at least maintained and is at a level that is sustainable in the long-term.

11.213 In light of my findings above, I consider that it cannot be demonstrated that the conservation objective for Twaite shad can be met and adverse effects on the integrity of the site cannot be excluded beyond reasonable scientific doubt.

River Usk / Afon Wysg SAC

11.214 The relevant interest features for this SAC are the Atlantic salmon and Twaite shad. The conservation objectives as set by NRW, are that the features should be in FCS where the population of the feature in the SAC is stable or increasing over the long-term.

11.215 My findings are that the qualitative assessments for the species are 0.2% for the Atlantic salmon and 0.4% for the Twaite shad population. Nonetheless, as set out above, these represent larger effects than for the Severn Estuary and uncertainties, coupled with the declining and unsustainable nature of the species

lead me to conclude that it cannot be demonstrated that the FCS can be maintained as either stable or increasing. Consequently, the conservation objectives for Atlantic salmon or Twaite shad cannot be met and adverse effects on the integrity of the site cannot be excluded beyond reasonable scientific doubt.

River Wye / Afon Gwy SAC

11.216 The relevant interest features for this SAC are the Atlantic salmon and Twaite and Allis shad. The conservation objectives as set by NRW, are that the features should be in FCS where the population of the feature in the SAC is stable or increasing over the long-term.

11.217 My findings are that the qualitative assessments for the species are 0.2% for the Atlantic salmon and 0.2% for the Twaite shad and 0.4% for the Allis shad population. Nonetheless, as set out above, although these represent slightly different effects than for the Severn Estuary, the assessed levels of uncertainties, coupled with the declining and unsustainable nature of the species, lead me to conclude that it cannot be demonstrated that the FCS can be maintained as either stable or increasing. Consequently, the conservation objectives for Atlantic salmon, Twaite and Allis shad cannot be met and adverse effects on the integrity of the site cannot be excluded beyond reasonable scientific doubt.

Other Legal and Policy Matters

11.218 SEI consider that neither the Agency nor the appellant have properly considered the WFD and Water Environment (Water Framework Directive)(England and Wales) Regulations 2017, and, together with D&S IFCA, the weight afforded by the recently adopted SWMP. [8.13, 8.21, 8.51-8.55, 9.97-9.102]

11.219 In terms of the WFD, it is a relevant matter to consider whether the effect of a proposal would compromise the requirement to seek to achieve good status across the relevant indices. Bridgwater Bay is the relevant water body and has an ecological status of 'moderate'. Although matters around invertebrates, raised by SEI, are outside the scope of this Inquiry, as they have been shown not to respond to an AFD, I note that SEI proposes that there is a positive duty on any public body to assess projects in terms of the achievement of objectives for the water body. SEI argue that there could be negative impacts associated with the return of dead fish entrained through the cooling system and that the demise of a species would result in the reduction of status of any relevant water body. [8.34, 8.46, 8.50]

11.220 However, no assessment before me concludes, at least within the short to medium term, that the proposal would result in such demise and I am satisfied that the Agency have properly assessed the effects of matters arising from the discharge of dead biomass following entrainment. This is clearly set out in their 2020 AA and the SoCG; I have no reason to question their findings. Also within that document, it is the Agency's view that the WFD imports the requirements of the Habitats Directive, stating that compliance with the conservation objectives of the SACs is a requirement of the WFD because they are protected areas for the purposes of the WFD. I concur. [6.246, 6.248]

- 11.221 Turning to the SWMP, the plan was adopted during the Inquiry and its policies clearly can be a material consideration. Four policies were referred to: SW-MPA-2, SW-NG-1, SW-BIO-2 and SW-MPA-1. These seek to address adverse impacts from a proposal in terms of the marine protected area's ability to adapt to climate change or seek environmental net gain, the impacts on habitats and species and to the objectives of the protected area. Some of the policies seek an 'avoid, minimise or mitigate' approach, while some allow for compensation of adverse effects. Indeed, my understanding of SEI's case is that they accept the detailed assessments against the requirement of the Habitats Directive would address these matters, but the policies reinforce the need, they say, for the proposal to seek derogation and address compensation. [8.21, 8.51, 8.52, 9.100]
- 11.222 The policies are material considerations, which carry the full weight of adopted plan policies. However their objectives clearly align with the AA of effects relative to the relevant designated sites in this case. I do not consider that they indicate any further requirement for assessment or imply that compliance with the Habitats Regulations would be insufficient to confirm compliance with these policies. [6.250]
- 11.223 Accordingly, while I note their materiality, I do not consider that they introduce any further assessment requirements and would recommend that the Secretary of State notes them, but can rely on the conclusion of the AA and any subsequent findings of the HRA.

12. HRA CONCLUSION

- 12.1 This is an unusual case in some ways, as the central proposition, that of a new nuclear facility requiring cooling water abstraction, was established in the granting of the Environment Permit, Marine Management Licence and DCO in 2013. The matter before this Inquiry relates solely to the proposed removal of the AFD and its consequential effects, and on a resulting AA focussed on the specific interest features that may be affected by such removal, that is, hearing fish species and their associated habitats. For all other species, these were addressed in the earlier AAs, and it was common ground that they need not be considered again as part of this assessment. I note, for the benefit of the Secretary of State, that these concluded, in effect, that an AA was required for a range of interest features, including non-hearing species, as likely significant effects could not be ruled out, but that with mitigation it was concluded that there would not be an effect, in relation to those interest features, on the integrity of the designated sites.
- 12.2 In relation to the hearing species and their associated habitats, in the Agency's 2020 AA, the conclusion was reached, and is common ground in this case, that significant effects on the designated sites from this variation of the project without adequate mitigation could not be ruled out. For some interest features, the conclusions of the Agency's 2020 AA was that the project, including removal of the AFD, would not lead to a likely significant effect. Nonetheless, a range of species, and associated habitats, remained of concern to the SNCBs and the Agency following that AA and have been the focus for this Inquiry. I address those which need to be considered in detail in my reasoning above. [11.23-11.46]
- 12.3 In seeking to inform the Secretary of State's AA, I have also set out above the conservation objectives, relevant to the specific matter of the removal of the AFD from the proposed mitigation approaches. I have then considered each of the relevant interest features and whether the AFD removal would affect the integrity of each designated site.
- 12.4 Consequently, having reviewed the submissions, assessed levels of uncertainty and areas of scientific disagreement, I have concluded that, in absence of an AFD, it cannot be concluded that there would not be adverse effects on the integrity of the Severn Estuary/ Môr Hafren SAC and Ramsar site, the River Usk / Afon Wysg SAC and the River Wye / Afon Gwy SAC.
- 12.5 The appellant has presented considerable evidence to support their quantitative assessments, which they set out to be precautionary and in accord with the legal test. Based on their figures alone, my recommendation would have been that there would be no adverse effects on the integrity of the relevant sites.
- 12.6 Accordingly, this recommendation draws heavily on the following key areas of disagreement and uncertainties, which should inform the Secretary of State's AA:
- The robustness of the RIMP and CIMP for recording impingement for specific species;
 - The appropriate EAV factor to use;
 - The conservatism of the LVSE factor;
 - The appropriate scale of population estimates for each species;

- That the assessment of impact includes the level of impingement and implications assessed against the status and sustainability of the population;
- The appropriateness of the application of the fish assemblage to assessment of the estuary habitat feature and consequential relevance to the integrity of the site;
- The comparison of the different locations between HPB and HPC in terms of population numbers, species types and age structure; and
- That the evidence is insufficient to conclude that HPB has not had adverse effects and that it cannot be considered as having a greater effect than HPC with its mitigation of LVSE and FRR.

12.7 These conclusions represent my assessment of the evidence presented to me but do not represent an appropriate assessment as this is a matter for the Secretary of State to undertake as the competent person.

12.8 If accepted, it needs to be recognised that the overall project is well advanced such that the time window to incorporate the AFD may be compressed and the appellant's clearly expressed concerns regarding the feasibility of delivering the system considered. Ultimately, the project would need to consider the three tests in Part 3 of an HRA:

- That there are no feasible alternative solutions that would be less damaging or avoid damage to the site.
- That the proposal needs to be carried out for imperative reasons of overriding public interest.
- That the necessary compensatory measures can be secured.

12.9 There is no evidence before this Inquiry as regards the IROPI arguments or potential compensatory measures or approaches. Further information would need to be sought, although, to inform the next steps were the appeal to be dismissed as recommended, it is appropriate to review the reasons set out by the appellant for the proposed change.

12.10 The appellant has set out incontrovertible evidence of the importance of a constant supply of water to provide cooling for the plant, which will be the first to be built in the UK in over 20 years.

12.11 At the time of the original permit and DCO, the appellant states that they were committed to the AFD, but had limited information on the scale and additional technical requirements that would be needed. The AFD system was taken forward to detailed engineering design, but no further because of the technical and implementation challenges identified. The appellant argues that there remains no engineering precedent for fitting an AFD to an open water intake with such comparable tide ranges anywhere in the world. [6.13]

12.12 From 2014-2017, a detailed optioneering process was carried out, assessing not just the operational requirements of the AFD, but the implications for installation and maintenance of the chosen system. This concluded that there were significant

diver requirements and risks and that ROV options were unable to address the challenges of the visibility and tidal velocities of the site.

- 12.13 The NNB findings were reviewed by Bureau Veritas⁵⁶² in a report that was finally published in 2018, but submitted in 2017 to NNB. This concluded that there would be a 39% chance of diver fatality within the 70 year operational period of the plant. The appellant states that they have updated this review, particularly in terms of the availability of ROVs to offset that risk, and concluded that the technology is not sufficiently advanced to do that. They confirm that safety issues were paramount in their decision to suspend work on the AFD and seek Cefas to review the environmental impacts of delivering the project without it. [6.14-6.17]
- 12.14 As I set out above, this matter is not central to the question of whether the proposal would or would not adversely affect the integrity of the relevant sites. However, it is clearly relevant to NNB's decision to pursue this variation and to the next steps of the HRA were the Secretary of State to dismiss the appeal.
- 12.15 It is important to note that this Inquiry has statements from a supplier of AFD systems challenging these findings, as well as emphasising the view shared by the Agency, the SNCBs and many others opposing the variation, that, despite some improvements to fish impingement offered by the LVSE head on its own, it is a vital part of any system to have a behavioural response operating in tandem, particularly in low visibility conditions. The evidence of this supplier suggested that the latest sound devices have much longer maintenance periods, limiting exposure of divers or ROVs, and that ROV development has progressed such that they can operate in the velocities and the low visibilities likely to be experienced. [9.13, 9.16, 9.31, 9.41]
- 12.16 Such arguments do bring into question the conclusion of the appellant that an AFD cannot be utilised because of the unacceptable levels of risk. However, I do not have comprehensive arguments on these matters, predominantly because there has been no presentation of evidence by the appellant as regards alternatives or IROPI, for reasons they set out regarding their conclusion that the proposal, absent AFD, was acceptable. A comprehensive review of the alternative options would be required for any further stages of the HRA should the Secretary of State accept my recommendation on this appeal.

⁵⁶² CD1.6

13. PROPOSED VARIATION

- 13.1 Irrespective of any recommendation, it is necessary that a full review is carried out on the implications of a finding in favour of the appellant, as regards to any direction the Secretary of State may need to make to the Agency to vary the permit. In response to my request, the parties submitted a proposed set of permit conditions as an addendum to the SoCG, highlighting areas of disagreement.
- 13.2 These matters were then discussed in a round table meeting during the Inquiry which included participation from all of the main parties. In the proposed revisions, there were some that went beyond the immediate consequence of the removal of the AFD and dealt with either an improvement to the permit or a response to the OSPAR Convention requirements in terms of the FRR system being regarded as a Water Discharge Activity to be specified within the permit. Under my questions, the Agency confirmed that such a change would be necessary and delivered under a regulator initiated variation to consolidate the permit in any case, albeit the full guidance for this is still in draft form. The appellant, conscious perhaps that this change will come, took no exception to those changes in principle, although the major points of disagreement related to the methodology for monitoring and compliance associated with this.
- 13.3 I have considered whether a revised set of conditions, accounting for the other Agency initiated changes proposed, should also be included should the Secretary of State decision be to dismiss the appeal. In this case, I have decided that that would not be appropriate. While consolidation to account for the latest legislation requirements of a permit that is being varied for other reasons is a typical occurrence and clearly acceptable, to do so in absence of a variation is not. This appeal deals with an application to vary the permit, and any changes to conditions should flow from that. The dismissal of an appeal against a variation application should result in the permit remaining as written. It is clearly still open to the Agency to pursue those changes as they see necessary to accord with the OSPAR Convention under a regulator initiated variation.
- 13.4 Dealing with the proposed changes, I am satisfied that those relating directly to the removal of the AFD are accepted by both main parties as reasonable and necessary. Other changes are suggested, although not part of the variation applied for but to improve the wording of the conditions, including, for example, various references to 'for approval' associated with the submission of plans. I find these to be acceptable and accepted by the appellant.
- 13.5 I also note that the appellant accepts the principle of the incorporation of the FRR as a separate activity, and relevant changes separating the Cooling Water and Process Effluent (CWPE) and the FRR. There are three matters of disagreement or discussion: the requirement for local population surveys of fish species; the inclusion of impingement monitoring; and the requirement to monitor moribund biomass from the FRR.
- 13.6 In terms of local surveys, this relates to a pre-operation measure, PO11, which the Agency confirmed was to be for pre-operational surveys to establish a better understanding of the local populations and to address the possible uncertainties. I have considerable sympathy for the concerns expressed by the appellant that this could represent a significant and open ended commitment in order to establish a

valid programme. While I note their suggestion that such matters are better assessed by an updated form of the RIMP survey through impingement monitoring, and I deal with that point below, there is a legitimate requirement to ensure that there is a proper understanding of the baseline, in order to ensure that monitoring of the process can be linked to any effects on the local environment.

- 13.7 Nonetheless, what is proposed is very broad in its terms. The requirement of PO11 is to submit for approval an Environmental Monitoring Plan (EMP) for the purposes of post scheme appraisal. While this was a requirement of the permit agreed in 2013, the addition of local species population surveys was not, and the only legitimate argument for its inclusion here is that the detailed assessments considered in this appeal have highlighted a level of uncertainty not previously considered relevant with the further mitigation of the AFD. On this basis, I note the concerns of the appellant, but also their in principle acceptance provided the approach is proportional. This Inquiry has shown that matters can be focussed on a relatively small number of key or indicator species and there are programmes already in existence, albeit not specifically focussed in this area, that could support such a programme.
- 13.8 As part of the development of an approved EMP, any requirements of the Agency that clearly exceeds the necessary requirements of the EMP to inform post-scheme appraisals could be challenged, which should reassure the appellant that this would not result in a new and unacceptably onerous responsibility. To that extent, I consider that, with the inclusion of proportionate in the wording and a reference to relevant species, the revised condition would be acceptable. I have included this in my recommended wording for PO11.
- 13.9 The appellant proposes an additional pre-operational measure, PO17, to establish an Impingement Monitoring Plan, this, they suggest, would provide clarity and an opportunity to properly demonstrate the levels of impact and provide a partnership based contribution to research. I am entirely supportive of the principle of the impingement of fish species being at least used to further research, but I fail to see that this can be a requirement of the permit. Instead, the permit must set out conditions required to monitor the performance of the operation.
- 13.10 The Agency argue that PO15 requires such and includes impingement and entrainment monitoring. I accept that the term Effluent Monitoring Plan, does not immediately indicate that in system impingement would be part of the requirement. However, the Agency provide further clarity, which would assist the appellant in development and reaching approval of such a plan. I therefore consider that PO17 is not necessary, but that the additions to Table S3.1a are required.
- 13.11 There were legitimate concerns that the monitoring, if required on a continual basis, would completely undermine the benefits of the FRR as the only methodology for sampling is through a bypass channel and fish trap, in which sampled fish do not survive. The Agency confirmed that this would be a periodic sampling programme and this can be established as part of the effluent monitoring plan.
- 13.12 However, the appellant further argues that the requirement to monitor entrainment losses is not in the existing permit and cannot, in fact, be practically sampled due to the technical design of the system. They further suggested that it would represent a factor on which the removal of AFD would have no effect. The

Agency consider that it was within the existing permit, and they confirmed this could include representative sampling elsewhere within the system.

- 13.13 Neither entrainment nor impingement monitoring are explicitly referred to in the existing permit, although there can be no doubt in my mind that both are components of appropriate monitoring requirements to assess the performance and effects of the operation. The final approach to the monitoring of impingement and entrainment, including any arguments as to its deliverability and methodologies, can be considered and resolved as part of the agreed adoption of the Effluent Monitoring Plan under PO15.
- 13.14 Finally, the Agency argue there is a requirement to monitor effluent associated with the activity of the FRR and that it is necessary to assess whether the plant meets acceptable levels of water quality subject to the mixing of moribund biota back into the environment. The Agency confirm that this is not a concern in their assessment of impacts from the scheme, but that it is a standard requirement to monitor effluent quality in order to monitor plant performance. They consider that the level they have set, 490kg, is reflective of some 5.5 times the maximum level of the appellant's modelled impacts, and by seeking that level to be assessed over a 90 day rolling average, they have accounted for seasonality in the quantity and type of biota entrained in the system.
- 13.15 The appellant argues that they can neither control the inputs to the system nor the outputs and that were there to be an exceedance of the limit there is no effective response they can make because of the nuclear safety requirements of maintaining the cooling water flows. The requirement to maintain flows is clearly accepted by all parties including the Agency, who nonetheless considered that exceedance of a limit set with considerable headroom above the expected effects, would provide an indication of operational issues and the need for investigation to seek optimisation of the process. They set out that any approach taken, if exceedance occurred, would be in accordance with their enforcement policy, which requires a proportionate response, and the Code of Crown Prosecutors, with its requirement for consideration in the public interest.
- 13.16 I accept that the Agency have to be able to regulate operations and in absence of monitoring of emissions there is no effective way of understanding whether the process is operating in accordance with the parameters set or expected. I fully accept that there would be limited responses available to the operator following an exceedance of the emission limit, but there will be optimisation opportunities, particularly as research in this area develops and techniques improve to ensure fish survival through an FRR. Realistically, there is a need to establish an agreed approach to monitoring as part of the Effluent Monitoring Plan, and I can see no option other than for there to be a limit set. If the appellant considers that the limit is untenable, then there are procedures to allow them to challenge that, but on the basis of the very limited evidence I have, I have no reason to challenge the Agency's approach at this time.
- 13.17 Accordingly I have presented a revised set of permit conditions, taking account of the removal of the AFD and incorporating the OSPAR and permit improvements as discussed above; this can be found in Annex 3.

14. CONCLUSION AND RECOMMENDATION

14.1 Having reviewed the submissions, assessed levels of uncertainty and areas of scientific disagreement, I have concluded that, in absence of an AFD, it cannot be concluded that there would not be adverse effects on the integrity of the Severn Estuary/ Môr Hafren SAC and Ramsar site, the River Usk / Afon Wysg SAC and the River Wye / Afon Gwy SAC.

14.2 **In light of my findings, I make the following recommendation to the Secretary of State for Environment, Food and Rural Affairs**

I RECOMMEND that the appeal be dismissed.

Mike Robins

INSPECTOR

APPENDIX 1

APPEARANCES AT THE INQUIRY

FOR THE APPELLANT:

Stephen Tromons QC
and Victoria Hutton of Counsel
who called:

Instructed by Herbert Smith Freehills

Dr Manus O'Donnell
BAI BA PhD IMechE

NNB Senior Manager, Head of Pressurised
Water Reactor Technology

Dr Simon Jennings
BSc(Hons) MSc PhD

Cefas – Principal Scientist

Tim Goodwin
BSc(Hons) MSc IEEM IES

Epcad – Environmental Consultant

FOR THE ENVIRONMENT AGENCY:

Richard Moules of Counsel

Instructed by Environment Agency Legal
Team

He called:

Dr Karen Edwards
BSc PhD CmarSci IMarEST

Environment Agency – Principal Marine
Modeller and Planner

Dr Jerome Masters
BSc(Hons)PhD MIFM

Environment Agency – Fisheries Specialist

Adam Waugh
BSc(Hons) MSc

Environment Agency – WFD lead for
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Charles Crundwell
BSc(Hons) MSc

Environment Agency - Senior Specialist
Fisheries

FOR THE SEVERN ESTUARY INTERESTS

Brendon Moorhouse of Counsel

Instructed by Severn Estuary Interests

He called:

Steve Colclough

Fisheries Scientist

BSc(Hons) FIFM CEnv

INTERESTED PERSONS:

David Bunt
Dr Paul Naylor
Dr David Lambert
Dr Andrew Turnpenny
Dr James Stuart

Morpheus Environmental Consulting
Fish Guidance Systems
Scientific Advisor – FGS
Devon and Severn Inshore Fisheries and
Conservation Authority

PARTICIPANTS AT THE ROUND
TABLE DISCUSSION:

For the Appellant:

Dr O'Donnell, Chris Fayers, Annika Holden

For the EA:

Dr Edwards, Huw Williams, Aaron Miller

For SEI:

Steve Colclough, Dr Appleby, Mr Morris

APPENDIX 2

Glossary and Definitions used in the report and evidence base

Glossary - Acronyms	
AA	Appropriate Assessment
ADCP	Acoustic Doppler Current Profiler
AFD	Acoustic Fish Deterrent
Agency	Environment Agency
ALARP	As low as reasonably practicable
APEM	Environmental consultancy specialising in terrestrial, freshwater and marine ecology and aerial surveys. Research contractor for the EA
B _{lim}	A limit reference point for spawning stock biomass, below which a stock is considered to have reduced reproductive capacity
BAT	Best Available Technique
BEEMS	Formerly British Energy Estuarine & Marine Studies
CD	Core Document
Cefas	Centre for Environment Fisheries and Aquatic Science, which acted as a research contractor for the Appellant
CEGB	Central Electricity Generating Board
CFD	Computational Fluid Dynamics
CIMP	Comprehensive Impingement Monitoring Programme. A monitoring study consisting of 24 hour samples of impinged fish conducted over a 12-month period (40 samples collected from February 2009 to January 2010) at Hinkley Point B.
CJEU	Court of Justice of the European Union
CL	Conservation limit
CPUE	Catch per unit effort
CWS	Cooling water system
D&S IFCA	Devon & Severn Inshore Fisheries and Conservation Authority
DCO	Development Consent Order
EAV	Equivalent Adult Value
EMS	European Marine Site
EPR	Environment Permitting (England and Wales) Regulations 2016 In evidence this also refers to: a third generation pressurised water reactor design. In Europe this reactor design was called European Pressurised Reactor, and the internationalised name was Evolutionary Power Reactor, but it is now simply named EPR
F	Fishing mortality
FCS	Favourable Conservation Status
FGS	Fish Guidance Systems
FIAT	Feature Impact Assessment Templates
FRR	Fish recovery and return system
GETM	General Estuarine Transport Model
HAWG	Herring Assessment Working Group for the Area South of 62°N
HPA	Hinkley Point A
HPB	Hinkley Point B
HPC	Hinkley Point C

HRA	Habitats Regulations Assessment
ICES	International Council for Exploration of the Sea
ID	Inquiry Document
IFCA	Inshore Fisheries and Conservation Authorities
IROPI	Imperative Reasons of Overriding Public Interest
IUCN	International Union for Conservation of Nature
LVSE	Low Velocity Side Entry
M	Natural mortality
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MSW	Multi-sea-winter fish
NASCO	North Atlantic Salmon Conservation Organisation
NE	Natural England
NNB	Nuclear New Build
NPPF	National Planning Policy Framework
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
NSN	National Site Network
OCS	Operational Catchment Services
PELTIC	Pelagic ecosystem survey in the Western Channel and Celtic Sea
PoE	Proof of Evidence
QIA	Quantitative Impact Assessment
RIMP	Routine Impingement Monitoring Programme. a long-term 37 year (1981-2017) dataset, consisting of monthly samples collected over a 6 hour period, during daylight, at HPB
ROV	Remotely Operated Vehicles
SAC	Special Area of Conservation designated under Council Directive 92/43/EEC (the "Habitats Directive")
SEI	Severn Estuary Interests
SNCB	Statutory Nature Conservation Body
SoC	Statement of Case
SoCG	Statement of Common Ground
SPA	Special Protection Area designated pursuant to the Wild Birds Directive (2009/147/EC)
SPF	Spawning Production Foregone
SPP	Scientific Position Paper prepared by Cefas on behalf of the Appellant
SSB	Spawning Stock Biomass
STP	Severn Tidal Power
STT	Selected Tidal Transport
SWMP	South West Marine Plan
SZC	Sizewell C
TAC	Total allowable catch
TB	Technical Briefs prepared by the Environment Agency
TR	Technical Report prepared by Cefas on behalf of the Appellant
UtS	Unlocking the Severn

WDA permit or OWDA	Hinkley Point C Water Discharge Activity Environmental Permit (EPR/HP3228XT) dated 13 March 2013
WFD	Water Framework Directive

Definitions	
Age class	All the fish of a stock spawned or hatched in a given year. Synonym for 'Year class'
Amphidromous	Refers to fishes that regularly migrate between freshwater and the sea (in both directions), but not for the purpose of breeding, as in anadromous and catadromous species. Sub-division of diadromous. Migrations should be cyclical and predictable and cover more than 100 km
Anadromous	Fishes that live in the sea and return to freshwater to spawn. Sub-division of diadromous.
Benthopelagic	Living and feeding near the bottom as well as in midwaters or near the surface
Biomass	Mass of living biological organisms in a given area or ecosystem at a given time
Bootstrapping / bootstrapped	Statistical method for resampling a single dataset to create many simulated samples. It was applied to impingement data to calculate mean and percentiles for impingement rates.
Catadromous	Fishes that live in freshwater but enter the sea to spawn. Sub-division of diadromous
Celtic Sea	The area of the Atlantic Ocean off the south coast of Ireland.
Clupeid	A type of fish including herring, sprat and shads
Cohort	All the fish of a stock spawned or hatched in a given period, usually one year. If the period is one year then cohort is a synonym for 'Year class' or 'Age class'
Compensation	[In a fish population] increases in population growth and/ or recruitment, and/ or reductions in natural mortality, that compensate for additional mortality. In a fisheries context, these are population responses to fishing mortality
Cumec	A cubic metre per second, as a unit rate of flow of water
Data storage tag (DST)	A combination of a data logger and multiple sensors that record environmental data at predetermined intervals. DSTs usually have a large memory size and a long lifetime: most are supported by batteries that allow the tag to record depth, day length and other data for several years. Data collected by the DST can be used to estimate position and reconstruct behavioural and migratory movements
Demersal	Fish living on, or near the bottom
Diadromous	Fish that spend part of their lives in freshwater and part in saltwater
Drum and band screens	Systems to filter the cooling water removing fish and debris
EAV methods	A class of methods to calculate the numbers of fish that would be expected to survive naturally to enter the spawning

	population had they not been killed by entrainment or impingement
EAV factor	The multiplication factor that is applied to the number of fish impinged across all life stages to estimate the equivalent adults lost
Ebb tide	The stage of the tidal cycle when the water level is falling
Embryogenesis	Egg development
Empirical	Based on observations
Entrained	Organisms (including fish eggs, larvae and other plankton) that pass through the whole cooling water system and are discharged back into the Bristol Channel
Entrainment	The passage of biota, too small to be filtered by the drum and band screen, through the cooling water system. This includes plankton, fish eggs, larvae and some juvenile stages
Entrapment	The entry of marine organisms into the intake heads regardless of the route they then take through the rest of the cooling water system. In an assessment context entrapment is the sum of entrainment and impingement
Epibenthic	Organisms living on or near the bottom sediments
Fecundity	The number of eggs produced
Fish recovery and return system	A means by which individuals impinged will be mechanically removed from the screens and returned to the Severn Estuary
Fish stock assessments	A method used to estimate the status of a fish stock and the rate at which it is fished
Fishing mortality	Loss of fish from a population due to fishing
Flood tide	The stage of the tidal cycle when the water level is rising
Gadoids	Group of bony fish containing several commercially important fishes, including the cod, haddock, whiting, and pollock
Genome	The complete set of genes or genetic material present in a cell or organism
Grilse	A returning adult salmon that has spent one winter at sea
Group	All the fish of a stock spawned or hatched in a given year. Often denoted with the year prefix e.g. 0-group, 1-group. Synonym for 'Year class'
Habitats Directive	Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
Habitats Regulations	The Conservation of Habitats and Species Regulations 2017 (as amended)
Hindcast	A way of testing a mathematical model. Known or closely estimated inputs for past events are entered into the model to see how well the output matches the known results
Hybridisation / hybridise	The successful breeding of two different species, to produce offspring that are hybrids (such as Twaite shad breeding with Allis shad to produce shad hybrids)
ICES fish stock Assessments	Stock assessments conducted by ICES

Impingement	The retention of fish or other marine organisms on the surface of filtration screens by the water current (typically includes juvenile adult fish, shrimp and crabs)
Indeterminate (growth)	Growth that is not terminated at any biological stage
Intake velocity cap factor	One of the family of scaling factors used to estimate the impingement due to HPC relative to the HPB. The intake velocity cap factor relates specifically to the reduction in impingement due to minimising the vertical velocity draw down of the intake
Iteroparous	Fish species that are repeat spawners i.e. have the potential to spawn year after year
Kelt	A spawned adult salmon, with the potential to become a returning adult in subsequent years
Length frequency	A distribution of the numbers of individual fish recorded in body length classes
LVSE factor	One of the family of scaling factors used to estimate the impingement due to HPC relative to the HPB. The LVSE factor relates specifically to the intake shape and geometry
Maturity	Point reached when a fish is able to spawn for the first time
Maximum Sustainable Yield	The maximum yield that can be continuously taken, on average, from a stock under existing environmental conditions while maintaining long-term productivity
Mean High Water Springs	Is the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest (Spring tides)
Metapopulation	A group of spatially separated populations of the same species which interact at some level
Monte Carlo	Statistical technique by which a quantity is calculated repeatedly, using randomly selected "what-if" scenarios for each calculation. These results approximate the full range of possible outcomes, and the likelihood of each
Multi-sea-winter fish	A returning adult that has spent more than one winter at sea
Natal stream or river	Stream or river of birth
Natural Mortality	Loss of fish due to predation and starvation, including disease and senescence (includes non-fishing human activities such as pollution)
Neap tides	Period of moderate tides occurring 7 days after a spring tide
Nursery area	An area where young fish grow
Parr	Juvenile salmon from the end of their first summer to their migration to sea
Pelagic	Fish associated with the surface or middle of the water column; and not in association with the seabed
Population	Many individuals of the same species that have the potential to interbreed as adults and live in the same geographical area at the same time. In fisheries science: a unit of interbreeding individuals of the same species within which

	birth and death rates have a far greater influence on abundance and dynamics than immigration and emigration
Post-smolt	Salmon from its departure from the river to the end of its first winter at sea
Principal Salmon River	A river having an annual rod catch in excess of 50 per year when the National Rivers Authority (now The Agency) Salmon Strategy was released in 1996
Proxy species	A species used to represent other fish that play a similar role within the assemblage of fish species. For example common goby, black goby and rock goby are assessed by proxy of sand goby as the most abundantly captured goby species
Qualitative	Descriptive assessment where quantitative (i.e. numerical) evidence is not available.
Quantitative	Assessment based on numerical data such as modelling or survey data.
Ramsar	A site designated under the criteria of the Ramsar Convention on Wetlands of International Importance
Recruitment	The number of fish reaching a specified stage of the life cycle at a given point in time (often an age close to the age at first maturity or the age when fish are first caught in a fishery)
Returning adult	An adult salmon returning to the river to spawn
River / site fidelity	Returning to the same river to spawn
Selective tidal stream transport	To move with the tide, taking advantage of the ebb or flood tide to move more rapidly through the estuary
Semelparity	Spawning only once during the lifetime of a fish
Semelparous species	Fish species which spawn once and then (usually) die
Slack water / tide	The period of time at the turn of the tide, at either high water or low water, when there is little or no horizontal or vertical motion of the tidal water
Smolt	Juvenile salmon migrating to sea
Spawners	Sexually mature fish
Spawning stock biomass	Total weight of all sexually mature fish in the stock
Spring tides	A tide just after a new or full moon, when there is the greatest difference between high and low water
Spring-neap tidal cycle	The period covered by a spring tide and neap tide, lasting 30 days
Stock	synonymous with the term "population" for the species considered in this Inquiry
Subpopulation	Geographically or otherwise (e.g. genetically) distinct groups in a population with less exchange between groups than within them
Total mortality	Mortality attributed to both fishing and natural causes
Total stock biomass	The total stock of a fish species present in a water body at a point in time expressed as total biomass

Volumetric Scaling Factor	The ratio of the volume abstracted at HPC versus HPB
Year class	All the fish of a stock spawned or hatched in a given year
Young-of-year	All of the fish in a population younger than one year of age

APPENDIX 3

Proposed variation conditions

Conditions

1 Management

1.1 General management

1.1.1 The operator shall manage and operate the activities:

- (a) in accordance with a written management system that identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents, non-conformances and those drawn to the attention of the operator as a result of complaints; and
- (b) using sufficient competent persons and resources.

1.1.2 Records demonstrating compliance with condition 1.1.1 shall be maintained.

1.1.3 Any person having duties that are or may be affected by the matters set out in this permit shall have convenient access to a copy of it kept at or near the place where those duties are carried out.

2 Operations

2.1 Permitted activities

2.1.1 The operator is only authorised to carry out the activities specified in schedule 1 table S1.1 (the “activities”).

2.2 The site

2.2.1 The activities shall not extend beyond the site, being the land shown edged in green on site plans 1 and 2 at schedule 7 to this permit and the discharge shall be made at the points marked on site plan 1 at schedule 7 to this permit and as listed in table S3.2 (discharge points).

2.3 Operating techniques

2.3.1 (a) The activities shall, subject to the conditions of this permit, be operated using the techniques and in the manner described in the documentation specified in schedule 1, table S1.2, unless otherwise agreed in writing by the Environment Agency.

(b) If notified by the Environment Agency that the activities are giving rise to pollution, the operator shall submit to the Environment Agency for approval within the period specified, a revision of any plan specified in schedule 1, table S1.2 or otherwise required under this permit, and shall implement the approved revised plan in place of the original from the date of approval, unless otherwise agreed in writing by the Environment Agency.

2.4 Improvement programme

2.4.1 The operator shall complete the improvements specified in schedule 1 table S1.3 by the date specified in that table unless otherwise agreed in writing by the Environment Agency.

2.4.2 Except in the case of an improvement which consists only of a submission to the Environment Agency, the operator shall notify the Environment Agency within 14 days of completion of each improvement.

2.5 Pre-operational conditions

2.5.1 The activities shall not be brought into operation until 31 October 2017 and until the measures specified in schedule 1 table S1.4 have been completed.

3 Emissions and monitoring

3.1 Emissions to water

3.1.1 There shall be no point source emissions to water except from the sources and emission points listed in schedule 3. 3.1.2 The limits given in schedule 3 shall not be exceeded.

3.1.3 Samples of the incoming and discharge water shall be taken on each sampling occasion. The difference between the discharge and incoming measurements will be calculated for each sampling occasion.

3.2 Emissions of substances not controlled by emission limits

3.2.1 Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved emissions management plan, have been taken to prevent or where that is not practicable, to minimise, those emissions.

3.2.2 All liquids in containers, whose emission to water or land could cause pollution, shall be provided with secondary containment, unless the operator has used other appropriate measures to prevent or where that is not practicable, to minimise, leakage and spillage from the primary container.

3.3 Monitoring

3.3.1 The operator shall, unless otherwise agreed in writing by the Environment Agency, undertake the monitoring specified in the following tables in schedule 3 to this permit: (a) point source emissions specified in tables S3.1a, S3.1b, S3.1c and S3.3;

(b) inlet quality specified in table S3.1a and S3.3; and the environmental monitoring specified in the environmental monitoring plan approved in accordance with pre-operational measure PO11 in table S1.4 in schedule 1 to this permit.

3.3.2 The operator shall maintain records of all monitoring required by this permit including records of the taking and analysis of samples, instrument measurements (periodic and continual), calibrations, examinations, tests and surveys and any assessment or evaluation made on the basis of such data.

3.3.3 Monitoring equipment, techniques, personnel and organisations employed for the emissions monitoring programme and the environmental or other monitoring specified in condition 3.3.1 shall have either MCERTS certification or MCERTS accreditation (as appropriate), where available, unless otherwise agreed in writing by the Environment Agency.

3.3.4 Permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in schedule 3 tables S3.1a, S3.1b, S3.1c, S3.2 and S3.3.

4 Information

4.1 Records

4.1.1 All records required to be made by this permit shall:

- (a) be legible;
- (b) be made as soon as reasonably practicable;
- (c) if amended, be amended in such a way that the original and any subsequent amendments remain legible, or are capable of retrieval; and
- (d) be retained, unless otherwise agreed in writing by the Environment Agency, for at least 6 years from the date when the records were made.

4.1.2 The operator shall keep on site all records, plans and the management system required to be maintained by this permit, unless otherwise agreed in writing by the Environment Agency.

4.2 Reporting

4.2.1 The operator shall send all reports and notifications required by the permit to the Environment Agency using the contact details supplied in writing by the Environment Agency.

4.2.2 A report on the performance of the activities over the previous year shall be submitted to the Environment Agency by 31 January (or other date agreed in writing by the Environment Agency) each year. The report(s) shall include as a minimum, a review of the results of the monitoring carried out in accordance with the permit including an interpretive review of that data.

4.2.3 A report on the performance of the activities during periods of planned maintenance when the power station is subject to operation in RF3 maintenance configuration, shall be submitted to the Environment Agency within 1 month of completion of the maintenance period (or other timeframe agreed in writing by the Environment Agency). The report need only include reference to waste stream A (as specified in table S1.1 of this permit) and shall include a review of the results of the cooling water flow and temperature monitoring carried out in accordance with the permit including an interpretive review of that data.

4.2.4 Within 28 days of the end of the reporting period the operator shall, unless otherwise agreed in writing by the Environment Agency, submit reports of the monitoring and assessment carried out in accordance with the conditions of this permit, as follows:

- (a) in respect of the parameters and emission points specified in schedule 4 table S4.1;
- (b) for the reporting periods specified in schedule 4 table S4.1 and using the forms specified in schedule 4 table S4.2; and
- (c) giving the information from such results and assessments as may be required by the forms specified in those tables.

4.3 Notifications

4.3.1 The Environment Agency shall be notified without delay following the detection of:

- (a) any malfunction, breakdown or failure of equipment or techniques, accident, or emission of a substance not controlled by an emission limit which has caused, is causing or may cause significant pollution;
- (b) the breach of a limit specified in the permit; or

(c) any significant adverse environmental effects.

4.3.2 The Environment Agency shall be notified in writing at least one month in advance of any periods of planned maintenance when the power station will be subject to operation in RF3 maintenance configuration. The notification shall contain the intended start date for, and the proposed duration of the maintenance works. Confirmation of the start date shall be received in writing by the Environment Agency within 1 week of commencement of the maintenance period.

4.3.3 Any information provided under condition 4.3.1 shall be confirmed by sending the information listed in schedule 5 to this permit within the time period specified in that schedule.

4.3.4 Where the Environment Agency has requested in writing that it shall be notified when the operator is to undertake monitoring and/or spot sampling, the operator shall inform the Environment Agency when the relevant monitoring and/or spot sampling is to take place. The operator shall provide this information to the Environment Agency at least 14 days before the date the monitoring is to be undertaken.

4.3.5 The Environment Agency shall be notified within 14 days of the occurrence of the following matters, except where such disclosure is prohibited by Stock Exchange rules:

Where the operator is a registered company:

- (a) any change in the operator's trading name, registered name or registered office address; and
- (b) any steps taken with a view to the operator going into administration, entering into a company voluntary arrangement or being wound up.

Where the operator is a corporate body other than a registered company:

- (a) any change in the operator's name or address; and
- (b) any steps taken with a view to the dissolution of the operator.

1.1.2 Where the operator proposes to make a change in the nature or functioning, or an extension of the activities, which may have consequences for the environment and the change is not otherwise the subject of an application for approval under the Regulations or this permit:

(a) the Environment Agency shall be notified at least 14 days before making the change; and (b) the notification shall contain a description of the proposed change in operation.

1.2 Interpretation

1.2.1 In this permit the expressions listed in schedule 6 shall have the meaning given in that schedule.

1.2.2 In this permit references to reports and notifications mean written reports and notifications, except where reference is made to notification being made "without delay", in which case it may be provided by telephone.

Schedule 1 - Operations

Table S1.1 Activities		
Activity reference	Description of activity	Limits of specified activity
CWPE	Discharge of trade effluent (comprising cooling water and process effluent) and treated sewage effluent via outlets 1 & 2	<p>The activity is limited to the following waste streams, as set out in Table 2.2.1 of the permit application:</p> <ul style="list-style-type: none"> • Waste stream A - Trade effluent consisting of returned abstracted cooling water. • Waste stream B - Trade effluent from operations within the 'nuclear island', excluding effluent from the Steam Generator Blowdown System. • Waste stream C - Trade effluent from the Steam Generator Blowdown System. • Waste stream D - Trade effluent from the Turbine Hall and uncontrolled area floor drains, excluding effluent from the Steam Generator Blowdown System. • Waste stream E - Trade effluent comprising of water potentially contaminated with hydrocarbons from areas where oils are used. • Waste stream F - Trade effluent from the production of demineralised water. • Waste stream G - Domestic sewage (sanitary effluent) from administration and mess facilities.
FRR	Discharge of trade effluent (comprising cooling water) via outlet 3	<p>The activity is limited to:</p> <ul style="list-style-type: none"> □ Waste stream H - Trade effluent consisting of a small proportion of returned abstracted cooling water via the Fish Recovery & Return (FRR) System.

Table S1.2 Operating techniques		
Description of documentation	Parts	Date Received
Environmental permit application for Hinkley Point C, application reference EPR/HP3228XT/A001 - Main document	Sections 2.3.2 - 2.3.7 - description of the treatment systems used to remove contaminants prior to discharge Section 2.6.2 - Prevention of Unplanned Emissions of Oils from Heat Exchangers Section 2.7.2 - Hot Functional Testing Section 3.5 - Oily Water Treatment Section 3.7.3 - Strategy for Minimising Chlorination Section 3.8 - Sanitary Effluent Section 3.11 - Outfall Design	23/09/11
Further information in response to Schedule 5 Notice	Question 25 - injection of biocide downstream of the drumscreens but before the condensers	23/12/11
Further information in response to Schedule 5 Notice	Question 9 - maximum expected pre-dilution substance concentrations in waste streams B & C (combined), and waste stream D	29/03/12
Further information in response to Schedule 5 Notice	Question 13 - maximum expected pre-dilution substance concentrations in waste stream F	14/02/12
Emissions Management Plan	As approved in accordance with Pre- operational measure PO5 in Table S1.4	To be received in accordance with pre- operational measure submission timescales in Table S1.4
Commissioning Discharges Management Plan	As approved in accordance with Pre- operational measure PO6 in Table S1.4	To be received in accordance with pre- operational measure submission timescales in Table S1.4
Operational strategy for the control of biofouling	As approved in accordance with Pre- operational measure PO7 in Table S1.4	
Commissioning Plan for FRR Systems	As approved in accordance with Pre- operational measure PO8 in Table S1.4	
Forebay de-silting Plan	As approved in accordance with Pre- operational measure PO9 in Table S1.4	

Hydrazine Removal Plan	As approved in accordance with Pre- operational measure PO10 in Table S1.4
Environmental Monitoring Plan	As approved in accordance with Pre- operational measure PO11 in Table S1.4

Table S1.2 Operating techniques

Description of documentation	Parts	Date Received
Priority Hazardous Substances Management Plan	As approved in accordance with Pre- operational measure PO12 in Table S1.4	To be received in accordance with pre- operational measure submission timescales in Table S1.4
Effluent Monitoring Plan	As approved in accordance with Pre- operational measure PO15 in Table S1.4	
Hydrodynamic Modelling Review Plan	As approved in accordance with Pre- operational measure PO16 in Table S1.4	

Table S1.3 Improvement programme requirements

Reference	Requirement	Date
IC1	The operator shall submit a written report to the Environment Agency on the implementation of its Environmental Management System and the progress made in the accreditation of the system by an external body or if appropriate submit a schedule by which the EMS will be subject to accreditation.	Within 12 months of the date on which the Hot Functional Testing phase of commissioning commences
IC2	The operator shall review their hydrodynamic modelling for the purpose of post-scheme appraisal within 5 years of the commencement of commercial operation of Unit 2, to validate their modelling predictions. The review shall include re-calibration and validation of the hydrodynamic model(s) if necessary, as well as a reassessment of the assumptions concerning the near-field behaviour of the discharges. The Operator shall submit a written report to the Environment Agency on the review of their hydrodynamic modelling within 1 month of completion of the review.	As specified in Improvement Condition IC2

IC3	<p>The operator shall review their hydrodynamic modelling and associated impact assessment in light of the following:</p> <ul style="list-style-type: none"> best available climate change projections; operational performance of the power station; the output from post scheme appraisal studies; within 5 years of the commencement of commercial operation of Unit 2 and every 10 years thereafter unless otherwise agreed in writing by the Environment Agency. <p>The review will assess how the climate change projections could influence the operation of the power station in the future. The results of the review shall be reported to the Environment Agency in writing within 1 month of completion of each review.</p>	As specified in Improvement Condition IC3
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Table S1.4 Pre-operational measures

Reference	Pre-operational measures	Date
PO1	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit a summary of the site Environment Management System (EMS) to the Environment Agency and make available for inspection all documents and procedures which form part of the EMS. The EMS shall be developed in line with Part 1 of How to comply with your Environmental Permit (EPR 1.00) and Horizontal Guidance note H6 on Environmental Management Systems; and shall include an Accident Management Plan for the Water Discharge Activity. The documents and procedures set out in the EMS shall form the written management system referenced in condition 1.1.1 (a) of the permit.</p>	<p>At least one calendar month prior to the commencement of the Hot Functional Testing phase of commissioning.</p>
PO2	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a report which includes a completed, as-built description of the plant and infrastructure relevant to the Water Discharge Activities. Note that the report shall take into account the cooling water system in its entirety, including the design of the Fish Recovery and Return (FRR) system; providing an update to Section 3.1.3 of the Environmental permit application for Hinkley Point C, application reference EPR/HP3228XT/A001 - Main document (received 23/09/11)-</p> <p>In addition the report shall contain an updated site plan clearly showing all relevant buildings and structures and the route of the associated pipework, including all land-based infrastructure associated with the cooling water system; and the national grid references of the cooling water intakes.</p> <p>Should the final design vary from that described in the permit application, the report shall include as appropriate, a risk assessment to demonstrate how the changes will prevent or minimise impacts on the receiving water environment, and ensure compliance with this permit.</p>	<p>At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.</p>

Table S1.4 Pre-operational measures		
Reference	Pre-operational measures	Date
PO3	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a report which reviews the proposed substance loadings and emissions to surface water from Hinkley Point C. The report shall include, but not be restricted to the following:</p> <ul style="list-style-type: none"> a summary of the lessons learnt through design evolution and/or commissioning and operating the EPR at Flamanville 3 in France, or any other EPR site worldwide; information from designers and suppliers which has influenced the final design with respect to the flow and composition of effluents; reference to outputs from the demineralisation plant (expected to be based on non-desalination technology in variance to the data provided in GDA and the permit application); reference to outputs from the ongoing Entrainment Mimic Unit (EMU) work regarding potential impacts on entrained marine organisms. <p>The report shall validate the proposed substance loadings and emissions from Hinkley Point C, fully describing and justifying:</p> <ul style="list-style-type: none"> any expected variances from the substance loadings and emissions proposed in the permit application; any additional mitigation measures required to ensure compliance with this permit. 	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.
PO4	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a scoping document for development of an Emissions Management Plan, to show how emissions not covered by emission limits in Table S3.1, will be prevented, or where that is not practicable, minimised.</p>	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.
PO5	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval an Emissions Management Plan in accordance with the scope agreed under PO4.</p>	At least two calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.

Table S1.4 Pre-operational measures		
Reference	Pre-operational measures	Date
PO6	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency a Commissioning Discharges Management Plan. The Plan shall describe how the operator intends to undertake Hot Functional Testing (HFT). The Plan shall include, but not be restricted to the following:</p> <ul style="list-style-type: none"> • the timetable for HFT of both UK EPR units; • a description of the HFT process; • a description of associated effluent treatment measures; • confirmation of the expected substance loadings and emissions to surface water; • confirmation of the expected thermal loading, including the expected temperature of the discharge; • proposals for effluent monitoring during the HFT process. <p>The Plan should also demonstrate how the operator’s management and engineering controls will ensure that substance loadings and emissions to surface water do not exceed the levels stated in the permit application, with particular reference to how: <input type="checkbox"/> environmental impacts will be prevented or minimised; and <input type="checkbox"/> compliance with this permit will be achieved.</p>	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.
PO7	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a report which confirms and justifies their operational strategy for the control of biofouling of the cooling water system. The report shall include, but not be restricted to the following:</p> <ul style="list-style-type: none"> • an appraisal of the operational conditions and chlorination strategy employed at Hinkley Point B power station, and a description of how this has been taken into account in defining the proposed strategy for HPC; • the lessons learnt through design evolution and/or commissioning and operating the EPR at Flamanville 3 in France, or any other EPR site worldwide; • details of how the operational strategy has been optimised to reduce the need for chemical dosing and the subsequent discharge of TRO and the formation of chlorinated by- products (CBP’s); • validation of the impacts of the proposed dosing regime, to include reference to numerical modelling and ecotoxicological studies as appropriate. 	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.

Table S1.4 Pre-operational measures		
Reference	Pre-operational measures	Date
PO8	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Commissioning Plan for the FRR System. The Plan shall include, but not be restricted to the following:</p> <ul style="list-style-type: none"> • a description of how the operator intends to optimise the FRR system to minimise impacts upon fish; • details of the monitoring proposed to facilitate optimisation and meet the above objective; • confirmation of the timetable associated with the FRR system commissioning; • proposals for demonstrating the effectiveness of the optimisation process to the Environment Agency prior to the start of Active Commissioning of Unit 1. 	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.
PO9	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Forebay de-silting Plan for the removal of accumulated silt from within the cooling water forebays. The Plan shall include:</p> <ul style="list-style-type: none"> • verification of the initial impact assessment findings detailed in the permit application; • a Method Statement for undertaking the de-silting activity. 	At least one calendar month prior to the commencement of the Hot Functional Testing phase of commissioning.
PO10	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Hydrazine Removal Plan which details how hydrazine shall be removed from the effluent prior to discharge. The Plan shall include, but not be restricted to the following:</p> <ul style="list-style-type: none"> • the methodology to be followed in removing hydrazine from the discharge; • proposals for monitoring during the Hot Functional Testing phase of commissioning to demonstrate that the level of hydrazine in (i) waste streams B & C (combined), and (ii) waste stream D, is below the Limit of Detection of the analytical method, the use of which shall be approved by the Environment Agency; • proposals for on-going process monitoring to ensure that the hydrazine removal process maintains its effectiveness; • details of contingency plans to deal with equipment failure and/or breakdown, or other reasonably foreseeable incidents which may compromise the effectiveness of the hydrazine removal process. 	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.

Table S1.4 Pre-operational measures		
Reference	Pre-operational measures	Date
PO11	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval an Environmental Monitoring Plan for the Severn Estuary SAC, SPA and Ramsar, for the purpose of post scheme appraisal.</p> <p>The Plan shall propose monitoring methods to determine the physical, chemical and biological characteristics of the area potentially affected by the water discharge activity (including impacts related to the abstraction of cooling water), and monitoring locations and frequencies. It shall also include the procedures for assessing any effects and reporting the results of the monitoring and assessment to the Environment Agency. The Plan shall include, but not be restricted to the following aspects:</p> <ul style="list-style-type: none"> • thermal plume monitoring; • subtidal and intertidal benthic ecology monitoring; • proportionate local population surveys of relevant fish species; • water quality monitoring (with reference to Activity CWPE and Activity FRR); • sediment quality monitoring; and • the quality assurance procedures in place; or • the progress towards MCERTS certification or MCERTS accreditation, unless otherwise agreed in writing by the Environment Agency, and if necessary a timetable for achieving the MCERTS standard. 	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.
PO12	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Priority Hazardous Substances Management Plan. The Plan shall describe how the operator intends to manage the use of chemicals so as to gradually cease or phase out discharging Priority Hazardous Substances, in accordance with the objectives set out under the Water Framework Directive.</p> <p>The Plan will make reference to amongst other things, the cadmium and mercury which is present as trace contaminants in bulk raw materials, and will propose a timetable for the gradual phasing out of the use of such chemicals.</p>	At least one calendar month prior to the commencement of the Hot Functional Testing phase of commissioning.

PO13	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency confirmation of the final national grid references (NGR's) for</p> <p>a) the individual diffuser heads on the cooling water outfall tunnel, to refine the NGR's in the permit application which were submitted with a 50m limit of deviation to allow for tunnel drilling contingency;</p> <p>b) the Fish Recovery and Return outfall (Outlet 3)-</p> <p>Following written approval by the Environment Agency, the NGR's shall be deemed to be incorporated under Table S3.2 of this permit.</p>	At least one calendar month prior to the commencement of the Hot Functional Testing phase of commissioning.
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Table S1.4 Pre-operational measures

Reference	Pre-operational measures	Date
PO14	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency:</p> <ul style="list-style-type: none"> • confirmation of the NGR's for the compliance monitoring points associated with each waste stream, as listed in table S3.3; • confirmation of the monitoring point references, to be prefixed by 'M', for the waste stream compliance monitoring points; and • detailed site plan(s) showing the exact location of the waste stream compliance monitoring points. <p>Following written approval by the Environment Agency, the NGR's and monitoring point references shall be deemed to be incorporated under Table S3.3 of this permit. The site plan(s) shall be deemed to be incorporated under Schedule 7 of this permit.</p>	At least one calendar month prior to the commencement of the Hot Functional Testing phase of commissioning.
PO15	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval an Effluent Monitoring Plan which specifies the monitoring techniques and assessments to be used for monitoring of effluents under this permit. The Plan shall also include, but not be restricted to the following:</p> <ul style="list-style-type: none"> • the quality assurance procedures in place; or • the progress towards MCERTS certification or MCERTS accreditation, unless otherwise agreed in writing by the Environment Agency, and if necessary a timetable for achieving the MCERTS standard. 	At least three calendar months prior to the commencement of the Hot Functional Testing phase of commissioning.
PO16	<p>Prior to the commencement of the Hot Functional Testing phase of commissioning the operator shall submit to the Environment Agency for approval a Hydrodynamic Modelling Review Plan. The plan shall include a description of the sampling and monitoring regimes that will be put in place to meet the requirement of Improvement Condition IC2 in table S1.3 of this permit.</p>	At least one calendar month prior to the commencement of the Hot Functional Testing phase of commissioning.

Schedule 2 - Waste types, raw materials and fuels

Wastes are not accepted as part of the permitted activities and there are no restrictions on raw materials or fuels under this schedule.

Schedule 3 – Emissions and monitoring

For the purpose of this schedule the following interpretations shall apply:

- “Daily load” shall be calculated as follows:
 - (a) for waste streams B & C (combined) and for waste stream D, by multiplying the volume of effluent released from an effluent tank by the release concentration in that effluent tank. Where more than one effluent tank is discharged per day then the daily load for each substance shall be calculated by summing the individual loads discharged from each tank;
 - (b) for cadmium and mercury arising from waste streams B & C (combined) and waste stream D, by summing the calculated loads from each contributory waste stream;
 - (c) for waste stream F, unless otherwise stated, by recording the amount of substance used in the demineralisation plant over that day.
- “Annual load” shall be calculated by summing the daily loads in a fixed calendar year from 1 January to 31 December inclusive.
- “Hourly” limits for total residual oxidant require a minimum of one sample result to be recorded should the dosing period be less than sixty minutes.
- “Percentile” limits apply over a fixed calendar year from 1 January to 31 December inclusive, with the data return for the calendar year being at least 99%.
- “Planned” (in the context of RF3 maintenance) means work that is specified within the operator’s standard maintenance schedule, whether short or long term. It does not include any un- scheduled, reactive, or emergency maintenance work.
- The maximum rate of discharge for waste stream A (Unit 1 & Unit 2 combined) shall be calculated by summing the 15-minute instantaneous or integrated flow in Unit 1 and the 15-minute instantaneous or integrated flow in Unit 2, i.e.

$$Q_{\text{UNIT 1 \& UNIT 2}} = Q_{\text{UNIT 1}} + Q_{\text{UNIT 2}}$$

where: Q refers to the 15-minute instantaneous or integrated flow

- “RF3 maintenance” means the situation when Hinkley Point C power station is operating with only three of the four main cooling water pumps (CRF pumps) running, with the remaining CRF pump under maintenance. This means that one EPR™ unit will have both of its CRF pumps running, while the other EPR™ unit will have only one of its two CRF pumps running. The increased temperature differential permitted during RF3 maintenance can only apply to one EPR™ unit at any given time, that being the EPR™ unit running with reduced pump capacity due to the maintenance work.
- The maximum temperature for waste stream A (Unit 1 & Unit 2 combined) shall be calculated by mass balance, as follows:

$$T_C = (Q_{\text{UNIT 1}} \times t_{\text{UNIT 1}}) + (Q_{\text{UNIT 2}} \times t_{\text{UNIT 2}}) / (Q_{\text{UNIT 1}} + Q_{\text{UNIT 2}})$$

where: T_C refers to the temperature of the combined flow from Unit 1 and Unit 2
Q refers to the 15-minute instantaneous or integrated flow
t refers to the instantaneous absolute temperature

All values for flow and temperature must be coincident in time, i.e. measured over the same time period.

- “Tidal mean” is defined as an average of 15 minute data over 12.5 hours, as computed every 15 minutes.

Table S3.1a Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Parameter	Limit	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic	
CWPE	Waste stream A (Unit 1 & Unit 2 combined)	Maximum rate of discharge	127.0 m ³ /s	Instantaneous	N/A	N/A	Tidal mean	
			134.6 m ³ /s	Instantaneous	N/A	N/A	98 percentile	
		Temperature	35.0 degrees C	Instantaneous (spot sample)	N/A	Continuous	99.5 Percentile	
		Impingement	N/A	In accordance with Effluent Monitoring Plan as approved in accordance with Pre- operational measure PO15 in Table S1.4			N/A	
		Impingement survivability	N/A				N/A	
		Entrainment	N/A				N/A	
		Entrainment survivability	N/A				N/A	
		Other 'insystem' mortality	N/A				N/A	
		Waste stream A (Unit 1)	15-minute instantaneous or integrated flow	No limit set. Record as l/s	15 minute	N/A	Continuous	N/A
				Temperature	11.8 degrees C	Instantaneous (spot sample)	N/A	Continuous

			22.2 degrees C	Instantaneous (spot sample)	During <u>planned</u> RF3 maintenance, as referred to in Schedule 3 „interpretations“	Continuous	Maximum increase compared to inlet as a tidal mean. Condition 3.1.3 applies
		Total residual oxidant (TRO)	200 µg/l	Instantaneous (spot sample)	During periods when the cooling water is dosed with sodium hypochlorite	Hourly	Maximum
		pH	6 to 9	Instantaneous (spot sample)	N/A	N/A	Minimum and maximum
		Visible oil or grease	No significant trace present	Instantaneous (spot sample)	N/A	N/A	No significant trace

Table S3.1a Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Parameter	Limit	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic
CWPE	Waste stream A (Unit 2)	15-minute instantaneous or integrated flow	No limit set. Record as l/s	15 minute	N/A	Continuous	N/A
		Temperature	11.8 degrees C	Instantaneous (spot sample)	N/A	Continuous	Maximum increase compared to inlet as a tidal mean. Condition 3.1.3 applies
			22.2 degrees C	Instantaneous (spot sample)	During <u>planned</u> RF3 maintenance, as referred to in Schedule 3 „interpretations“	Continuous	Maximum increase compared to inlet as a tidal mean. Condition 3.1.3 applies

	Total residual oxidant (TRO)	200 µg/l	Instantaneous (spot sample)	During periods when the cooling water is being dosed with sodium hypochlorite	Hourly	Maximum
	pH	6 to 9	Instantaneous (spot sample)	N/A	N/A	Minimum and maximum
	Visible oil or grease	No significant trace present	Instantaneous (spot sample)	N/A	N/A	No significant trace
Waste streams B & C (combined)	Maximum daily discharge volume	1500 m ³ /d	Total daily volume	N/A	N/A	Maximum
	Maximum rate of discharge	35 l/s	Instantaneous	N/A	N/A	Mean
	pH	6 to 9	Instantaneous (spot sample)	N/A	N/A	Minimum and maximum

Table S3.1a Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Parameter	Limit	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic
CWPE	Waste streams B & C (combined) cont/d...	Visible oil or grease	No significant trace present	Instantaneous (spot sample)	N/A	N/A	No significant trace
	Waste stream D	Maximum daily discharge volume	1500 m ³ /d	Total daily volume	N/A	N/A	Maximum
		Maximum rate of discharge	35 l/s	Instantaneous	N/A	N/A	Mean
		pH	6 to 9	Instantaneous (spot sample)	N/A	N/A	Minimum and maximum

	Visible oil or grease	No significant trace present	Instantaneous (spot sample)	N/A	N/A	No significant trace
Waste stream E	Maximum daily discharge volume	240 m ³ /d	Total daily volume	N/A	N/A	Maximum
	Visible oil or grease	No significant trace present	Instantaneous (spot sample)	N/A	Daily	No significant trace
Waste stream F	Maximum daily discharge volume	4000 m ³ /d	Total daily volume	N/A	Continuous	Maximum
	Maximum rate of discharge	46 l/s	Instantaneous	N/A	N/A	Maximum
	pH	6 to 9	Instantaneous (spot sample)	N/A	N/A	Minimum and maximum
	Visible oil or grease	No significant trace present	Instantaneous (spot sample)	N/A	N/A	No significant trace

Table S3.1a Point Source emissions to water (other than sewer) – emission limits and monitoring requirements

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Parameter	Limit	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic
CWPE	Waste stream G	Maximum daily discharge volume	175 m ³ /d	Total daily volume	N/A	Continuous	Maximum
		ATU-BOD as O ₂	20 mg/l	Instantaneous (spot sample)	N/A	N/A	Maximum
		Suspended solids (measured after drying at 105° C)	30 mg/l	Instantaneous (spot sample)	N/A	N/A	Maximum

		Ammoniacal nitrogen (as N)	20 mg/l	Instantaneous (spot sample)	N/A	N/A	Maximum
		Visible oil or grease	No significant trace present	Instantaneous (spot sample)	N/A	N/A	No significant trace
FRR	Waste stream H	Total moribund biomass	<u>490 kg</u>	Daily mean (90 day rolling average)	In accordance with Effluent Monitoring Plan as approved in accordance with Pre-operational measure PO15 in Table S1.4		<u>Maximum</u>

Table S3.1b Point Source emissions to water (other than sewer) – emission limits and monitoring requirements (ANNUAL LOADS)

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent							
Activity	Discharge source	Parameter	Limit (kilograms per year)	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic
CWPE	Waste streams B & C (combined)	Boron (as B)	2448	N/A	N/A	Daily	Maximum
		Lithium hydroxide	8.73				
		Morpholine	210				
		Ethanolamine	65				
		Nitrogen (as N)	10				
		Ammoniacal nitrogen (as NH ₄ ⁺)	15				
		Phosphate (as PO ₄ ³⁻)	602.50				
		Detergents	3200				
		COD	600.95				
		Aluminium	0.41				
		Copper	0.03				
		Chromium	0.65				
		Iron	2.70				
		Manganese	0.26				
		Nickel	0.03				
Lead	0.02						

		Zinc	0.46				
		Cadmium	N/A				
		Mercury	N/A				
	Waste stream D	Morpholine	1464	N/A	N/A	Daily	Maximum
		Ethanolamine	854				
		Nitrogen (as N)	10120				
		Ammoniacal nitrogen (as NH ₄ ⁺)	12994				
		Phosphate (as PO ₄ ³⁻)	187.50				
		COD	4449				
		Aluminium	4.85				

Table S3.1b Point Source emissions to water (other than sewer) – emission limits and monitoring requirements (ANNUAL LOADS)

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Parameter	Limit (kilograms per year)	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic
CWPE	Waste stream D cont/d...	Copper	0.39	N/A	N/A	Daily	Maximum
		Chromium	7.72				
		Iron	32.27				
		Manganese	3.07				
		Nickel	0.41				
		Lead	0.28				
		Zinc	5.54				
		Cadmium	N/A				
		Mercury	N/A				
		Waste streams B & C (combined) and D		Cadmium	0.37		
Mercury	0.1						
Waste stream F		Detergents	624	N/A	N/A	Daily	Maximum
		Amino tri - phosphonic acid (ATMP)	9100				
		Hydroxy Ethylidene Diphosphonic acid (HEDP)	890				

	Acetic acid	14				
	Phosphoric acid	12				
	Sodium polyacrylate	8030				
	Acrylic acid	165				
	Iron	46000	Instantaneous (spot sample)	N/A	Daily	Maximum

Table S3.1c Point Source emissions to water (other than sewer) – emission limits and monitoring requirements (DAILY LOADS)

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Parameter	Limit (kilograms per day)	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic
CWPE	Waste streams B & C (combined)	Boron (as B)	984	N/A	N/A	Daily	Maximum
		Lithium hydroxide	4.4				
		Morpholine	75				
		Ethanolamine	15				
		Nitrogen (as N)	8				
		Ammoniacal nitrogen (as NH ₄ ⁺)	1.83				
		Phosphate (as PO ₄ ³⁻)	150				
		Detergents	270				
		COD	39.27				
		Aluminium	0.09				
		Copper	0.01				
		Chromium	0.14				
		Iron	0.60				
		Manganese	0.06				
		Nickel	0.01				
		Lead	0.01				
		Zinc	0.10				
		Cadmium	N/A				
Mercury	N/A						
	Waste stream D	Morpholine	17.25	N/A	N/A	Daily	Maximum

	Ethanolamine	9.75			
	Nitrogen (as N)	320			
	Ammoniacal nitrogen (as NH ₄ ⁺)	71.3			
	Phosphate (as PO ₄ ³⁻)	202.5			
	COD	290.7			

Table S3.1c Point Source emissions to water (other than sewer) – emission limits and monitoring requirements (DAILY LOADS)

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Parameter	Limit (kilograms per day)	Reference Period	Limit of effective range	Monitoring frequency	Compliance Statistic
CWPE	Waste stream D cont/d...	Aluminium	1.01	N/A	N/A	Daily	Maximum
		Copper	0.07				
		Chromium	1.56				
		Iron	6.55				
		Manganese	0.61				
		Nickel	0.08				
		Lead	0.05				
		Zinc	1.10				
		Cadmium	N/A				
		Mercury	N/A				
	Waste streams B & C (combined) and D	Cadmium	0.005	N/A	N/A	N/A	Maximum
		Mercury	0.001				
	Waste stream F	Amino tri - phosphonic acid (ATMP)	45	N/A	N/A	Daily	Maximum
		Hydroxy Ethylidene - Diphosphonic acid (HEDP)	4.50				
		Acetic acid	0.10				
		Phosphoric acid	0.10				
		Sodium polyacrylate	40				

	Acrylic acid	1				
	Iron	250	Instantaneous (spot sample)	N/A	Daily	Maximum

Table S3.2 Discharge points

Activity	Effluent Name	Discharge Point	Discharge point NGR	Receiving water/ Environment
CWPE	Trade effluent (comprising cooling water and process effluent) and treated sewage effluent	Outlet 1	ST 19176 47521 Final NGR to be confirmed in accordance with preoperational measure PO13.	Bristol Channel
		Outlet 2	ST 19128 47578 Final NGR to be confirmed in accordance with preoperational measure PO13.	
FRR	Trace effluent comprising water cooling	<u>Outlet 3</u>	Final NGR to be confirmed in accordance with pre-operational measure PO13.	

Table S3.3 Monitoring points

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

CWPE	Waste stream A (Unit 1)	Influent sample point	NGR's to be specified in accordance with pre- operational measure PO14.	Monitoring point references to be specified in accordance with preoperational measure PO14.
		Effluent sample point		
		Flow monitoring point		
	Waste stream A (Unit 2)	Influent sample point		
		Effluent sample point		
		Flow monitoring point		
	Waste streams B & C (combined)	Effluent sample point		
		Flow monitoring point		
	Waste stream D	Effluent sample point		
		Flow monitoring point		

	Waste stream E	Effluent sample point		
		Flow monitoring point		
	Waste stream F	Effluent sample point		
		Flow monitoring point		
	Waste stream G	Effluent sample point		
		Flow monitoring point		
FRR	Waste stream H	Effluent sample point(s)	NGRs to be specified in accordance with pre- operational measure PO14.	Monitoring point references to be specified in accordance with pre-operational measure PO14.

All monitoring points to be appropriately labelled

Schedule 4 – Reporting

For the purposes of this schedule the following interpretations shall apply:

- Substance loading data for waste streams B & C (combined), D and F shall be reported as:
 - (a) the calculated load for each substance; and
 - (b) the corresponding effluent volume and effluent concentration;

unless monitoring is based on a record of the amount of substance used, in which case that data shall be reported.

Determinands, for which reports shall be made, in accordance with conditions of this permit, are listed below.

Table S4.1 Reporting of monitoring data					
Trade effluent (comprising cooling water and process effluent) and treated sewage effluent					
Activity	Discharge source	Determinand	Monitoring point reference	Reporting period	Period begins
CWPE	Waste stream A	15-minute instantaneous or integrated flow	Monitoring point references to be specified in accordance with pre-operational measure PO14.	Quarterly, plus annual summary	1 st of month
		Temperature			
		Total Residual Oxidant (TRO)			
	Waste streams B & C (combined)	Boron (as B)		Quarterly, plus annual summary	1 st of month
		Lithium hydroxide			
		Morpholine			
		Ethanolamine			
		Nitrogen (as N)			
		Ammoniacal nitrogen (as NH ₄ ⁺)			
		Phosphate (as PO ₄ ³⁻)			
		Detergents			
		COD			
		Aluminium			
		Copper			
		Chromium			
		Iron			
		Manganese			
		Nickel			

Table S4.1 Reporting of monitoring data

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Determinand	Monitoring point reference	Reporting period	Period begins
CWPE	Waste streams B & C (combined) cont/d...	Lead	Monitoring point references to be specified in accordance with pre-operational measure PO14.	Quarterly, plus annual summary	1 st of month
		Zinc			
		Cadmium			
		Mercury			
	Waste stream D	Morpholine		Quarterly, plus annual summary	1 st of month
		Ethanolamine			
		Nitrogen (as N)			
		Ammoniacal nitrogen (as NH ₄ ⁺)			
		Phosphate (as PO ₄ ³⁻)			
		COD			
		Aluminium			
		Copper			
		Chromium			
		Iron			
		Manganese			
		Nickel			
		Lead			
		Zinc			
		Cadmium			
		Mercury			
Waste stream F	Maximum daily discharge volume	Quarterly, plus annual summary	1 st of month		
	Amino tri -phosphonic acid (ATMP)				
	Hydroxy Ethylidene - Diphosphonic acid (HEDP)				
	Acetic acid				
	Phosphoric acid				

		Sodium polyacrylate		
		Acrylic acid		
		Iron		

Table S4.1 Reporting of monitoring data

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Determinand	Monitoring point reference	Reporting period	Period begins
CWPE	Waste stream G	Maximum daily discharge volume		Quarterly, plus annual summary	1 st of month
FRR	Waste stream H	Total moribund biota biomass	Monitoring point references to be accordance with pre-operational measure PO14.	In accordance with Effluent Monitoring Plan as approved in accordance with Pre-operational measure PO15 in Table S1.4	

Table S4.2 Reporting forms

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Determinand	Reporting format
CWPE	Waste stream A	15-minute instantaneous or integrated flow	WISKI electronic format specified by the Environment Agency
		Temperature	Electronic format specified by the Environment Agency
		Total Residual Oxidant (TRO)	
	Waste streams B & C (combined)	Boron (as B)	Electronic format specified by the Environment Agency
		Lithium hydroxide	
		Morpholine	
		Ethanolamine	
		Nitrogen (as N)	
		Ammoniacal nitrogen (as NH ₄ ⁺)	
		Phosphate (as PO ₄ ³⁻)	
Detergents			

		COD	
		Aluminium	
		Copper	
		Chromium	
		Iron	
		Manganese	
		Nickel	
		Lead	
		Zinc	
		Cadmium	
		Mercury	
	Waste stream D	Morpholine	Electronic format specified by the Environment Agency
		Ethanolamine	
		Nitrogen (as N)	
		Ammoniacal nitrogen (as NH ₄ ⁺)	
		Phosphate (as PO ₄ ³⁻)	
		COD	
		Aluminium	
		Copper	
		Chromium	
		Iron	

Table S4.2 Reporting forms

Trade effluent (comprising cooling water and process effluent) and treated sewage effluent

Activity	Discharge source	Determinand	Reporting format
CWPE	Waste stream D cont/d...	Manganese	Electronic format specified by the Environment Agency
		Nickel	
		Lead	
		Zinc	
		Cadmium	
		Mercury	
	Waste stream F	Maximum daily discharge volume	WISKI electronic format specified by the Environment Agency

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		Amino tri -phosphonic acid (ATMP) Hydroxy Ethylidene - Diphosphonic acid (HEDP) Acetic acid Phosphoric acid Sodium polyacrylate Acrylic acid Iron	Electronic format specified by the Environment Agency
	Waste stream G	Maximum daily discharge volume	WISKI electronic format specified by the Environment Agency
FRR	<u>Waste stream H</u>	Total moribund biota biomass	Electronic format specified by the Environment Agency

Schedule 5 - Notification

These pages outline the information that the operator must provide.

Units of measurement used in information supplied under Part A and B requirements shall be appropriate to the circumstances of the emission. Where appropriate, a comparison should be made of actual emissions and authorised emission limits.

If any information is considered commercially confidential, it should be separated from non-confidential information, supplied on a separate sheet and accompanied by an application for commercial confidentiality under the provisions of the EP Regulations.

Part A

Permit Number	
Name of operator	
Location of Facility	
Time and date of the detection	

(b) Notification requirements for the breach of a limit	
To be notified within 24 hours of detection unless otherwise specified below	
Emission point reference/ source	
Parameter(s)	
Limit	
Measured value and uncertainty	
Date and time of monitoring	

Measures taken, or intended to be taken, to stop the emission	
(a) Notification requirements for any malfunction, breakdown or failure of equipment or techniques, accident, or emission of a substance not controlled by an emission limit which has caused, is causing or may cause significant pollution	
To be notified within 24 hours of detection	
Date and time of the event	
Reference or description of the location of the event	
Description of where any release into the environment took place	
Substances(s) potentially released	
Best estimate of the quantity or rate of release of substances	
Measures taken, or intended to be taken, to stop any emission	
Description of the failure or accident.	

Time periods for notification following detection of a breach of a limit	
Parameter	Notification period

(c) Notification requirements for the detection of any significant adverse environmental effect	
To be notified within 24 hours of detection	
Description of where the effect on the environment was detected	
Substances(s) detected	
Concentrations of substances detected	
Date of monitoring/sampling	

Part B - to be submitted as soon as practicable

Any more accurate information on the matters for notification under Part A.	
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Measures taken, or intended to be taken, to prevent a recurrence of the incident	
Measures taken, or intended to be taken, to rectify, limit or prevent any pollution of the environment which has been or may be caused by the emission	
The dates of any unauthorised emissions from the facility in the preceding 24 months.	

Name*	
Post	
Signature	
Date	

* authorised to sign on behalf of the operator

Schedule 6 - Interpretation

"accident" means an accident that may result in pollution.

"annually" means once every year.

"application" means the application for this permit, together with any additional information supplied by the operator as part of the application and any response to a notice served under Schedule 5 to the EP Regulations.

"EP Regulations" means The Environmental Permitting (England and Wales) Regulations SI 2010 No.675 and words and expressions used in this permit which are also used in the Regulations have the same meanings as in those Regulations.

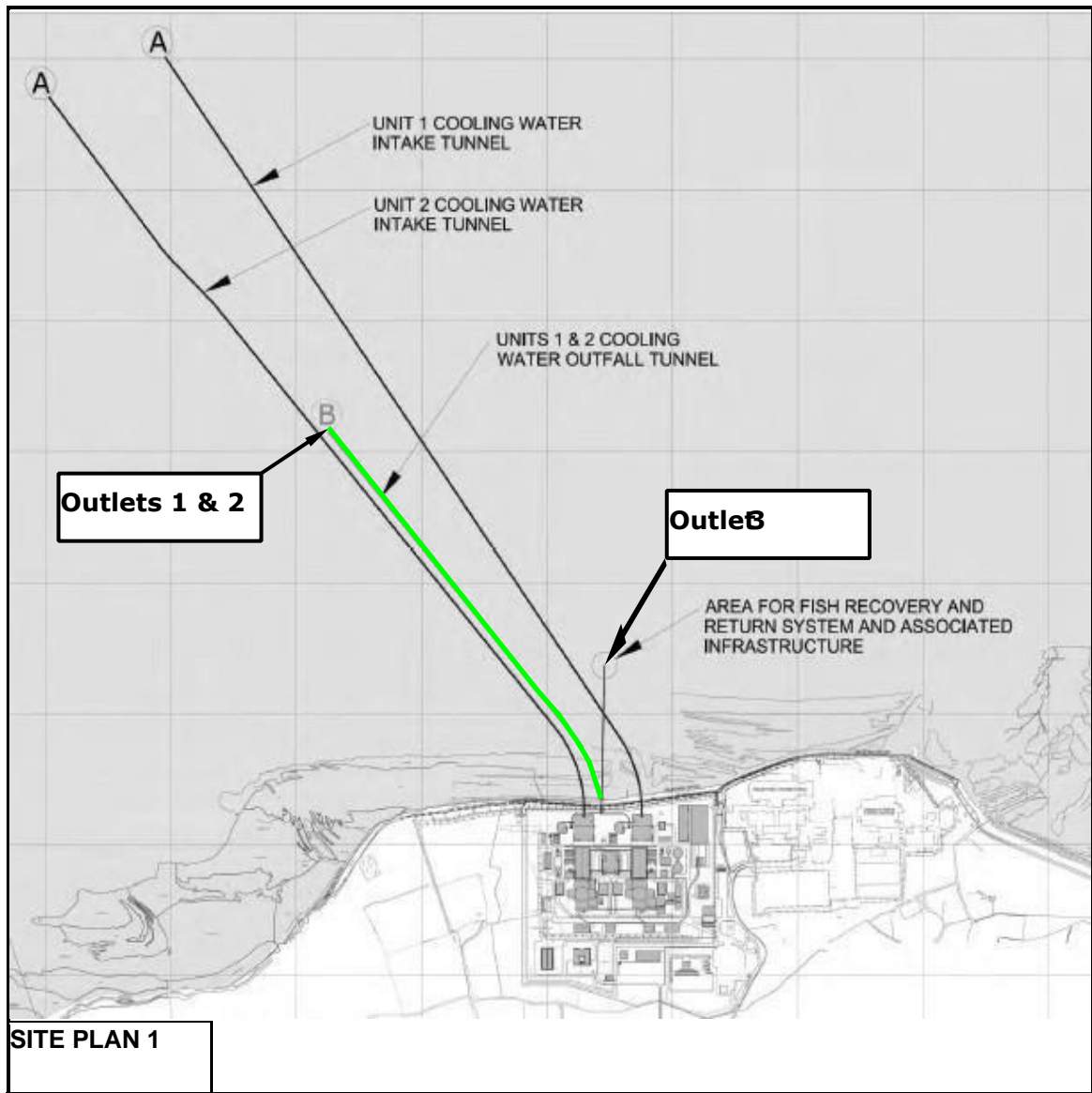
"emissions of substances not controlled by emission limits" means emissions of substances to air, water or land from the activities, either from the emission points specified in schedule 3 or from other localised or diffuse sources, which are not controlled by an emission limit.

"groundwater" means all water, which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

"MCERTS" means the Environment Agency's Monitoring Certification Scheme.

"quarter" means a calendar year quarter commencing on 1 January, 1 April, 1 July or 1 October. "year" means calendar year ending 31 December.

Schedule 7 – Site plans



KEY to buildings and structures

14 - Effluent tanks (waste streams B, C & D)

16 - Turbine Halls (waste stream A)

22 - Hydrazine and ammonia storage

25 - Cooling water pumphouses

26 - Cooling water forebays

27 - Outfall ponds (all waste streams)

30 - Attenuation pond (waste stream E)

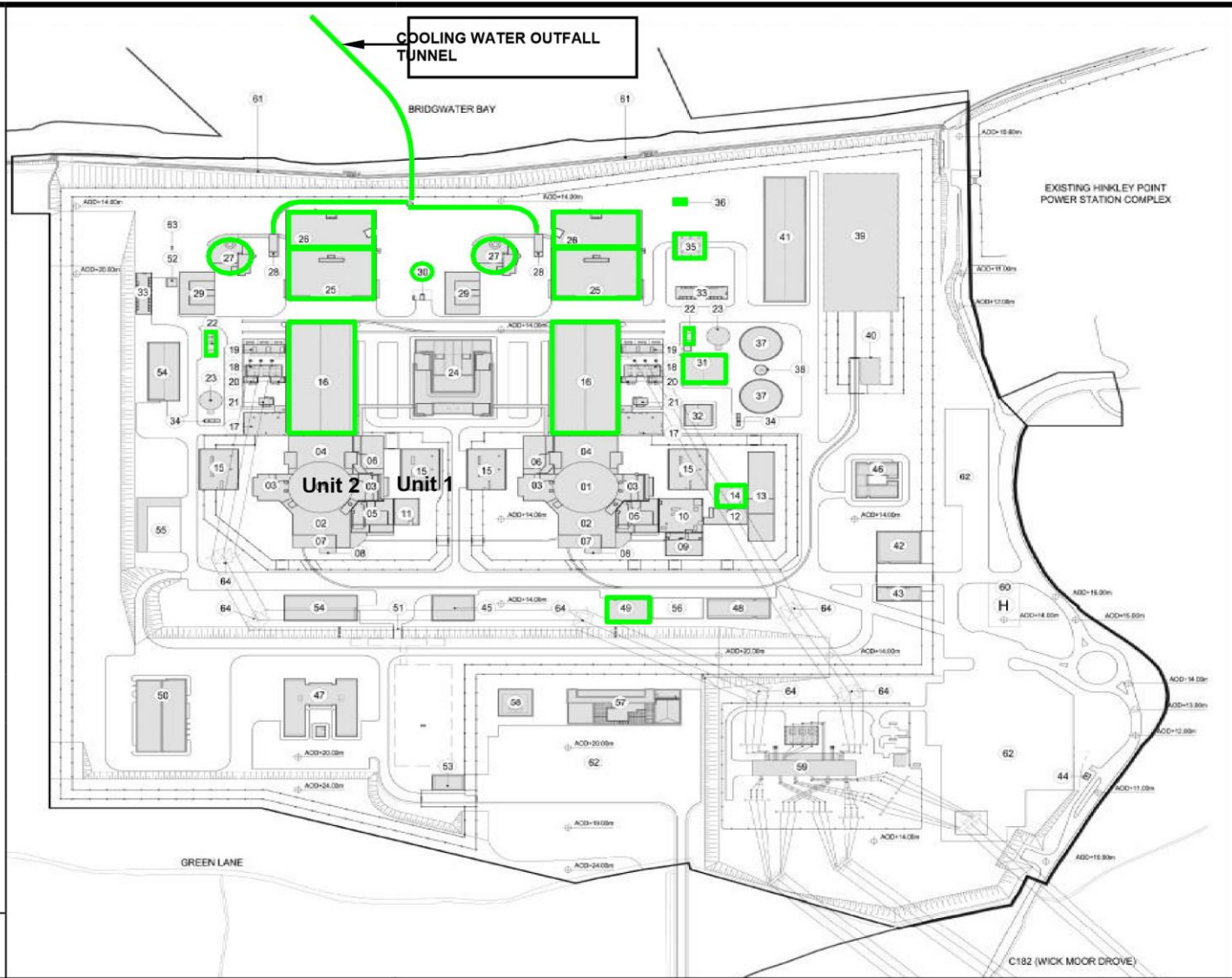
31 - Demineralisation station (waste stream F)

35 - Chemicals storage

36 - Sewage treatment plant (waste stream G)

49 - Oil & grease storage and oil ancillary building

SITE PLAN 2



END OF PERMIT.

APPENDIX 4**Documents**

Inquiry Documents (those submitted during the Inquiry, cross-referenced with the Core Documents below).

ID1	CD6.23	Appellant’s opening statement
ID2	CD6.24	Environment Agency’s opening statement & legal submissions
ID3	CD6.25	SEI’s opening statement
ID4	CD10.5	Ms Attwater’s written representation to the Inquiry
ID5	CD10.6	D&S IFCA’s written representation to the Inquiry
ID6	CD10.7	Mr Bunt’s written representation to the Inquiry
ID7	CD6.6c	The Agency Agreement to intercept ratio of 1
ID8	CD10.8	Dr Naylor’s written representation to the Inquiry
ID9	CD10.9	Fish Guidance System’s written representation to the Inquiry
ID10	CD10.10	Dr Turnpenny’s written representation to the Inquiry
ID11	CD15.9	The Agency Response to Dr Jennings’ note on simulation of Atlantic Salmon EAVs
ID12	CD6.26	Comparison of EA/Cefas values
ID13	CD6.11d	Appellant’s technical note, response to ID7
ID14	CD9.121	Bryhn et al (2013) Biomass and number of fish impinged at a nuclear power plant
ID15	CD10.11	Letter to Fish Guidance Systems – Herbert Smith Freehills 14 April 2021
ID16	CD10.12	Letter from Fish Guidance Systems – Response to NNB queries
ID17	CD15.10	Assessor’s report on the Thames basin heaths SPA and the DDP
ID18	CD6.11e	Dr O'Donnell's note on HPB Defuelling
ID19	CD12.36	SEI and Devon & Severn IFCA submissions - Draft Marine Plan
ID20	CD14.8	Natural England view on the Agency’s legal submissions
ID21	CD14.9	Natural England view on fish assemblage and Ramsar site
ID22	CD14.10	Natural Resources Wales view on fish assemblage and Ramsar site
ID23	CD13.2a	Opinion of Advocate General Sharpston re Case C-25811 (CD13.2)
ID24	CD13.22	Regina (Mynydd y Gwynt Ltd) v Secretary of State for BEIS [1274 – 2018]
ID25	CD13.23	Friends of the earth application for judicial review [Lough Neagh – 2017]
ID26	CD6.28	Closing Submissions on behalf of the Appellant
ID27	CD6.27	Closing Submissions on behalf of the Environment Agency
ID28	CD6.29	Closing Submissions on behalf of the Severn Estuary Interests

Core Document List: 24 June 2021

To reach overarching folder containing all Core Documents follow hyperlink: <https://ea.sharefile.com/d-sa7a70bbe9bf2420ba7866087a3092b26>

Section 1 – Variation Application Documents		Hyperlink
CD1.1	Consultation Overview Document (April 2019)	https://ea.sharefile.com/d-s7865479c269542b1a4d300ce5f3e6012
CD1.2	Application for Variation – Application Forms (14 February 2019)	https://ea.sharefile.com/d-sc4c2a72f6c9e4fbe8ba39ebe4b78d095
CD1.3	Application Supporting Information: Document setting out the Applicant’s Case for Removal of the Requirement to Install an Acoustic Fish Deterrent (NNB-308-REP-000721) (13 February 2019)	https://ea.sharefile.com/d-sa2ed080f100b4bb4b1eef91e1daeb1ec
CD1.4	Application Supporting Information: Justification and Supporting Evidence Report (Appendix A to the Case for Removal) (13 February 2019)	https://ea.sharefile.com/d-s3fb9621d8ef7437797e0ceaaf96e17f2
CD1.5	Application Supporting Information: Summary of the Engineering Optioneering Process (11 February 2019)	https://ea.sharefile.com/d-sfef07c728cf34c41b6e91f51eaad029d
CD1.6	Application Supporting Information: Bureau Veritas Acoustic Fish Deterrent Health and Safety Review (“Bureau Veritas Report”, appended to AFD Optioneering Report)	https://ea.sharefile.com/d-s9b089dfea5c04981985c191d9a51b918
CD1.7	Application Supporting Information: Updated Water Framework Directive Compliance Assessment (13 February 2019)	https://ea.sharefile.com/d-sdbaf3849504448cabc812d18b0f73db1
CD1.8	Hinkley Point C Cooling Water Infrastructure Fish Protection Measures: Report to Discharge DCO requirement CW1 and Marine Licence Condition 5.2.31 (March 2016)	https://ea.sharefile.com/d-sb76a812b43b24b93a98dedae27f8fef3
CD1.9	Application Supporting Information: Updated Report to Inform the Habitats Regulations Assessment (11 February 2019)	https://ea.sharefile.com/d-s7a1f8f1b88664b708e10ca5aa31ddadb
CD1.10	Application Supporting Information: Report on the Implications for Compliance with the Eels Regulations (13 February 2019)	https://ea.sharefile.com/d-s2ed166ab5f7e40d8a638c4524eb64fa0
CD1.11	Application Supporting Information: Additional Item 1 Cefas Revised Predictions of Impingement Effects at Hinkley Point C 2019 (also known as TR456 (Ed 2, version 10). (Published 4 April 2019, issued to the Agency on 11 April 2019)	https://ea.sharefile.com/d-sa7f5fd7e1ca44aafb6a6a98c90528b0e

CD1.12	Application Supporting Information: Additional Item 2 BEEMS Scientific Position Paper SPP071/S Shad (Alosa fallax and Alosa alosa) impingement predictions for HPC (22 February 2019) (Issued to the Agency 3 April 2019)	https://ea.sharefile.com/d-se4798b3c26ac4afda3e799e3138eec26
CD1.13	Application Supporting Information: Additional Item 3 Numerical & Physical Modelling of Flows at Intake Heads (TN10) (May 2013) (Issued to the Agency 7 March 2019)	https://ea.sharefile.com/d-sfbd3e5635b8b4a90860f59239bf3a33e
CD1.14	Application Supporting Information: Additional Item 4 Particle Tracking Study of Impinged Sprat from the Proposed Hinkley Point C Fish Recovery and Return (TR479) (20 March 2019) (Issued to the Agency 03 April 2019)	https://ea.sharefile.com/d-sd87f19a9d2354472932a6b5dc395dc6a
CD1.15	Application Supporting Information: Additional Item 5 The effect of not fitting an AFD system at HPC on the operation of the HPC FRR systems (TR493) (28 June 2019) (Issued to the Agency 28 June 2019)	https://ea.sharefile.com/d-sc73b577ab35544d59723b2a9ef6ef38d
CD1.16	Application Supporting Information: Additional Item 6 Hinkley Point C: Water quality effects of the fish recovery and return system (TR515) (21 April 2020)	https://ea.sharefile.com/d-sebaa6ded0f464c85a29e15b8d50e7c9c
Section 2 – Schedule 5 Notices and Responses		
CD2.1	Notice served by the Agency (Aaron Miller) under Schedule 5 - request for further information – (16 April 2019)	https://ea.sharefile.com/d-s05ceaf910d2948b29be4f83c147ca505
CD2.2	Letter from Aaron Miller enclosing request for further information (16 April 2019)	https://ea.sharefile.com/d-s2f92744b0ca147c8b936768a78a8cc66
CD2.3	Appellant response to the Agency notice dated 16 April 2019 (enclosing TR493 – CD Ref: 1.15)	https://ea.sharefile.com/d-s01935997fbd34e04816e138ca2e0a51b
CD2.4	Notice served by the Agency (Aaron Miller) under Schedule 5 – request for further information (7 October 2019)	https://ea.sharefile.com/share/view/s1adb8a5e25034ab3a32212d45419096f
CD2.5	Letter from Aaron Miller enclosing request for further information - 7 October 2019	https://ea.sharefile.com/d-s2ada1d2dfb124f748baad0ea3e6bf934

CD2.6	Appellant response to the Agency notice dated 7 October 2019 on 16 January 2020 (enclosing TR515 version 1) and 21 April 2020 (enclosing TR515 version 2 – CD Ref: 1.16)	https://ea.sharefile.com/d-sc35392c142d2418a9d7e163f9302d7a2
Section 3 – Notice of Deemed Refusal		
CD3.1	Appellant’s notice under Schedule 5, Part 1, paragraph 15(1) of the Environmental Permitting (England and Wales) Regulations (notice of deemed refusal) (4 August 2020)	https://ea.sharefile.com/d-sca347c89f53e4fb1b937ff1c3acacf3f
Section 4 – the Agency’s 2020 Appropriate Assessment		
CD4.1	Environment Agency’s Appropriate Assessment in respect of the Variation Application (final) (13 November 2020)	https://ea.sharefile.com/d-s3ca03dcf62e34305a368cd5e85a25df0
Section 5 – Documents relating to Original DCO/Marine Licence/Environmental Permit		
CD5.1	Development Consent Order for Hinkley Point C (18 March 2013)	https://ea.sharefile.com/d-sdb379bf05d7d4707a4d7b60c6a7c0870
CD5.2	Marine Licence for Hinkley Point C (7 June 2013)	https://ea.sharefile.com/d-s0bcf7bd2f3d4443abe9e6d6c1e31519e
CD5.3	Environment Agency Appropriate Assessment for 2013 Permissions (July 2012)	https://ea.sharefile.com/d-sea6e20c6b8354cb380f1a4af06e3d86e
CD5.4	2013 WDA Permit – The Agency Decision Document accompanying Environmental Permit	https://ea.sharefile.com/d-s9d687d1f662745388dd72cdb5d2a9309
CD5.5	Water Discharge Activity Environmental Permit (Permit No: EPR/HP3228XT) (13 March 2013)	https://ea.sharefile.com/d-sd43129d194fc40b9833c43c6361c322e
CD5.6	Hinkley Point C Cooling Water Infrastructure Fish Protection Measures: Report to Discharge DCO requirement CW1 and Marine Licence Condition 5.2.31 (May 2017)	https://ea.sharefile.com/d-s49a246a3e78c4fc7bd6adb71a62bf11e
CD5.7	Discussion Paper Concerning the HPC Proposed Cooling Water System and Fish Impingement – Issued 7 June 2012	https://ea.sharefile.com/d-s3ffe26b95a6b44e3a956dae21fd72322
CD5.8	Secretary of State’s HRA report for Original DCO (March 2013)	https://ea.sharefile.com/d-s20810a2f7043426684928d0990c6739c
Section 6 – Inquiry Documents		

CD6.1	Appellant’s Statement of Case	https://ea.sharefile.com/d-s0400e39411c84c9783ee81382722568b
CD6.2	The Agency’s Statement of Case	https://ea.sharefile.com/d-sbd7c81250d634bc79fb57338a59a7b49
CD6.3	Appellant’s Response to the Agency Statement of Case	https://ea.sharefile.com/d-sb67df38e50f0458a815485c010fa8243
CD6.4	Rule 6 Party – Severn Estuary Interests – Statement of Case	https://ea.sharefile.com/d-sb366ebc38c6b4b1c8e6ff5e9521067b4
CD6.5	Statement of Common Ground + Appendix 1	https://ea.sharefile.com/d-s3c09940e95774518b9d68ad6f267a8f0
CD6.5a	Addendum to Statement of Common Ground – Permit conditions – 25.5.21	https://ea.sharefile.com/d-s745a0eaa30c649aaa2aca5463eef25a1
CD6.5b	Addendum to Statement of Common Ground – Glossary – 25.5.21	https://ea.sharefile.com/d-sfa5d8c65bc70411a85bf4f2a1acf420b
CD6.5c	Letter to Inspector on behalf of SEI - SoCG representations 14.05.21	https://ea.sharefile.com/d-sc31b8fe2f9b54d1e9aca8e082c12b5ca
CD6.5d	Annex to SEI SoCG letter - Conditions	https://ea.sharefile.com/d-s6240fb14bbdf4f74929d5f0bd0623013
CD6.6	Proof of evidence of witness Karen Edwards (Overview and LVSE Intakes)	https://ea.sharefile.com/d-s7e2baed33a0848e6879cf108cdc11783
CD6.6a	Correction to intercept area for HPB intake – 04.06.21	https://ea.sharefile.com/d-s2a38a5c0a4344e958b7e501aecbb2357
CD6.6b	CORRECTED TB006 – Supporting Calculations – Draft-05 – 04.06.21	https://ea.sharefile.com/d-s92ed53e7ead5420688aec6b1b9feb878
CD6.6c	ID 7 - Agreement to a intercept area ratio of 1 – EA 080621	https://ea.sharefile.com/d-s63f6277b9d554196a4816c9d887b10bc
CD6.7	Proof of evidence of witness Jerome Masters (EAVs)	https://ea.sharefile.com/d-sb94cddcf621c46b9ab81cb2f5f8c89ac
CD6.8	Proof of evidence of witness Adam Waugh (Scale of Assessment and the Fish Assemblage)	https://ea.sharefile.com/d-s65a5895fee974dbca4c13cb950a6e28f

CD6.9	Proof of evidence of witness Charles Crundwell (Shad Assessment)	https://ea.sharefile.com/d-s43f32e5eb12643aaaa452a4392bb9c92
CD6.10	Proof of evidence of witness Jerome Masters (Salmon Assessment)	https://ea.sharefile.com/d-s84c3a6e7d8844246b169ea49b33d388b
CD6.11	Proof of evidence of Manus O'Donnell (Overview and Background)	https://ea.sharefile.com/d-sac2d10d805c34217bf3d8597166682e0
<i>Appendices to Proof of evidence of Dr Manus O'Donnell</i>		
CD6.11a	Appendices index	https://ea.sharefile.com/d-sffa5e5b488a64dbb9f6244087bf36221
CD6.11b	Appendix 1 – Letter from Brian Allen	https://ea.sharefile.com/d-s9814e0f5800546b78be21f8bd2997bd4
CD6.11c	Appendix 2 - Figures	https://ea.sharefile.com/d-s19d9a4e888bd4196b4e97955e35b7ca7
CD6.11d	ID 13 – Appellant note for submission – Technical note to respond to CD 6.6c – 11 June 2021	https://ea.sharefile.com/d-s094f04dbfe7649c190ab4cceb7de0c9b
CD6.11e	ID 18 - Dr O'Donnell's note on HPB Defuelling - 16 June 2021	https://ea.sharefile.com/d-s3bb8de42473341fc8597632ea8ee2505
CD6.12	Proof of evidence of Simon Jennings (Entrapment and Fish Populations)	https://ea.sharefile.com/d-sa19a55d9c0d241fb85c01f77f39c55ac
<i>Appendices to Proof of evidence of Simon Jennings:</i>		
CD6.12a	Appendices index	https://ea.sharefile.com/d-sbdc5c45862be44f6bda678fad7c140a8
CD6.12b	Appendix A - Equivalent Adult Value	https://ea.sharefile.com/d-s43cc1866b0c54e3da9dff60998aa6bf1
CD6.12c	Appendix B - Aspects of fish population biology that influence entrapment effects	https://ea.sharefile.com/d-s3eab544003c542a3b9f5cb0f7b3aff99
CD6.12d	Appendix C - Stock assessment and the role of the International Council for the Exploration of the Sea (ICES)	https://ea.sharefile.com/d-s07e13eb8bb264cd4a665be831b400ee9
CD6.12e	Appendix D - CIMP and RIMP data sources	https://ea.sharefile.com/d-s3790e73f2e7c4e94aabec292bc0ab598
CD6.12f	Appendix E - Biology of relevant species	https://ea.sharefile.com/d-s311eef0a189a4e65b4f5243233691bfa

CD6.12g	Appendix F - Application of stock assessment	https://ea.sharefile.com/d-s37450741fe0647eabf4ed8121a2b4421
CD6.12h	Appendix G - Calculation of Cefas EAV estimates	https://ea.sharefile.com/d-s20324323d11b420790c8623f465b63fa
CD6.12i	Appendix H - Relationships between population abundance and RIMP survey numbers	https://ea.sharefile.com/d-sabd9ca466a724ab1a2348b892ed0a4b0
CD6.12j	Appendix I - Comparison of the Agency's and the Appellant's interpretation of the Agency's Quantitative Impact Assessment model	https://ea.sharefile.com/d-s9db23881705f41b5bfc45aff7b6b5295
CD6.12k	Appendix J - Comparisons of Cefas and The Agency data, parameters and outputs	https://ea.sharefile.com/d-se2fc9f24686c462281b7c13127b70efb
CD6.12l	Appendix K - Species populations listed in third party representations	https://ea.sharefile.com/d-sdfa77c30656541609733f6a855780204
CD6.12m	Note on Salmon EAV calculations – 04.06.21	https://ea.sharefile.com/d-s12bdc49f4ff04f66a1314ebec4506507
CD6.13	Proof of evidence of Tim Goodwin (Ecology, SAC, SPA, Ramsar, effects on integrity)	https://ea.sharefile.com/d-s17ddee37406347d58eebd9dc13e9ec8f
<i>Appendices to Proof of evidence of Tim Goodwin:</i>		
CD6.13a	Appendices index	https://ea.sharefile.com/d-sa178c42cec3145279c273891dad58998
CD6.13b	PLAN ECO1 - Relationship between the Appeal Site and relevant designated sites	https://ea.sharefile.com/d-s6653c5a0b8f3402d9b888e0633e2bf1e
CD6.13c	Annex 1 - Key Legislation, Case Law and Associated Guidance	https://ea.sharefile.com/d-s903d896683af48f69052f3759896444d
CD6.13d	Annex 2 - Conservation Objectives of the relevant designated sites	https://ea.sharefile.com/d-s4f1a560d01e842acb8b2fb67259624fd
CD6.13e	Annex 3 - Discussion on assessing favourable condition in relation to qualifying interest features	https://ea.sharefile.com/d-scd265a41974d479aa29dd9db320b94ed
CD6.13f	Annex 4 - Information downloaded from MAGIC and Lle Geo-Portal regarding relevant designated site locations	https://ea.sharefile.com/d-s750e97b1cb344902884fb22bee5abe38
CD6.13g	Annex 5 - Relevant Natura 2000 Data Forms and Citations (where available)	https://ea.sharefile.com/d-s50e90ea1ff414d53b8fef57457005f4f

CD6.13h	Annex 6 - Copy of Severn Estuary EMS Regulation 33 Advice	https://ea.sharefile.com/d-s0e65e6c50da542d49898b2a1a5532c4c
CD6.13i	Annex 7 - Extracts from the DCO HRA submitted by the Appellant	https://ea.sharefile.com/d-sc086f348be8f4efdbfd343b207adf597
CD6.14	Proof of evidence of witness Steve Colclough (Ecological impacts, up to date assessments and uncertainties)	https://ea.sharefile.com/d-se11db8b97edf41ac9249200db78d34d5
<i>Appendices to Proof of evidence of Steve Colclough:</i>		
CD6.14a	SEI 19 – Original DCO ES Marine Ecology Chapter	https://ea.sharefile.com/d-seac5dfedcf8d4f44ba4ec1dcddef225c
CD6.14b	SEI 20 – Colclough (2013) Fish ecology in estuaries SC2 final 15113	https://ea.sharefile.com/d-s41d896e2f8fa4bc3ae6cbbf884221fe1
CD6.14c	SEI 21 – Colclough (2018) Saltmarsh and Fish - A UK Perspective SRC 1718	https://ea.sharefile.com/d-sf7523088b6d64a74af49ee82ab979dc6
CD6.14d	SEI 22 – Colclough et al. (2000) A fish population survey of the tidal Thames 1994-1996	https://ea.sharefile.com/d-sb1929e66271646f4b68a9319225f556b
CD6.14e	SEI 23 – Colclough et al. (2002) Fish and fisheries in the Tidal Thames	https://ea.sharefile.com/d-s9c51eb2cbef141958e7f9d3dafd91e0e
CD6.14f	SEI 24 - Laffaille et al (2000) Composition of Fish Communities in a European Macrotidal Salt Marsh	https://ea.sharefile.com/d-s5107fb753fcc4058b546d164b75dacd3
CD6.14g	SEI 25 - Colclough (2005) Fish Utilisation of managed realignments	https://ea.sharefile.com/d-s47fde5bbd51d489f9fa7bf1f9c225231
CD6.14h	SEI 26 - Able (2005) A re-examination of fish estuarine dependence	https://ea.sharefile.com/d-s22f2c531e45a47b3b303ae78d6394daf
CD6.14i	SEI 27 - Becker (2016) Fish Movement Through an Estuary Mouth Is Related to Tidal Flow	https://ea.sharefile.com/d-s8a459ce9fd2d423599e5c1d10406b33d
CD6.14j	SEI 28 - Henderson & Henderson (2017) Population regulation in a changing environment: Long-term changes in growth, condition and survival of sprat, <i>Sprattus sprattus</i> L. in the Bristol Channel, UK. <i>[same document as CD 9.113]</i>	https://ea.sharefile.com/d-s1d7c0456957b49e5a40137d4d88cbf81
CD6.14k	SEI 29 – Henderson (2019) A long-term study of whiting, <i>Merlangius merlangus</i> (L) recruitment and population regulation in the Severn Estuary, UK.	https://ea.sharefile.com/d-s9c3f3d54693c4ee3b747db4cad718f48

CD6.14l	SEI 30 – Seaby (2020) Nuclear power station cooling waters : protecting biota. The Agency Evidence Report [<i>same document as CD 9.23</i>]	https://ea.sharefile.com/d-se692ae5c061244c197e24189d098aae9
CD6.14m	SEI 31 - Colclough (2021) Sturgeon in Great Britain An Evidence Report	https://ea.sharefile.com/d-s26846d2ebf9040a19182408c5959926f
CD6.14n	SEI 32 - Colclough (2021) The Case for Compensatory Measures associated with HPC (28 April 2021)	https://ea.sharefile.com/d-sf2b9c59f084e4ec2865fb20dfa83dde7
CD6.15	Rebuttal Proof of Evidence of Karen Edwards	https://ea.sharefile.com/d-sc57c1045db744a3196fac54fe704aea9
CD6.16	Rebuttal Proof of Evidence of Jerome Masters	https://ea.sharefile.com/d-se6ad9d6669084fd1ad88376cc9d01d30
CD6.17	Rebuttal Proof of Evidence of Adam Waugh	https://ea.sharefile.com/d-s6549ea97ee79480c9ac4dfbdfe4fa01b
CD6.18	Rebuttal Proof of Evidence of Charles Crundwell	https://ea.sharefile.com/d-s2d79e0d92ef0455dbad9635db4991262
CD6.19	Rebuttal Proof of Evidence of Simon Jennings	https://ea.sharefile.com/d-se7167ce2cd7040fab807c5d65fe76498
CD6.19a	Correction To Twaite Shad EAV Factor – 03.06.21	https://ea.sharefile.com/d-sd6c1cbff74854e84823d2d6ad9fa8a72
CD6.19b	Corrected Twaite Shad EAV Calculations – 02.96.21	https://ea.sharefile.com/d-s44c020afd7b8403b89e2610129e700fe
CD6.20	Rebuttal Proof of Evidence of Manus O’Donnell	https://ea.sharefile.com/d-s06b8e5aaad2e47bd81054039e7fa2c47
CD6.21	Agreed Legal Principles – 25.5.21	https://ea.sharefile.com/d-sab94a490a0034b9f817aa31a2f93b343
CD6.22	SEI Legal Principles – Water Framework Directive – 01.06.21	https://ea.sharefile.com/d-sf0874672a2d44f7fb39b5f993591f637
CD6.23	ID 1 – Appellant’s opening statement	https://ea.sharefile.com/d-s609f678f7f02432a8605c919fb4f0628
CD6.24	ID 2 – Environment Agency’s opening statement & legal submissions	https://ea.sharefile.com/d-s5f1d5f9b3c7e404cadf31fb2a0499051

CD6.25	ID 3 – SEI’s opening statement	https://ea.sharefile.com/d-s4b341d856e864af584712e4303a70156
CD6.26	ID 12 – Comparison of EA and Cefas values – 10.06.21	https://ea.sharefile.com/d-s1bddf0c2d1ae4198b871d95bc5643352
CD6.27	ID 27 - Closing Submissions on behalf of the Environment Agency – 24.06.21	https://ea.sharefile.com/d-s0833aa4c32d44ca5a5975c5f5639d1e1
CD6.28	ID 26 - Closing Submissions on behalf of the Appellant – 24.06.21	https://ea.sharefile.com/d-scc732095710e4c3d9613abcfce801e2d
CD6.29	ID 28 - Closing Submissions on behalf of SEI – 24.06.21	https://ea.sharefile.com/d-secd70011202e410d8125819931980f1a
Section 7 – Technical Reports issued by Appellant		
CD7.1	TR129; Hinkley Point- Comprehensive Impingement Monitoring Programme 2009-10, Final Report	https://ea.sharefile.com/d-s263a28a864b94a02a6e07fb33696c8f8
CD7.2	TR148 (Ed 2) Hinkley Point- A synthesis of impingement and entrainment predictions for NNB at Hinkley Point (Rev 5) (10 May 2012)	https://ea.sharefile.com/d-sfdd9d4cd36fd4b8bbf4d753f7aac49a3
CD7.3	TR274 -Dynamics of glass eels in the Bristol Channel 2012-2013 (Rev 3) (30 June 2014)	https://ea.sharefile.com/d-s2024f03e28774d9a8abe6ad6618dcaa5
CD7.4	TR383 – Sizewell C EAV calculations Metrics paper (Rev 2) (3 August 2020)	https://ea.sharefile.com/d-s3625845a52c14c899ebe784c96fc2c50
CD7.5	TR426- Hinkley Point- Equivalent Adult Value (EAV) metrics (Rev 3) (29 November 2017)	https://ea.sharefile.com/d-s8727b3a0c4784af0b294b8a91d912e74
CD7.6	~ DOCUMENT REMOVED DUE TO DUPLICATION WITH CD 7.4 ~	
CD7.7	SPP082 - The Potential for fish impingement on HPC trash racks (17 November 2015)	https://ea.sharefile.com/d-s8c57d2ba12be4acdba42fe7aab330885
CD7.8	SPP102 - Use of Spawning Production Foregone EAVs for impingement assessment (Rev 2) (30 April 2020)	https://ea.sharefile.com/d-sece0357707fa4e4d965cc5b92fa56b80
CD7.9	SPP106 – HPC assessment of local effects on fish assemblage (Rev 3) (20 July 2020)	https://ea.sharefile.com/d-s2a0ae48393f244baa37401ddf8faf2be
CD7.10	SPP107 – Worst Case Glass Eel Entrainment for HPC (Rev 3) (26 April 2021)	https://ea.sharefile.com/d-s2cb82622898c43d8a380e5f4660e9ca9

CD7.11	SPP112 - Hinkley Point C impingement predictions corrected for Hinkley Point B raising factors and cooling water flow rates (Rev 2) (30 March 2021)	https://ea.sharefile.com/d-sca3ace5cf0184bd7a206ce2770f835e2
CD7.12	TR117 – Assessment of Effect of CW Intake Velocity on Fish Entrapment Risk at Hinkley Point (31 December 2010)	https://ea.sharefile.com/d-s1d37af76e19d486bb4e5d37f8ba97a30
CD7.13	TR197 – Modelling of the optimal position of a fish recovery and return system for Hinkley Point C (22 September 2011)	https://ea.sharefile.com/d-s6bea69b7243a405a9c6c76cefec7ad9d
CD7.14	TR267 – Hinkley Point: GETM Plume Model - Version 2 - Model Setup and Validation (31 March 2015)	https://ea.sharefile.com/d-sd8f745fe1262460f98edd9d30af2af8e
CD7.15	SPP105 – Predicted performance of the HPC LVSE intake heads compared with the HPB intake (Rev 1) (06 July 2020)	https://ea.sharefile.com/d-sc30314482c9348078eef0549e388c4b8
CD7.16	TR147 - CIMP II (2010) at HPB Quarterly Report	https://ea.sharefile.com/d-s689aeac2ba7f4a4d9110554f90dd197f
CD7.17	TR102 – GETM Modelling of Thermal Plume Dispersion Stage 1	https://ea.sharefile.com/d-s7718da5b181e46d9948ed07b2f313f0b
CD7.18	SPP105 supporting calculations – LVSE supplemental calculations 5 May 2020	https://ea.sharefile.com/d-sf49cab4244134aedada0891c862a2179
CD7.19	SPP105 supporting calculations – HPB intake velocities 2-5m from bed v2.	https://ea.sharefile.com/d-s60a36f2f1f1841b382cd562a3c174c38
CD7.20	SPP105 supporting calculations – HPB intake velocities 2-5m from bed v5.	https://ea.sharefile.com/d-s20636d2d90ea4ceda6814bf5879b3bf3
CD7.21	TR442 – HPC Acoustic Fish Deterrent Review (15 November 2017)	https://ea.sharefile.com/d-s2f448a4e9ee1486ca14bcaedcad55da6
CD7.22	TR083 - Hinkley Point Nearshore Communities - Results of the 2m Beam Trawl and Plankton Surveys 2008–2010	https://ea.sharefile.com/d-s74ac51574bb247988718615c88dbb568
CD7.23	TR083a - Hinkley Point Nearshore Communities - Plankton Surveys 2010	https://ea.sharefile.com/d-scfc0ab9db8c04066b63cbb2a49bf30d1
Section 8 - Technical Reports issued by the EA		
CD8.1	TB001 - Vertical Audit - Draft-03 (2019)	https://ea.sharefile.com/d-s0ce99498ea1a4c7a92fdcc98ccb5b0c2

CD8.2	TB004 - Accounting for entrainment losses and difference in drum screen size. Draft-02 (2020)	https://ea.sharefile.com/d-sf85bf2d26aee4039a56ad9afffa398fb
CD8.3	TB005 - Ebb tide sampling bias at HPB - Draft-02	https://ea.sharefile.com/d-sd0d915aa18044035acc8b47953b6f939
CD8.4	TB006 - Low Velocity Side Entry Intake Design; effect of intake intercept area. Draft-04 (2020)	https://ea.sharefile.com/d-s72f137a9ea984febae6e098aa2182bed
CD8.5	TB007 - Low Velocity Side Entry Intake Design; effect of intake velocity cap. Draft- 03 (2020)	https://ea.sharefile.com/d-sc505840cfca84b7c95bc2fe9da9b06a7
CD8.6	TB008 – FRR Morality Rates. Draft-04 (2020)	https://ea.sharefile.com/d-s61339f123dad4ed794643b4b4f6932b9
CD8.7	TB008 – Supporting Calculations	https://ea.sharefile.com/d-s6e94c7b03076448fa3f201c2e4c4d669
CD8.8	TB010 - Converting impingement and entrainment numbers to Equivalent Adult Values and Spawning Production Foregone. Draft-03 (2019)	https://ea.sharefile.com/d-sddce1f4520fc4dd5931b0888b4ed54fe
CD8.9	TB010 - Converting impingement and entrainment numbers to Equivalent Adult Values and Spawning Production Foregone. Draft-06 (2020)	https://ea.sharefile.com/d-s35ddffd9bdf54c6ab410a3e80d5c4068
CD8.10	TB011 - Scale of assessment areas for marine fishes and assessment method comparing Sprat losses with Spawning Stock Biomass. Draft-04. (2020)	https://ea.sharefile.com/d-se9ddfc7416d34332af84c2b734ae572f
CD8.11	TB012 - Predicting adult sea trout populations in the Severn Estuary. Draft-03 (2020)	https://ea.sharefile.com/d-s4825c0028dc44e6885f2e2d9139f1d1a
CD8.12	TB013 – Uncertainty Analysis Report – Draft-04 (2020)	https://ea.sharefile.com/d-se7dc8f08ebb54c49b4ab4ac7c6bf8a44
CD8.13	TB013 - HPC Entrapment Predictions – Uncertainty Analysis Report. Draft-06 (2020)	https://ea.sharefile.com/d-se9d7c16c926845a5af580999e8a8918a
CD8.14	TB015 - Review of adult run size estimates for river lamprey and sea lamprey in the Severn Estuary, River Wye and River Usk. Draft-02 (2020)	https://ea.sharefile.com/d-s6e1641c95068450d958ce2845c7b020b
CD8.15	TB016 - Review of adult run size estimates for Twaite shad and Allis	https://ea.sharefile.com/d-s7879aa4c1e574f8b9085a3d656abb597

	shad in the Severn Estuary, River Wye and River Usk. Draft-06 (2020)	
CD8.16	TB017 - Review of adult run size estimates for Atlantic Salmon in the Severn Estuary, River Wye and River Usk. Draft-05 (2020)	https://ea.sharefile.com/d-s2436f643959e403d905c473c2e8de3c9
CD8.17	TB018 - Review of European (silver) Eel escapement biomass for the Severn Estuary. Draft-04 (2020)	https://ea.sharefile.com/d-sc3088905afa74707be09fc831cca2bc4
CD8.18	TB019 - Statistical Analysis of Routine Impingement Monitoring Programme Data. Draft-05 (2020)	https://ea.sharefile.com/d-s79d04ccce7f744deb2aac757cbdd2d90
CD8.19	TB020 - Summary Technical Brief: Summary of Quantitative Impact Assessment Results. Draft-03 (2020)	https://ea.sharefile.com/d-sbf23d8d541f44b31a31af5e690c00a33
CD8.20	TB020 - Summary Technical Brief: Summary of Quantitative Impact Assessment Results. Draft-06 (2020)	https://ea.sharefile.com/d-s0fddcf17bee944979c0ab7fecd0bb8eb
CD8.21	Quantitative Impact Assessment (QIA) Model flow diagram. Draft-05.	https://ea.sharefile.com/d-s9cd3e487b55c40af9cd20a75f6983d58
CD8.22	Environment Agency’s Response to SPP106	https://ea.sharefile.com/d-sbb23514278d8466fa9f285f35bac3289
CD8.23	Environment Agency’s Response to SPP107	https://ea.sharefile.com/d-s91e1d54f75904fa8927368fe6ef0cfb9
CD8.24	EA32 - Summary of HPC cooling water system impact results on fish species without AFD (November 2020)	https://ea.sharefile.com/d-s352b0c8029eb420fb9449ba4c75e59c2
CD8.25	Defra family feedback on the proposed removal of the AFD from the Hinkley Point C marine intake (Rev 2 – 2018)	https://ea.sharefile.com/d-sc84c8a60eae34a00bb95594e787902e8
CD8.26	TB000 - Overarching Technical Brief: Description of Quantitative Impact Assessment Process. Draft-04 (2020)	https://ea.sharefile.com/d-sae52300940604dfebcc3a41af6d26512
CD8.27	TB001 - Vertical Audit. Draft-04 (2020)	https://ea.sharefile.com/d-s3a5edb351b314fe9a78a3a42d83fec4b
CD8.28	TB003 - The relationship between number of fish impinged and abstraction volume for Power Stations cooling water intakes. Draft-02 (2020)	https://ea.sharefile.com/d-s35b2c04f5b704321970fae64754731dc
CD8.29	TB008 – FRR Morality Rates. Draft-06 (2021)	https://ea.sharefile.com/d-s06c506aed4c640ae819304ce2f09807e

CD8.30	FASD - Fish Assemblage Selection Definition Report - v3	https://ea.sharefile.com/d-s17c5f600e6b14aeda92fcec6389f4104
CD8.31	TB002 - Spawning and nursery periods of marine fish species – Draft-03 (2020)	https://ea.sharefile.com/d-s155a25177ef44a378efe3525ba3e862b
CD8.32	HPC Water Framework Directive Assessment – v1.7 DRAFT – 16.10.20	https://ea.sharefile.com/d-scd8d61cfe80844dea17ed65b73fbb590
CD8.33	FIAT – Atlantic salmon – v3	https://ea.sharefile.com/d-s67970590132f4140a31607c44a20fa92
Section 9 – Other Technical Reports and Evidence (including published scientific papers)		
CD9.1	The Agency Evidence Report – Protection of Biota from Cooling Water Intakes at Nuclear Power Stations: Scoping Study (August 2018)	https://ea.sharefile.com/d-sad999ba641e64451925359b2d8cf7300
CD9.2	Environment Agency/APEM Evidence Report "Nuclear power station cooling waters: evidence on 3 aspects" (April 2019)	https://ea.sharefile.com/d-s04f0927c25b54ac28b6033767b637c4e
CD9.3	Environment Agency Best Practice Guide for the Screening of Intakes and Outfalls. Turnpenny & O’Keefe (2005)	https://ea.sharefile.com/d-s4395de46e7d14ee489c8cfe8c999504e
CD9.4	Cooling Water Options for the New Generation of Nuclear Power Stations in the UK (2010)	https://ea.sharefile.com/d-s1c282aa86ca8433282efebb65efea663
CD9.5	Ellis et al. (2012) Spawning and nursery grounds of selected fish species in UK waters.	https://ea.sharefile.com/d-s78cffc95cfda47db9aecb2eb18db9715
CD9.6	Defra - Report to the European Commission in line with Article 9 of the Eel Regulation 1100/2007 Implementation of UK Eel Management Plans. (June 2018)	https://ea.sharefile.com/d-s8ea8b7eaf74c4501bed90dcf2b454cd0
CD9.7	Aprahamian & Wood (2021). Estimation of glass eel (<i>Anguilla anguilla</i>) exploitation in the Severn Estuary, England.	https://ea.sharefile.com/d-s06309d2f0aab42e6891a20dcaa541173
CD9.8	The Agency (2020). Salmonid and fisheries statistics for England and Wales 2019, published 28 July 2020.	https://ea.sharefile.com/d-sf79e9bba5e8f40f590b3521fc1b82504
CD9.9	SEI 15 – Blue Marine Foundation, European Sturgeon in the UK: A Summary (2021)	https://ea.sharefile.com/d-s8b8d71be75d54ef493d0ff5fa7bea978
CD9.10	SEI 16 – Blue Marine Foundation, Saving the UK's sturgeon: A project to restore populations of native sturgeon to the UK (2021)	https://ea.sharefile.com/d-s17a10c1816484fde96b131c1bcbe5510

CD9.11	SEI 18 – Defra, A Green Future: Our 25 Year Plan to Improve the Environment (2018)	https://ea.sharefile.com/d-sc12d0676fe8d43f1a550db8269ccd7f1
CD9.12	O’Neill et al (2018) The novel use of pop-off satellite tags (PSATs) to investigate the migratory behaviour of European sea bass <i>Dicentrarchus labrax</i> .	https://ea.sharefile.com/d-s92c793e78a834595a901915eaf314e51
CD9.13	ICES - 2020 - Cod (<i>Gadus morhua</i>) in divisions 7.e-k (western English Channel and southern Celtic Seas) (4 November 2020)	https://ea.sharefile.com/d-s13fe6e2a18fa4e1b9197858d5d7ca101
CD9.14	ICES - 2020 - Whiting (<i>Merlangius merlangus</i>) in divisions 7.b–c and 7.e–k (30 October 2020)	https://ea.sharefile.com/d-s7268ce5058144a03b72dfa3ca92cb1a9
CD9.15	ICES - 2020 - Sea bass (<i>Dicentrarchus labrax</i>) in divisions 4.b–c, 7.a, and 7.d–h (30 June 2020)	https://ea.sharefile.com/d-s3d12269113fb4335992cb0697ad851a3
CD9.16	Bendall et al. (2009) Spatio-temporal dynamics of Atlantic cod (<i>Gadus morhua</i>) in the Irish and Celtic Sea	https://ea.sharefile.com/d-s68b512f0dd354558928f014566b3065d
CD9.17	Cowx et al. (2017) Impact of catch and release angling practices on survival of salmon. The Agency Evidence Report.	https://ea.sharefile.com/d-s11e60c75e69141afa272e15a53bf4f8a
CD9.18	Taillebois et al (2020) Variable outcomes of hybridization between declining <i>Alosa alosa</i> and <i>Alosa fallax</i> .	https://ea.sharefile.com/d-sfd26c12f6b7648549909b1af57dfc6f5
CD9.19	Maitland and Lyle (2005) Ecology of Allis shad <i>Alosa alosa</i> and Twaite shad <i>Alosa fallax</i> in the Solway Firth, Scotland.	https://ea.sharefile.com/d-s83463b8e21974be3b16bebb647e03c40
CD9.20	ICES (2021). Working group for the Celtic seas ecoregion (WGCSE). ICES Scientific Reports, 2(40).	https://ea.sharefile.com/d-saea33fe1df284885a0402fbf95debde3
CD9.21	ICES (2018). Report of the Benchmark Workshop on Sea bass (WKBASS), 20–24 February 2017 and 21–23 February 2018.	https://ea.sharefile.com/d-sb1b6eee6bfba4cc2b8466f5029b16535
CD9.22	ICES (2020). Benchmark Workshop on Celtic Sea Stocks (WKCELTIC). ICES Scientific Reports.	https://ea.sharefile.com/d-scf843117f6d14c908503d85f62679089
CD9.23	Environment Agency - Nuclear power station cooling waters: protecting biota (April 2020)	https://ea.sharefile.com/d-s50389ed6f1f64d49a8c1dea5259d13a0
CD9.24	ICES. 2020. European eel (<i>Anguilla anguilla</i>) throughout its natural range. ICES Advice on fishing opportunities, catch, and effort: 1–5.	https://ea.sharefile.com/d-s5d478b2dd1534f828fbd984cd854da7a
CD9.25	OSPAR (2010) Background Document for European eel Biodiversity Series. 2-24 pp.	https://ea.sharefile.com/d-sdb334ea03baf49988b6fda51f5887e01

CD9.26	Wilson and Veneranta (2019) Data-limited diadromous species – review of European status. ICES Cooperative Research Report.	https://ea.sharefile.com/d-s34b2ece300ef4f828462e30b29002dcb
CD9.27	Bonhommeau et al. (2009) Estimates of the mortality and the duration of the trans-Atlantic migration of European eel	https://ea.sharefile.com/d-se3acd40ff6de47628d362fb60eca3b7b
CD9.28	Pinder et al. (2007) Evidence for an autumn downstream migration and the subsequent estuarine residence of 0+ year juvenile Atlantic salmon in England.	https://ea.sharefile.com/d-s78487275c172494894c603f5c52a305d
CD9.29	Riley et al. (2008) Physiological seawater adaptation in juvenile Atlantic salmon (<i>Salmo salar</i>) autumn migrants.	https://ea.sharefile.com/d-sbe3dafcbd9754e4c8bacd08a69a42b22
CD9.30	Cefas, the Agency & NRW (2019). Salmon stocks and fisheries in England and Wales in 2018	https://ea.sharefile.com/d-s2cc90f235494437d9a9eb2d388446d67
CD9.31	Swain (1982). The migrations of salmon (<i>Salmo salar</i> L.) from three rivers entering the Severn estuary.	https://ea.sharefile.com/d-s1b6c6d0bd921443da8a907e808d435bc
CD9.32	Hendry and Cragg-Hine, 2003. Ecology of the Atlantic Salmon, Peterborough: English Nature.	https://ea.sharefile.com/d-sf55b91c527cd4ee8ae408e55a8f8f863
CD9.33	Ó Maoiléidigh et al. (2018) Fifty years of marine tag recoveries from Atlantic salmon	https://ea.sharefile.com/d-s974b1c1542d64a0dbe7645e7996d0dce
CD9.34	Moore et al (1992) Estuarine behaviour of migrating Atlantic Salmon smolts	https://ea.sharefile.com/d-sab2a44802a3b4191a8e4ed978a10c981
CD9.35	Moore et al (1995) The migratory behaviour of wild Atlantic salmon (<i>Salmo salar</i> L.) smolts	https://ea.sharefile.com/d-s265af223877940f087709ca4c22c7b77
CD9.36	Davies et al. (2020) Novel insights into the marine phase and river fidelity of anadromous Twaite shad <i>Alosa fallax</i> in the UK and Ireland.	https://ea.sharefile.com/d-s0f514df0b0fd4872b21245357736facf
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CD9.95	Pawson et al. (2007) Migrations, fishery interactions and management units of sea bass	https://ea.sharefile.com/d-s7f8cc80ee544454f9379fa5970d9ba1d
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CD9.107	Stamp (2021) PhD The ecology and distribution of European bass in inshore and coastal waters of the UK	https://ea.sharefile.com/d-s8db9b409478c49b588be263989b1378d
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CD9.119	Beraud et al. (2018) The influence of oceanographic conditions and larval behaviour on settlement success – Sea bass	https://ea.sharefile.com/d-s60d14a9b413a44eb870dcd672ccc8820
CD9.120	CEFAS (2018) Presence of European sea bass and other species in proposed bass nursery areas	https://ea.sharefile.com/d-sc2093e5349ca45cf818cb9520acce60c
CD9.121	ID 14 - Bryhn et al (2013) Biomass and number of fish impinged at a nuclear power plant	https://ea.sharefile.com/d-s017a6f392ada4edd81af1c1db20cc01d
Section 10 – Third Party Representations		
CD10.1	SEI 6 - Devon and Severn Inshore Fisheries and Conservation Authority (IFCA) – Representation on NNB Generation Company (HPC) Ltd Environmental Permit Appeal (2020)	https://ea.sharefile.com/d-sa3836342fb384abe964debb626e10c21
CD10.2	SEI 7 – Dr Andy Turnpenny Review of Application to vary an existing Environmental Permit from NNB Generation Company (HPC) Limited at HPC	https://ea.sharefile.com/d-s537f402c1d4a43aa887cc765d8f55628
CD10.3	SEI 5 - Dr P A Henderson Comments on supporting information on impingement at Hinkley C variations application (2019)	https://ea.sharefile.com/d-s69d00a434b964141ae29063025ff68fe
CD10.4	Fish Guidance Systems Ltd Response to NNB Appeal to remove AFD at Hinkley Point C	https://ea.sharefile.com/d-sb1d2e63f385844ceadfb53dcde699c87

CD10.5	ID 4 – Ms Attwater’s written representation to the Inquiry – 08.06.21	https://ea.sharefile.com/d-s38dd3c9115a24438a428d97ebf60b809
CD10.6	ID 5 - D&S IFCA’s written representation to the Inquiry – 08.06.21	https://ea.sharefile.com/d-s18839677009b486f974c2ec487ef19fc
CD10.7	ID 6 - Mr Bunt’s written representation to the Inquiry – 08.06.21	https://ea.sharefile.com/d-sccb71d3ef8414520b46a3a4c1b501a46
CD10.8	ID 8 – Dr Naylor’s written representation to the Inquiry – 08.06.21	https://ea.sharefile.com/d-s120c7e3a24eb4bdf99446572cb8dde62
CD10.9	ID 9 – FGS’s written representation to the Inquiry – 09.06.21	https://ea.sharefile.com/d-scff2a9c28fe4471da535d90fe0926f03
CD10.10	ID 10 – Dr Turnpenny’s written representation to the Inquiry – 09.06.21	https://ea.sharefile.com/d-sbdd728265c26491db25e04b51bc2ae55
CD10.11	ID 15 - Letter to Fish Guidance Systems – 14.04.21	https://ea.sharefile.com/d-sd5e117a6571e4f60a55764987f6c8d93
CD10.12	ID 16 - Letter from Fish Guidance System – Response to NNB queries – 27.04.21	https://ea.sharefile.com/d-s7afe06a02bd4414aae3e57c12a5dcd8a
Section 11 – Legislation, regulations and conventions		
CD11.1	Environmental Permitting (England and Wales) Regulations 2016 (extracts)	https://ea.sharefile.com/d-s5e0488a600724d43ad29c3a895e963d2
CD11.2	Conservation of Habitats and Species Regulations 2017 (extracts)	https://ea.sharefile.com/d-sea3caa86c3744951ab5f97ea6ae7930b
CD11.3	Council Directive 92/43/EEC (the “Habitats Directive”) (extracts)	https://ea.sharefile.com/d-s9d62fda014974bbc920832516902cb6e
CD11.4	Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (extracts)	https://ea.sharefile.com/d-s1f55280dc1634415ac8cc291f2d6d9e3
CD11.5	European Union (Withdrawal) Act 2018 (extracts)	https://ea.sharefile.com/d-s9edacff6daf74ffd8d6f0716b43bb7aa
CD11.6	Conservation of Habitats and Species (Amendment)(EU Exit) Regulations 2019	https://ea.sharefile.com/d-s6f10e43bb1f9487fa299a3cba83fec53
CD11.7	European Union (Withdrawal) Act 2018 (Relevant Court) (Retained EU Case Law) Regulations 2020	https://ea.sharefile.com/d-s15c22ca10b204a6dab671853da622e5f

CD11.8	The Health and Safety at Work Act 1974	https://ea.sharefile.com/d-s054347c6d0c14f2395caad2fe0f7072a
Section 12 – Relevant Policy and Guidance		
CD12.1	Defra, Natural England, Welsh Government and Natural Resources Wales, 2021. Habitats Regulation Assessments: Protecting a European Site.	https://ea.sharefile.com/d-s931dd08497e148668b6d6c9167ed4236
CD12.2	European Commission, 2019. <i>Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.</i>	https://ea.sharefile.com/d-sd0015bfe2c0f4bb9a6b4c10404b0726d
CD12.3	Assessment of Plans and Projects Significantly Affecting Natura 2000 sites- Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission 2001)	https://ea.sharefile.com/d-sf5f01482151f451d9c08c72ac75e8c98
CD12.4	JNCC, 2004. Common Standards Monitoring Guidance Introduction to the Guidance Manual.	https://ea.sharefile.com/d-sacbb570ee09f4ed0a7770cfafcd348a2
CD12.5	ODPM Circular and Defra Circular, 2005. Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System. TSO (The Stationery Office)	https://ea.sharefile.com/d-s8d0c56c54ee741b99a9752a57b4195ba
CD12.6	Commission of the European Communities, 2000. Communication from the Commission on the Precautionary Principle. Brussels	https://ea.sharefile.com/d-s8b057bbe2e0649149bcde5649d61f771
CD12.7	Guide to ICES advisory framework and principle	https://ea.sharefile.com/d-s962216cef49b4a9bae5f885db99f599b
CD12.8	Guidelines for ICES Groups Version 2021-1	https://ea.sharefile.com/d-sdb0d36cc99bb4ba29f92724ae6a239e0
CD12.9	ICES Meeting and Activities etiquette	https://ea.sharefile.com/d-sa2da52baf57241d4b24be3220206eccb
CD12.10	ICES data policy	https://ea.sharefile.com/d-sad92e0cd263f4b1697d1acb0e8039553
CD12.11	ICES User Handbook: Best practice for Data Management January 2019	https://ea.sharefile.com/d-sfc3bde264b954cb5ba6535f2bf31481b

CD12.12	ICES Guidelines for Advice Drafting Groups 2019	https://ea.sharefile.com/d-sb0108c54e4d54207a99aa9a732635ffe
CD12.13	Conservation Objectives for Severn Estuary/Môr Hafren Special Area of Conservation, (27 November 2018)	https://ea.sharefile.com/d-s4e54916cefdd40fe934613f703e4ad9c
CD12.14	Conservation Objectives for River Wye Special Area of Conservation. (27 November 2018)	https://ea.sharefile.com/d-s7ab9589a88504a5babc3491ec49b5229
CD12.15	Core Management Plan including Conservation Objectives for River Usk SAC (7 March 2008)	https://ea.sharefile.com/d-s3dfc8697ebc44983ad28b861afcd9f89
CD12.16	Natural England and Countryside Council for Wales, advice given under regulation 33 in relation to the Severn Estuary (June 2009)	https://ea.sharefile.com/d-sb32a3212add5441fa9b4ae69be987477
CD12.17	Core Management Plan including conservation objectives for River Wye SAC (September 2017)	https://ea.sharefile.com/d-s6ce71f258b654a6e8b8dff6c02ac0ddb
CD12.18	National Planning Policy Framework (February 2019)	https://ea.sharefile.com/d-sff11a6cd83ab4e2c9c7292f40facf4fa
CD12.19	SEI 8 – EU Technical report 2013 – 068 Guidelines on Climate Change and Natura 2000	https://ea.sharefile.com/d-sb6d20c80aeb442a8888f9ba6c7670864
CD12.20	SEI 17 – OSPAR Commission, Recommendation 2014/1 on furthering the protection and conservation of the common or European sturgeon (Acipenser sturio) in Regions II, III1 and IV of the OSPAR maritime area (2020)	https://ea.sharefile.com/d-s7f9ea7a9a83443248788c61542a15d07
CD12.21	NASCO Guidelines for the Management of Salmon Fisheries (2009).	https://ea.sharefile.com/d-se9c266c863234ca3ba2fc3e966a9c1a7
CD12.22	Changes to the Habitats Regulations 2017. Policy paper “The main points and processes of the 2019 Regulations, which amend the Habitats Regulations 2017 that transpose the Habitats and Wild Birds Directives, to make them operable from 1 January 2021”, 1 January 2021	https://ea.sharefile.com/d-s0ebea7d1d24649779d7a37d2f5d44e48
CD12.23	PINS Advice Note Ten: Habitats Regulations Assessment relevant to Nationally Significant Infrastructure Projects. Republished November 2017 (version 8)	https://ea.sharefile.com/d-scdd338aab2ff43ae9f5eb85e2747b4b4

CD12.24	Conservation Objectives: Supplementary advice on conserving and restoring site features, River Wye Special Area of Conservation (SAC) (21 January 2019)	https://ea.sharefile.com/d-sd0dd4068917d4b55ac9a4ab26a462a25
CD12.25	IUCN Red List (2009) Salmon and Climate Change – Fish in hot water	https://ea.sharefile.com/d-sf2fe0b2cab264f8db6ae8dc06afc5dd8
CD12.26	The Civil Service code	https://ea.sharefile.com/d-sb738a390f148481982920045e599e9f1
CD12.27	NASCO (2019) State of North Atlantic Salmon	https://ea.sharefile.com/d-s75945b6357a04d18895e9c91f2641881
CD12.28	NRW Evidence Report - Severn Estuary / Môr Hafren Special Area of Conservation: Indicative site level feature condition assessments (January 2018)	https://ea.sharefile.com/d-s84781b11912148eeb7b13d09de95d233
CD12.29	Severn Estuary SAC Citation	https://ea.sharefile.com/d-sc4a73f826d1245a4a3d57fc4db056c96
CD12.30	Severn Estuary Natura 2000 Standard Data Form	https://ea.sharefile.com/d-s74631700207c414abf3149735d97d6a6
CD12.31	River Usk Natura 2000 Standard Data Form	https://ea.sharefile.com/d-s0cddfaefd16e47ab8c107579945b8090
CD12.32	River Wye SAC Citation	https://ea.sharefile.com/d-sdbf7de7f99a04a68b823fc0b5985bc90
CD12.33	River Wye Nature 2000 Standard Data Form	https://ea.sharefile.com/d-s74c773c1441e47a795e85dcc5747a9c7
CD12.34	Commission Implementing Decision of 11 July 2011 - concerning a site information format for Natura 2000 sites	https://ea.sharefile.com/d-s699c4592d0614eb4987c49f00584e1cf
CD12.35	People and Wetlands: The Vital Link (May 1999)	https://ea.sharefile.com/d-s4e7d7a40b5244b7cb84220e2ee6e5f20
CD12.36	ID 19 - SEI and Devon & Severn IFCA submissions - Draft Marine Plan - 21.06.21	https://ea.sharefile.com/d-s3b9334af8bc54668b581382c9dbd0247
Section 13 – Case law and Appeal Decisions		

CD13.1	Landelijke Vereniging tot Behoud van de Waddenzee v Staatssecretaris van Landbouw Natuurbeheer en Visserij [C-127-2] (7 September 2004)	https://ea.sharefile.com/d-sdefb3f17d7464a849953f2975504b92d
CD13.2	Sweetman and others v An Bord Plean la [C-258_11] (11 April 2013)	https://ea.sharefile.com/d-sc5c6e3bcb61e40e887ba663b289e52be
CD13.2a	ID 23 - Opinion of Advocate General Sharpston re Case C-25811	https://ea.sharefile.com/d-s1c8ce8a780044f409e4645179dcc0099
CD13.3	Morge vs Hampshire County Council [2010] EWCA Civ 608	https://ea.sharefile.com/d-sa4260dea638042f59fb7d4f504774612
CD13.4	R (Champion v An North Norfolk District Council) [2015] UKSC 52	https://ea.sharefile.com/d-s47bdedcd5c1644baa9be4c043a6b7946
CD13.5	Grace v An Board Pleanála (ESB Wind Developments intervening) [C-164/17] (25 July 2018)	https://ea.sharefile.com/d-s7e0f744b60e84f43a24d76fb2e22a826
CD13.6	Holohan v An Bord Pleanála [C-461/17] (7 November 2018)	https://ea.sharefile.com/d-s61ea3591e75648348200de6e567dde04
CD13.7	Smyth v Secretary of State for Communities and Local Government [2015] EWCA Civ 174	https://ea.sharefile.com/d-s86bd3c0c521f45078a683ea679363abf
CD13.8	Commission v Germany [C-142/16] (26 April 2017)	https://ea.sharefile.com/d-sb50f9671a3184dd4956a0ac0e54eeb18
CD13.9	Coöperatie Mobilisation for the Environment and Vereniging Leefmilieu [C-293/17 and C-294/17] (7 November 2018)	https://ea.sharefile.com/d-s90ba12c7b5f0404889d3e4e7086e72b0
CD13.10	R (Hart District Council) v Secretary of State for Communities and Local Government and ors [2008] EWHC 1204]	https://ea.sharefile.com/d-s169f736121fc48e7927e3a7fc15c193c
CD13.11	R (Akester) v Department for Environment, Food and Rural Affairs and anr [2010] EWHC 232	https://ea.sharefile.com/d-s6fcad88e9a6647c784862a48ac661683
CD13.12	R (on the application of Mott) v Environment Agency [2016] EWCA Civ 564	https://ea.sharefile.com/d-sccb5bf408a124d989c016a9dd489953b
CD13.13	Keir v NE [2021] EWHC 1059	https://ea.sharefile.com/d-s82523434058841c48baeb304f1df1975
CD13.14	ADT Auctions Ltd v Secretary of State Environment, Transport and the Regions and Hart District Council (2000) (CO/4040/99)	https://ea.sharefile.com/d-sd5de96ed2db0406fa3f357111b7e32cd

CD13.15	R (Wealden) v Secretary of State for Communities and Local Government and ors [2017] EWHC 351	https://ea.sharefile.com/d-se3f8498344a748e987f494c907e9558f
CD13.16	SEI 11 - Case C-144/17 Commission v Poland (Białowieża Forest)	https://ea.sharefile.com/d-s9ebc61e68a9546c787b73857b2c1af56
CD13.17	SEI 12 - Case C-323/17 People Over Wind & Sweetman	https://ea.sharefile.com/d-s4b6dfaa4ed184975883fbc9d60e4c38a
CD13.18	SEI 13 - Case C-461/13 Bund fur Umwelt and Naturschutz Deutschland	https://ea.sharefile.com/d-s84f2910c50514471b9b2968ab2e79e11
CD13.19	SEI 14 – Case C-404/09 European Commission v Kingdom of Spain	https://ea.sharefile.com/d-s836ffbf7639d467ab8686f172acaa956
CD13.20	Peter Charles Boggis, Easton Bavents Conservation v Natural England v Waveney District Council	https://ea.sharefile.com/d-s661b7882c9cb49068edc329806c95f0d
CD13.21	R(oao) Wyatt v Fareham Borough Council [2021] EWHC (Admin)	https://ea.sharefile.com/d-s48a1c52cbde94664942344008499b501
CD13.22	ID 24 - Regina (Mynydd y Gwynt Ltd) v Secretary of State for BEIS [1274 – 2018]	https://ea.sharefile.com/d-s1e53d19b8e6d4c9688d6fa9f743231de
CD13.23	ID 25 - Friends of the earth application for judicial review [Lough Neagh – 2017]	https://ea.sharefile.com/d-s88c1df451b744d89bbf22bd8cb2fb17d
Section 14 – Statutory Consultee Responses		
CD14.1	Natural England Response to the Agency on draft Habitats Regulations Assessment (HRA) (3 November 2020)	https://ea.sharefile.com/d-s11eee464cc3447b0b55ff2c84ee776db
CD14.2	Natural Resources Wales response to the Agency on draft HRA assessment (2 November 2020)	https://ea.sharefile.com/d-sf3078139532a47f3a5e830878ccff993
CD14.3	Natural England – Response to the Agency Final HRA (28 April 2021)	https://ea.sharefile.com/d-s6e11e0f1d1554b23aba02ff1cb843c57
CD14.4	Natural Resources Wales additional representation to PINS (18 February 2021)	https://ea.sharefile.com/d-sc7ed443ba0414e99a5aba65182fc1bfc
CD14.5	Natural England's comments on NNBGenco's HPC sHRA (31 October 2018)	https://ea.sharefile.com/d-s20dee807b1704b5798c3771137f6f09a
CD14.6	Natural England's representation to PINS (27 October 2020)	https://ea.sharefile.com/d-sd4649aeb79f24927a06a54ed7fc2d237

CD14.7	FIAT marine fish assemblage 200205 v13 - with NRW comments	https://ea.sharefile.com/d-s315921f59bd449a28ae37d9bc80b1f1c
CD14.8	ID 20 - Natural England view on the Agency's legal submissions - 17.06.21	https://ea.sharefile.com/d-sc0b8241a8e814472afb8bfeede4c1a88
CD14.9	ID 21 - Natural England view on fish assemblage and Ramsar site - 22.06.21	https://ea.sharefile.com/d-s5d0aa272f16a4c98be60e085a9197fbe
CD14.10	ID 22 - Natural Resources Wales view on fish assemblage and Ramsar site – 22.06.21	https://ea.sharefile.com/d-s60be643404554be7b58aeb5d761b061b
Section 15 – Miscellaneous		
CD15.1	SEI 4 - Complaint to European Commission for breach of the Habitats Directive in relation to HPC (23 October 2019)	https://ea.sharefile.com/d-s977a17d7c8c64eed9dcf8666217c2480
CD15.2	SEI 2 – Hinkley Point C Stakeholder Reference Group - The implications of Hinkley Point C for Wales' environment and its people (2021)	https://ea.sharefile.com/d-sbdf74e26d41142c28764f0dfffa81d046
CD15.3	SEI 9 – The Swansea Bay Tidal Generating Station Order 2015	https://ea.sharefile.com/d-s9e15b3f5cfea4c5fa694d6615e6b65e5
CD15.4	SEI 10 – Tidal Lagoon Swansea Bay plc - Adaptive Environmental Monitoring Plan (Appendix 23.1)	https://ea.sharefile.com/d-s41d2613c086f468d8e4b09dd2ef55a2c
CD15.5	SEI 3 – Devon and Severn IFCA Response to the Agency consultation Regarding the EDF Energy Proposal to remove the requirement for AFD at HPC (July 2019)	https://ea.sharefile.com/d-s6e615eb69da940dbab6191da2e446c4a
CD15.6	SEI 1 – EPR Appeal Defra Secretary of State Recovery notification email (24 March 2021)	https://ea.sharefile.com/d-s4700adbc23b942e4914b0c2852b01d1f
CD15.7	HSF letter in response to the Agency rebuttal proofs – 28.05.21	https://ea.sharefile.com/d-s656b5894a6a945ae8288112d1af146ee
CD15.8	Response to Location of Severn Estuary Receivers information request – 07.06.21	https://ea.sharefile.com/d-sd2ed7085579540779e38f56bb89abf17
CD15.9	ID 11 – The Agency Response to Dr Jennings' note on simulation of Atlantic Salmon EAVs – 09.06.21	https://ea.sharefile.com/d-s9da202bcb9f44353a837386dd6d996f4
CD15.10	ID 17 – Assessor's report on the Thames basin heaths SPA and the DDP – 19.02.2007	https://ea.sharefile.com/d-s57634ecc305f48ddb57e6fcf80d631af

