HPC COMPANY DOCUMENT

COMPANY DOCUMENT
DCO MATERIAL CHANGE APPLICATION: SHADOW HABITATS REGULATIONS ASSESSMENT EVIDENCE REPORT – PRE-APPLICATION CONSULTATION VERSION

Revision	01
Date of Issue	Refer to EDRMS
Document No.	101211875
Status	S4A – Reviewed: Approved
Next Review Date	
Owner & Approver	Planning Manager
Technical Reviewer	John Pingstone
Author	Jennifer Wilson

APPROVAL: SHADOW HABITATS REGULATIONS ASSESSMENT EVIDENCE REPORT – PRE-APPLICATION CONSULTATION VERSION

Prepared by:	**Name:** Jennifer Wilson **Title:** Associate Director (Aquatic Ecology)	Date: 20/12/2023
Verified by:	**Name:** John Pingstone **Title:** Planning Lead, Site Nuclear Compliance	Date: 21/12/2023
Approved by:	**Name:** Andrew Goodchild **Title:** Planning Manager, Hinkley Point C	Date: 21/12/2023

DOCUMENT CONTROL

Revision	Purpose	Amendment	By	Date
Revision *	Status *	*	*	Click or tap to enter a date.
Revision *	Status *	*	*	Click or tap to enter a date.
Revision *	Status *	*	*	Click or tap to enter a date.
Revision *	Status *	*	*	Click or tap to enter a date.
Revision *	Status *	*	*	Click or tap to enter a date.
Revision *	Status *	*	*	Click or tap to enter a date.

CONTENTS

ABBREVIATION TABLE

ABBREVIATION	DEFINITION
AA	Appropriate Assessment
ACFM	Alternating Current Field Measurement
ACOP	Health and Safety Executive Approved Code of Practice
AFD	Acoustic Fish Deterrent
ALARP	As Low As Reasonably Practicable
AMMP	Adaptive Monitoring and Management Plan
AMMPAG	AMMP Advisory Group
AOD	Above Ordnance Datum
APCU	Active Pressure Compensation Units
AROV	Autonomous Remotely Operated Vehicle
BAT	Best Available Technique
BEIS	The Department for Business, Energy and Industrial Strategy
BESS	The British Energy Security Strategy
BOD	Biochemical Oxygen Demand
BTO	British Trust for Ornithology
CDM Regulations	The Construction (Design and Management) Regulations 2015
CEMP	Construction Environmental Management Plan
CEP	Compensation Expert Panel
CI	Confidence Interval
CIMP	Comprehensive Impingement Monitoring Programme
CJEU	Court of Justice of the European Union
CoNaWR	The Control of Noise at Work Regulations 2005
CPUE	Catch Per Unit Effort
CR	Critically Endangered
CV	Coefficient of Variation
CWS	Cooling Water System
DESNZ	The Department for Energy Security and Net Zero
EA	Environment Agency
EAV	Equivalent Adult Value
EIA	Environmental Impact Assessment

ABBREVIATION	DEFINITION
ELWL	Extreme Low Water Level
EPR	European Pressurised Reactor
EQS	Environmental Quality Standard
ES	Environmental Statement
ESO	Electricity Systems Operator
FCS	Favourable Conservation Status
FRR	Fish Recovery and Return
GCER	Gloucestershire Centre for Environmental Records
GCN	Great Crested Newt
HAZOP	Hazard and Operability Study
HDPE	High-Density Polyethylene
HEMS	Habitat Enhancement Measures
HIRA	Hazard Identification and Risk Assessment
HLSF	Design Basis High Level Safety Function
HPC	Hinkley Point C
HRA	Habitats Regulations Assessment
HSE	Health Safety Executive
HSW Act	The Health and Safety at Work etc. Act 1974
ICES	International Council for Exploration of the Sea
IDB	Internal Drainage Board
IFCA	Inshore Fisheries and Conservation Authority
IROPI	Imperative Reasons of Overriding Public Interest
ISFS	Interim Spent Fuel Store
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LiDAR	Light Detection and Ranging
LOLER	The Lifting Operations and Lifting Equipment Regulations 1998
LSE	Likely Significant Effect
LVSE	Low Velocity Side-Entry
MCCIP	Marine Climate Change Impacts Partnership
MHSWR	The Management of Health and Safety at Work Regulations 1999
MK	Mann-Kendall
MMO	Marine Management Organisation

ABBREVIATION	DEFINITION
MTF	Marine Technical Forum
NAO	North Atlantic Oscillation
NAS	No Alternative Solutions
NDE	Non-Destructively Examine
NDF	Non-Detriment Finding
NE	Natural England
NNB	NNB Generation Company Limited
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPS EN-1rov	The Overarching National Policy Statement for Energy
NPS EN-6	The National Policy Statement for Nuclear Power Generation
NRW	Natural Resources Wales
NSER	No Significant Effects Report
NSIP	Nationally Significant Infrastructure Projects
NSN	National Site Network
NVC	National Vegetation Classification
ONR	Office for Nuclear Regulation
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PUWER	The Provision and Use of Work Equipment Regulations 1998
RIMP	Routine Impingement Monitoring Programme
ROV	Remote Operated Vehicle
RR735	The Health and Safety Executive Research Report 735
SAC	Special Area of Conservation
SCI	Site of Community Importance
SEA	Strategic Environmental Assessment
SEAG	Socio-Economic Advisory Group
SERC	Somerset Environmental Records Centre
SIP	Site Improvement Plan
SKT	Seasonal Kendall Test
SMP	Shoreline Management Plan
SNCB	Statutory Nature Conservation Body

ABBREVIATION	DEFINITION
SODAR	Sound Detection and Ranging
SPA	Special Protection Area
SSB	Spawning Stock Biomass
SSSI	Site of Special Scientific Interest
SWNNR	Somerset Wetlands National Nature Reserve
SZB	Sizewell B
TR	Technical Report
TRG	Transport Review Group
WDA	Water Discharge Activity
WeBS	Wetland Bird Survey
WFD	Water Framework Directive
WMO	World Meteorological Organization
ZOI	Zone of Influence

1 INTRODUCTION

1.1 Purpose of document

1.1.1 This shadow Habitats Regulations Assessment ('HRA') Evidence Report ('HRA Report') has been prepared by WSP Environment & Infrastructure Solutions UK Limited and Jacobs UK Limited on behalf of NNB Generation Company Limited ('NNB').

1.1.2 It presents NNB's current evidence base and approach to assist the Secretary of State in undertaking an HRA under the Conservation of Habitats and Species Regulations 2017 ('Habitat Regulations') in relation to NNB's forthcoming application for a material change ('DCO Material Change') to the Hinkley Point C (Nuclear Generating Station) Order 2013 ('2013 DCO'). This 2013 DCO permitted the construction and operation of a new nuclear power station and associated development at Hinkley Point in Somerset, known as Hinkley Point C ('HPC'). The DCO Material Change application will seek permission for six changes to the design of HPC and certain associated compensatory habitat measures. The six design changes are listed further below at Section 1.3. Full details of the six design changes and the proposed compensatory measures (comprising compensatory measures proposed to be within the boundary of the DCO Material Change application (referred to as the DCO Material Change Order Limits) and out with the DCO Material Change Order Limits) are provided within Section 3.

1.1.3 In this HRA Report, the 'Project' to be assessed is the construction (already ongoing); operation; and (to the extent assessment is possible) decommissioning of the nuclear build project at HPC "as changed" by the DCO Material Change application to be made (comprising the six changes to the design of HPC and the delivery of associated compensatory habitat measures).

1.1.4 This HRA Report of the Project will accordingly consider, for the following pathways of impact, the construction, operational and (to the extent that assessment is possible) decommissioning impacts arising from the (i) six HPC design changes "as changed"; and (ii) from (to the extent assessable at this time) the compensatory measures:

- any pathways of impact to European / Ramsar sites already identified in the Secretary of State's Record of the HRA undertaken under Regulation 61(1) of the Conservation of Habitats and Species Regulations 2010 (as amended) for an application under the Planning

Act 2008 (as amended) dated 18 March 2013 ('Secretary of State's 2013 DCO HRA') which are relevant to the six HPC design changes; and

- any new pathways of impact to European sites (not already identified in the Secretary of State's 2013 DCO HRA) from the six HPC design changes or (to the extent assessable at this time) from the compensatory habitat measures.

1.1.5 This version of the HRA Report has been written to support the pre-application consultation for the DCO Material Change application and is based on the information and evidence available to NNB at the time of its writing. An HRA is an iterative process and accordingly, NNB will work further on this HRA Report, taking account of consultation responses and further details of the proposed compensatory measures, as it prepares to make the formal DCO Material Change application.

1.1.6 Those proposed compensatory measures which will fall outside the Order Limits of the DCO Material Change will also be subject to separate consenting procedures and as such will, where necessary, be subjected to further HRAs by the relevant competent authorities for those separate consenting procedures at the relevant time. In addition, further consents or permits may be needed for proposed compensatory measures which will fall within the Order Limits of the DCO Material Change and again these will, where necessary, be subjected to further HRAs by the relevant competent authorities for those separate consenting procedures at the relevant time.

1.1.7 The term 'HPC Site' used in this HRA Report refers to the area identified as the 'Hinkley Point C Permanent Development Site Boundary' in the document titled 'Hinkley Point C Material Change Application Plans', ref: HINK-A1-SL-00-GA-010.

1.1.8 The six HPC design changes of the Project and some of the compensatory habitat measures within the Project are / will be located adjacent to and / or within the Severn Estuary European Marine Site (Severn Estuary Special Area of Conservation ('SAC'), Severn Estuary Special Protection Area ('SPA') and Severn Estuary Ramsar site). Additional European sites in the wider area either fall within the selected Zone of Influence ('ZOI')[1] of the design changes of the Project or are within the selected ZOI of the locations where compensation habitat measures are to be or may be located. It is recognised that the Project may have the

1 The ZOI for a project is the area over which ecological features may be subject to significant effects as a result of the proposed project and associated activities (CIEEM, 2016).

potential to affect these designated sites such that an HRA is required in the context of the DCO Material Change application.

1.2 History of consents and associated assessments

1.2.1 The 2013 DCO application was submitted by NNB on 31 October 2011 and the DCO was made on 18 March 2013[2].

1.2.2 An Environmental Statement ('ES') was prepared to document the findings of the Environmental Impact Assessment ('EIA') process, undertaken for the 2013 DCO application, as was required by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the 'EIA Regulations')[3]. The ES was carried out to identify the likely significant impacts arising from the 2013 DCO application, and to establish appropriate measures to mitigate adverse impacts. The ES is referred to as the 'HPC 2013 DCO ES' in this HRA Report.

1.2.3 The Hinkley Point C Project Report to Inform Habitats Regulations Assessment[4] also accompanied the 2013 DCO application and considered the construction and operation of the new nuclear power station, as well as associated developments. This report is referred to as the '2013 DCO NNB HRA report' in this HRA Report.

1.2.4 When determining the 2013 DCO application, the Secretary of State adopted the Secretary of State's 2013 DCO HRA.

1.2.5 Following the grant of the 2013 DCO, errors identified in the 2013 DCO were corrected by a correction order and there have been a number of further non-material changes to the 2013 DCO. These are summarised in Table 1-1. These non-material changes will form part of the current and future baseline within the HRA Report.

2 The Hinkley Point C (Nuclear Generating Station) Order 2013 (no date) Legislation.gov.uk. Available at: https://www.legislation.gov.uk/uksi/2013/648/contents/made (Accessed: 18 November 2023).

3 All documentation associated with the HPC DCO ES is available via the National Archive website at https://webarchive.nationalarchives.gov.uk/ukgwa/20190919100903/https://infrastructure.planninginspectorate.gov.uk/projects/south-west/hinkley-point-c-new-nuclear-power-station/?ipcsection=docs

4 NNB GenCo (2011). Hinkley Point C Project Report to Inform Habitats Regulations Assessment. Doc Ref 3.16.

Table 1-1: Correction Order and Non-Material Changes to the HPC 2013 DCO

Reference	Summary of change
The Hinkley Point C (Nuclear Generating Station) (Correction) Order 2013 (Statutory Instrument 2013 No. 2938)	Corrects errors identified in the 2013 DCO.
The Hinkley Point C (Nuclear Generating Station) (Amendment) Order 2015 (Statutory Instrument 2015 No. 1666)	Changes to buildings and structures within the HPC Site layout and changes to facilitate safety and better design.
The Hinkley Point C (Nuclear Generating Station) (Amendment) Order 2017 (Statutory Instrument 2017 No. 843)	Consolidation of the two temporary off-site accommodation campuses into a single campus (named Bridgwater A) including minor changes to the campus itself.
The Hinkley Point C (Nuclear Generating Station) (Amendment) Order 2018 (Statutory Instrument 2018 No. 413).	Changes to buildings and structures within the HPC Site layout, an alteration to the alignment of the sea wall and erection of additional pipework along the underside of the temporary jetty.
The Hinkley Point C (Nuclear Generating Station) (Amendment) Order 2021 (Statutory Instrument 2021 No. 1474).	Changes to buildings and structures within the HPC Site layout.

1.2.6 A number of marine licences ('Marine Licences') have been granted in respect of HPC since 2013 by the Marine Management Organisation ('MMO') on behalf of the Secretary of State and by Natural Resources Wales ('NRW') on behalf of the Welsh Government for carrying on activities associated with the 2013 DCO for which a licence is required under Part 4 of the Marine and Coastal Access Act 2009.

1.2.7 A summary of the currently active Marine Licences is provided in Table 1-2.

Table 1-2: Currently Active Marine Licences associated with HPC

Case Reference	Licence reference	Date originally granted	Licence title	Revision
35012/101213/5	L/2012/00244/5	13 December 2010	Application (Construction, Miscellaneous Disposal) Hinkley Point Temporary Aggregate Jetty	4
MLA/2019/00241/2	L/2021/00143/2	23 April 2021	Application (Other removals) Hinkley Point C UXO Clearance	1
MLA/2020/00324/2	L/2021/00148/1	23 April 2021	Application (Wildlife licence)	1
MLA/2021/00189	L/2022/00206/1	16 April 2021	Application (Maintenance of existing works, Navigational dredging (maintenance)) Combwich Wharf Operational Marine Licence	1
MLA/2012/00259/9	L/2013/00178/10	15 June 2012	Application (Construction, Dredging, Miscellaneous Disposal) Hinkley Point C Project: New Nuclear Development	9

1.2.8 In 2011, NNB made an application to the Environment Agency ('EA') under the Environmental Permitting (England and Wales) Regulations 2010 (as amended) for a permit relating to a Water Discharge Activity ('WDA') associated with the operational phase of HPC. This permit was determined on 13 March 2013 referenced EPR/HP3228XT[5] and is hereby referred to as the 'WDA Permit' throughout this HRA Report.

1.2.9 On 14 February 2019, NNB submitted an application to vary the WDA Permit to remove conditions relating to the requirement for installation of an Acoustic Fish Deterrent ('AFD').

1.2.10 In accordance with the Environmental Permitting (England and Wales) Regulations 2016 (Schedule 5, Part 1), NNB served notice of deemed refusal on 4 August 2020, stating that the EA had not determined the application within the relevant period, leading to an appeal. The appeal was submitted on 23 September 2020.

5 Environment Agency (2013) Permit No. EPR/HP3228XT. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291296/LIT_7947_e754c0.pdf (Accessed: 14 November 2023).

1.2.11 On 24 March 2021, the Secretary of State for Environment, Food and Rural Affairs confirmed that the appeal would be recovered on the grounds 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" (paragraph 1.2 of Inspector's Report[6])

1.2.12 In its Appropriate Assessment ('AA') dated 2020 for the WDA Permit variation, the EA was unable to conclude that the proposed variation would not adversely affect the integrity of the Severn Estuary SAC, Severn Estuary Ramsar site, the River Usk SAC and the River Wye SAC.

1.2.13 The Inspector recommended, following an inquiry ('WDA Permit inquiry'), that the appeal be dismissed, and the WDA Permit not be varied. In making the decision, and having reviewed the Inspector's advice, including regarding levels of uncertainty and areas of scientific disagreement, the Secretary of State agreed with the Inspector's conclusion that, in the absence of an AFD, it could not be concluded that there would not be adverse effects on the integrity of the Severn Estuary SAC, Severn Estuary Ramsar site, the River Usk SAC and the River Wye SAC. The Secretary of State dismissed the appeal and refused the application to vary the WDA Permit on 2 September 2022.

1.2.14 In December 2022, a further variation application was submitted to the EA to request removal of the AFD from the WDA Permit. The submission of this further application followed discussions with the EA where they confirmed to NNB that potential effects arising from abstraction of cooling water in the context of the proposed removal of the AFD would be assessed in the context of a DCO Material Change application, whilst impacts from discharges would be considered within a further WDA Permit variation application. Accordingly, in July 2023, the EA issued a variation to the WDA Permit to remove all references and conditions (or parts of conditions) relating to the proposed AFD as well as adding a new waste stream to additionally regulate the discharge of seawater through the Fish Recovery and Return ('FRR') system. The EA's assessment of the impact of the FRR system discharge concluded that there would be no adverse effect on the integrity of the relevant European sites (in relation to

6 Paragraph 1.2 of Inspectors Report dated 7 December 2021

pollution from regulated discharges to water from the FRR) where there is no AFD in place, including to sites functionally linked to the Severn Estuary, and that the discharges will not result in the condition of relevant Sites of Special Scientific Interest ('SSSIs') deteriorating, or prevent them from improving or recovering.

1.2.15 The formal DCO Material Change application will be made following the pre-application consultation process and this will include assessments pursuant to the Habitats Regulations, The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended), The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended) and The Eels (England and Wales) Regulations 2009 (as amended).

1.3 Proposed changes to be made via the DCO Material Change application

1.3.1 A summary of the changes which NNB intends to seek via the DCO Material Change application, and an explanation of the reasons for the proposed changes, is set out in the Consultation Overview Document and in Section 3 of this HRA Report. In summary the proposed changes are as follows:

(i) Requirements CW1(2), CW1(3) and CW2(1) of the 2013 DCO require the submission of a detailed design and then installation of an AFD system as one of the mitigation measures introduced to reduce the risk to fish populations as a result of fish entrapment in the Cooling Water System ('CWS'). An AFD system would act as an acoustic behavioural deterrent intended to provoke an avoidance reaction amongst hearing sensitive fish from entering the CWS. NNB proposes that the requirement to fit an AFD system is removed from the 2013 DCO;

(ii) A change from a 'wet' Interim Spent Fuel Store ('ISFS') to a 'dry' ISFS, and associated increase in the building's size. This includes removal of the 55m gaseous discharge stack;

(iii) Replacement of the previously proposed Access Control Building with a new Equipment Storage Building;

(iv) The relocation and redesign of the meteorological mast, and removal of supporting meteorological station that is no longer required. The meteorological station would be replaced by an equipment compound;

(v) The retention of the existing temporary electrical substation as a permanent feature to supply electricity to neighbouring Hinkley Point A and Hinkley Point B power stations during their decommissioning; and

(vi) The addition of four new structures to house sluice gates and lifting beams in the area close to the power station's cooling water forebays.

1.4 Supporting documentation

1.4.1 This HRA Report should, for the purposes of the pre-application consultation, be read in conjunction with the Preliminary Environmental Information Report ('PEIR') published with the pre-application consultation, which presents further details in relation to the environmental impacts of the Project, not limited to potential effects on European and Ramsar designated sites.

2 THE HRA PROCESS

2.1 Introduction

2.1.1 The Habitats Directive protects habitats and species of European nature conservation importance. Together with the Wild Birds Directive, it establishes a network of internationally important sites designated for their ecological status.

2.1.2 SACs and Sites of Community Importance ('SCIs') are designated under the Habitats Directive and promote the protection of flora, fauna and habitats. SPAs are designated under the Wild Birds Directive in order to protect rare, vulnerable and migratory birds. These designated sites together create a Europe-wide 'Natura 2000' network of designated sites, which are hereafter referred to as 'European sites'.

2.1.3 The Habitats and Wild Birds Directives are transposed into English and Welsh law (in large part) by the Habitat Regulations. The Habitat Regulations retain reference to Natura 2000, but clarify in Regulation 3(10) that "*for the purposes of the Habitat Regulations, and any guidance issued before exit day (being 31 December 2020) by the appropriate authority or the appropriate nature conservation body, relating to the application of the Habitat Regulations, on or after exit day, references to 'Natura 2000' are to be construed as references to the national site network*" ('NSN').[7]

2.1.4 The 2013 DCO NNB HRA report and the Secretary of State's 2013 DCO HRA were carried out under the Conservation of Habitats and Species Regulations 2010 (as amended) which were not different in any material respect to the Habitat Regulations.

2.1.5 Ramsar sites are not European sites covered by the Habitat Regulations. However, in England the National Planning Policy Framework ('NPPF') affords to Ramsar sites, as a matter of national planning policy, the same level of protection as European sites (see paragraph 181 of the NPPF dated 5 September 2023). This is also reflected in Wales through paragraph 6.4.18 of Planning Policy Wales, Edition 11, dated February 2021. This is also reflected in the Planning

7 'National site network' is defined as "the network of sites in the United Kingdom's territory consisting of such sites as (a) immediately before exit day formed part of Natura 2000; or (b) at any time on or after exit day are European sites, European marine sites and European offshore marine sites for the purposes of any of the retained transposing regulations".

Inspectorate ('PINS') 'Advice Note 10: Habitats Regulations Assessment relevant to nationally significant infrastructure projects' ('Advice Note 10')[8] (paragraph 1.2).

2.2 Procedure and process

2.2.1 The Habitat Regulations provide, *inter alia*, a framework for the protection of European sites on land and within the English inshore region and the Welsh inshore region (defined within the Habitat Regulations as the area of sea within the seaward limits of the territorial sea adjacent to England or Wales, as applicable).

2.2.2 Amongst other things, the Habitat Regulations define the process for the assessment of the implications of plans or projects on European sites. This process is termed the HRA, and advice on the application of this process to Nationally Significant Infrastructure Projects ('NSIP') is provided in Advice Note 10. Further guidance on the HRA process is also available from other national and EU sources.

2.2.3 The key regulation is Regulation 63 of the Habitat Regulations, as set out below:

"(1) A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for a plan or project which -

(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects), and

(b) is not directly connected with or necessary to the management of that site,

must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives."

2.2.4 Regulation 84(1) of the Habitat Regulations confirms that the assessment provisions (Regulations 63 and 64) apply in relation to the making of an order granting development consent under the Planning Act 2008.

8 National Infrastructure Planning (2022) Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-ten/ (Accessed: 14 November 2023).

2.2.5 In accordance with Regulation 63(3), in undertaking an AA, the competent authority must for the purposes of the assessment consult the appropriate nature conservation body (Natural England ('NE') or NRW) and have regard to any representations made by that body within such reasonable time as the competent authority specifies.

2.2.6 NE and NRW are also commonly consulted in the process of screening plans and projects to establish whether AA is required.

2.2.7 The HRA is a staged process that is described in Advice Note 10. The stages are as follows:

- HRA Stage 1 – Screening: The first stage of the HRA process is to assess whether the plan or project will have a Likely Significant Effect ('LSE') on any European site either alone or in-combination with any other plan or project. This is called the screening or LSE assessment. The screening assessment is only required if the plan or project is not directly connected with or necessary to the management of the site concerned. If there is no LSE identified for any European site considered, the report will take the form of a No Significant Effects Report ('NSER') and HRA stages 2-3 will not be required.
- HRA Stage 2 – AA: If Stage 1 identifies a LSE of the plan or project on any European site, an assessment of the implications of the plan or project is needed in view of the European site(s)'s conservation objectives. Subject to HRA Stage 3, the competent authority may then only agree to the plan or project if it has ascertained that it will not adversely affect the integrity of any European site alone or in combination with other plans or projects.
- HRA Stage 3 – Derogations: If Stage 2 concludes that the plan or project will or may adversely affect the integrity of any European site then the plan or project may proceed if three HRA derogation tests are met. These are that (i) there are no alternative solutions; (ii) the plan or project must be carried out for Imperative Reasons of Overriding Public Interest ('IROPI'); and (iii) any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000 (now the NSN) is protected.

2.2.8 Stages 1 and 2 are covered by Regulation 63 (as stated above) and Stage 3 is covered by Regulations 64 and 68 of the Habitat Regulations.

2.2.9 The Project in this case is not directly connected with or necessary to the management of any European site.

2.2.10 With respect to Stage 2, the 'integrity' of a European site is defined as " the coherence of the site’s ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified."[9].

2.2.11 The HRA screening process uses the threshold of LSE to determine whether potential effects of a plan or project on any European site should be the subject of further assessment. The Habitat Regulations do not define the term LSE. However, in *Waddenzee*[10] (Case C-127/02) the European Court of Justice confirmed, at paragraph 45, that *"…the first sentence of Article 6(3) of the Habitats Directive must be interpreted as meaning that any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects"*.

2.2.12 Within this HRA Report, each potential effect of the Project is considered using information from surveys undertaken to inform the HRA process, published literature (where available), other available baseline data, modelling outputs and professional judgement (informed by CIEEM, 2018[11]).

2.2.13 PINS Advice Note 10 provides guidance on the HRA information which should be provided with an application.

9 European Commission, Directorate-General for Environment, (2019) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Available at: https://data.europa.eu/doi/10.2779/02245 (Accessed: 21 November 2023).

10 *Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels v Staatssecretaris van Landbouw, Natuurbeheer en Visserij* (Case C-127/02)

11 CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management, Winchester.

3 PROJECT DESCRIPTION

3.1 Project overview

3.1.1 The Project to be assessed in this case is the construction (already ongoing); operation; and (to the extent that assessment is possible) decommissioning of the nuclear build project at HPC "as changed" by the DCO Material Change application to be made (which includes six changes to the design elements of the HPC build and the delivery of associated compensatory habitat measures).

3.1.2 The nuclear project at HPC is a nuclear power station, comprising two UK European Pressurised Reactor (‘**EPR’**) pressurised water reactors and associated infrastructure for the generation of electricity at Hinkley Point, Somerset.

3.1.3 The two UK EPR units will operate for 60 years, each with the capacity to produce 1650 MWe. The new station (the 'C' station) will be the third nuclear power station to be built at Hinkley Point and will be 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 ceased generating on 1 August 2022 and is being decommissioned). Unit 1 at HPC is programmed to begin commercial operation in June 2027, with Unit 2 at HPC programmed to become operational a year later in June 2028.

3.1.4 Following HPC's 60-year operational phase, HPC will enter a decommissioning phase. The first stage of decommissioning is defueling. Defueling of HPC is at present expected to take approximately four years during which time the nuclear island cooling water ('SEC') pumps are expected to run to pull in sea water for cooling purposes. These pumps are much smaller than the main cooling water ('CRF') pumps which are only to be used during the operational phase. The SEC pumps (to be used in both the operational and decommissioning phase) have a flow rating in the range of 2-3 m^3/s whereas the CRF pumps (operational phase only) have a flow rating of around 132 m^3/s. Use of the SEC pumps during the later phases of decommissioning is not envisaged at present as no cooling water from the sea is expected to be needed after the approximately 4 years of defueling.

3.1.5 The following sets out full details of the six design changes to be sought via the DCO Material Change application.

3.2 AFD

Current approved design

3.2.1 Three measures to protect fish were incorporated into the design of the CWS for HPC, as consented by the 2013 DCO:

- Low Velocity Side-Entry ('LVSE') water intake heads with a capped head design;
- An FRR system; and
- An AFD system.

3.2.2 An AFD system was intended to be the first fish protection measure that fish would encounter in the CWS design.

3.2.3 The intention of an AFD was to use sound to repel hearing-sensitive fish, such as herring, sprat and shad, as well as moderately hearing-sensitive fish, including cod and whiting, from the CWS intake head[12]. Consent for an AFD was included in Work No.s 2B and 2D in Schedule 1, Part 1 of the 2013 DCO.

3.2.4 Requirements relating to the design, installation and monitoring of an AFD were imposed at Requirements CW1 (Cooling water infrastructure design) and CW2 (Monitoring and adaptive measures) in Schedule 2, paragraph 6 of the 2013 DCO.

3.2.5 Four LVSE intake heads have been installed at HPC, with two heads fitted on each of two intake tunnels. The intake heads are located approximately 3.3 km offshore. The intake surfaces (apertures) are 2 m high with centres approximately 2.5 m above the seabed, with the base of the aperture being approximately 1.5 m above the seabed to reduce the abstraction of benthic organisms. The intakes are submerged throughout the tidal cycle even at Extreme Low Water Level ('ELWL'). The HPC LVSE intakes are the first deployment of this technology on an operational power station and the design features are intended to reduce impingement of fish. The LVSE design features include:

12 EDF Energy (2011) Hinkley Point C Development Consent Order Application: Environmental Statement Volume 2 Hinkley Point C Development Site. Document ref: Environmental Statement 4.3, October 2011. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010102/EN010102-000078-HPCMC1%20-%20Scoping%20Report%20(App%20C%20Landscape%201%20of%205%20-%20Original%20ES%20Volume%202).pdf (Accessed 31 October 2023).

(i) Reducing vertical velocities which fish are ill equipped to resist, by means of velocity caps on the intakes (hereafter 'capped heads').

(ii) Limiting the exposure of the intake surfaces to the tidal stream, to reduce impingement for fish swimming with the tidal stream. That is, they reduce the cross-sectional intercept area of the intake presented to the prevailing tidal directions by mounting the apertures at right angles to the tidal flow.

(iii) Reducing intake velocities into the head to a target velocity of 0.3 m s-1 over as much of the length of the intake surface, which is intended to reduce intake velocities to rates allowing fish the potential to avoid abstraction.

(iv) Raising the base of the aperture approximately 1.5 m above the seabed to reduce entrapment of benthic species.

3.2.6 The LVSE heads are designed to be an improvement over the existing caisson intake design which extracted cooling water for Hinkley Point B ('HPB') and extracted water for the former Hinkley Point A ('HPA') station. The cross-sectional aperture of the LVSE heads exposed to the tide is less than the exposed aperture of the HPB caisson and the efficacy of the LVSE head design was modelled using a scaled version in a flume tank. However, the extent to which the LVSE design features reduce impingement in practice remains uncertain and is not agreed despite being best practice[13]. The EA position is that the use of an LVSE in the absence of an AFD provides no deterrent cue, and there is no behavioural stimulus to elicit avoidance behaviours. Therefore, the EA considers that reduced intake velocities in the absence of an AFD offer no mitigation. Consequently, during the WDA Permit inquiry, both NNB and the EA applied a factor of 1.0 when scaling impingement rates at HPB to predict impingement at HPC. This assumes no benefit from features ii. and iii. of paragraph 3.2.5 above.

3.2.7 The capped head (feature (i) at paragraph 3.2.5 above) is predicted to provide mitigation for species in the water column, notably pelagic species, and the EA during the WDA Permit inquiry proposed a mitigation factor with an associated uncertainty range for pelagic species only (Section 6.2). The benefits afforded to benthic species by raising the heads from the

---

13 See Horsfield, R. (2018) Protection of biota from cooling water intakes at nuclear power stations: scoping study. Available at: https://assets.publishing.service.gov.uk/media/5b6943afe5274a1501725186/Protection_of_biota_from_cooling_water_intakes_at_nuclear_power_stations_scoping_study.pdf (Accessed: 22 November 2023) and Turnpenny, AWH et al (2010) Evidence report: Cooling Water Options for the New Generation of Nuclear Power Stations in the UK. Available at: https://assets.publishing.service.gov.uk/media/5a7c7688ed915d6969f450b2/scho0610bsot-e-e.pdf (Accessed: 22 November 2023).

seabed (feature (iv) in section Section 3.2.5 is not accounted for in the assessment providing a degree of precaution for those species.

3.2.8 For those fish that do nevertheless enter the intake tunnels, the FRR system is designed to recover and return them to the Bristol Channel quickly and with as little damage as possible. The FRR mitigation is considered further in Section 6.2.

3.2.9 The FRR is a more sophisticated version of return systems such as the system operating at Sizewell B ('SZB'). Fish recovery and return applies from the point fish are first recovered by the filtration equipment in the cooling water pump house until subsequent return to sea via the dedicated FRR tunnel and outfall. Since the granting of the 2013 DCO, the design of the FRR has been refined and improved. Detailed engineering design of the FRR system was submitted to and approved by the MMO, in consultation with the EA through the discharge of 2013 DCO requirement CW1. The design of the FRR system at HPC was approved by the MMO on 16 June 2017.

3.2.10 This section briefly summarises the FRR design specifications that are pertinent to the assessment of entrapment effects.

3.2.11 Following abstraction, water is drawn through the intake tunnels and arrives at the landward end at the forebay. The forebay is a 29 m deep structure that dissipates the hydraulic energy from the incoming seawater before it enters the pumping station. Within the pumping station, the sea water passes through the fine filtration screens of the drum and band screens. The drum and band screens will be situated in the Filtering Debris Recovery Pit and employ fine mesh filters to remove impinged organisms from the CWF. The default mesh size for the EPR is 5 mm square mesh as opposed to the 10 mm mesh filters employed at HPB. Biota large enough to be retained on the filtration screens is impinged and would be returned via the FRR outfall. Biota small enough to pass through the fine mesh filters would be entrained through the main power station cooling water flow and returned to sea via the cooling water outfalls.

3.2.12 Located immediately before the drum and band screens will be a series of trash racks that are designed to protect the screens from debris and overloading. The trash rack has 50 mm vertical bar spacing. Material that cannot pass through the bars will be sent to the debris recovery building. The debris recovery building has another trash rack with 200 mm bar spacing. Any fish that pass through this secondary trash rack will be returned to sea via the FRR tunnel. Any fish or debris that cannot pass through the 200 mm bars will go to waste.

3.2.13 Fish and biota that are impinged on the 5 mm mesh of the band or drum screens enter 'buckets'. Very low-pressure wash water sprays help to remove fish from the screens. The buckets are emptied into gutters. The bucket and gutter system has been optimised for fish protection by removing all vertical drops, the use of shrouded Archimedes screws to manage height differentials and the inclusion of 3 m swept bends rather than acute bends. The surface of the gutters will be smooth with a low coefficient of friction reducing the risk of abrasion to the fish and prevent fouling within the system.

3.2.14 The filtration system has been designed to have capacity to respond adaptively to clogging risks and variable frequency drivers can increase the drum and band screen rotation rate such that biota or debris are returned to sea via the FRR system at a faster rate.

3.2.15 A dedicated FRR tunnel will extend approximately 600 m under the foreshore to return impinged fish back to the sea. This differs from some of the more rudimental designs, such as at SZB where recovered biota is returned in the main cooling water flow that is subject to thermal uplifts and chlorination. The single FRR tunnel servicing both units will have a High-Density Polyethylene ('HDPE') pipe lining and will terminate with two outfall heads at the seaward end. The outfall structure is located such that biota impinged will be returned under water at all tidal states and separate from the water returning from the heat removal system. At HPA and HPB, no FRR system was installed and impinged biota went to landfill.

3.2.16 The EA reviewed FRR survival studies based on SZB, Le Blayais (on the Gironde Estuary) and Pembroke (Milford Haven) power stations and provided a Technical Report ('TR'), TB008 (Environment Agency[14]), to determine the range and uncertainty in fish mortality predictions for the FRR system at HPC. The EA-predicted FRR mortality rates for HPC are applied in the assessments of impingement in this report (Section 6.2).

Reason for the change

3.2.17 NNB is applying to remove the requirement to fit an AFD system from the 2013 DCO because, after lengthy and careful analysis, NNB has concluded that there are significant technical feasibility problems associated with the design, installation, maintenance and repair of an AFD system in the hydrologically dynamic tidal conditions of the Severn Estuary. This presents two key risks with the development as currently authorised.

---

14 Environment Agency (2020) Technical Brief: TB008. Fish Recovery and Return System Mortality Rates. Draft-04. Available at: https://consult.environment-agency.gov.uk/psc/ta5-1ud-nnb-generation-company-hpc-limited-2/supporting_documents/F.14 %20TB008 %20 %20FRR%20Mortality%20Rates%20 %20Draft04.PDF p 15 (Accessed: 22 November 2023).

3.2.18 First, there would be indefinite delays whilst an AFD system was developed and installed. This is because there was (and remains) no engineering precedent anywhere in the world for fitting an AFD system to open water intake heads, such as those at HPC, in waters with a comparable tidal range and currents. Despite extensive work by NNB and its specialist advisors, the engineering difficulties proved so challenging that NNB made the decision in November 2017 not to proceed with the AFD system. If the Project is not approved and an AFD system is required, HPC would not be able to commence operations in mid-2027, as planned. It would instead be necessary to delay the commencement of operations, potentially indefinitely, until an appropriate system had been designed, developed and tested. Approval of the Project allows that delay to be avoided and will ensure that HPC is able to contribute to meeting the urgent national need for a reliable and secure supply of new nuclear power.

3.2.19 Second, an important element of the technical feasibility problems associated with an AFD system is that the works in connection with it would need to rely heavily on remotely operated vehicles ('ROVs'). The independent expert advice that NNB has received is that existing ROVs fall significantly short of being able to undertake the work associated with the installation, maintenance and repair of an AFD system. This means it is highly unlikely that ROV's would ever, on their own, be an effective solution for the complex tasks which the installation, maintenance or repair activities an AFD system would require. The reasons why ROV technology alone cannot be used are discussed in Stage 3 of this HRA Report.

3.2.20 In the absence of suitable ROV technology to undertake the necessary tasks at the level of accuracy and reliability required for the installation, maintenance and repair of an AFD system, NNB would need to rely heavily on the use of human divers to undertake these activities. Doing this would expose divers for significant periods on a regular basis to intolerable health and safety risks which could lead to their deaths. NNB is firmly of the view that compliance with health and safety legislation, principles and guidance could not be achieved if divers were required to undertake work at the level of frequency and exposure to the high risks that such complex work would entail. These intolerable health and safety risks are discussed in Stage 3 of this HRA Report.

Description of the change

3.2.21 The proposed change is the removal of the requirement to install an AFD system.

3.2.22 There are currently no other significant changes proposed to the remainder of the cooling water infrastructure design.

3.2.23 The location of the cooling water intake heads where an AFD system was proposed to be installed can be seen on Figure 3.1 and Figure 3.2.

3.2.24 Requirement CW1 of the 2013 DCO provides that an AFD shall be installed prior to water abstraction commencing, not at the point at which the cooling water intake heads are fitted. The cooling water intake heads were installed during the summer of 2022.

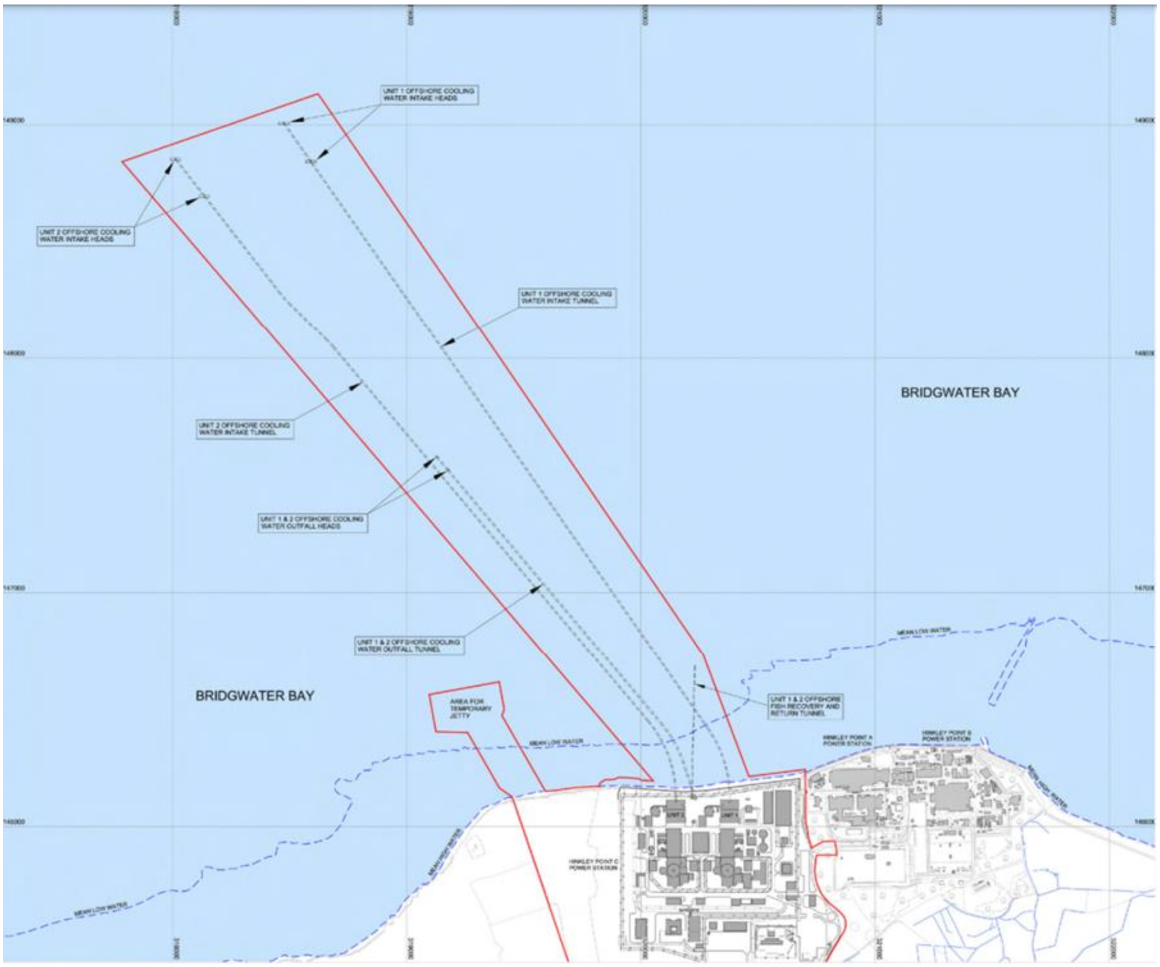


Figure 3-1: Locations of the four cooling water intake heads at which an AFD system was proposed to be installed

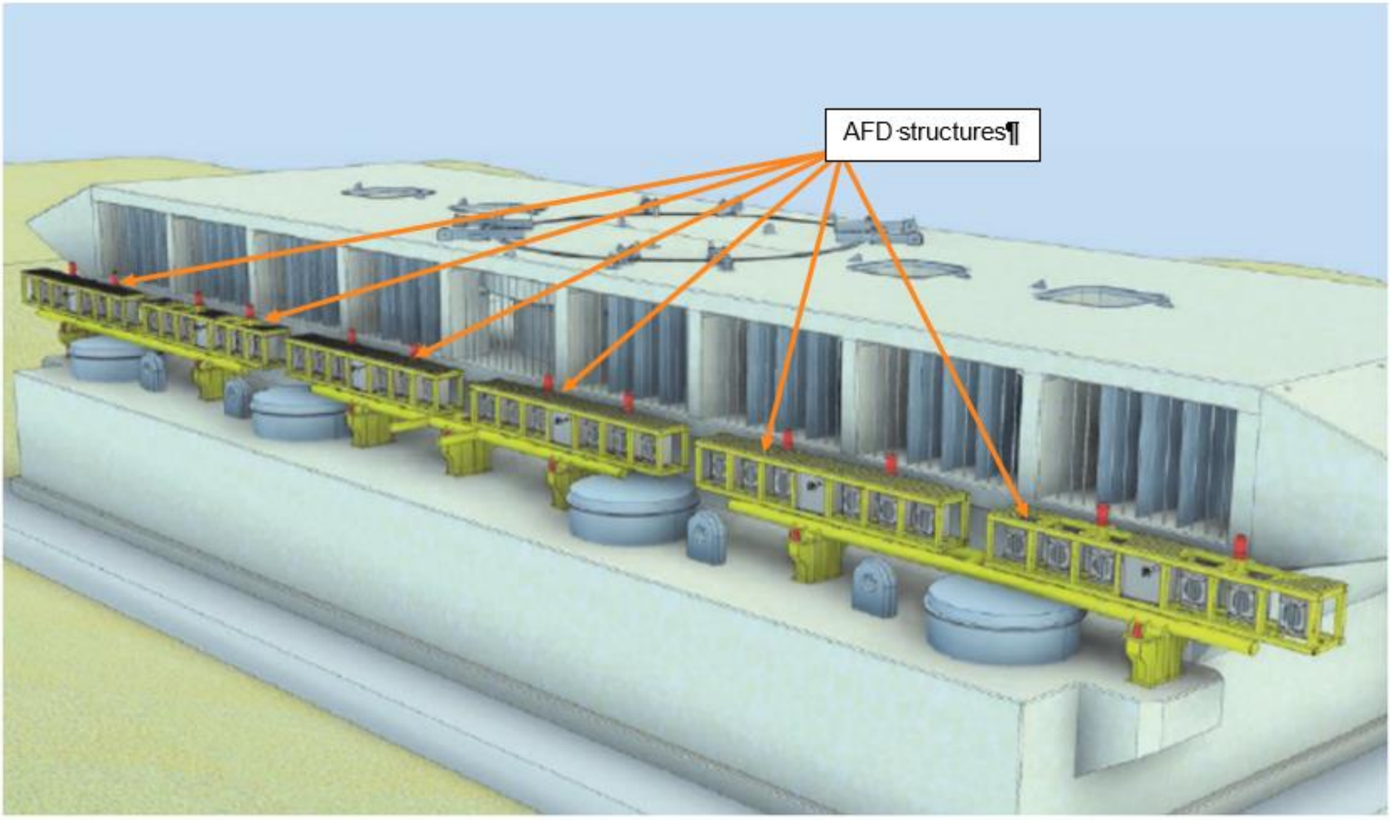


Figure 3-2: Siting of AFD structures originally proposed as part of the LSVE intake head

3.3 ISFS

Current approved design

3.3.1 The ISFS will be one of two buildings on site designed to store spent fuel generated by the operation of the two nuclear reactors. The ISFS will be located towards the north-eastern part of the HPC Site, and adjacent to HPA which is currently being decommissioned. In order to provide necessary flexibility, parameters were approved that allowed the sizing of the building to be increased or decreased within certain limits. In addition, Requirement MS16 of the 2013 DCO was imposed so the design appearance and the final layout would be approved at a later date by (now) Somerset Council.

3.3.2 Within the Design and Access Statement which formed part of the 2013 DCO application, it was stated that the ISFS will be constructed towards the end of the construction phase and the facility will only be required to be available approximately ten years after the start of operation of Unit 1. In addition, it explains that the spent fuel will be stored under water in a pool.

3.3.3 The original proposal to proceed with wet storage over dry storage was based on operational experience at the time and ease of inspection of spent fuel. This was an operational preference as there was no clear difference in performance between the two options. However, the factors which have now led NNB to prefer dry over wet storage are outlined below.

3.3.4 As part of the consented DCO, an Access Control Building was also proposed, located to the south of the ISFS.

3.3.5 The Access Control Building had two security functions: (i) control and access of pedestrians in and out of the ISFS, and the control; and (ii) monitoring of vehicles accessing through the vehicle inspection area.

3.3.6 The location and layout of the Access Control Building was based on operational requirements, particularly in relation to entrance and exit arrangements.

Reason for the change

3.3.7 The proposed changes are:

- a change from a 'wet' ISFS to a 'dry' ISFS, and associated increase in the building's size. This includes removal of the 55 m gaseous stack; and
- the replacement of the previously proposed Access Control Building associated with the original ISFS with a new larger Equipment Storage Building.

3.3.8 The proposed change from wet to dry storage is being driven by the advantages of the dry storage of spent fuel in comparison to wet storage, as approved within the 2013 DCO. These factors are outlined below:

3.3.9 **Engineering issues**: A wet store requires building an aircraft protection shell over a large pool to protect the wet store of spent fuel from accident or attack. The casks used for a dry storage method provide this same protection in a more compact and efficient way.

3.3.10 **Management**: Whilst both methods are equally safe, a wet storage method requires active management via circulating water cooling, to ensure that the pools are providing the correct environment for the storage of fuel. In a dry storage method, the casks are cooled by air convection, which does not require active management. Whilst both methods are capable of being operated safely, passive safety measures are preferable.

3.3.11 As outlined in a strategic assessment in 2010, both wet and dry storage options demonstrate Best Available Technique ('BAT') and As Low As Reasonably Practicable ('ALARP'):

- BAT: vehicle by which the EA meets the requirements of the International Basic Safety Standards to keep radiation doses to the public and environment ALARP. This should include all relevant factors, including health and safety, operability, cost etc.
- ALARP: term used by the Office for Nuclear Regulation ('ONR') and the Health Safety Executive ('HSE') to ensure risks to workers and members of the public from all risks and hazards are mitigated.

3.3.12 By demonstrating both BAT and ALARP, both wet and dry storage options can be considered safe from the perspectives of the nuclear site licence regulatory bodies: EA, ONR and HSE.

3.3.13 As the HPC design process progressed, a revised assessment was made in 2017 to re-evaluate wet storage. This study recognised that the design considerations for wet storage had changed, such as modular pool construction no longer being viable. This study also considered the enhanced safety measures required following the Fukushima accident in Japan in 2011, whereby the (then) Secretary of State for Energy and Climate Change requested in March 2011 that the Chief Inspector of nuclear installations and head of the ONR examine the accident to see what lessons could be learnt to enhance the safety of the UK nuclear industry.

3.3.14 A dry store has been operational at SZB in Suffolk. This facility provides valuable operational experience and adopting a dry storage method at HPC would deliver clear advantages to having a consistent method across power stations increasing efficiency and allowing the sharing of best practice.

3.3.15 This revised assessment also found that there was a greater cost associated with the aircraft protection shell required for wet storage in comparison to dry storage methods. Dry storage is not any less costly overall, but the cost is spread across the operation of the power station more evenly.

3.3.16 In summary, there were no safety or environmental performance advantages for wet storage over dry storage.

Description of the change

3.3.17 The proposed change to the ISFS involves changing the method of storing spent fuel from wet storage underwater in a pool to dry storage in concrete casks.

3.3.18 The concrete casks used to store the spent fuel will be sealed, meaning no gaseous emissions will occur. Therefore, it is proposed that the 55 m gaseous discharge stack required for wet storage of spent fuel is removed from the ISFS.

3.3.19 Dry storage requires more space per unit of fuel stored and casks must be installed at ground level. Therefore, the ISFS building dimensions need to be amended. Table 3.1 outlines the proposed changes to the building dimensions. These dimensions would be approved via the relevant elevations and roof plans submitted as part of the proposed DCO Material Change application.

3.3.20 The overall footprint of the building will increase from 9,750 m^2 to 16,717 m^2, an increase of 70 %; however, this extra footprint is 6,967 m^2 and represents a small percentage (5.25 %) of the overall construction / built up area considered in the original ES.

Table 3-1: Proposed change in dimensions of the ISFS

Building	Dimensions (m) (length x width x height)
ISFS (original ES design)	150 x 65 x 25 with 55 m stack
ISFS (proposed revised design)	229 x 73 x 30 with no 55 m stack

3.4 Meteorological Mast

Current approved design

3.4.1 A meteorological instrumentation mast is proposed at HPC to carry instruments to measure environmental conditions such as wind speed, wind direction and air temperature. The data from this instrumentation will monitor and record climatic and atmospheric conditions and will provide important information in the event of an emergency situation.

3.4.2 The current approved design features a meteorological mast at 50 m in height. The mast is located on a platform at 14 m Above Ordnance Datum ('AOD') making it a total of 64 m AOD. A separate building (the meteorological station) will house the meteorological equipment.

Reason for the change

3.4.3 The proposed change involves lowering in height and relocating the meteorological mast to an area that reduces the potential for interference from surrounding buildings and infrastructure, which could lead to inaccurate wind speed and temperature readings.

3.4.4 The proposed changes will ensure that the meteorological mast and station will meet the World Meteorological Organization ('WMO') guidelines[15], which were published in 2018 after the 2013 DCO had been approved. A 4-year study of the prevailing weather conditions on site was carried out, which also contributed to the design change.

3.4.5 As the proposed mast is much reduced in height, the current authorised location is inadequate for the following reasons:

- asphalt within the proximity of the nearby internal road could result in inaccuracies in the measurements of temperature;
- shadows cast by surrounding buildings could lead to inaccuracies in the measurements of temperature;
- nearby buildings could cause a wind barrier resulting in insufficient wind quality to accurately measure wind velocity and direction; and
- proximity of buildings meaning Sound Detection and Ranging ('SODAR') or Light Detection and Ranging ('LiDAR') equipment to measure the wind at >70 m could not be installed. SODAR is used to measure wind speed at various heights. LiDAR is used to preview wind speed before it interacts with other measuring methods.

15 World Meteorological Organization (WMO) (2018) Guide to Instruments and Methods of Observation. WMO-No. 8. Available at: https://community.wmo.int/en/activity-areas/imop/wmo-no_8 (Accessed 8 December 2023).

Description of the change

3.4.6 Taking account of the newly proposed location approximately 60 m south-west of its current approved location (which is on a platform 20 m above sea level, as opposed to only 14 m above sea level), and the use of more advanced technology, the change would involve substantially reducing the height of the mast from 50 m to 10 m. Overall the height of the mast above sea level will therefore be reduced by 34 m (from a height of 64 m above sea level to a height of 30 m above sea level).

3.4.7 This new arrangement would not require the previously consented separate building (the meteorological station) to house the meteorological equipment. The equipment would instead be located outside, within a compound area situated proximate to the mast. It is therefore proposed that the meteorological station currently authorised by the 2013 DCO is not constructed.

3.4.8 The compound will include the meteorological mast, precipitation gauge, meteorological station cabinet, SODAR or LiDAR and guy ropes to secure the equipment. The current construction parameters for the erection of the meteorological mast and station are:

- +/- 5 m in any direction for the meteorological station; and
- +/- 5 m east, west and south and +/- 20 m north for the meteorological mast.

3.4.9 In accordance with Requirement PW3 of the 2013 DCO, the design of the proposed changes set out in the proposed DCO Material Change application will need to be in accordance with the approved plans, including the Parameter Plan, which defines the maximum movement for a building. An updated Parameter Plan (drawing reference HINK-A1-SL-00-GA-002), which can be found in the Hinkley Point C Material Change Application Plans, will therefore be submitted with the proposed DCO Material Change application. The updated parameters are:

- +/- 6 m in a north direction;
- +/- 6 m in an east direction;
- +/- 13 m in a west direction; and
- +/- 44 m in a south direction.

3.4.10 In accordance with Requirement MS21 of the 2013 DCO, the construction of the meteorological mast shall not commence until details of the siting, scale and external appearance of the mast have been submitted to and approved by Somerset West and Taunton District Council (now Somerset Council).

3.4.11 A visual representation of the proposed change can be seen in Figure 3-3.

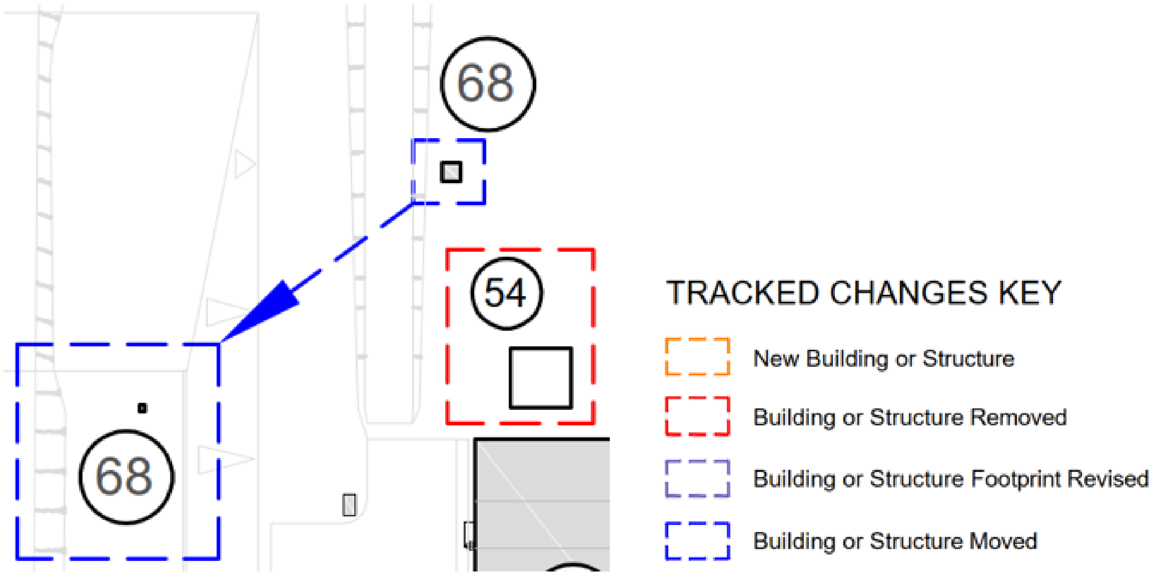


Figure 3-3: Relocation of the meteorological mast to a compound of increased area (68) and removal of the meteorological station building (54)

3.4.12 The mast will need to be in place around a year before first fuel delivery, in time for Unit 1 operation. Information is not yet available on the construction duration of the mast.

3.5 Hinkley Point Substation

Current approved design

3.5.1 The Hinkley Point Substation was constructed in 2014 as a temporary building to be retained only during the construction of HPC. It is contained within a small building to the northeast of the site, adjacent to the access road to HPA.

3.5.2 The Hinkley Point Substation feeds in power from the National Grid via HPB's existing 400 kV connection (significantly reducing the need for mobile generators during construction). Despite the relatively short period during which the substation would be required, the building and systems were built with at least a 60-year design life, due to the critical nature of its function.

Reason for the change

3.5.3 The proposed change involves an amendment to retain the existing temporary Hinkley Point Substation as a permanent feature to supply electricity to HPA and HPB.

3.5.4 NNB has an obligation under agreements between the three Hinkley Point sites to either provide power to HPA and HPB (for decommissioning activities) or provide them with an alternative like for like supply at least until 2040. To fulfil that obligation, EDF Energy and National Grid originally planned to build a new substation and 11 kV overhead line to HPB.

3.5.5 However, after further consideration and discussions with Magnox Ltd (HPA) and EDF Energy Ltd (HPB), NNB has concluded that instead of building a new substation, the optimal solution is to reconfigure the supply arrangements and retain the existing 11 kV temporary Hinkley Point Substation during the operational phase of the HPC Project as a permanent feature. This would avoid the need to design and construct a new substation and overhead line in the future to supply electricity to HPA and HPB, which will require extensive construction works.

Description of the change

3.5.6 The current temporary Hinkley Point Substation imports electricity to HPC via an electrical supply for the construction of HPC. The proposed change involves switching the Hinkley Point Substation from importing electricity, to exporting an 11 kV supply to Hinkley Point A and Hinkley Point B (to support decommissioning activities) at the end of the construction of HPC. The temporary substation would therefore be retained as a permanent feature during the operation of HPC. The location of the Hinkley Point Substation can be seen on the Site Layout Plan (Tracked Changes) (drawing reference HINK-A1-SL-00-GA-011) in the Hinkley Point C Material Change Application Plans. The dimensions of the building are 34.16 m x 4.04 m x 5 m (length x height x width).

3.5.7 The Hinkley Point Substation was originally only required during the construction phase of the HPC Project, to feed-in power from the National Grid via Hinkley Point B's existing 400 kV connection. Despite the relatively short period during which the substation would be required, the building and systems were built with at least a 60-year design life, due to the critical nature of its function.

3.5.8 It is anticipated that the plant layout within the Hinkley Point Substation will require very minor internal modification to accommodate the change from temporary to permanent.

3.5.9 The Hinkley Point Substation is already constructed and the proposed change to not remove it and no longer construct a new 11 kV substation to supply Hinkley Point A and Hinkley Point B will reduce the level of workforce and construction traffic later in the construction programme.

3.5.10 The location of the Hinkley Point Substation in relation to the ISFS and new Equipment Storage Building can be seen in Figure 3-4.

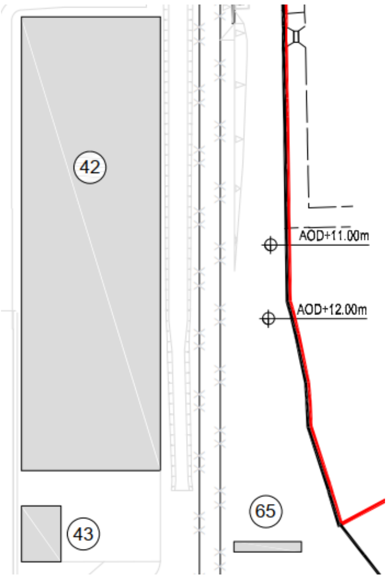


Figure 3-4: Location of the Hinkley Point Substation (65) in relation to the ISFS (42) and new Equipment Storage Building (43)

3.6 Sluice Gate Storage Structures

Current approved design

3.6.1 At present, the design of the power station does not include an area for the storage of sluice gates and lifting beams for the Forebay and Outfall Pond (surge chamber), and the lifting beams of the Pumphouse sluice gates. The Forebay, Outfall Pond (surge chamber) and Pumphouse (one per Unit of Hinkley Point) are located on the north/coastal side of the HPC Site.

Reason for the change

3.6.2 Located within HPC's CWS, the sluice gates are used only during 'outages', i.e., periods of time where the reactors are shut down to carry out maintenance and refuelling. The sluice gates allow maintenance to be performed on equipment that is usually submerged, by holding back sea water from the rest of the system.

3.6.3 Sluice gate storage structures were not included within the original DCO submission because detailed design of the Forebay and Outfall Pond had not yet been undertaken. During the post-consent detailed design process, it has become apparent that a storage solution is required.

3.6.4 The proposed change therefore involves the construction of four new structures (two per Unit of HPC) to house the sluice gates and lifting beams.

Description of the change

3.6.5 As mentioned above, the proposed change involves four new structures to house sluice gates and lifting beams. Two storage structures are required for each Unit of HPC (Unit 1 and Unit 2). The structures will provide toaster-style storage racks which will be local to each Unit and fixed to a concrete base (see Plate 3-1 and Plate 3-2).

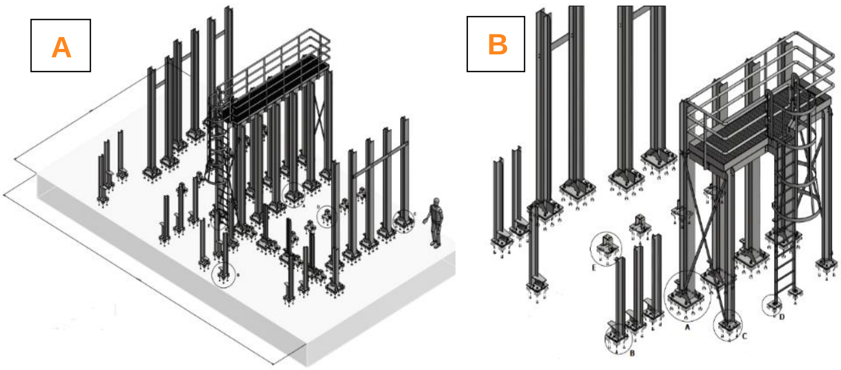


Plate 3-1: Toaster-style storage rack (A: Large rack; B: Small rack) for illustrative purposes only

Plate 3-2: Example of a toaster-style storage rack from Flamanville 3

3.6.6 There will be two storage locations per Unit that will allow mobile cranes to lift the sluice gates from their storage position in the toaster-style storage racks to their guides within the Forebay and Outfall Pond (surge chamber) buildings. Two storage locations are required because the cranes have to reach both Forebay and Outfall Pond buildings. It would not be possible for one crane to serve both the Forebay and Outfall Pond buildings from one location.

3.6.7 The footprint of the two storage structures will be 10.6 m x 7.3 m (Type 1) and 6.3 m x 4.9 m (Type 2). The two storage structures vary in size because one is designed to hold the sluice gates for the Forebay and the other for the Outfall Pond (surge chamber); each building requires a different number of sluice gates.

3.6.8 The proposal includes 14 sluice gates rather than 24 as not all the sluice gates will be in use at the same time. However, the storage structures will be designed to hold 24 sluice gates to future proof for expansion if required.

3.6.9 The sluice gates will be used infrequently, spending the majority of the time in storage and will only be used during outages (maintenance periods).

3.6.10 During outages the sluice gates will be moved by crane from the storage structure to either the Outfall Pond or Forebay buildings which are adjacent to the proposed storage structures. The sluice gates will be used to isolate parts of the secondary CWS such as the Intake Tunnel or forebay to allow water storage areas to be drained and maintenance to be performed. When the maintenance is complete for the outage, the water storage areas will be reflooded and the sluice gates returned to the storage structure.

3.6.11 The storage racks are required prior to Hot Functional Testing which will be carried out around a year before the power station is commissioned. Construction duration is anticipated to last two weeks.

3.7 Compensatory Measures

3.7.1 In addition to the above changes of the Project, a range of compensatory habitat measures are being proposed by NNB, which form part of the Project. These compensatory measures are required in this case because this HRA Report has determined that the risk of an adverse effect on the integrity of four European / Ramsar sites cannot be excluded beyond reasonable scientific doubt due to the first design change to HPC mentioned above, namely the removal of the requirement for the AFD. In accordance with the Habitat Regulations this means that three HRA 'derogation tests' must be met in order for the DCO Material Change to be approved by the Secretary of State. All three derogation tests are addressed in full below (Sections 10, 11 and 12). The third test requires that "*any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000* (*now the NSN*) *is protected*"[16].

3.7.2 As set out in the list below, the compensatory measures currently proposed comprise of habitat creation / enhancement at two identified sites (Pawlett Hams and The Island); fish

16 Regulation 68, Habitats Regulations

passage improvements including river barrier removal or easement at three of the barriers listed below; and three types of marine habitat creation at locations which are not as yet identified.

3.7.3 The measures comprise:

3.7.4 Barrier removal (meaning total removal or partial removal) or barrier easement (meaning fish pass installation or natural bypass channel) of three barriers to be selected from the following:

- Maisemore Weir, River Severn (this site would be within the DCO Material Change Order Limits);
- Trostrey Weir, River Usk (this site would be outside the DCO Material Change Order Limits);
- Upper Lode Weir, River Severn (this site would be within the DCO Material Change Order Limits);
- Manorafon Weir, River Towy (this site would be outside the DCO Material Change Order Limits); and
- One of the Mousenatch Weir or Eyton Weir or Coxall Weir, River Lugg which is a tributary in the River Wye catchment (each of these sites would be within the DCO Material Change Order Limits).

3.7.5 Saltmarsh (and associated habitats) creation / enhancement (approximately 340 ha):

- Pawlett Hams (313 ha) (this site would be within the DCO Material Change Order Limits); and
- The Island (27 ha) (this site would be within the DCO Material Change Order Limits).

3.7.6 Marine habitat creation:

- Seagrass beds (5 ha) (location(s) at present unknown but will be outside the DCO Material Change Order Limits);
- Native Oyster reefs (1-2 ha) (location(s) at present unknown but will be outside the DCO Material Change Order Limits); and
- Kelp forest (15 ha) (location(s) at present unknown but will be outside the DCO Material Change Order Limits).

3.7.7 In relation to the proposed barrier removal / easement, at the current stage of assessment it is expected that Maisemore Weir (River Severn) and Trostrey Weir (River Usk) will be two of the three barriers taken forward as compensatory measures, however this is not at present fixed and hence other weirs listed have been assessed in this HRA Report.

3.7.8 At each of the identified weir sites there are a number of possible design options, including full or partial weir removal, fish pass or natural bypass channel.

Maisemore Weir, River Severn

3.7.9 Maisemore Weir is located on the River Severn in Gloucestershire, approximately two miles northwest of Gloucester City Centre at Grid Reference SO 818 216.

3.7.10 Following consultation with the EA it is understood that the majority of shad fish migrating upstream in the River Severn do so via Maisemore Weir. However, it is only passable at certain tide states or when river flows are high. As a consequence, the Weir can result in delays to shad migration and thus limit their migration upriver with the consequent impact on spawning success and increase in predation pressure.

3.7.11 Full removal, partial removal, or bypass of this weir would significantly ease passage for shad as well as improving chances of passage for eel, lamprey and salmon.

Trostrey Weir, River Usk

3.7.12 Trostrey Weir was built in the late 1960s as part of a gauging station on the River Usk in Monmouthshire, Wales. It is located approximately two miles northwest of the town of Usk at Grid Reference SO 358041 and is within the River Usk SAC.

3.7.13 This is one of the remaining barriers on the Usk and improving passage here would enable both shad and salmon to benefit from upstream improvements that have been already made.

3.7.14 There are several options available for the improvement of passage at Trostrey Weir, including technical passes, partial removal or full removal of the weir. All of these options depend on the acceptability of the relocation of the existing NRW hydrological gauging station from Trostrey to another NRW site on the Usk at Chainbridge. Discussions with NRW are ongoing and a detailed comparison of the hydrological characteristics at each site is underway.

Upper Lode Weir, River Severn

3.7.15 Upper Lode Weir is located on the River Severn approximately half a mile east of Tewkesbury in Gloucestershire at Grid Reference SO 881 327.

3.7.16 Only 50 % of the shad reaching this weir are able to pass beyond it, thus significantly limiting the extent of migration. Full or partial removal will significantly ease fish passage to the upper reaches of the Severn where key improvements of other barriers have already been made.

3.7.17 Full removal, partial removal or bypass of this weir would ease passage for shad as well as improving chances of passage for salmon.

Manorafon Weir, River Towy

3.7.18 Manorafon Weir is located in the River Towy SAC in Carmarthenshire, Wales. It is part of what appears to be a series of rock weirs, on the River Towy approximately two miles northeast of Llandeilo town at Grid Reference SN 65717 24006.

3.7.19 Emerging monitoring data has shown that shad that migrate up the River Towy are sometimes present in the Bristol Channel in the vicinity of the HPC cooling water intake heads. As such, a barrier removal on the Towy is being considered.

3.7.20 Full removal, partial removal or bypass of this weir would ease passage for shad as well as improving chances of passage for salmon.

Mousenatch Weir or Eyton Weir or Coxall Weir, River Lugg

3.7.21 These weirs are a series of rock weirs on the River Lugg to the northwest of Leominster in Herefordshire. Their respective locations are:

- Mousenatch- Grid ref: SO4680260971
- Eyton- Grid ref: SO4719660672
- Coxall- Grid ref: SO4773260636

3.7.22 As no suitable sites could be identified on the River Wye, it was decided (in discussion with NRW and EA) that the best approach would be to explore options on the River Lugg (a tributary of the River Wye). Improvement to the River Lugg at these points would allow for improved successful migration of salmon to the upper reaches of the river and may also support lamprey, eel and sea trout.

3.7.23 Whilst there are three separate weirs in this location, they are largely grouped together for this assessment since they are in close geographical proximity to each other and largely of the same construction. Their construction is of large masonry block stone and the current plans are to remove the large blocks from the crest of the weir and use to reconstruct a trapezoidal channel with associated bed and bank works, thus achieving a functional removal of the weir.

Pawlett Hams

3.7.24 The 313 ha site at Pawlett Hams is located on the east bank of the River Parrett opposite the village of Combwich, approximately 3.5 km from the estuary mouth at Stert Point (centered on OS grid reference ST 273 425).

3.7.25 It is located adjacent to the WWT's Steart Marshes site. The site comprises permanent pasture of semi-improved and neutral grassland and arable land. The area is drained by rhynes (agricultural drainage ditches), which act as a drainage system in winter and as stock barriers and drinking water supplies in the summer. A contemporary flood embankment and naturally developed shingle ridges separate the intertidal area of the River Parrett from the terrestrial, grazing marsh areas of Pawlett Hams.

3.7.26 Pawlett Hams is located within the Severn Estuary SPA, Severn Estuary Ramsar and Bridgwater Bay SSSI. The Severn Estuary SAC follows the River Parrett but the SAC boundary extends inland, up to approximately 65 m in places, along the outer edge of Pawlett Hams. See Figure 3-5 (Appendix 13.3).

3.7.27 The proposal at Pawlett Hams is for a 313 ha managed retreat scheme and saltmarsh (and associated habitat) creation through breaching of the soft landscape flood defences and the excavation of new creeks to allow tidal waters to flood the low-lying areas of the Pawlett peninsula. The works will be very similar to the scheme developed at Steart Marshes wetland site on the opposite bank of the River Parrett. The Somerset Wetlands National Nature Reserve ('SWNNR') is also nearby. Developing this location will provide good ecological connectivity between Steart Marshes and the SWNNR. It is also in close proximity to another of NNB's proposed compensation measures at The Island (discussed below).

3.7.28 Saltmarsh provides a supportive habitat for the Severn Estuary fish assemblage by providing feeding and nursery grounds as well as shelter from predation. Saltmarsh also provides valuable habitats for birds, plant species and invertebrates, as well as providing amenity value to the local community and visitors. Saltmarsh can also help improve water quality and provide natural flood defences. There are also well documented 'blue carbon' benefits associated with saltmarsh as they can act as a very efficient natural carbon sink. Some grassland would be retained as part of the managed retreat.

The Island

3.7.29 The Island (which is not in fact an island) contains 27 ha of existing saltmarsh located on the right (east) bank of the River Parrett opposite the opening to the Steart Marshes managed realignment, approximately 1.2 km from the estuary mouth at Stert Point (centered on OS grid reference ST 290 455), see Figure 3-5 (Appendix 13.3). The site comprises saltmarsh habitat intersected by drains. A large tidal creek extends from north to south through the site and there is a contemporary flood embankment, which separates the intertidal area of The Island from the terrestrial areas to the east. The Island is located within the Severn Estuary SPA, Severn Estuary SAC, Severn Estuary Ramsar and the Bridgwater Bay SSSI. The Island is included in the European Marine Site.

3.7.30 The proposal for The Island is saltmarsh enhancement and associated habitats over 27 ha of land in close proximity to the existing Steart Marshes wetland site, the SWNNR and the proposed compensation site at Pawlett Hams. The indicative proposals at The Island include the excavation of a new creek system leading into the marsh with proposed extensions to the existing creek and three shallow pools at the heads of the creeks to create additional shallow mudflat areas.

3.7.31 The area would be lowered to create areas of pioneer marsh. of existing saltmarsh and associated habitats through the lowering of the existing high-level marsh to create a range of habitats more amenable to fish usage including tidal creek, mudflat and lower saltmarsh.

3.7.32 Developing this location will provide good ecological connectivity between the Steart Marshes wetland site, the proposed managed re-alignment at Pawlett Hams and the SWNNR.

Marine habitat creation

3.7.33 At the time of writing, the concept design and location for the proposed marine habitats is not confirmed. It is expected that these habitats will be subject to trials within an identified study area to determine the most suitable locations for their development, and subject to ongoing studies, as required. However, where possible, details have been provided below.

Seagrass beds

3.7.34 Following discussions with the Statutory Nature Conservation Bodies ('SNCBs') regarding the development of an appropriate package of compensatory habitat measures, the creation / enhancement of 5 ha of seagrass beds is proposed.

3.7.35 At the time of writing, discussions are still ongoing with the relevant bodies with regard to location and approach to the development of seagrass beds. The EA have identified potential areas within the Severn Estuary based on key physical attributes which are being investigated. An example of such a site is the mouth of the River Axe, from the headland at Brean Down Fort to Weston-Super-Mare, due to its sheltered position against prevailing wind conditions. Further sites are being considered including on the Welsh side of the estuary, and within the wider Bristol Channel.

Native Oyster reefs

3.7.36 As with seagrass beds, at the time of writing, discussions are still ongoing with relevant bodies with regards to the planned 1-2 ha of native oyster reefs to be created / enhanced within the wider area. Depending on the outcome of feasibility and precise location of the proposed sites, the work may involve the reaction of entirely new native oyster reefs or the creation / enhancement of existing or historic areas of native oyster reef that have become degraded due to overfishing, disturbance or other environmental stressors.

3.7.37 There is a lack of historic native oyster reef in the immediate locality of the HPC Site. At present, potentially suitable areas off the coast of south-west Wales are being assessed. The EA have identified potential areas within the English side of the Severn Estuary for potential creation / enhancement based on key environment variables, these will also be considered as part of the feasibility process.

Kelp forest

3.7.38 Following discussions with the SNCBs regarding the development of an appropriate package of compensation, NNB is proposing to introduce 15 ha of kelp forest. Kelp is a community of brown seaweed, which can form dense submerged forests in temperate seas. Kelp forests establish in the photic zone on hard, rocky substrate, and are distributed across the UK. Kelp forests are highly dynamic systems, exhibiting pronounced spatial-temporal variability, with species composition varying depending on the physical, chemical and biological environment.

4 CONSULTATION AND ENGAGEMENT

4.1 Previous consultation and engagement

4.1.1 An extensive consultation process was undertaken during the initial application for the 2013 DCO.

4.1.2 Further engagement was undertaken as applicable for the non-material changes to the 2013 DCO as listed above and the Marine Licences (as presented in Section 1).

4.1.3 There has also in recent months been significant engagement with the relevant SNCBs around potential compensatory habitat measures to be proposed as part of the DCO Material Change application as explained in this HRA Report. This consultation is summarised in Table 4-1.

Table 4-1: Engagement to date on proposed HPC design changes and compensatory habitat measures changes

Date	Consultee	Summary of engagement
Ongoing (12 October 2022 onwards)	HPC, NE, NRW, EA	AFD Compensation Progress Catch Ups
Ongoing	HPC, Somerset Council, NE, EA	HPC lookahead meetings. Ongoing fortnightly meetings discussing all planning matters including Material Change DCO.
19 January 2023	HPC, NE, NRW, EA	Compensation Workshop #1. EA & NRW draft Principles Guidance noted as helpful and supportive of developing approach. Focus of Severn Estuary Assemblage rather than individual marine species agreed to be appropriate
28 February 2023	HPC, NE, NRW, EA	Compensation Workshop #2. Overall content of the shortlist of potential measures (mosaic approach) agreed to be appropriate by all parties.
23 March 2023	HPC, NE, NRW, EA	Compensation Workshop #3. Outlining potential locations for the compensatory measures

Date	Consultee	Summary of engagement
14 June 2023	Somerset Council	Summary of DCO Material Change, and overview of the compensation package.
4 July 2023	HPC, NE, NRW, EA	Adaptive Monitoring and Management Plan ('AMMP'). NNB outlined wanting to utilise the Marine Technical Forum ('MTF') as the basis for the AMMP Requirement to ensure the transparency and correct representation. Monitoring to be done to ensure adequate compensation taking place, care to be taken to not enter a 'monitoring loop'. Acknowledged difficulty in understanding what can and cannot be monitored in relation to potential HPC impacts.
14 August 2023	EA	General introduction to a new member of staff to wider HPC issues but a focus on DCO Material Change, and overview of the compensation package.
15 August 2023	Canal & River Trust	Introduction to DCO Material Change and compensation. Discussion on possible riverine barrier removal sites.
22 August 2023	Tewkesbury Borough Council	Summary of DCO Material Change, and overview of proposed compensation package.
23 August 2023	Somerset Council – officers and elected members	Summary of DCO Material Change, and overview of proposed compensation package.
24 August 2023	The Crown Estate	Brief overview of DCO Material Change, and proposed compensation package. Particular focus on compensation-related marine habitat creation, and associated potential leasing / licensing requirements
13 September 2023	Somerset Council – officers and elected members	Summary of DCO Material Change and overview of proposed compensation package.
20 September 2023	Somerset Council	Summary of DCO Material Change, and overview of proposed compensation package.

Date	Consultee	Summary of engagement
		Particular focus on compensation and consenting strategy.
26 September 2023	Monmouthshire County Council	Summary of DCO Material Change, and overview of proposed compensation package. Discussion of Town & Country Planning Act 1990 application on River Usk. Particular focus on compensation and consenting strategy.
3 October 2023	MMO	Summary of DCO Material Change, and overview of proposed compensation package. Particular focus on compensation and marine licensing options
5 October 2023	Devon & Severn Inshore Fisheries and Conservation Authority ('IFCA')	Summary of DCO Material Change, and overview of proposed compensation package.
5 October 2023	Carmarthenshire County Council	Summary of DCO Material Change, and overview of proposed Compensation Package. Discussion of T&CPA 1990 application on River Towy. Particular focus on compensation and consenting strategy.

5 DEFINITION OF THE BASELINE

5.1.1 For the purposes of this HRA Report, the environmental baseline against which the HRA will be made is three-fold in nature:

- the original 2013 DCO baseline: This has been summarised from the original 2013 DCO ES, describing the baseline as it stood at the time of the original DCO application in 2011 (having been informed by extensive surveys and studies prior to this);
- the current baseline: This comprises the original baseline updated to incorporate the changes approved through the four DCO non-material changes and the relevant planning consents obtained under the Town and Country Planning Act 1990 since the original baseline was prepared, as well as other relevant changes to the baseline including elements of the Hinkley Point C project that have already been constructed; and
- the future baseline: this is the current baseline updated to take into account changes to the baseline that are expected to have been made by the time Hinkley Point C is operational (assume to be 2027), including as a result of the currently consented Hinkley Point C project in the absence of the proposed changes that will be the subject of the material change DCO application.

5.1.2 For each receptor group, the original 2013 DCO baseline, current baseline and future baseline is described.

5.1.3 Key resources used to inform the baseline include:

- The HPC 2013 DCO ES;
- The Secretary of State's 2013 DCO HRA[17];
- The EA's AA of NNB's application to vary the WDA Permit for HPC dated 13 November 20[18];
- The Inspector's report on the WDA Permit inquiry dated 7 December 20[19];
- The Secretary of State's decision letter following the WDA Permit inquiry dated 2 September 20[20];

17 The Hinkley Point C (Nuclear Generating Station) Order 2013 (legislation.gov.uk) (Accessed: 11 December 2023).

18 Appropriate assessment of the application to vary the water discharge activity permit for Hinkley Point C (environment-agency.gov.uk) (Accessed: 11 December 2023).

19 Removal of Acoustic Fish Deterrent Conditions from Water Discharge Activity (WDA) Permit (publishing.service.gov.uk) (Accessed: 11 December 2023).

20 Removal of acoustic fish deterrent conditions from Water Discharge Activity (WDA) Permit (publishing.service.gov.uk) (Accessed: 11 December 2023).

- HPC ecology and ornithology surveys undertaken as part of the HPC construction monitoring requirements;
- Site-specific work undertaken to inform ongoing HPC Marine Licence variations; and
- Third-party, publicly-available data and information.

5.1.4 As noted above, the Project to be assessed is the construction (already ongoing); operation; and (to the extent that assessment is possible) decommissioning of the nuclear build project at HPC "as changed" by the DCO Material Change application to be sought (comprising the six changes to the design of HPC and the delivery of associated compensatory habitat measures). The HRA of the Project will accordingly consider, for the following pathways of impact, the construction, operational and (to the extent that assessment is possible) decommissioning impacts arising from the (i) six HPC design changes "as changed"; and (ii) from (to the extent assessable at this time) the compensatory measures:

- any pathways of impact to European sites already identified in the Secretary of State's 2013 DCO HRA which remain relevant to the six HPC design changes; and
- any new pathways of impact to European sites (not already identified in the Secretary of State's 2013 DCO HRA) from the six HPC design changes or (to the extent assessable at this time) from the compensatory habitat measures.

6 APPROACH TO ASSESSMENT WITHIN THIS HRA REPORT

6.1 Introduction

6.1.1 Within each of the subsections below, we have set out the methodology used to inform the assessment in this HRA Report and whether this is qualitative or quantitative in nature, as appropriate.

6.2 Entrapment (meaning impingement and entrainment) effects on fish

6.2.1 Impingement represents the primary impact pathway for most of the fish species and life-history stages present at Hinkley Point. Smaller life history stages (such as eggs, larvae, juveniles and for some small-bodied species, adult fish) may be entrained. Collectively, these impacts are known as entrapment. Impingement and entrainment losses have been quantified separately in the shadow AA within this HRA Report, using the most relevant data sets, before being combined to allow the entrapment effect to be assessed.

6.2.2 Impingement assessments are based on data collected from sampling conducted at HPB. Data from the sampling programme, known as the Comprehensive Impingement Monitoring Programme ('CIMP'), has been used to predict the unmitigated numbers of individuals that would be impinged by HPB.

6.2.3 To estimate mitigated impingement by HPC (in the absence of an AFD), factors have first been applied to raise the estimated unmitigated numbers impinged at HPB to predicted unmitigated numbers impinged by HPC. Additional factors have been applied to account for the embedded HPC mitigations, namely the capped head intake design and the FRR system. Predicted losses are assessed in two ways, firstly, population level effects convert losses of predominantly juvenile fish into equivalent adults that can be contextualised relative to the adult population estimate. In addition, for the typical fish species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC, direct numerical / biomass losses of fish from the typical fish species assemblage and their feeding / functional roles are considered as part of the assemblage assessment.

6.2.4 The following text in this section explains the first "population level effect" methodology. At the end of the fish methodology part of this Section 6.2 (6.2.64 – 6.2.65 below), the approach to the additional methodology for the typical fish species assemblage is briefly explained. This typical fish species assemblage methodology is then expanded on in Section 9 (the shadow AA) where the potential effects of entrapment on the typical fish species assemblage are assessed.

Assessment of fish population level effects

6.2.5 To determine population level effects, factors have been developed in consultation with the EA to convert the numbers of the predominantly juvenile impinged fish to equivalent adults, allowing losses to be contextualised relative to the adult population. Where relevant, the numbers of adults that are predicted to be impinged by HPC have been converted to a biomass of impinged adults. The steps are further summarised in Figure 6-1.

6.2.6 The methodology adopted to assess the population level effect is the same as that used by the EA in their AA and favoured by the Planning Inspector at the WDA Permit inquiry. More specifically, the methods used by the EA to convert predominantly juvenile fish into equivalent adults, and the scale of the spawning population against which equivalent adult losses are contextualised, have been replicated here.

6.2.7 Entrainment assessments are based on data from ichthyoplankton surveys and, for European eel, on data from dedicated glass eel surveys. As with predictions of impingement, the number of larvae and juveniles that would be entrained or that will be impinged on a 5 mm mesh by HPC has been converted to an equivalent number and biomass of lost adults.

6.2.8 The number of adults lost by impingement and entrainment has been summed to give the predicted entrapment losses, either by number or by weight.

6.2.9 Two different methods have been used to assess the entrapment effects of HPC (without the AFD), based on whether there is population data available for individual species of fish. Information from both the quantitative and qualitative assessments for individual fish species have been used to qualitatively assess the effects on the Severn Estuary SAC Estuaries qualifying habitat feature, which incorporates a typical fish species assemblage:

- Quantitative assessments: For fish species where data is available on the population size (either biomass (e.g., as Spawning Stock Biomass ('SSB') which is an estimation of the biomass of reproductively mature adults or reported landings for commercial species) or the number of adult spawners), a quantitative assessment has been carried out. This includes marine fish species that are commercially exploited and the Habitat Directive Annex II species.

- Qualitative assessments: For fish species where no estimate of population size is available (generally marine species that are not commercially exploited), a quantitative assessment cannot be made. In this case, losses have been assessed qualitatively, by comparing entrapment losses against trends in the Routine Impingement Monitoring Programme ('RIMP') or based on species' life history and ecology.

6.2.10 The following subsections summarise each step in the process of estimating annual fish entrapment from the operation of HPC without use of an AFD.

Step 1. Raise both HPB CIMP datasets to full operational capacity to achieve two annual monitoring records.

↓

Step 2. Calculate mean annual HPB impingement and 95th confidence intervals using statistical bootstrapping.

↓

Step 3. Raise data to HPC full operational capacity by multiplying by ratio of flow rates (131.86 ÷ 34.37) = **3.836**.

↓

Step 4. Apply capped head mitigation factor of **0.23** for pelagic species only **(uncertainty range 0.18-0.28)**.

↓

Step 5. Apply FRR mitigation factor to account for species specific mortality. Length distribution (LD) data from CIMP used to inform FRR mortality based on passage through trash racks, drum screens and band screens. Uncertainty analysis (step 11) uses predicted values and upper and lower ranges.

↓

Step 6. Calculate and apply Environment Agency EAV-SPF factors to raw numbers impinged at HPC to give EAV-SPF number of fish impinged (adult equivalents).

↓

Step 7. Add EAV-SPF number of fish impinged at HPC to additional EAV-SPF number of fish entrained and impinged on the 5mm mesh to to give adult equivalent number of fish entrapped at HPC.

↓

Step 8. Convert EAV-SPF number of fish entrapped to EAV-SPF biomass of fish entrapped using information on mean weight of adult fish from ICES data sources**.**

↓

Step 9. Determine the most relevant adult population unit including SSB, landings or population estimate from ICES data sources. Apply Environment Agency re-scaling factor to reduce stock area SSB or landings, assuming homogeneous distribution of fish**.**

↓

Step 10. Determine population effects of entrapment (%).
Entrapment effect = Adult equivalent biomass or Adult equivalent numbers ÷ population unit**.**

↓

Step 11. Conduct uncertainty analysis using bootstrapping method to determine variability in entrapment effects**.**

Figure 6-1 - An overview of the fish entrapment calculation, in line with EA methods.

6.2.11 As explained above, the fish entrapment effects of HPC have been assessed based on CIMP and RIMP datasets, and data from offshore plankton and glass eel surveys.

Estimating unmitigated impingement at HPC (using CIMP data) (Steps 1-3 of Figure 6-1)

6.2.12 The first step in the assessment process is to determine the number of fish, by species, that would be impinged by HPC. Data from the CIMP was used to estimate the annual unmitigated numbers of fish that would be impinged by HPB annually and to predict the unmitigated number of fish that would be impinged by HPC.

6.2.13 The CIMP data comprises CIMP1 and CIMP2, two annual datasets of impingement monitoring at HPB, which form the basis of impingement predictions at HPC. Within the calculations each CIMP dataset was treated separately, so variation in impingement rates for different fish species and relative effects at the population level could be assessed against two points in time. When losses are contextualised against the population, CIMP1 was assessed against the original 2013 DCO baseline, considering any updates to population data. CIMP2 was assessed against the current baseline.

6.2.14 For both CIMP datasets, the sample target was to collect 40 × 24-hour samples over the course of a year. Each 24-hour sample consists of:

- six samples of one hour each during daylight hours, and
- one 18-hour bulk sample set overnight.

6.2.15 During the CIMP, impinged fish and invertebrates were collected from all operational drum screens. All fish from each sample were sorted to the highest taxonomic resolution. The total number and weight of each species was recorded and the length of individuals to the nearest half cm below was measured (i.e., a fish measuring between 3.0 cm – 3.4 cm would be recorded as 3 cm). In some instances, a sub-sample was required if impingement rates were high. For subsequent analysis, all individuals in a length class were assigned to the mid-point of that length class, ensuring the assessments were not underestimating the effects (as the distribution of individuals in a length class will generally be weighted to the smaller individuals).

6.2.16 The details of the surveys were as follows:

CIMP1:

- core period ran from 24 February 2009 to 29 January 2010; and
- 40 sample visits / 10 per quarter, sampling dates were randomly selected, within operational constraints.

CIMP2:

- core period ran from 15 June 2021 to 16 June 2022; and
- 35 sample visits, spread across all quarters, sampling dates were randomly selected within operational constraints.

6.2.17 The volume of water abstracted by HPB, and the volume screened by each drum screen, varies depending on the number of screens and pumps in operation. Raw sample data was raised to estimate impingement for HPB at full operational capacity (Step 1 of Figure 6-1). Therefore, impingement rates represent the scenario of the HPB station running at full operational capacity throughout the year. This provides initial precaution in the impingement estimates for HPC, as neither station is likely to operate at full capacity for the whole year.

6.2.18 The full operational capacity of HPB was defined as 34.37 cumecs and included the main cooling water and reactor cooling water, both of which are filtered through the screening systems.

6.2.19 Once the data for each sample trip was raised to full operational capacity, a statistical bootstrapping approach was applied to estimate the mean annual impingement at HPB for each CIMP data series separately (Step 2 of Figure 6-1). This approach iterates the existing samples with replacement 10,000 times, thereby mimicking a higher frequency of repeated sampling than can be achieved experimentally. Confidence intervals ('CIs') were derived from the bootstrap distribution of the resulting sums. The CIs represent 95 % of the data. Thus, the lower CI represents the 2.5 percentile value whilst the upper CI represents the 97.5 percentile value.

6.2.20 Finally, the mean annual impingement rates for HPB were raised to give annual impingement rates for HPC at full operational capacity (Step 3 of Figure 6-1). Scaling of impingement rates at HPB to predict impingement at HPC assumes that the density of fish at the location of both intakes is approximately equal and that there is a linear relationship between abstraction volume and impingement. At full operational capacity the abstraction rate by HPC is defined in the assessments as 131.86 cumecs at mean sea level. Therefore, a scaling factor of 3.836 (131.86/34.37) was applied to mean impingement rates at HPB for all fish species.

Application of mitigation factors to HPC impingement estimates (Steps 4 and 5 of Figure 6-1)

6.2.21 The HPC impingement assessment in the shadow AA below considers the following embedded mitigation measures:

LVSE intakes

6.2.22 The LVSE intake heads at HPC have been designed to reduce impingement rates by reducing per unit of water abstracted relative to the HPB heads. However, in the absence of an AFD providing a deterrent cue there is uncertainty over the effectiveness of the reduced cross-sectional intercept area and reduced intake velocities of the LVSE. As a result of the uncertainty, the assessments undertaken pursuant to this report assume no mitigation benefit of the LVSE beyond that of the capped head cap, below. As such a factor of 1.0 is applied to the LVSE when scaling fish impingement rates from HPB impingement monitoring to estimate HPC impingement rates. The application of a factor of 1.0 is consistent with the position of both NNB and the EA during the WDA Permit inquiry.

Capped head mitigation

6.2.23 The LVSE intake heads are designed to minimise vertical draw of water down into the aperture by means of a capped head design. Pelagic species are less able to swim against vertical currents than horizontal ones. The intake cap reduces the vertical current of the seawater and therefore reduces the impingement of pelagic fish species by the HPC cooling water intake.

6.2.24 The intake velocity cap factor is a multiplier that represents the number of fish that are expected to be impinged by an intake with a cap as opposed to an open intake (Step 4 of Figure 6-1).

6.2.25 During the WDA Permit inquiry, the intake velocity cap factors were agreed for the species relevant to the inquiry process[21]. The EA proposed a factor of 0.23 (uncertainty range 0.18 -

21 DEFRA (2021) Statement of Common Ground between the Appellant and the Environment Agency (25 May 2021). Available at: https://ea.sharefile.com/share/view/s3c09940e95774518b9d68ad6f267a8f0 (Accessed: 19 November 2023).

0.28) for pelagic Allis shad, twaite shad and Atlantic herring. Atlantic salmon also had the same application factor based on the understanding that adult salmon, kelts and smolts migrate close to the sea surface. The cap factor has also been applied to pelagic sprat.

6.2.26 All other species are assumed to have no benefit from the velocity capped head design[22].

6.2.27 The application of a capped head factor for pelagic species only is considered precautionary. This is because a review of the evidence for head designs undertaken by the EA (Environment Agency[23]) concluded that capped heads afford a *"higher level of protection for pelagic species than for benthic and proximo-benthic species"*. The literature cited therein includes a review by the New York State Department of Environmental Conservation that suggests capped heads reduce catches of all species by around 76 % (+/- 14.7 %) and benthic-dominated catches by 57 %. Whilst the EA (2020) report identifies flaws in some of the studies reviewed, applying no mitigation factor for demersal and epibenthic species is still considered precautionary.

FRR

6.2.28 The FRR system is a large filtration system, designed to remove biota and debris from the cooling water prior to passage through the power station. The FRR has been carefully designed to allow robust species to be returned alive to Bridgwater Bay. A description of the FRR system is provided in Section 3.2.9. Fish retained on the drum or band screens FRR system will be recovered through a dedicated FRR system and returned to Bridgwater Bay, rather than passing through the power station condensers with the main cooling water flow. Whilst the FRR system is designed to reduce fish mortality, not all fish returned will survive. FRR mortality is based on passage through the trash racks, drum screens and band screens and is informed by the length distribution of each impinged species. The level of FRR mortality is species-specific, and ranges between 1 for 100 % mortality, and 0 for 100 % survival (Table 6-1). The EA predicted FRR efficiency, and range of efficiency values has been applied within the uncertainty analysis, below.

22 For calculations of FRR biomass, additional species (sand smelt Atherina boyeri, anchovy Engraulis encrasicolus, horse mackerel Trachurus trachurus, garfish Belone belone, and pilchard Sardina pilchardus) are also assumed to benefit from the capped head design.

23 Environment Agency (2020) Technical Brief: TB007. Low Velocity Side Entry Intake Design; effect of intake velocity cap. Draft-03. Available at: https://consult.environment-agency.gov.uk/psc/ta5-1ud-nnb-generation-company-hpc-limited-2/supporting_documents/EA23%20%20TB007%20%20LVSE%20design%20effect%20of%20intake%20velocity%20cap%20%20Draft03.pdf (Accessed: 12 November 2023).

6.2.29 For each species in turn, the relevant mitigation factors were applied to the estimated (unmitigated) number of fish that would be impinged at HPC, by multiplication (Step 5 of Figure 6-1).

Table 6-1: FRR (value and uncertainty range), capped head and LVSE mitigation factors applied to fish and brown shrimp impinged at HPC. WDA Permit inquiry species are shown in bold.

Species	Predicted FRR mortality	Predicted capped head effect	Predicted LVSE effect
Twaite shad	**1 (0.9552-1)**	**0.23**	**1**
Atlantic salmon	**1 (0.9697-1)**	**0.23**	**1**
Allis shad	**1**	**0.23**	**1**
River lamprey	0.2 (0.109-0.2)	1	1
Sea lamprey	0.4071 (0.3397-0.4071)		1
European eel	0.2 (0.109-0.2)	1	1
Sea trout	1	1	1
Atlantic cod	**0.5626 (0.1812-0.5626)**	**1**	**1**
Atlantic herring	**1 (0.8999-1)**	**0.23**	**1**
Whiting	**0.5516 (0.4081-1)**	**1**	**1**
European sea bass	**0.6081 (0.3008-0.953)**	**1**	**1**
Sprat	1 (0.9545-1)	0.23	1
Dover sole	0.2 (0.0535-0.2)	1	1
European plaice	0.2 (0.018-0.2)	1	1
Thornback ray	0.545 (0.4085-0.545)	1	1
Blue whiting	0.6614 (0.5531-0.6614)	1	1
Thin-lipped grey mullet	1 (0.545-1)	1	1
European flounder	0.2 (0.109-0.2)	1	1

Species	Predicted FRR mortality	Predicted capped head effect	Predicted LVSE effect
Five-bearded rockling	0.2 (0.2-0.545)	1	1
Sand goby (*Pomatoschistus* spp.)	0.2 (0.2-0.545)	1	1
Poor cod	1 (0.545-1)	1	1
Bib	1 (0.545-1)	1	1
Common sea snail	0.545 (0.545-1)	1	1
Conger eel	0.545	1	1
Lesser spotted dogfish	0.5	1	1
Brown shrimp	0.2	1	1

Calculation of adult equivalent impingement losses (application of EA EAV-SPF factors) (Step 6 of Figure 6-1)

6.2.30 For many finfish species, entrapment affects the juvenile part of a population because it is that part that is particularly vulnerable due to their presence in inshore nursery areas and poorer swimming capability than adult fish. Most species of fish have dramatically different reproductive strategies to mammals and birds. Adults congregate at spawning sites, where a mature finfish female can produce thousands to millions of eggs. The proportion of eggs that hatch into larvae, and of larvae that survive to become juveniles, will vary considerably from year to year and from species to species. For long-term population persistence, one for one replacement is required on average. On average, as one adult fish dies, a new fish should join the spawning population to replace it. Fish early life-history stages have very high mortality rates and individuals have a very low probability of becoming an adult. Therefore, the loss of one juvenile fish does not equate to the loss of one adult. A method is therefore required to place the losses of entrapped juveniles into the context of lost adults.

6.2.31 Equivalent Adult Value ('EAV') converts the impingement losses of mostly juvenile fish into an annual rate of loss of fish that are maturing, and joining the adult, spawning populations. This step is required due to the predominantly juvenile nature of the impinged fish; if it was mostly adult fish being impinged, the step would not be required. A method of calculating EAV factors was developed by the Centre for Environment, Fisheries and Aquaculture Science

('Cefas') as that is based on growth and natural mortality of an impinged species and on the concept that a small juvenile fish has a lower probability of surviving to maturity than a larger individual of the same species that is closer to maturity. The method gives a factor that represents how close to maturity the impinged fish are, based on the measured length distribution. A factor close to 1 indicates that most fish are close to maturity, and a factor close to zero indicates that most of the fish are small juveniles with a low probability of survival to maturity. The method uses the collated length distribution of fish sampled during impingement sampling, making the factors specific to CIMP1 and CIMP2, and reflecting species-specific year-class strength and environmental factors that may affect early growth.

6.2.32 The EA further developed the Cefas method to include fish that would spawn multiple times, giving the total number of potential spawners that would have been alive at maturity, and in each subsequent year, had they not been impinged. Because of this extension, the EA EAV-SPF factor is always larger for a given species than the Cefas EAV factor and can exceed 1.

6.2.33 In addition, neither method includes the effects of fishing mortality, which can be high for some commercially exploited fish species, even at younger ages.

6.2.34 The exclusion of fishing mortality means that more fish are predicted to survive to maturity than would occur if some were fished. As some fish species are exploited in targeted fisheries or caught as bycatch, the application of the EA EAV-SPF extension excluding fishing mortality give estimates of the equivalent numbers of adults lost to impingement that are precautionary. The EA EAV-SPF extension exacerbates the precaution of excluding fishing mortality (*F*) as *F* typically increases with age in exploited stocks. At IR11.74 of his report24, the Planning Inspector concluded that *"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"*. In respect of the WDA Permit inquiry outcome, *F* is not calculated within the assessment. However, to illustrate the level of precaution assessments can be undertaken with *F* included, based on the assumption that *F* in the EA re-scaled International Council for Exploration of the Sea ('ICES') stock areas is consistent with that across the ICES stock area. In the case of species such as European sea bass and Atlantic cod, accounting for *F* results in approximate 30 %-70 % reductions in the EAV-SPF factor, and thereby the predicted population level effects of HPC.

---

24 Removal of Acoustic Fish Deterrent Conditions from Water Discharge Activity (WDA) Permit (publishing.service.gov.uk) (Accessed: 11 December 2023).

6.2.35 For each species in turn, the mitigated number of fish that would be impinged by HPC is multiplied by the relevant EA EAV-SPF factor to give the EA EAV-SPF equivalent number of adults that would be impinged by HPC (Step 6 of Figure 6-1). For species where an EA EAV-SPF could not be calculated due to a lack of available biological data, a precautionary value of 1 was applied, i.e., it assumes that all impinged fish would have gone on to become mature adults. Because the length distributions and some biological parameters of fish impinged during CIMP1 and CIMP2 were different, separate EA EAV-SPF factors were calculated for the two years of impingement numbers (Table 6-1).

Entrainment losses (Step 7 of Figure 6-1)

6.2.36 Entrainment primarily impacts the early life-history stages of fish including eggs, larvae and post-larvae. For some species, juveniles and even adults may be susceptible to entrainment. Although entrainment may be minor when compared with impingement, losses due to entrainment form part of the station's overall entrapment effect.

6.2.37 Estimates of entrainment were based on data from offshore plankton surveys carried out between February and May 2010 and were obtained by scaling the volumetric density of the eggs and larvae in the samples to the volume of water that would be abstracted by HPC. Species for which the numbers of entrained larvae and juveniles were estimated were sprat, Dover sole, Atlantic herring, European sea bass and European plaice. The final estimates were used in the 2013 DCO application and were not revised as part of the WDA Permit variation application.

6.2.38 In their 2020 AA, the EA used the estimates of entrainment from the 2013 DCO application in their entrapment assessments. The EA also sought to estimate the additional impingement that would occur on the HPC drum and band screens fitted with a 5 mm mesh instead of a 10 mm mesh at HPB. These fish would otherwise have been entrained at HPB. The number of larvae that were predicted to be entrained were apportioned into two entrainment fractions - those that would be impinged on a 5 mm mesh instead of being entrained, and those that would still be entrained through a 5 mm mesh.

6.2.39 For each species and entrainment fraction, the numbers of individuals were converted to equivalent adults using similar methods used for impingement, i.e., the numbers were multiplied by an entrainment mortality factor and by an EAV-SPF factor, calculated by the EA. However, it is noted that for some species the EAV-SPF values applied by the EA are high, suggesting a higher than anticipated probability of survival for the larvae and juveniles. The resulting estimates of numbers of adults lost to entrainment were included in their EA entrapment assessments by adding the equivalent number of entrained adults to the equivalent number of impinged adults (Step 7 of Figure 6-1). The estimates of equivalent adults lost due to entrainment and impingement on the 5 mm mesh at HPC, derived by the EA are applied here.

6.2.40 To estimate the entrainment of the juvenile glass eel stages of European eels, three dedicated glass eel surveys commissioned by NNB and carried out by Cefas in the Severn Estuary in January-February 2012 and by Cefas in collaboration with the EA in January-February 2013 and April 2013. In their 2020 AA, the EA applied the mean density of eels in samples collected at the site of the HPC intakes to estimate the number of glass eels that would be abstracted by HPC annually. An entrainment mortality factor was applied to estimate the number of glass eels that would be lost due to entrainment.

6.2.41 Predicting missing size fractions is uncertain and alternative methods may be applied. However, based on the precautionary assumptions regarding the length distribution of the ichthyoplankton and the conservative EAV-SPF values applied, the current entrapment assessments used the EA estimates of entrained and additionally impinged individuals with a 5 mm mesh for predicting population level effects.

Conversion of entrapped adult numbers to adult biomass (Step 8 of Figure 6-1)

6.2.42 For many of the key species, annual losses are compared with the biomass of the spawning population (ICES SSB estimates) or the weight of recorded commercial landings. For these species, the EA EAV-SPF numbers have been converted to EA EAV-SPF biomass to enable a like-for-like comparison.

6.2.43 The EAV-SPF biomass is calculated by multiplying the EA EAV-SPF number (of first-time spawners) by the mean individual adult weight of fish in the spawning population (all spawners) (Step 8 of Figure 6-1). The mean adult weight is a weighted average based on the mean weight of all spawners in each age class and the number of spawners in each age class. This will result in a higher, and thus more conservative, EAV-SPF biomass estimate for repeat spawning species because the mean individual weight of first-time spawners will be lower than the mean weight of all spawners which include older and larger individuals. This is a further precautionary aspect to the methodology.

6.2.44 Where EA EAV-SPF numbers are compared to adult population sizes in numbers (river lamprey, sea lamprey, Allis shad, twaite had, Atlantic salmon and sea trout) or there is no population comparator and the assessment is based on RIMP trend analysis, no attempt is made to convert EA EAV-SPF numbers to EAV-SPF biomass. Because the mean weight of individuals in each age class is different, depending on environmental factors and year-class strength, the calculated mean spawner weight was different in 2009 (CIMP1) and 2021 (CIMP2) (Table 6-2).

Table 6-2: EA EAV-SPF factors and mean spawner weights applied to key taxa. WDA Permit inquiry species are shown in bold.

Species	EAV-SPF factor		Mean spawner weight		Comment
	CIMP1	CIMP2	CIMP1	CIMP2	
Twaite shad	**0.0982**	**0.0351**	**N/A**	**N/A**	**-**
Atlantic salmon	**0.21**	**0.502**	**N/A**	**N/A**	**No salmon recorded in CIMP2. EAV factors are based on the RIMP and CIMP1 data.**
Allis shad	**0.663**	**N/A**	**N/A**	**N/A**	**No Allis shad recorded in CIMP2. The EAV-SPF factor has increased compared to the value used in the WDA Permit inquiry, due to the application of a revised calculation method similar to that used for all other species.**
River lamprey	1	N/A	N/A	N/A	Lampreys are semelparous (spawn once then die). An EAV of 1 represents the theoretical maximum assuming all impinged fish would survive to contribute to the spawning population. No lamprey were recorded in the 2021/22 CIMP, but one sea lamprey was caught in samples outside of the core CIMP2 period.
Sea lamprey	1	N/A	N/A	N/A	
European eel	1	1	0.329		Eels are semelparous (spawn once then die). An EAV of 1 represents the theoretical maximum assuming all impinged fish would survive to contribute to the spawning population.
Sea trout	1	N/A	N/A	N/A	No sea trout recorded in CIMP2
Atlantic cod	**0.214**	**0.221**	**4.739**	**2.54**	-
Atlantic herring	**1.272**	**0.228**	**0.065**	**0.084**	

Species	EAV-SPF factor		Mean spawner weight		Comment
	CIMP1	CIMP2	CIMP1	CIMP2	
Whiting	**0.938**	**0.615**	**0.298**	**0.158**	
European sea bass	**0.489**	**0.397**	**1.124**	**1.204**	
Sprat	1.55	0.535	0.0155	0.009	
Dover sole	1.075	1.227	0.353	0.223	
European plaice	0.672	1.255	0.32	0.228	
Thornback ray	0.526	0.581	3.28	2.693	
Blue whiting*	0.938	0.615	0.298	0.315	
Thin-lipped grey mullet	1	1	-	-	An EAV is given, but assessments are based on RIMP trends.
European flounder	1	1	-	-	
Five-bearded rockling	1	1	-	-	
Sand goby (*Pomatoschistus* spp.)	1	1	-	-	
Poor cod	1	1	-	-	
Bib	1	1	-	-	
Common sea snail	1	1	-	-	
Conger eel			-	-	

Species	EAV-SPF factor		Mean spawner weight		Comment
	CIMP1	CIMP2	CIMP1	CIMP2	
Lesser spotted dogfish			-	-	
Brown shrimp	1	1	0.00149	0.00149	

Spawning populations (Steps 9 and 10 of Figure 6-1)

6.2.45 The next stage of the assessment determines an appropriate adult population for each species (Step 9 of Figure 6-1) and contextualises entrapment losses as a percentage of this value (Step 10 of Figure 6-1). For Habitat Directive Annex II fish species, losses as adult equivalent numbers were contextualised relative to the number of adults in the population, given as a percentage. For river lamprey and sea lamprey and sea trout, the estimates of adult population sizes used by the EA in their 2020 AA for the WDA Permit inquiry were applied. For European eels, the most recent estimates of silver eel escapement biomass (an estimate of the spawning population size) were used to contextualise losses. For twaite shad and Allis shad, a model of adult population numbers developed by APEM Ltd. and used by the EA in their AA and the WDA Permit inquiry was revised and applied.

6.2.46 For commercially exploited species, entrapment losses as adult equivalent biomass were contextualised relative to the SSB or reported commercial landings, given as a percentage. ICES provides full analytical stock assessments for many marine species, particularly those of commercial importance. For these data rich species, stocks are defined based on a species' life history, spawning and feeding migrations, fishing effort and catches and the practicalities of assessment and management. The stock areas, which usually span one or more ICES Areas or Subdivisions are regularly reviewed during benchmark assessments to incorporate new knowledge and are updated where appropriate. In their annual assessments, ICES compare the current stock SSB to biomass reference points to provide advice on the status and opportunities for sustainable exploitation of the stock.

6.2.47 For the updated impingement assessments to support the WDA Permit variation application, the ICES stock areas and their relevant SSBs were used to contextualise losses of whiting, Dover sole, Atlantic cod, European sea bass, European plaice and blue whiting. For thornback ray and Atlantic herring where no SSB estimate was available, losses were contextualised against the landings of the relevant stocks.

6.2.48 In their 2020 AA for the WDA Permit inquiry the EA reviewed the use of the ICES stocks and determined that, for several species, these spanned areas that were too large to reflect local impacts on entrapped species in the context of their AA. For each of these species, the EA proposed revised areas, each of which was geographically smaller than the area spanned by the ICES stock. For each species, the estimated ICES, SSB or landings value from its respective ICES stock assessment was reduced by the ratio of the area spanned by the ICES stock area and the smaller area proposed by the EA, under the assumption that the distribution of fish was equal throughout any stock area. During the WDA Permit inquiry, although the Planning

Inspector favoured the EA re-scaled areas for Atlantic cod, Atlantic herring, whiting and European sea bass over the ICES areas, he also concluded that these would likely represent the upper level of likely impact, providing precaution in the assessments for these species. For all species for which SSBs or landings estimates are available, the re-scaled EA areas were used to contextualise the entrapment losses, in line with the Planning Inspector's conclusions. The SSBs and landings values were revised from those used in the EA's 2020 AA based on more recent stock assessment outputs (which may change the historic perception of stock dynamics). In addition, following a change to the assessment process for European plaice, losses for this species were contextualised against landings and not SSB, making the assessment more precautionary.

Uncertainty analysis (Step 11 of Figure 6-1)

6.2.49 The final stage of the entrapment assessments is to determine the level of confidence in the calculated entrapment effects. The confidence of entrapment predictions is determined by the underlying assumptions used to parameterise the assessment. For many input parameters, a lower and upper value can be estimated, giving a range of parameter estimates around the mean value used. Parameters for which variability around the parameter value was calculated include the estimated numbers of fish impinged at HPB, the effectiveness of the FRR and capped head mitigation, the predicted EAV-SPF factors for some species (Atlantic salmon, and entrained sprat, Atlantic herring and European plaice) and the range in estimates of the relevant population comparator. Each of these parameters has an associated probability density function that determines how the variability around the mean value is distributed, which is based on the way in which the parameter was calculated.

6.2.50 For each species, uncertainty analysis was undertaken whereby the total entrapment effect was re-calculated many times, using the bootstrapping statistical methods described in the sections above. In each iteration of the entrapment calculation, the input value for each parameter was randomly selected from all possible values within the lower and upper range. The entrapment calculation was repeated 100,000 times, each giving a value of % effect for the given population, and from these values, the mean and the CIs were calculated. The CIs represent 95 % of the data. Thus, the lower CI represents the 2.5 percentile value whilst the upper CI represents the 97.5 percentile value.

6.2.51 This provides an estimate of the mean entrapment effect, along with the associated uncertainty based on the uncertainties in all parameters.

6.2.52 In the shadow AA, the given entrapment mean values (%) may be below the predicted impingement effects values (%). This is because the impingement results use the predicted values for each parameter to calculate a single value, whilst the entrapment effects include the uncertainty analyses and the variation in input parameters. Therefore, it is possible to have lower predicted rates of entrapment for species with low entrapment predictions relative to the variation in the other input parameters. This is particularly the case when the applied FRR mortality terms used are the maximum in the uncertainty range, e.g., lamprey species.

The RIMP dataset

6.2.53 The RIMP collected impingement data from HPB over the period 1981-2019. Sampling consisted of 6 × 1 hour samples of the drum screen backwash channels each month. During each sampling visit, two of the four drum screen backwash channels were sampled. As with the CIMP sampling, the 6 hours of sampling was raised to the estimated number of fish impinged during a 24-h period, by first multiplying the number of fish in the samples by 2 (to account for the number of drum screens sampled), and then by 4 (to raise the data to 24 hours sampled). A full year of RIMP sampling consisted of 12 × 24-h samples.

6.2.54 Sampling was always conducted on the same state of the tide. Although not as intense as the CIMP, RIMP sampling provides a valuable long-term data set that can be used to provide insight into the population dynamics of the species assemblage in the HPB area.

6.2.55 Trends analysis was undertaken for all species using a non-parametric Mann-Kendall ('MK') statistic to evaluate trends. Briefly, for a particular species, the analysis looks at all pairs of counts (numbers of fish per 24-h sample chronologically through the sampling time series) and gives each pair a score. If the second number is larger than the first then the pair scores a 1, if the second number is smaller than the first then the pair scores a -1. If the number of fish is the same between paired samples, then the score is 0. The MK statistic is the sum of all these scores. An increasing series would have a positive score and a decreasing series would have a negative score. This statistic only measures trends in an average sense over the whole range of years and detects generally increasing positive or negative trends. If there is a perfect increasing series, then the statistic will have value +1; if there is a perfect decreasing series then the statistic will have value -1.

6.2.56 The analysis was further extended to account for the existence of different distributions in fish populations in different months of the year by implementing the Seasonal Kendall Test ('SKT') for trends. This test is insensitive to seasonality in the data and is conducted by computing the MK test separately for each month. The SKT is not able to tease out more subtle situations where, for example, the trend increases and then decreases, and it is important to consider the outputted values in conjunction with plots of the data (numbers of fish). RIMP data was also used to analyse long term trends in the abundance of fish impinged at HPB. Trends for individual species were used to qualitatively assess entrapment impacts for species where no population comparator was available to quantitatively contextualise losses.

6.2.57 Furthermore, no Atlantic salmon were recorded in the core CIMP datasets, although two individuals were recorded in samples in February and March 2010, outside of the core CIMP1 period. Predictions of the number of Atlantic salmon impinged annually could not be calculated using the CIMP data. In their 2020 AA, the EA used the long-term RIMP dataset to calculate the mean number of fish impinged annually. Although the sampling intensity of the RIMP is less than that of the CIMP, RIMP samples are available since 1981. For their analysis, the EA calculated the mean daily number of salmon caught in the RIMP and raised this to an annual number impinged. Following the WDA Permit inquiry additional RIMP data for 2018 and 2019 were available. The annual number of Atlantic salmon impinged was updated, with agreement from the EA, using the additional RIMP data and the data from both CIMPs, using the EA methods.

Assumptions, limitations and precaution in the impingement assessment

6.2.58 The data used to predict impingement rates at HPC has been collected from the adjacent HPB station during its operational lifetime, with entrainment predictions informed by ichthyoplankton surveys and dedicated glass eel surveys. The HPB and HPC intakes are in different locations, approximately 2.5 km apart. Whilst the HPB monitoring provides a powerful tool for HPC predictions, differences between the impingement rates between HPB and HPC would be expected because of the intake designs and distribution and behaviour of fish relative to the heads. These considerations are factored into the assessment of effects for each species.

6.2.59 Impingement predictions for HPC are bound by the limitations and assumptions of sampling and are subject to variation due to natural variation in relative abundance and distribution of species within the assemblage and the contribution of stochasticity[25] to the probability of encounters of species with the intake, as recorded in sampling programme.

6.2.60 The results of the quantitative assessments of proportional losses of fish relative to population comparators should be interpreted in relation to the uncertainties in the data and relative to the degree of precaution in the assessment approach.

6.2.61 Uncertainty analysis was undertaken to incorporate, where possible, known uncertainties in the assessment inputs.

6.2.62 NNB will undertake operational monitoring of HPC to quantify impingement rates and verify predictions. Impingement monitoring is anticipated to form part of the AMMP.

Reasons why the entrapment assessment undertaken for this HRA Report is precautionary

6.2.63 There are several reasons why the entrapment assessment for this HRA Report is precautionary:

(i) Intake design. The HPC intake apertures would be 1.5-3.5 m above the seabed and have been designed to reduce the entrapment of benthic species. The benefits afforded to benthic species by raising the heads from the seabed is not accounted for in the assessment, providing a degree of precaution for those species. No additional benefit is assumed in the current assessment from the other design features (reduced cross-sectional intercept and reduced intake velocities).

(ii) Raising the HPB data to full operational capacity. Impingement rates represent the scenario of both stations running at full operational capacity throughout the year. As this is unlikely (e.g., reduced capacity during periods of outage), this provides initial precaution for estimates of HPC.

(iii) Capped head mitigation is applied to Allis shad, twaite shad, Atlantic herring, Atlantic salmon and sprat only, which are all pelagic species. An EA review of head designs concluded that capped head may also provide some protection for benthic and other

25 Stochastic events related to the randomness of factors influencing sampling. Sampling may be influenced by species behaviour shaping local abundance or environmental stochastic events such as storm events that may alter the distribution of species.

demersal species. However, the degree to which a capped head provides this additional protection is uncertain, and therefore no additional protection for these species is assumed.

(iv) The mean weight of a mature fish is calculated using the weight of all spawners in the stock. However, the mean individual weight of first-time spawners will be lower than the mean weight of all spawners which include older and larger individuals. The use of a larger mean weight to convert equivalent adult numbers to equivalent adult weight gives rise to an overestimate of the percentage entrapment loss when compared against the population comparator.

(v) In the calculation of the EA EAV-SPF values, all fish within a length class were assigned to the mid-point of the length class. This ensures that the assessments do not underestimate the effects (as the distribution of individuals in a length class will generally be weighted to the smaller individuals).

(vi) For species where an EAV-SPF factor could not be calculated due to a lack of biological data (such as sea lamprey, river lamprey and sand goby *Pomatoschistus* sp.), a precautionary value of 1 was applied. This assumes that all impinged individuals would survive to maturity, irrespective of their size or age and is therefore more precautionary.

(vii) The applied EA EAV-SPF values exclude fishing mortality. This implies that more fish would survive to maturity than is the case, giving rise to a higher (and more precautionary) EAV-SPF factor. Whilst the Planning Inspector concluded that this was a necessary position, for some commercially exploited species such as European sea bass and Atlantic cod, the exclusion of fishing mortality from the EAV-SPF calculation has a large bearing on the predicted effects of HPC.

(viii) The Planning Inspector concluded that the re-scaled stock areas that have been applied to Atlantic cod, whiting and European sea bass were likely too restrictive, giving rise to upper values of population effects. The re-scaled stock area defined by the EA have been used here.

(ix) For Atlantic herring, European plaice and thornback ray, entrapment losses were compared to commercial landings, which represent only a portion of the spawning population, making the entrapment assessment for these species more conservative.

(x) For many species, particularly those that are commercially exploited, the predicted population level effects from CIMP1 were higher that the predicted CIMP2 effects. However, the effect for each species was drawn from both datasets and the worst case of the two datasets was considered in the assessment, providing additional precaution for each species. This difference between the two CIMP datasets further highlights natural variability in species abundance in the Bridgwater Bay area.

Assessment of the potential effects on the typical fish species assemblage of the Estuaries qualifying habitat of the Severn Estuary SAC

6.2.64 The assemblage of typical fish species of the Estuaries qualifying habitat of the Severn Estuary SAC is highly dynamic and made up of over 100 species that use the estuary for a variety of purposes such as feeding, spawning, nursery areas and as a migration route. Some fish species spend their whole lives within the estuary environment, while other species are more transitory, and use the estuary for one or more functions depending on their life history stage.

6.2.65 Following from the approaches applied by the EA in their 2020 AA, the potential for impingement of fish to adversely affect the integrity of the Severn Estuary SAC site by affecting the structure and function (including typical species) of the Estuaries habitat feature has been considered in relation to the rates of variability in rates of entrapment, the feeding and functional guilds of species entrapped, and information on natural variability and dietary composition of these species.

6.3 Changes to water quality

6.3.1 Changes to water quality considered within this HRA Report include changes through:

- release of contaminants; and
- release of nutrients.

6.3.2 This assessment has focused on potential changes to water quality through the decay of dead or moribund biota released through the FRR system, having passed through the HPC CWS. Through the removal of the AFD requirement from the CWS, there is the potential for this material to increase.

6.3.3 Introduction of such material to the marine environment has been considered based on organic matter discharges, with calculations derived for levels of organic carbon, nutrients, oxygen demand and un-ionised ammonia associated with the decay of discharged dead and moribund biomass. Calculations have been based on the revised CIMP1 and CIMP2 data.

6.3.4 Discharges to sea are regulated under the Environmental Permitting (England and Wales) Regulations 2016 and consented within the WDA Permit. The HPC WDA Permit version 5[26] consents the discharge of seawater containing organic material derived from the FRR system. In determining the WDA Permit the EA undertook an HRA assessing the potential effects of the discharge on European sites[27]. The EA's HRA considered all pathways applicable to changes to water quality as they relate to the removal of the AFD. The EA concluded no adverse effect on the integrity of any of the sites considered from the operational WDA Permit (as varied). The assessment described below largely mirrors the EA's HRA in approach, assessment and conclusions.

6.3.5 **Discharge estimates of dead and moribund biomass:** Biomass values were derived from direct weight measurements from CIMP1 and CIMP2 multiplied up to daily (24 hour) estimates. Daily annual average and quarterly average estimates of impingement weight have been generated by statistical bootstrapping using the observed CIMP data. Calculations were based on all fish species and invertebrates, a refinement on a previous TR undertaking the same analysis which including only fish. Whilst the impingement values are taken from HPB datasets, HPC predictions have been made, accounting for the differing water abstraction volume, intake head design at HPC (capped head) and species-specific FRR mortality factors, accounting for the level of biota survival through the FRR system.

6.3.6 **Determination of elemental composition:** To establish levels of organic matter and nutrient loading, the wet weight of discharged dead and moribund biomass was converted to dry weight. Following a review of conversion factors from wet to dry weight applied in previous assessments, new factors for broad taxonomic groups were identified, and the source of conversion factors standardised. For fish, the factors for herring (*Clupea harengus*)

26 Environment Agency Permit No. EPR/HP3228XT/V0005 (2023). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1172563/Decision-document-Hinkley-Point-C-permit-variation-July-2023.pdf. (Accessed 13 November 2023).

27 Environment Agency Permit No. EPR/HP3228XT/V0005 (2023). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1172563/Decision-document-Hinkley-Point-C-permit-variation-July-2023.pdf. (Accessed 13 November 2023).

were applied to all fish because the factors for herring are slightly higher than the average for bony fish (*Osteichthyes*), other fish dominant in terms of biomass (e.g., whiting and sprat) also have similar conversion factors, however herring were the most conservative and therefore applied to all fish. Therefore, the use of herring conversion values for all fish is considered precautionary.

6.3.7 **Water quality effects assessment:** Detailed methods for calculating levels of organic carbon, nutrients, biological oxygen demand, ammonia and un-ionised ammonia were presented within BEEMS Technical Report TR515[28], and results were updated to include the refinements described above and incorporate the CIMP2 data. The total organic carbon input from FRR discharges has been calculated as 46 kg/day, based on CIMP1 data, and 42 kg/day based on the CIMP2 data. With no formal Environmental Quality Standard ('EQS') for organic carbon enrichment, the area in excess of the derived daily benchmark[29] of 0.3 g organic carbon/m^2/day is 0.17 km^2 (CIMP1 data) and 0.15 km^2 (CIMP2 data). It should be noted that this assessment is conservative as it compares a maximum quarterly U95 CI value to an annual average benchmark. For nutrients, total nitrogen and phosphorus calculated from the CIMP1 data is 5.1 kg/day and 1.4 kg/day, respectively as an annual U95 CI. From the CIMP2 data the values are 4.4 kg/day and 0.8 kg/day for nitrogen and phosphorus, respectively as an annual U95 CI.

6.3.8 The total Biological Oxygen Demand ('BOD') generated by the decomposition of discharged dead and moribund biota is estimated to be 162 kg/day as an U95 CI in Q4 from the CIMP1 data and 146 kg/day U95 CI in Q3 from the CIMP2 data. This level of BOD leads to an oxygen reduction of between 49 and 54 kg/day which, based on the background oxygen concentration of 5 mg/l would be met by the volume of water in approximately 0.15 ha. The reaeration area, based on 3.2 gm^2/day (Hull, 2016), would be approximately 1.7 ha.

6.3.9 Decaying biomass can also be a source of ammonia, which can be in the form of toxic un-ionised ammonia (NH_3). A single conversion factor of 125 mg of ammonia per kg of wet biomass, derived from cod tissue decay, has been used. The conversion factor is precautionary, however, evidence of ammonia release from biomass decay for most biota is not available. The proportion of total ammonia in the un-ionised form is dependent on the physico-chemical properties of the water and was calculated based on annual average background conditions (pH 8.06 salinity 31.7 and temperature of 12.55°C). To assess the inter-

28 Cefas (2020) Cefas BEEMS Technical Report TR515 Hinkley Point C Water quality effects of the fish recovery and return system.

29 100 g organic carbon/m2/year from Marine Evidence-based Sensitivity Assessments (MarESA) (Tyler-Walters et al 2018) which is equivalent to 0.3 g organic carbon/m2/day.

related Project effects from the thermal plume which will be generated by HPC, a 2°C temperature uplift has also been applied. The estimated amount of ammonia which could be released from decaying biomass is estimated as 43 g/day (CIMP1) or 55 g/day (CIMP2) based on the maximum quarterly U95 CI value. The un-ionised proportion is calculated to be 0.9 g/day and 1.1 g/day respectively for CIMP1 and CIMP2. When accounting for the HPC thermal plume the proportion of un-ionised ammonia increases slightly to 1 g/day (CIMP1) and 1.3 g/day (CIMP2). This amount of un-ionised ammonia would dilute to below the EQS within and area of 8-10 m^2 of the FRR outfall and represents approximately 0.0005 % of the daily exchange of un-ionised ammonia within the Bridgwater Bay water body.

6.4 Bioaccumulation

6.4.1 The potential risks of bioaccumulation associated with the Project are considered only as a result of any initial changes to water quality, as described within Section 6.3. The assessment of bioaccumulation is therefore qualitative in nature, drawing on the quantitative outcomes of changes to contaminant levels through FRR discharges.

6.5 Habitat loss / physical damage in the marine environment

6.5.1 The potential effects of habitat loss and physical damage on qualifying features in the coastal and marine environment are primarily associated with the proposed compensatory habitat creation schemes, and the area of existing habitat which would be affected by their installation. These areas are as outlined within Section 3.7.

6.5.2 At the time of writing, the locations of compensatory habitat creation schemes outside the DCO Material Change Order Limits are not confirmed, therefore the exact habitat types which may be affected by the works cannot be specified. Therefore, the assessment of these potential effects is qualitative in nature. For work within the DCO Material Change Order Limits, where in some cases a greater understanding of habitats is available, a quantitative or semi-quantitative assessment has been undertaken. Where more information becomes available as feasibility studies progress, the qualitative assessments will be refined for the final application.

6.6 Changes to hydrodynamics / sediment transport

6.6.1 There is currently limited specific information around the proposed compensatory measure sites and potential effects on hydrodynamics / sediment transport. Therefore, the assessment of potential changes to these processes has been predominantly qualitative in nature. Where more information becomes available as feasibility studies progress, the qualitative assessments will be refined for the DCO Material Change application.

6.7 Disturbance / displacement effects

6.7.1 Temporary disturbance of sensitive species is possible where construction activities (including those within the terrestrial or intertidal areas) generate noise, vibration or lighting. This may result in effects on migratory routes, survival rates and fecundity. There is currently limited specific information on the location of some compensatory measures outside the DCO Material Change Order Limits; in these instances, assessment has been qualitative, using professional judgement. For work within the DCO Material Change Order Limits, in cases where a greater understanding of habitats is available, a quantitative or semi-quantitative assessment has been undertaken. Where more information becomes available as feasibility studies progress, the qualitative assessments will be refined for the DCO Material Change application.

6.8 Indirect effects on piscivorous seabirds / marine mammals through changes to prey resources

6.8.1 For piscivorous seabirds and marine mammals, where these are qualifying features of designated sites, impacts on the availability of prey resources must be considered. With the potential for effects on these prey resources, there is the need to consider indirect effects on predator species.

6.8.2 The assessment of potential effects on marine mammals and seabirds is largely qualitative in nature, considering the area of available foraging grounds for the species of concern and their diets.

6.9 Habitat loss / fragmentation in the terrestrial environment

6.9.1 Habitat loss / fragmentation can be temporary during construction activities where habitats would be reinstated post works; or permanent where one a new habitat or feature is created. The permanent change (modification) or loss of a habitat can have an effect on species that are dependent upon those habitats resulting in permanent displacement of mobile species. There is currently limited specific information on the location of some compensatory measures outside the DCO Material Change Order Limits; in these instances, assessment has been qualitative, using professional judgement. For work within the DCO Material Change Order Limits, in cases where a greater understanding of habitats is available, a quantitative or semi-quantitative assessment has been undertaken. Where more information becomes available as feasibility studies progress, the qualitative assessments will be refined for the DCO Material Change application.

6.10 Disruption of commuting corridors

6.10.1 Mobile species use a range of habitat features to commute through the landscape, be that migratory fish and otter using rivers or bats using hedgerows in the terrestrial environment. Where physical changes to those commuting features occur, dependent species can be affected in terms of accessing feeding grounds, breeding locations or seasonal migratory routes.

6.10.2 There is currently limited specific information on the location of some compensatory measures outside the DCO Material Change Order Limits; in these instances, assessment has been qualitative, using professional judgement. For work within the DCO Material Change Order Limits, in cases where a greater understanding of habitats is available, a quantitative or semi-quantitative assessment has been undertaken. Where more information becomes available as feasibility studies progress, the qualitative assessments will be refined in the DCO Material Change application.

6.11 Mortality / injury through construction activities

6.11.1 Construction activities can result in injury or mortality of fauna directly through interaction with construction machinery or indirectly e.g., through unintended entrapment.

6.11.2 There is currently limited specific information on the location of some compensatory measures outside the DCO Material Change Order Limits; in these instances, assessment has been qualitative, using professional judgement. For work within the DCO Material Change Order Limits, in cases where a greater understanding of habitats is available, a quantitative or semi-quantitative assessment has been undertaken. Where more information becomes available as feasibility studies progress, the qualitative assessments will be refined in the DCO Material Change application.

7 OVERVIEW OF THE BASELINE ENVIRONMENT

7.1 Introduction

7.1.1 The following subsections present an overview of the baseline environment relevant to this HRA Report. These subsections include details of the original, current and future baselines, as described in Section 5.

7.2 Marine / freshwater / terrestrial ecology

Fish populations

Original baseline

7.2.1 A detailed description of the fish of the Severn Estuary / Inner Bristol Channel at the time of carrying out the DCO HRA was presented within Chapter 19 of the 2013 DCO ES. That baseline drew on two primary datasets for evaluation of impingement: the RIMP, conducted at HPB from 1981, and the BEEMS CIMP, conducted at HPB in 2009/10.

7.2.2 In addition, an extensive desk-based study was undertaken, looking at the numerous studies which had been conducted examining fish within the Severn Estuary and the Bristol Channel.

7.2.3 Impingement data collected at HPB since 1981 through monthly sampling recorded 83 estuarine and marine fish species from the surveys' commencement at the point of submission of the 2013 DCO ES. Between 1981 and 2010, the number of species observed in a given RIMP year ranges from 28-47, with an average of 38. In the more intensive CIMP sampling programme in 2009-2010 the number of species observed in the annual sample record was 64.

7.2.4 The ten most abundant species recorded within impingement monitoring were sprat (*Sprattus sprattus*), whiting (*Merlangius merlangus*), sand goby (*Pomatoschistus minutus*), poor cod (*Trisopterus minutus*), Dover sole (*Solea solea*), bib (pout) (*Trisopterus luscus*), common sea snail (*Liparis liparis*), European sea bass (*Dicentrarchus labrax*), European flounder (*Platichthys flesus*) and dab (*Limanda limanda*).

7.2.5 The broader fish community / assemblage of the Severn Estuary and Bristol Channel was noted as having a similar species composition to that of other estuaries and coastal regions in south-west England, and Europe as a whole, comprising approximately 80 species[30]. The most common species were sprat and whiting, present in numbers an order of magnitude higher than the next most abundant species, namely poor cod, sand goby, sea snail, bib (pout) and Dover sole.

7.2.6 Numbers of individual fish present in the Severn Estuary, indicated by captures at HPB, showed a clear seasonal pattern with lowest numbers present in April and May rising steadily through the summer and autumn to a peak in December, where numbers decline in January, February and March.

7.2.7 Ten marine species found within the area were UK BAP species: Atlantic cod (*Gadus morhua*), Atlantic herring (*Clupea harengus*), European plaice (*Pleuronectes platessa*), Dover sole, whiting, blue whiting (*Micromesistius poutassou*), hake (*Merluccius merluccius*), horse mackerel (*Trachurus trachurus*), ling (*Molva molva*) and saithe (*Pollachius virens*).

7.2.8 Seven diadromous fish species are known to migrate through the Severn Estuary; Atlantic salmon (*Salmo salar*), twaite shad (*Alosa. fallax*), allis shad (*A. alosa*), river lamprey (*Lampetra fluviatilis*), sea lamprey (*Petromyzon marinus*), sea trout (*Salmo trutta*) and European eel (*Anguilla anguilla*).

7.2.9 Most of the diadromous species were rarely recorded in the baseline data set. Only 8 Atlantic salmon, 9 river lamprey and 2 sea lamprey were recorded in the RIMP prior to 2013, and no allis shad or sea trout were recorded. In CIMP1, two allis shad were recorded, and no Atlantic salmon were present in the core CIMP sampling period, although two individuals were recorded in samples in February and March 2010. No sea trout were recorded in CIMP1. Higher numbers of juvenile twaite shad were impinged at Hinkley Point with annual catches ranging from fewer than ten individuals to over 100 in the RIMP. Numbers of twaite shad impinged at Hinkley Point tended to peak in July and August.

7.2.10 The Severn Estuary and its rivers constitute the largest European eel fishery in the UK; comprising 95 % of all glass eels (juveniles migrating towards freshwater) caught in England and Wales. RIMP data indicated a decline in the number of European eels impinged at HPB through the time series. Data from CIMP1 were used as the baseline for adult eel

30 Franco, A., Elliott, M., Franzoi, P. and Torricelli P., 2008. Life strategies of fishes in European estuaries: the functional guild approach. MEPS, 354:pp. 219-228.

impingement. Glass eels are vulnerable to entrainment as they migrate from the marine environment to freshwater rivers and estuaries. Information of the relative distribution and abundance of glass eels at HPC relative to HPB was determined from a dedicated glass eel survey carried out in January-February 2012. Results from the survey suggested that glass eels were more abundant close to the south shore (near the HPB intake location) and in the surface layers.

7.2.11 Ichthyoplankton (fish eggs and larvae) are susceptible to entrainment by HPC. The baseline for entrainment in the 2013 DCO ES was determined using data from five monthly surveys undertaken between February and June 2010. A total of 29 sites were sampled in each survey, using a Gulf VII high-speed plankton sampler. These surveys were used to provide information on the seasonality and abundance of fish eggs and larvae and were specifically designed to cover the spawning periods of most fish species in the Bristol Channel. During this period the abundance of 18 taxonomic groups were identified, including the eggs of nine fish taxa and larvae of 16 species or taxonomic groups.

Current baseline

7.2.12 With regards to the fish impingement data collected at HPB, the original data has been augmented as appropriate, taking into account the second year of CIMP data (CIMP2) of 2021-22, as well as two additional years of RIMP data, from 2018 and 2019.

7.2.13 The RIMP detected 90 fish species at HPB between 1981-2019, with about 38 species sampled in each year. The CIMP2 data from 2021/2022 recorded 62 species of fish at HPB.

7.2.14 For many species the seasonal patterns correspond with those reported in the original baseline. Sprat and whiting are the species with the greatest abundance in the CIMP and RIMP datasets. Whiting abundance in the RIMP was typically low between April-June, peaking in winter. Similarly, sprat abundance peaked in the RIMP in January and December, with low abundance throughout the spring and summer (Henderson and Bird, 2010), a situation also reflected in the CIMP. Dab are another species that were impinged most frequently in winter and nearly absent over the summer months. Other species are most commonly impinged in summer, including juvenile Atlantic cod, Dover Sole and flounder.

7.2.15 Of the Annex II species of conservation importance for the Severn Estuary/ Bristol Channel, there were no occurrences of river lamprey, sea lamprey Atlantic salmon or Allis shad observed in the CIMP2. However, one sea lamprey was recorded in additional data collected in March 2022 when a bulk sample was unable to take place. A higher number of juvenile twaite shad were recorded in CIMP2 compared to CIMP1. The RIMP data collected since the baseline included two additional Atlantic salmon (in 2018) and one sea trout (in 2017), and no additional river lamprey, sea lamprey or allis shad. Nearly 600 twaite shad were recorded at variable rates throughout the RIMP time series. Whilst there is a high degree of variability in impingement rates, these peaked in 1990. Twaite shad were the most commonly impinged Annex II species in the RIMP. The current RIMP baseline for Annex II species includes ten Atlantic salmon, nine river lampreys, two sea lampreys and one sea trout from the 39-year period. For many species the seasonal patterns correspond with those reported in the original baseline.

7.2.16 Additional glass eel surveys were carried out in February/March 2013 and April 2013 to augment the survey carried out in January-February 2012. The surveys yielded over 2,500 glass eels from the flood tide when individuals would be expected to be in the water column. Analysis of the data indicated that glass eel density was higher in February/March than in April, suggesting seasonal changes in abundance. Data on the density of glass eels within the samples collected at the HPC intake locations was used as the basis of estimates of glass eel entrainment.

Future baseline

7.2.17 Given the temporal proximity between the current baseline and the future baseline (defined as the Project beginning operational cooling water abstraction, see Section 5), it is not considered there will be any substantial changes between the current and future baselines. Therefore, the current baseline description represents a reasonable future baseline for the start of operations. This is due to long-term changes in the baseline (for example through climate change) not being anticipated by the start of operations and differences in the baseline in any given year would be subject to interannual variability rather than longer term trends. This interannual variability in the relative abundance of the fish species in the Severn Estuary/ Inner Bristol Channel is driven by changes in recruitment events and environmental factors.

7.2.18 As a result of the long-term operation of the station an overview of the potential implications for climate on the fish species assemblage is described below. Another factor that influences the relative abundance of fish species in the Severn Estuary/ Inner Bristol Channel is fishing practices and intensity.

7.2.19 Mean sea temperatures around the UK and Ireland have been warming at between 0.2 and 0.6 °C decade^{-1} over the past 30 years. Projected future changes in the temperature and chemistry of marine waters around the UK and Ireland are having, and will continue to have, effects on the phenology (timing of lifecycle events), productivity and distribution of marine fish and shellfish[31]. Perry *et al.* (2005)[32] described that distributions of both exploited and non-exploited North Sea fishes have responded to recent increases in sea temperature, with nearly two-thirds of species shifting in mean latitude or depth or both over 25 years. They found that species with shifting distributions have faster life cycles and smaller body sizes than non-shifting species and that the differential change between species could have consequences for predator-prey relationships. For species that shifted, the mean shift was 99 km northwards in 25 years. Dulvy *et al.* (2008)[33] found that the North Sea winter bottom temperature had increased by 1.6 ^{o}C over 25 years and that during this period, the whole demersal fish assemblage deepened by ~3.6 m decade^{-1}. Simpson *et al.*, (2011)[34] found that most common northeast Atlantic fishes are responding significantly to warming with:

- three times more species increasing in abundance with warming than declining;
- local communities are being reorganized despite decadal stability in species composition; and
- species range shifts are likely to have smaller ecological impacts than modification of local communities.

7.2.20 However, the effects of climate change on fish communities are hard to predict with accuracy because behaviour, genetic adaptation, habitat dependency and the impacts of fishing on species result in complex responses (Heath *et al.*, 2012). As some past studies have not accounted for population structure and geographic attachment, distinguishing between other drivers and climate-induced effects on fish distributions is challenging[35 36 37]. Petitgas *et*

31 Heath, M.R., Neat, F.C., Pinnegar, J.K., Read, D.G., Sims, D.W., Wright, P.J., 2012. Review of climate change impacts on marine fish and shellfish around the UK and Ireland. Aquat. Conserv. 22, 337–367.

32 Perry, A.L., Low, P.J., Ellis, J.R., Reynolds, J.D., 2005. Climate Change and Distribution Shifts in Marine Fishes. Science (80-.). 308, 1912–1915.

33 Dulvy, N.K., Rogers, S.I., Jennings, S., Stelzenmuller, V., Dye, S., Skjoldal, H.R., 2008. Climate change and deepening of the North Sea fish assemblage: a biotic indicator of warming seas. J. Appl. Ecol. 45, 1029–1039.

34 Simpson, S.D., Jennings, S., Johnson, M.P., Blanchard, J.L., Schon, P.-J., Sims, D.W., Genner, M.J., 2011. Continental Shelf-Wide Response of a Fish Assemblage to Rapid Warming of the Sea. Curr. Biol. 21, 1565–1570.

35 Bruge, A., Alvarez, P., Fontán, A., Cotano, U., Chust, G., 2016. Thermal niche tracking and future distribution of Atlantic mackerel spawning in response to ocean warming. Front. Mar. Sci. 3. https://doi.org/10.3389/fmars.2016.00086

36 Brunel, T., van Damme, C.J.G., Samson, M., Dickey-Collas, M., 2018. Quantifying the influence of geography and environment on the northeast Atlantic mackerel spawning distribution. Fish. Oceanogr. 27, 159–173. https://doi.org/10.1111/fog.12242

37 Hughes, K.M., Dransfeld, L., Johnson, M.P., 2014. Changes in the spatial distribution of spawning activity by north-east Atlantic mackerel in warming seas: 1977–2010. Mar. Biol. 161, 2563–2576. https://doi.org/10.1007/s00227-014-2528-1

al., (2013)[38] considered that the key issue for the significance of climate change impact on fishes is habitat availability and connectivity between lifecycle stages with climate driven changes in larval dispersion being a major unknown. *Petitgas et al.*, (2013) considered that there was a significant risk for species with strict connectivity between spawning and nursery grounds.

7.2.21 Investigating the first 25 years of the Hinkley Point impingement dataset, Henderson (2007) noted periods of change in the fish community, linked to temperature, salinity and the North Atlantic Oscillation ('NAO')[39]. For example, in the late 1980's, a change in the northeastern plankton community resulted in a change in the relative abundances of the Bristol Channel fish community, and in the early 1990's a change in seawater temperatures was correlated with the disappearance of cold-water species. Continuous increases in species richness and the annual number of fish caught each year were also observed during the 25-year period. Henderson and Bird (2010) reported inter-annual fluctuations in the abundance of many species. For example, the abundance of European sea bass and Dover sole was noted to increase during warm years, while the abundance of common sea snail was noted to decline with increasing water temperature[40].

7.2.22 Many recent studies have characterised shifts in the distribution of fish and shellfish around the UK and Ireland that correlate with observed climate change, with decreases in cold-water species such as the Atlantic wolffish *Anarhichas lupus* in the southern North Sea. In addition, juvenile recruitment of several species such as Atlantic cod, Atlantic herring and whiting in the Bristol Channel / Celtic Sea in 2020 and 2021 was lower than the average over the period 1980-2010. However, increases in the abundance warm water fish species such as trigger fish, *Balistes capriscus*, gilthead bream *Sparus auratus* and comber *Serranus cabrilla*, and cephalopods such as *Loligo forbesii* and *L. vulgaris* have also been observed in UK waters[41]. Other models investigating the potential change in the distribution of small pelagic fish species suggest that the environmental suitability for Atlantic horse mackerel *Trachurus trachurus* and sprat may decrease around the British Isles, but suitability for sardine, anchovy,

38 Petitgas, P., Rijnsdorp, A.D., Dickey-Collas, M., Engelhard, G.H., Peck, M.A., Pinnegar, J.K., Drinkwater, K., Huret, M., Nash, R.D.M., 2013. Impacts of climate change on the complex life cycles of fish. Fish. Oceanogr. 22, 121–139.

39 Henderson, P.A., 2007. Discrete and continuous change in the fish community of the Bristol Channel in response to climate change. J. Mar. Biol. Assoc. UK 87, 589–598.

40 Henderson, P.A., Bird, D.J., 2010. Fish and macro-crustacean communities and their dynamics in the Severn Estuary. Mar. Pollut. Bull. 61, 100–114.

41 Pinnegar, J.K., Garrett, A., Wouters, J., Kelly, R., Stiasny, M.H., Marshall, C.T., 2023. Climate Change Impacts on Commercial and recreational Fisheries Relevant to the UK and Irelannd. MCCIP Science Review 2023, 29pp. doi: 10.14465/2023.reu11.fis.

Mediterranean horse mackerel *T. mediteraneus* and bogue *Boops boops* may increase, especially in the North Sea.

7.2.23 Due to the complexities described above with regards to predicting effects of climate change on fish communities, an accurate description of the composition and relative abundances of the Severn Estuary / Inner Bristol Channel fish community cannot be defined. However, some of the key observed trends in the Bristol Channel and Severn Estuary are likely to continue during the operational lifetime of the Project and are summarised:

- Relative changes in species abundance with growing numbers of species that favour warmer water (in winter, in summer or both) and reducing abundance of species near to their southern latitudinal boundary. Henderson and Bird (2010) reported and increasing number of 'tourist' species resulting in an increase in the monthly number of species recorded in the RIMP at HPB between 1981 and 2008;
- Effects on the phenology of some species (e.g. timing of the arrival of new recruits or migrations) and changes in migration patterns as some estuarine habitats become more or less suitable for each species and / or their prey; and
- The presence of large numbers of juvenile species in the estuary is dependent upon the connectivity between spawning locations further offshore to the west of Hinkley Point and their nursery grounds in the Severn Estuary. Some species have a lower tolerance to changes in winter temperatures than to summer temperatures and it is possible that higher winter temperatures will mean that some species may have to abandon fidelity to long established spawning locations which could produce a rapid reduction in the numbers of recruits to the estuary. Conversely, spawning of species favouring warmer temperatures may become more prevalent, with greater numbers of juveniles recruiting to the estuary.

Marine mammals

Original baseline

7.2.24 Eighteen species of cetacean have been recorded in the Severn Estuary and Bristol Channel since 1990. Of these, the following five species have either been noted as being present at any time of the year, or recorded annually as seasonal visitors within the Bristol Channel (Reid et al, 2003[42]; Baines and Evans, 2012[43]): harbour porpoise (*Phocoena phocoena*), Risso's

42 Reid, J.B., Evans, P.G.H. & Northridge, S.P. 2003. Atlas of Cetacean distribution in north-west European waters, JNCC, Peterborough, ISBN 1 86107 550 2.

43 Baines, Mick & Evans, Peter. (2012). Atlas of the Marine Mammals of Wales. 10.13140/RG.2.1.5141.6802.

dolphin (*Grampus griseus*), common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*) and minke whale (*Balaenoptera acutorastrata*). Occasional sightings and strandings of other cetaceans such as the long-finned pilot whale (*Globicephala melas*), fin whale (*Balaenoptera physalus*) and killer whale (*Orcinus orca*) have been recorded.

7.2.25 A desk-study review of available data on marine mammals within the Severn Estuary and Bristol Channel was conducted to inform the original ES. Following the publication of guidance from the Joint Nature Conservation Committee ('JNCC')[44], a network of acoustic sensors was also deployed offshore.

7.2.26 A study of the Welsh shore of the Bristol Channel (around the Gower Peninsula and Swansea Bay) during the early 2000s documented regular occurrences of the harbour porpoise (*Phocoena phocoena*), as well as occasional sightings of the common dolphin (*Delphinus delphis*)[45].

7.2.27 Aside from this study, there was little available information regarding cetacean activity in the areas of the Inner Bristol Channel and Severn Estuary, although common dolphin, bottlenose (*Tursiops truncatus*) and Risso's dolphins (*Grampus griseus*), as well as grey seals (*Halichoerus grypus*) had been recorded in the wider Bristol Channel area in the past[46].

7.2.28 The BEEMS programme initiated an acoustic monitoring programme to assess cetacean usage in relation to potential Hinkley Point C construction impacts with recording devises deployed at two locations around the proposed temporary jetty and the cooling water intake and outfall structures, and a further three locations on a depth transect from the front of the station around 25 km westwards into the Bristol Channel. These record cetacean 'clicks' (the vocalisations used as a means of navigation and prey location). The devices were placed in situ in early 2011.

7.2.29 As a result of this harbour porpoise were located at each of the five locations and initial inspection of data on dolphin clicks suggests that they were also present in the area.

7.2.30 The harbour porpoise is the most common recorded cetacean in the Bristol Channel. A resident population of harbour porpoise is present in the central and outer Bristol Channel

44 Joint Nature Conservation Committee. Statutory nature conservation agency protocol for minimising the risk of disturbance and injury to marine mammals from piling noise, 2000.
45 Watkins, H. and R. Colley. Harbour porpoise, Phocoena phocoena occurrence: Carmarthen Bay Gower Peninsula Swansea Bay. CCW Species Challenge Fund Report, Gower Marine Mammals Project: 98,2004.
46 DECC / Severn Tidal Power. SEA Environmental Report. Parsons Brinkerhoff Ltd and Black and Veach Ltd for DECC. May 2010.

using the area around Carmarthen Bay and around the Gower Peninsula in Swansea Bay, Wales. The area has been designated as the Bristol Channel Approaches SAC for harbour porpoise as a qualifying feature. Individuals are also known to enter the estuaries that communicate with the Bristol Channel (e.g., the Parrett) on isolated rare occasions.

7.2.31 Although, as described above, the bottlenose dolphin is present in the Inner Bristol Channel it is generally considered an infrequent visitor[47].

7.2.32 Grey seals (*Halichoerus grypus*) have been regularly observed in the Outer and Central Bristol Channel, although usually in small numbers. Grey seal sightings have been widespread in previous years in the Bristol Channel, with no evidence of clustering at any particular location. In general, grey seal sightings in the Severn Estuary are infrequent compared to areas within the Bristol Channel and there are no recorded haul out sites. Around Britain and Ireland, harbour seals (*Phoca vitulina*) haul out on tidally exposed areas of rock, sandbanks, or mud[48]. Between 2014 and 2016, no harbour seals were recorded at haul-out sites in south-west England and only five were recorded in Wales. Occasional vagrants have been observed in the wider area over the last decade, but there is no evidence of significant resident populations.

Current baseline

7.2.33 Since the HPS 2013 DCO ES was completed, a range of further surveys and studies have been undertaken into the marine mammal populations of the Severn Estuary and Inner Bristol Channel, including by the Somerset Sea Watch Surveys, which were completed between 2014 and 2018 at different locations along the Somerset coast[49]. These surveys recorded bottlenose dolphin, common dolphin (*Tursiops truncatus*), harbour porpoise and grey seal.

7.2.34 Cardigan Bay SAC, approximately 43 km from the Project, is one of the two main recognised bottlenose dolphin populations in Britain. A summer mark-recapture estimated a range of

47 Atlantic Array Offshore Wind Farm Draft Environmental Statement Volume 3: Annex 9.1: Marine Mammals. Channel Energy Limited, 2012.

48 Offshore Energy SEA (2009), Chapter A3a.7 Marine and other Mammals [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/194339/OES_A3a7_Marine_Mammals.pdf (accessed 11 December 2023)

49 The Wildlife Trust Somerset (2020) Somerset Sea Watching. Available online at: https://www.somersetwildlife.org/sites/default/files/2020-01/SomersetSeaWatch5YearsV2.pdf (Accessed November 2023).

152-342 individuals, with the latest estimate (2015) being 222 individuals (95 % CI: 184-300 individuals)[50].

7.2.35 For common dolphin, only casual sightings have been recorded, with a range of sighting densities of 0.1-0.49 animals/km during the summer and autumn seasons.

7.2.36 As noted above, harbour porpoise is still the most commonly-recorded cetacean in the Bristol Channel, and within UK waters as a whole[51]. As a qualifying feature of Bristol Channel Approaches SAC, which is the closest European site to the development with harbour porpoise as a qualifying feature, marine monitoring programmes are carried out, with the last results from year 2016, with an estimated density ranging between 0-0.25 animals per km^2 for Bristol Channel area[52].

7.2.37 Other cetacean species found within the Bristol Channel, but not frequently-recorded due to their preference for deep offshore waters, include Risso's dolphin (*Grampus griseus*), Long-finned Pilot Whale (*Globicephala melas*) and Fin whale (*Balaenoptera physalus*).

7.2.38 Of the two most common seal species in UK waters, the grey seal is still the most frequently-observed within the vicinity of the Project. The closest European site to the development (102 km) is Lundy SAC, with a permanent Grey seal population of 70 individuals[53]. The species is most seen during Spring and Summer season. According to the Pembrokeshire Marine SAC (120 km distance from the development) condition assessment, the grey seal population is in favourable condition, as the pupping sites have been maintained for over a decade[54].

Future baseline

7.2.39 Given the temporal proximity between the current baseline and the future baseline (defined as the Project beginning operational cooling water abstraction, see Section 5), it is not

50 Evans, P.G.H. and Waggitt, J.J. 2023. Modelled Distribution and Abundance of Cetaceans and Seabirds in Wales and Surrounding Waters. NRW Evidence Report, Report No: 646, 354 pp. Natural Resources Wales, Bangor.

51 Jenkins, R.E., Brown, R.D.H., Phillips, M.R. (2009) Harbour porpoise (Phocoena phocoena) conservation management: A dimensional approach. Available online at: https://www.sciencedirect.com/science/article/abs/pii/S0308597X09000220 (Accessed November 2023)

52 Lacey, C. et al. (2022) Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Available online at: https://scans3.wp.st-andrews.ac.uk/files/2022/08/SCANS-III_density_surface_modelling_report_final_20220815.pdf (Accessed November 2023).

53 Joint Nature Conservation Committee (JNCC) (2015) Lundy, Special Area of Conservation. Available online at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0013114.pdf (Accessed November 2023).

54 NRW, 2018. Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 233, 67pp, NRW, Bangor.

considered there will be any substantial changes between the current and future baselines. Therefore, the current baseline description represents a reasonable future baseline for the start of operations. This is due to long-term changes in the baseline (for example through climate change) not being anticipated by the start of operations and differences in the baseline in any given year would be subject to interannual variability rather than longer term trends.

7.2.40 On a longer-term basis, across the life-cycle of the Project, and as previously noted, mean sea temperatures around the UK and Ireland have been warming at between 0.2 and 0.6 °C per decade over the past 30 years. Projected future changes in the sea temperature around the British Isles will continue to have effects on the distribution and breeding status of marine mammals in future years / decades.

7.2.41 As part of the Marine Climate Change Impacts Partnership ('MCCIP') rolling evidence programme, an updated review of the current and future impacts of climate change on UK marine mammals has recently been published[55]. The review states that the main impacts of climate change on marine mammals are:

- geographic range shifts;
- reduction in suitable habitats;
- food web alterations; and
- increased prevalence of disease.

7.2.42 The proportion of recorded strandings of warm water adapted species e.g. common dolphin and striped dolphin (*Stenella coeruleoalba*) has increased over time, while that of cold water adapted species such as Atlantic white-sided (*Lagenorhynchus acutus*) and white-beaked dolphins (*L.albirostris*) has decreased in these same northern regions.

7.2.43 The semi-resident bottlenose dolphin population previously observed on the southern coasts of Devon and Cornwall may now be extending throughout the English Channel, with sightings recorded from the Bristol Channel and as far east as Sussex (Duncan, 2021)[56].

55 Climate Change Impacts on Marine Mammals around the UK and Ireland.pdf (mccip.org.uk) (Accessed on 22 November 2023).

56 Duncan, S. (2021) Is conservation management fit for purpose: a case study using a small coastal resident bottlenose dolphin (Tursiops truncatus) population. MSc Thesis, University of Plymouth.

7.2.44 However, because the southern UK is already within the established range of warmer water species, a northward shift in range may not be reflected in a change to the distribution of populations of some species in the Bristol Channel.

7.2.45 These observed shifts in marine mammal distribution are considered to represent a functional response to distribution shifts in their cold-blooded prey which are more sensitive to environmental changes such as increased sea surface temperatures and decreased salinity. This may affect, for example, harbour porpoise that rely heavily on sandeels for prey. The key timings in the sandeel lifecycle are linked to the seasonal cycle of copepod production which in turn rely on phytoplankton blooms. With the timing of peaks in copepod abundance shifting, sandeel lifecycles no longer correlate as effectively and recruitment has subsequently declined (van Deurs et al., 2009)[57]. Ultimately, changes to marine mammal distributions and behaviours may occur if they are required to switch prey or foraging strategies.

7.2.46 However, JNCC has highlighted the wide range of anthropogenic pressures acting on marine mammals and the difficulty determining causal relationships. They conclude that:

"More long-term species monitoring, and a better understanding of cumulative impacts and bottom-up effects are needed to improve confidence in the impacts of climate change on marine mammals and what could happen in the future[55]".

Marine ornithology

7.2.47 Overwintering and migratory wildfowl and waders, which are not piscivorous, are covered in Terrestrial and freshwater ecology / ornithology below.

7.2.48 For the purposes of this section on the marine ornithology baseline, focus has been on predominantly piscivorous bird species in the Severn Estuary / Inner Bristol Channel (and in particular the marine and estuarine areas to the east of Hartland Point and Carmarthen Bay, referred to hereafter as the 'study area'), drawing on existing data sources to understand the potential level at which such bird species could be present in the vicinity of the Project. Where applicable, this has drawn on known foraging ranges, and populations within nearby colonies / designated sites.

57 van Deurs, M., van Hal, R., Tomczak, M.T., Jónasdóttir, S.H. and Dolmer, P. (2009) Recruitment of lesser sandeel Ammodytes marinus in relation to density dependence and zooplankton composition. Marine Ecology Progress Series, 381, 249-258.

Original baseline

7.2.49 The DCO 2013 baseline information from 2011/2013 provided limited information on predominantly piscivorous birds. The information instead focused on waders and waterfowl (winter and passage birds) associated with Severn Estuary SPA / Ramsar sites. The primary effects assessed in 2011/2013 considered disturbance of waders and waterfowl on intertidal / mudflats and terrestrial habitat.

7.2.50 Gulls (black headed and herring, both piscivorous species) were considered in the HPC 2013 DCO ES in relation to human disturbance (construction activities) but no assessment relating to prey availability was undertaken (at that time, of course, a AFD was intended to be fitted). It was also noted that there was (at the time) insufficient information available on the functional response in black-headed and herring gull to allow incorporation in the MORPH - a trophic model of bird predator - prey dynamics, therefore detailed modelling was not undertaken.

Current baseline

7.2.51 In order to consider the current distribution and density of predominantly piscivorous bird species within the study area, a review of available datasets has been undertaken to determine whether highly mobile species associated with local or more distant European sites are likely to occur within the study area. This has included the following sources:

- JNCC Seabird 2000 survey (Mitchell et al 2004) and subsequent census counts;
- DEFRA Project MB0126[58] risk assessment of seabird bycatch in UK Waters (which includes predicted densities of key species on a 3 km x 3 km grid basis using a combination of boat and aerial survey data); and
- Predicted and observed foraging ranges for seabirds as detailed in Thaxter et al (2012)[59] and Woodward et al (2019)[60].

58 Department for Environment, Food & Rural Affairs (2017) ArcGIS layers accompanying report Risk assessment of seabird bycatch in UK waters - MB0126. Available online at: https://environment.data.gov.uk/dataset/db447840-e7ed-40d7-8cc9-e0c4f1ea6857 (Accessed 17 November 2023.)

59 Thaxter, Chris & Lascelles, Ben & Sugar, Kate & Cook, Aonghais & Roos, Staffan & Bolton, Mark & Langston, R. & Burton, Niall. (2012). Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation. 156. 10.1016/j.biocon.2011.12.009.

60 Woodward, I., Thaxter, C.B., Owen, E. & Cook, A.S.C.P. 2019. Desk-based revision of seabird foraging ranges used for HRA screening, Report of work carried out by the British Trust for Ornithology on behalf of NIRAS and The Crown Estate, ISBN 978-1-912642-12-0.

7.2.52 The distribution and foraging range data from these above three sources have been used to consider where breeding and wintering predominantly piscivorous birds (which are likely to be associated with European sites) occur and whether this includes the study area (and so potentially in the vicinity of the Project). For the purposes of this HRA Report, this has focused on the marine and estuarine areas to the east of Hartland Point and Carmarthen Bay. The following species accounts provide an overview of the key predominantly piscivorous species with the potential to be in the vicinity of the Project.

Lesser black-backed gull

7.2.53 Lesser black-backed gull are listed under Criterion 6 of the Severn Estuary Ramsar site designation for the Severn Estuary as the site regularly supports 1 % of the individuals in a biogeographical breeding population.

7.2.54 A key location for lesser black-backed gull in the vicinity of the study area is Flat Holm, one of the species' largest breeding colonies in the UK. In the JNCC Seabird 2000 survey (Mitchell et al 2004[61]) Flat Holm was recorded as supporting 3,309 nests, showing a significant increase in numbers between 1985-88 and 1998-2002. Flat Holm is located >18 km from the HPC Site. However, lesser black-backed gulls have been regularly recorded as part of the ongoing site surveys and utilise mudflat and estuarine habitats associated with the River Parrett, Steart Marshes and wider Bridgwater Bay area.

7.2.55 Lesser black-backed gull are a highly mobile species and have a mean maximum foraging range of 127 km[66] – 141 km[65] which could lead to birds associated with other European sites (such as Skomer and Skokholm SPA) foraging within the inner Bristol Channel / Severn Estuary. However, the predicted density of this species is predicted to be relatively uniform and low with no obvious concentrations outside of the known breeding colony (and areas immediately adjacent).

Manx shearwater

7.2.56 Manx shearwater are highly mobile and can forage for extended periods during the breeding season over large distances. The mean maximum foraging range is >1,000 km. Birds from Skomer, Skokholm and the Seas off Pembrokeshire SPA, off the Pembrokeshire coast, feed

61 Mitchell, P.I., Newton, S.F., Ratcliffe, N. & Dunn, T.E. 2004. Seabird Populations of Britain and Ireland, JNCC, Peterborough, ISBN 0 7136 6901 2.

primarily to the west of the UK with predicted densities highlighting large offshore areas to the west of Wales. Manx shearwater are rarely recorded in the inner Severn Estuary.

Gannet

7.2.57 Gannet are a designated feature of the Grassholm SPA, off the south-west coast of Wales, with 33,000 pairs in the breeding season making up 12.5 % of the breeding North Atlantic population (count as at 1994/5). This is the only gannet colony in Wales, although occasionally single pairs have set-up territories elsewhere without colonies becoming established. Changes in the size of the Grassholm gannetry have been documented since its foundation around 1820. In 2009, using high resolution digital images, 39,282 apparently-occupied sites[62] (AOS) were recorded – making it the third largest gannetry in the UK and Ireland. The most recent survey in 2015 counted 36,011 AOS.

7.2.58 Gannets are highly mobile and forage both near to their nesting sites but also further out to sea. Birds that are feeding young have been recorded searching for food up to 320 km from their nest, although there can be significant variation in this, up to double the distance; generally, foraging can be within less than 150 km[63]. Birds from Grassholm have been GPS tagged and tracked foraging primarily north, north-east, south and south-west of Grassholm in 2012 with none of a sample of 43 tagged birds recorded within the inner Severn Estuary[64].

Atlantic puffin

7.2.59 Puffins are a highly mobile species, with a foraging range varying between colonies and seasonally, although the mean range is 61.3 km[66], with a mean maximum recorded foraging range of between 105.4 km[65] and 137.1 km[66]. Their prey is smaller schooling fish, particularly sandeels and they fish in inshore and offshore waters. There is some evidence to indicate a strong association with tidal fronts.

7.2.60 Primarily a marine species, the predicted distribution of Atlantic puffin during the breeding season is centred around the breeding colony at Skomer, off the Pembrokeshire coast, therefore outside the study area. The study area lies approximately 150 km from Skomer

62 An apparently active site occupied by a bird, pair of birds, or with eggs or chicks present.

63 Nelson, J. Bryan (2005). Pelicans, Cormorants and their relatives. Oxford: Oxford University Press.

64 https://community.rspb.org.uk/placestovisit/ramseyisland/b/ramseyisland-blog/posts/gannet-tracking-on-grassholm (Accessed on 22 November 2023).

Island well over 100 km from the colony suggesting that Puffins from the designated site would rarely use the area for foraging.

Guillemot

7.2.61 Guillemots are a highly mobile species with mean and mean maximum foraging ranges between 33.1[66]-37.8 km[65] and 73.2[66] and 84.2[65] km respectively.

7.2.62 The study area lies c. 150 km from Skomer Island (the nearest colony to the study area) suggesting that Guillemots would rarely enter the area, staying much closer to the colony on Skomer and foraging out in deeper waters.

Razorbill

7.2.63 Razorbill are considered a coastal species rather than pelagic, and birds tend to be concentrated within 10 km of the shore. Razorbill have mean and mean maximum foraging ranges between 23.7[65]-61.3 km[66] and 84.2[65]- 73.2 km[66] respectively.

7.2.64 The study area lies c. 150 km from Skomer Island (the nearest breeding colony), suggesting that Razorbills would rarely enter the inner Severn Estuary, staying much closer to the colony on Skomer and remains concentrated within a 10-40 km radius.

Black-legged kittiwake

7.2.65 There are an estimated 3,188 pairs of black-legged kittiwake nest sites in the wider Dyfed area and 1,204 nest sites in Devon[67] (though this includes sites on the southern coast). The most recent census results from Skomer recorded 1,439 nest sites (2021).

7.2.66 Black-legged Kittiwake have a mean maximum foraging range between 60 km[65] and 156 km[66] and are a primarily marine gull species which forage in the marine environment. Whilst observations during ornithological surveys show the species does occasionally occur within the Inner Bristol Channel and Severn Estuary during periods of poor weather, and therefore may occur within the study area, the predicted distribution of black-legged kittiwake during the breeding season is highest immediately adjacent to breeding areas such as Skomer, Skokholm (off the Pembrokeshire coast) and the north Devon Coast.

Northern fulmar

7.2.67 Northern fulmar are a highly mobile seabird with mean maximum foraging ranges between 400 km[65] and 542 km[66]. Predicted densities for this species as presented in the DEFRA Project MB0126 show a low and uniform density of Fulmar within the inner Bristol Channel and Severn Estuary, with greater densities in waters to the west of the Welsh coast. As a primarily marine species, they are less common in the inner Bristol Channel and Severn Estuary.

7.2.68 There are Fulmar breeding colonies within the Bristol Channel, widespread along the Pembrokeshire and Ceridigion coast[67] but the species does not occur in internationally or nationally important numbers at Skomer, Skokholm and the seas off Pembrokeshire SPA.

Common scoter

7.2.69 Wintering common scoter in the UK typically gather in large flocks in shallow offshore areas, feeding in areas with sandy seabed where they can feed on small fish, sand eels, mussels and bivalves. Their distribution within the Bristol Channel and inner Severn Estuary is largely constrained to Carmarthen Bay, however occasional small flocks or individual birds may occur in the wider area. Monitoring of shelduck and waterfowl associated with HPC has recorded very small numbers of common scoter within the study area, however these are not regular or common sightings.

Other species and locations

7.2.70 Other piscivorous species include breeding species such as sandwich tern, common tern, little tern and Mediterranean gull. European sites for these species are located along the southern coast of England and the north Wales coast. These species are more range restricted during the breeding period with mean maximum distances of <34 km[65 66]. Therefore, it is not anticipated that these species would occur in significant numbers in within the inner Bristol Channel and Severn Estuary.

65 Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas (2012). Biological Conservation 156: 53-61.

66 Woodward, I., Thaxter, C.B., Owen, E. & Cook, A.S.C.P. 2019. Desk-based revision of seabird foraging ranges used for HRA screening, Report of work carried out by the British Trust for Ornithology on behalf of NIRAS and The Crown Estate, ISBN 978-1-912642-12-0.

67 Mitchell, P.I., Newton, S.F., Ratcliffe, N. & Dunn, T.E. 2004. Seabird Populations of Britain and Ireland, JNCC, Peterborough, ISBN 0 7136 6901 2.

7.2.71 Wintering species, such as red-throated diver, which are associated with the Northern Cardigan Bay SPA behave in a similar manner to common scoter, gathering in localised locations. Small numbers of red-throated diver (and other diver species) do occur within the Severn Estuary / Inner Bristol Channel, however these are typically individual and transient individuals.

Future baseline

7.2.72 Given the temporal proximity between the current baseline (as described above) and the future baseline (defined as the Project beginning full cooling water abstraction), it is not considered that there will be any substantial changes between the current and future baselines. Therefore, the current baseline description represents a reasonable future baseline for the start of full operations. This is due to substantial changes to the baseline (for example, through climate change), not being anticipated by the start of full operations.

7.2.73 On a longer-term basis, across the life-cycle of the Project, the distribution of marine birds will be affected by a range of factors, including increasing sea temperatures and inter-annual variability of both their own numbers and that of prey resources. Changes in seawater temperature may result in: shifts in species' geographic ranges; reduction / movement of suitable habitats; changes in dietary composition; and increased disease prevalence.

Terrestrial and freshwater ecology / ornithology

7.2.74 For the purposes of this HRA Report, terrestrial ecology covers the habitats and species that live, feed and breed above mean high water springs level. Shorebirds, waders and waterfowl are also included.

Original baseline

HPC Site

7.2.75 The HPC Site was (prior to HPC construction) characterised by lowland farmland, comprising managed pasture fields and other grasslands, hedgerows, small blocks of woodland, scattered trees, occasional small ponds and a small network of narrow streams and drainage ditches which flow into the adjacent Bridgwater Bay. These habitats within the HPC Site supported a range of terrestrial species, some of which (namely certain bat species and otter) were qualifying features of European sites. The northern boundary of the HPC Site lies adjacent to Bridgwater Bay, from which it is separated by a low cliff, forming an escarpment between land and sea. Intertidal areas (comprising rock platforms, mud and sand), which can also support terrestrial species (namely certain waterbird species which are qualifying features of European sites) were present along the shore adjacent to the HPC Site.

7.2.76 The 2007 breeding bird survey reported in the HPC 2013 DCO ES recorded 39 species of breeding bird on and within 250 m of the HPC Site (prior to construction). The majority of bird species recorded were common passerine species, though a number of farmland birds that had been subject to rapid population decline over recent years were also recorded. None of the terrestrial breeding bird species recorded were features of the NSN.

7.2.77 Diurnal and nocturnal surveys for birds foraging, loafing or roosting within agricultural fields within and adjacent to the HPC Site were undertaken between September 2007 and March 2009 (prior to construction, as reported in the HPC 2013 DCO ES). The maximum counts for species, which were interest features or components of the waterbird assemblages of the Severn Estuary SPA and Ramsar and / or Somerset Level & Moors SAC and Ramsar sites were for: shelduck; teal; curlew; redshank; whimbrel; golden plover; and lapwing. Nocturnal wintering surveys found that fields of the HPC Site were not being regularly used by large numbers of roosting or foraging birds, although there was consistent use of coastal fields by small numbers of golden plover.

7.2.78 At least nine bat species were recorded on and adjacent to the HPC Site prior to construction during various surveys conducted between 2007 and 2010 (as reported in the HPC 2013 DCO ES). Three of these species are features of the NSN: barbastelle (*Barbastella barbastellus*), greater horseshoe bat (*Rhinolophus ferrumequinum*) and lesser horseshoe bat (*Rhinolophus hipposideros*). The occurrence of the lesser and greater horseshoe bats was no more than occasional and appeared to be largely restricted to one well-vegetated lane (Green Lane) through the HPC Site (prior to construction). Regular barbastelle bat activity (commuting and foraging) at woodlands and taller hedgerows in the northern part of the HPC Site and along both Green and Benhole Lanes was recorded prior to construction. Surveys conducted in 2010, primarily off the HPC Site prior to construction, indicated regular usage of the landscape by barbastelle but they were unlikely to be roosting in close proximity to survey locations.

7.2.79 Otter surveys were conducted on all water features within the HPC Site prior to construction and at selected locations within approximately 5 km, in 2007 and 2009 (as reported in the HPC 2013 DCO ES). On the HPC Site prior to construction, otter presence was recorded at three locations along the Bum Brook (along the southern edge of the HPC Site). With the exception of this location, surveys found that water features within the HPC Site prior to construction offered limited commuting, foraging or resting / breeding opportunities for otter due to their lack of connectivity and ephemeral nature.

Pawlett Hams, The Island and the Weirs

7.2.80 The compensation package was not part of the original DCO 2013 and the design locations were, therefore, not included in any of the original DCO documentation. The different elements of the compensation package are discussed in terms of current and future baseline only.

Current baseline

HPC Site

7.2.81 Construction activities associated with HPC began in June 2016 and are ongoing as of September 2023. The HPC Site is currently being constructed as per the 2013 DCO (as amended by a correction order and further non-material changes, the details of which are set out in Table 1-1 of the HRA Report). Construction is currently approximately 60 % complete. Much of the civil works are complete and the site is now transitioning to the internal installation of mechanical electrical and heating systems. Two permanent buildings (the Simulator Building and Framatone Warehouse) are complete and operational.

7.2.82 The DCO ES anticipated 5,600 workers during the peak construction period and various strategies, management plans and mitigation measures were agreed and secured within the DCO and accompanying Deed of Development Consent Obligations ('s106 agreement') to manage the impacts arising. In May 2022 the Transport Review Group ('TRG') and Socio-Economic Advisory Group ('SEAG') approved a series of amended strategies and management plans which were based on an increased workforce of around 8,500 workers at the peak of construction. A voluntary package of mitigation measures was agreed to address the impacts which were anticipated to arise from the increased workforce.

7.2.83 A second workforce uplift has been discussed with relevant organisations including Somerset Council, National Highways, the Emergency Services and NHS. The premise of the second workforce uplift includes a peak workforce increasing to 12,040 workers. This was revised in light of the need for greater overlap between the civils and mechanical, electricity, heating and ventilation ('MEH') phases and a larger number of support, professional and management roles to be based at the main HPC Site.

7.2.84 The revised construction plan outlines the overarching programme through providing the schedules and timescales for each required activity. The revised plan applies this Second Workforce Uplift, which enables MEH installation, main civil works and commissioning activities to be delivered concurrently. Requests for access to this data can be made directly to NNB. Any impacts arising from the second workforce uplift will be discussed and mitigation agreed by the TRG and SEAG.

7.2.85 Possible pathways of effect between the workforce uplift, the second workforce uplift and the proposed DCO Material Change application in relation to Transport and Air Quality have been identified and assessed within the PEIR.

7.2.86 Areas of habitat have been created or enhanced as part of the DCO, some prior to 2016, and include hedgerow, woodland, scrub and freshwater wetland.

Pawlett Hams

7.2.87 The site at Pawlett Hams is described at Section 3.7. As noted there, Pawlet Hams is located within the Severn Estuary SPA, Severn Estuary Ramsar site and Bridgwater Bay SSSI. The Severn Estuary SAC follows the River Parrett but the SAC boundary extends inland, up to approximately 65 m in places, along the outer edge of Pawlet Hams.

7.2.88 The Bridgwater Bay SSSI units that make up Pawlett Hams (Units 82 to 88 – lowland neutral grassland and unit 99 – littoral sediment) were last checked by NE in 2018 when all units were categorised as unfavourable-recovering. Previous to this, freshwater supply from the Cannington Brook to Pawlett Hams was cut-off following a landslide. This was re-instated by the Internal Drainage Board ('IDB') in March 2018 by installing a new 'directionally drilled' pipe under the River Parrett in early August 2017 which acts as a siphon under the river. The inlet comprises a reinforced concrete headwall, weed screen, temporary pumping facility and penstock located upstream of Stallington Clyce on the bank of the Cannington Brook. The summer supply of freshwater to the Hams is therefore guaranteed. The SSSI interest features (ditches, invertebrate assemblages and ponds of units 82-88) are now recovering (Natural England, 2018). NE estimates that the units will be in favourable condition by 2024 with the most southernmost SSSI units potentially having met favourable condition by 2021.

7.2.89 Priority habitat coastal and floodplain grazing marsh is distributed throughout Pawlett Hams, with sporadic areas of coastal saltmarsh and mudflat bordering the perimeter of the site (DEFRA, 2023). Given the diverse range of intertidal, freshwater and terrestrial habitats present on the site, Pawlett Hams has the potential to support a range of protected and / or notable habitats and species, including those that are features of the NSN, such as rare plants, invertebrates, internationally important numbers of over-wintering and passage migrant waders and waterfowl, Great Crested Newt ('GCN'), bats and otter.

7.2.90 A wide variety of freshwater aquatic and bankside plant species (some nationally restricted) are found in the ditches, some of which are slightly brackish in nature. Ponds are present in some of the fields containing plant and invertebrate communities similar to adjacent ditches (English Nature, n.d.).

7.2.91 Five Red Data Book invertebrate species have been recorded within the brackish and freshwater rhyne systems and ponds at Pawlett Hams: two water beetles, a hover fly and two soldier flies. It supports a water mite new to Britain (at the time), *Diplodontus scapalaris*, and at least three additional nationally scarce species. Habitat survey for the Pawlet IDB pipeline identified the following rare plants on the southern coastal boundary of Pawletts Hams with the river Parrett: sea wormwood; sea barley; rock-sea lavender; and slender hare's-ear.

7.2.92 The British Trust for Ornithology Wetland Bird Surveys (WeBS) in winter 2020/21 and 2021/22 recorded thirteen bird species on Pawlett Hams of which two species are specified within the Severn Estuary SPA designation: shelduck and redshank. Field survey for the Bridgwater Tidal Barrier Order in 2016/17 (Environment Agency, 2019) recorded the following Severn Estuary SPA species (including the assemblage) either within Pawlett Hams or on the River Parrett on the immediate boundary of Pawlett Hams: shelduck, wigeon, teal, ringed plover, grey plover, dunlin, whimbrel, curlew and redshank. Somerset Environmental Records Centre ('SERC') (2023) provided records of the following Severn Estuary SPA qualifying features / water assemblage: Bewick's swan, gadwall, wigeon, teal, pochard, tufted duck, curlew, whimbrel and spotted redshank. Please note that a number of these records are over twenty years old.

7.2.93 Pawlett Hams is under current management to encourage breeding lapwing (a qualifying feature of the Somerset Levels & Moors Ramsar) with recent success resulting in 15 breeding pairs (pers.comm Colin Leopard, Natural England, autumn 2023).

7.2.94 Two ponds within Pawlett Hams were surveyed in 2018 for GCN (DEFRA, 2023). No presence was confirmed. GCN presence has been recorded south of Pawlett village approximately 2.5 km to the east of Pawlett Hams. Field survey for the Bridgwater Tidal Barrier Order (Environment Agency, 2019) confirmed the presence of GCN in the River Parrett, approximately 1.5 km east of Pawlett Hams.

7.2.95 SERC (2023) provided numerous records of otter on both sides of the River Parrett with additional otter presence confirmed during the Bridgwater Tidal Barrier Order (Environment Agency, 2019).

7.2.96 Field survey supporting the Bridgwater Tidal Barrier Order (Environment Agency, 2019) identified barbastelle bat activity on the opposite side of the river, in Combwich. SERC (2023) also provided records of barbastelle bat with additional lesser horseshoe bat records at Dunball approximately 3 km to the southeast of Pawlett Hams. Greater horseshoe bat records were also provided by SERC at over 4 km to the east of Pawlett Hams at Puriton Level.

7.2.97 Pawlett Hams is included in the Bridgwater Bay SSSI partly as it is of local importance for its network of ditches and ponds with notable aquatic flora. The Bridgwater Bay SSSI citation states a wide variety of aquatic and bankside plant species occur in the ditches.

The Island

7.2.98 The Island is described at Section 3.7 above. The Island is located within the Severn Estuary SPA, Severn Estuary SAC, Severn Estuary Ramsar and the Bridgwater Bay SSSI. The Island is included in the Severn Estuary European Marine Site. The SSSI unit that makes up The Island, Unit 93, comprises littoral sediment and when last assessed in 2010 it was in favourable condition.

7.2.99 Coastal saltmarsh priority habitat is distributed throughout The Island site with additional coastal and floodplain grazing marsh priority habitat bordering the eastern boundary and mudflat bordering the northern and western boundaries of the site (DEFRA, 2023).

7.2.100 The Island has the potential to support a range of protected and / or notable habitats and species.

7.2.101 DEFRA (2023) did not identify any protected species mitigation licences at The Island, nor any GCN surveys (although this is a saline environment, unsuitable for amphibians).

7.2.102 Use of coastal habitats by bats is greatest at rocky shores, with coastal cliff vegetation being used for navigation and foraging. However, The Island is comprised primarily of saltmarsh and mudflats which is less suitable for bats. A record of barbastelle bat is present approximately 2 km to the east, inland from The Island.

7.2.103 Multiple otter records were returned within 1 km of The Island site from SERC. The closest of these includes four records from between 2017 and 2018, approximately 25 m north of The Island site, adjacent to the Huntspill Sluice. Given The Island's regular inundation by seawater, it would not be considered suitable holt / couch building habitat, but it is considered likely that otter use the saltmarsh within the site for foraging and commuting.

7.2.104 Eight bird species (either qualifying feature species or within the 16 species of the wider assemblage of the Severn Estuary SPA) were returned by SERC as being recorded within The Island: curlew (*Numenius arquata*); grey plover (*Pluvialis squatarola*); spotted redshank (*Tringa erythropus*); teal (*Anas crecca*); whimbrel (*Numenius phaeopus*); pochard (*Aythya ferina*); tufted duck (*Aythya fuligula*); and wigeon (*Anas penelope*).

7.2.105 The Island site comprises saltmarsh habitat and therefore is tidally influenced. Although the tidal limit of the Huntspill River (and hence freshwater habitat) is close to The Island this is owing to the sluices (Huntspill Sluice) in place which create a seaward limit much closer to the sea. Fish communities upstream of this would have limited two-way connectivity to The Island. EA fish catch data (2013) indicate a typical lowland freshwater fish community. These habitats are also likely to support freshwater communities of invertebrates and macrophytes.

Weirs

<u>Maisemore Weir, River Severn</u>

7.2.106 Maisemore Weir is located on the River Severn extending along its entire width of 80 m. Aerial photography suggests that the riverbanks are lined with mature trees in a wider area of agricultural grazing and crop land.

7.2.107 The Gloucestershire Centre for Environmental Records ('GCER') provided data in 2023 that identified the following Annex II species within 2 km of the weir: GCN, greater horseshoe bat, lesser horseshoe bat, otter and a grey seal at the weir in 2019. GCER also provided a range of bird species records, some of which are within the Severn Estuary SPA and Ramsar designations under the Regulation 33 advice, although at distance from the weir.

7.2.108 The macrophyte status for this section of the River Severn (River Severn – confluence of River Avon to confluence of Upper Parting: ID GB109054044404) is classed as High in 2022 (an improvement from Moderate in 2019). Macrophytes sampled by the EA upstream of Maisemore Weir, northwest of Norton, indicate freshwater habitat comprising reeds (*Phalaris*), brooklime (*Veronica beccabunga*), water pepper (*Persicaria hydropiper*), horsetails, mosses and liverworts. Overall, the macrophyte communities are not indicative of permanent saline / brackish conditions south of Maisemore Weir.

7.2.109 The invertebrate status for this section of the River Severn has been classed as Bad since 2019. Macro-invertebrate data indicate that monitoring sites downstream of the weir are representative of transitional waters and do not contain freshwater taxa. Upstream taxa are a mixture of those tolerant of brackish conditions and / or brackish taxa tolerant of freshwater conditions. The non-native invasive zebra mussel (*Dreissena polymorpha*) and Asian clam (*Corbicula fluminea*) have been recorded upstream of the weir.

7.2.110 The EA has freshwater fish catch data over the past ten years for the River Severn upstream of Maisemore Weir. Downstream of the River Chelt tributary (i.e., closest site upstream of Maisemore Weir) fish communities sampled by the EA comprised freshwater and migratory / estuarine species. Ten species were found in 2014 and 2016 surveys, dominated by common goby and minnow, respectively. Other species included bleak, roach, gudgeon dace, perch, chub, 3-spined stickleback, flounder, European eel, ruffe and rudd. On the River Chelt close to its tributary with the Severn, roach, dace and chub dominated, with stone loach, Atlantic salmon, European eel, flounder, minnow, perch and bleak among the other species that were present. Other notable species expected to be present are lampreys and shads. However, it is only passable at certain tide states or when river flows are very high. Overall, the fish communities show that estuarine species can penetrate Maisemore Weir towards Tewkesbury. This also includes migratory species such as European eel and Atlantic salmon.

<u>Upper Lode Weir, River Severn</u>

7.2.111 The Upper Lode Weir is located on the River Severn and crosses the righthand channel at this location. While the lefthand channel appears to be a navigation channel with engineered banks, the weir crosses for approximately 150 m between the separating wooded island on the west and the eastern riverbank, which has occasional tree and scrub cover.

7.2.112 GCER provided records for the following Annex II species within 2 km of the weir: GCN, grey seal and otter. GCER also provided a range of bird species records typical of freshwater rivers.

7.2.113 The macrophyte and invertebrate status of this stretch of the River Severn (River Severn – confluence of River Avon to confluence of Upper Parting: ID GB109054044404) are the same as the Masiemore Weir (see above).

7.2.114 The fish assemblage at this location is as summarised above for Masiemore Weir. Overall, the fish communities show that estuarine species can penetrate the weir north of Tewkesbury, to around Upton upon Severn. Migratory species such as European eel and Atlantic salmon also reach above the Weir at Tewkesbury; Shads are also able to navigate the weir here.

River Lugg Weirs

7.2.115 The three weirs for consideration on the River Lugg (Mousenatch Weir, Eyton Weir, Coxall Weir) are within the River Lugg SSSI which is classed as unfavourable (declining) (Natural England, 2023). Aerial photography suggests that the River Lugg watercourse appears to be no more than 35 m wide at its widest point with dense tree cover along both banks. The wider landscape comprises crop land divided by a range of native hedgerow types.

7.2.116 Herefordshire Biological Records Centre provided multiple records of Atlantic salmon and brown / sea trout which included juveniles. European eel were consistently recorded just upstream of the weirs.

7.2.117 The three weir sites are located within the River Lugg at this location. The macrophyte status of this stretch of river is classed as Moderate. All the EA macrophyte monitoring sites in the vicinity of the Lugg weirs are downstream where a range of submerged to emergent species have been recorded. There are three EA macro-invertebrate monitoring sites within the Lugg, all upstream of the weirs, where the current Water Framework Directive ('WFD') classification is of High status.

7.2.118 The fish species that are features of the River Lugg SSSI (Atlantic salmon, bullhead, twaite shad and brook lamprey) are classed as in unfavourable (declining) condition. In terms of Atlantic salmon, EA (Unpubl.) states that the River Wye and Lugg are deemed to be iconic for their salmon population, although the salmon population of the downstream River Wye is in a critical state. This is because the number of returning adult fish to spawn is significantly below those required to meet the minimum biologically safe level for a sustainable fishery. It is also noted that the River Wye has not achieved its salmon Management Objective for several years. In 2021, the reported rod catch was the second lowest rod catch recorded for the Wye (328) (lowest was in 1992 at 320 salmon). As the overall catch of salmon within the Wye rod fishery has declined substantially and the stock has failed to achieve the conservation limit, the stock is projected to be At Risk in five years' time.

7.2.119 Three EA monitoring site datasets have been examined, both up and downstream of the River Lugg weirs. All sites had broadly similar species composition, comprising fish species such as bullhead, stone loach, minnow, sea / brown trout and Atlantic salmon, lamprey species and European eel. The communities are characteristic of the faster flowing waters upstream of Leominster, which the SSSI citation notes as a brown trout fishery and the migratory species were present both up and downstream of the Lugg weirs. The citation also states that few coarse fish are found upstream of Aymestry which marks the limit of the Atlantic salmon migration. It should also be noted that the twaite shad features would only reach as far as Urdimarsh (approximately 10 km south of Leominster) on their migration.

Trostrey Weir, River Usk

7.2.120 The Trostrey Weir is located within the River Usk SAC where it crosses the entire watercourse width of approximately 30 m. An additional man-made feature is present in the watercourse, to which the southern end of the weir is attached. Linear woodland lines both banks in an otherwise agricultural landscape comprising mostly arable fields.

7.2.121 The WFD status for this section of river (GB109056040083 – River Usk – confluence River Gavenny to confluence Olway Brook) is Moderate, failing to reach good status for fish, macrophytes and phytobenthos, phosphates and polyaromatic hydrocarbons.

Manorafon Weir, River Towy

7.2.122 Manorafon Weir is located within the River Towy SAC where it crosses the entire watercourse width of approximately 30 m. The banks are sparsely vegetated with occasional trees, in a predominately arable landscape.

7.2.123 The WFD status for this section of river (GB110060036250 – River Towy – Llandovery Bran to Cothi confluence) is Good.

Future baseline

HPC Site

7.2.124 It is anticipated that the HPC Site will be fully constructed and operational by 2027. In addition, the terrestrial habitat creation and enhancement (associated with the 2013 DCO, and not the measures described within Section 3) will be in situ and if not already functional, successfully establishing.

7.2.125 Further into the future, the United Kingdom Climate Projections ('UKCP18') report a greater chance of hotter, drier summers and warmer, wetter winters with more extreme weather and rising sea levels. In coastal Somerset, future sea level rise and flood water management are likely to drive habitat changes and the dispersal of mobile species. The HPC Site has been designed and constructed with consideration of climate change and the anticipated environmental changes will have been factored in so that there would be no change to the HPC Site itself.

Pawlett Hams and The Island

7.2.126 The ecological baseline of the wider area comprising Pawlett Hams and The Island is unlikely to change significantly up to and including 2027 as the land use at these locations would likely remain the same (i.e. the grazed and agricultural practices) with the recent enhanced freshwater supply at Pawlett Hams likely to continue. The Island is assumed to be already a functioning intertidal habitat.

7.2.127 Legal protection and planning policy reduces the likelihood that these sites (Pawlett Hams / The Island) would undergo significant modification due to changes in land use and management or other activities, although there could be some local changes due to positive habitat management measures. As such, any corresponding significant change in ornithology presence or numbers is not anticipated.

7.2.128 In the longer term, it is anticipated that climate change will bring a possible 1.3 to 5.1 °C increase in mean summer temperatures (Department for Energy Security and Net Zero, 2023), with milder winters, changes in rainfall distribution and seasonality, more extremes of weather and sea level rise. Whilst climate models project changes in temperature with reasonable confidence, the complexities of ecological responses mean that there is a range of possible future outcomes, with Climate Change and the UK's Birds[68] acknowledging there are significant gaps in knowledge for wintering bird populations. However, an increase in breeding waterbirds colonising the UK from continental Europe is already being seen and is likely to continue and increase in future. Climate Change and the UK's Birds also identified that breeding seabirds are one of the two bird groups most vulnerable to climate change. Fourteen seabird species are regarded as being at risk of negative climate change impacts through, *inter alia*, increasing sea temperatures disrupting marine food webs and storms that lead to adult mortality.

68 Pearce-Higgins, J. (2021) Climate Change and the UK's Birds. British Trust for Ornithology.

The Weirs

7.2.129 Water quality of the main rivers will, in the immediate future, continue to reflect existing land and water management practices, and is influenced by run off from the surrounding agricultural run-off and purposeful / accidental discharges.

7.2.130 In the longer term, water quality will remain an important factor determining habitat quality. Climate change is also likely to affect the freshwater habitats on the Rivers Usk, Wye, Towy and Severn. Climate change is predicted to result in increases in freshwater temperatures and increase variability in precipitation resulting in changes to river levels resulting in flooding and droughts. The effects of climate change may progressively worsen the impacts of existing obstacles for fish migration. Reduced river flow during key periods of the year may lead to longer migration delays, and lower passage success at obstacles, in turn worsening declines in abundance and breeding success of diadromous species (Assunção *et al.,* 2014[69]; Moore *et al.,* 2019[70]).

7.2.131 Atlantic salmon, for example, are a cold-water affiliated species and increases in water temperature are already having deleterious effects on river populations. Water temperature influences all salmon life stages. Optimal growth for juvenile salmon occurs between water temperatures of 16 to 20 °C and stops at temperatures of approximately 23 °C, with some rivers already experiencing summer temperatures close to, or exceeding, lethal limits (Thorstad *et al.,* 2020[71]).

7.2.132 Unlike Atlantic salmon, Allis and twaite shad are Lusitanian or warm-water species. Increases in water temperatures related to climate change may benefit shad recruitment in the long term (e.g., Knights, 2014[72]).

69 Assunção, M.G.L., Copp, G.H. and Moore, A. 2014. Changing environment: predicted effects of climate change on UK salmonid populations. Lowestoft: Cefas. Science Series Technical Report.

70 Moore, A., Bašić, T., Copp, G.H. and Olsson, K. 2019. Predicting the effects of climate change on data poor diadromous species. Lowestoft: Cefas. Evidence Project Report.

71 Thorstad, E.B., Bliss, D., Breau, C., Damon-Randall, K., Sundt-Hansen, L.E., Hatfield, E.M., Horsburgh, G., Hansen, H., Maoiléidigh, N.Ó., Sheehan, T. and Sutton, S.G. 2021. Atlantic salmon in a rapidly changing environment—Facing the challenges of reduced marine survival and climate change. Aquatic Conservation: Marine and Freshwater Ecosystems, 31(9), pp.2654-2665.

72 Knights AM. 2014. Modelling the response of the twaite shad (Alosa fallax) population in the Afon Tywi SAC to a modified temperature regime. NRW Evidence Report No: 6, 49 pp, Natural Resources Wales, Bangor.

7.2.133 Detail provided on the effects of climate change on marine species abundance and distribution in the *Fish population* section above is equally relevant here with regard to anticipated effects on aquatic species.

8 HRA STAGE 1: SCREENING

8.1.1 This section of the HRA Report presents the HRA screening assessment for the Project.

8.1.2 As set out in Section 2.2 of this HRA Report, the first stage of the HRA process is to assess whether the Project is likely to have a significant effect on any European site or Ramsar site, either alone or in-combination with any other plan or project. The screening assessment is only required if the plan or project is not directly connected with or necessary to the management of the site concerned.

8.1.3 The Project is not directly connected with, or necessary to, the management of any European site or Ramsar site, and therefore a screening assessment has been undertaken.

8.2 Activities with the potential to influence designated sites

Project

8.2.1 As set out in Section 1.1 of this HRA Report, the 'Project' to be assessed is the construction (already ongoing); operation; and (to the extent assessment is possible), decommissioning of the nuclear build project at HPC "as changed" by the DCO Material Change application to be sought (comprising the six changes to the design of HPC and delivery of associated compensatory habitat measures). This HRA Report of the Project accordingly considers, for the following pathways of impact, the construction, operational and (to the extent that assessment is possible) decommissioning impacts arising from the (i) six HPC design changes "as changed"; and (ii) from (to the extent assessable at this time) the compensatory measures:

- any pathways of impact to European / Ramsar sites already identified in the Secretary of State's 2013 DCO HRA which are relevant to the six HPC design changes; and
- any new pathways of impact to European sites (not already identified in the Secretary of State's 2013 DCO HRA) from the six HPC design changes or (to the extent assessable at this time) from the compensatory habitat measures.

8.2.2 The six design changes have been summarised in Section 1.3 and described in more detail within Section 3 of this HRA Report.

8.2.3 The proposed compensatory habitat measures have been described above at Section 3.7 of this HRA Report.

8.2.4 In this HRA Report mitigation measures are not relied upon in the context of HRA Stage 1 screening. This is in accordance with the decision of the Court of Justice of the European Union ('CJEU') in the case of Case C323/17 (*People over Wind, Peter Sweetman v Coillte Teoranta*)[73] which confirmed that mitigation measures may not be relied upon in the context of HRA Stage 1 screening. Mitigation measures are instead considered within the AA stage of the HRA.

Potential Pathways of Effect

8.2.5 Pathways of effect are the means by which a project may have an effect on a receptor, in this case, the qualifying feature(s) of a European / Ramsar site. Such pathways may be direct or indirect.

8.2.6 The pathways of effect considered relevant within this HRA Report (for the relevant designated sites, as applicable) are as follows:

8.2.7 On qualifying habitats of the Severn Estuary SAC:

- Changes to water quality through release of contaminants / nutrients.
- Habitat loss and physical damage.
- Changes in hydrodynamics and sediment transport.

8.2.8 On fish qualifying species of relevant SACs / the typical fish species assemblage of the Estuaries qualifying feature of the Severn Estuary SAC, the migratory fish assemblage of Criterion 4 of the Severn Estuary Ramsar site:

- Entrapment (impingement / entrainment): Impingement is the physical contact of a fish against a barrier structure, due to intake velocities being too high to enable escape. Entrainment is defined as the passage of fish through a water intake system. Entrainment and impingement are together described as entrapment.
- Mortality / injury through construction activities.
- Disturbance (noise, vibration, light) and temporary displacement through construction activities.

73 People Over Wind & Peter Sweetman v Coillte Teoranta (Case C-323/17), dated 12 April 2018.

- Indirect effects on fish populations through changes to water quality (contaminant / nutrient release).
- Indirect effects on fish populations through changes in hydrodynamics and sediment transport.
- Disruption of migratory routes.
- Note that the fish impact pathway of 'disturbance' is, in this HRA Report, considered to be adequately covered by the other fish impact pathways listed.

8.2.9 On bird qualifying features of relevant SPAs / Ramsar sites:

- Disturbance and temporary displacement during construction activities.
- Temporary habitat loss during construction activities.
- Indirect effects on piscivorous (fish-eating) birds through changes to prey resources.
- Permanent modification of bird habitat and permanent displacement of species.
- Indirect effects on bird species through changes to water quality (contaminant / nutrient release).
- Indirect effects on bird species through changes in hydrodynamics and sediment transport.
- Bioaccumulation.

8.2.10 On marine mammal and otter qualifying features of relevant SACs:

- Indirect effects on marine mammals or otters through changes to prey resources.
- Indirect effects on marine mammals or otters through changes to water quality (contaminant / nutrient release).
- Disturbance and displacement.
- Bioaccumulation.

8.2.11 On terrestrial qualifying features of relevant SACs:

- Habitat loss and fragmentation of foraging habitat.
- Disruption of commuting corridors.
- Disturbance (noise, vibration, light) and temporary displacement through construction activities.

8.2.12 Impact pathways that have been considered in this assessment but no pathway to effect has been established, and so they are not relevant, comprise:

- Changes in air quality during construction and operation.
- Change in ground water quality and quantity.
- Mortality / injury on qualifying feature bird species / assemblages.
- Introduction or spread of non-native invasive species.
- Decommissioning impacts on compensatory measures.
- Construction, operation and decommissioning of the 5 terrestrial design elements listed above.

8.2.13 The 'noteworthy' features detailed in Ramsar citations are not considered within this assessment as they are not criteria for designation.

8.3 ZOIs adopted in this HRA Report

8.3.1 The spatial scope of any HRA should be based on the potential pathways of impact from the project, its ZOI and the interest features of the relevant European / Ramsar sites, including their potential vulnerabilities.

8.3.2 For the purposes of this HRA Report, a series of precautionary ZOI have been applied for the Project, taken from the centre-point of each of the six HPC design changes, and the proposed compensatory measures sites of Pawlett Hams and The Island and each of the weirs under consideration for easement.

8.3.3 Since the locations of the proposed marine compensatory measures of native oyster reefs, kelp forest and seagrass are not at the present time known, it has not been possible to identify a ZOI for these elements of the compensatory package. Once these locations are known then a further screening exercise will be undertaken and any required further designated sites will be included. In the meantime, the approach in this pre-application consultation HRA Report has been to consider, qualitatively, the possible pathways of impact arising from these marine compensatory measures in relation to the designated sites which fall within the ZOI identified through the other Project elements.

8.3.4 For this pre-application consultation HRA Report the following ZOI have been adopted so as to capture European / Ramsar sites which may experience both direct and indirect effects from the Project, along the pathways as outlined above:

- For designated sites with aquatic / coastal / marine / fish eating species (including otter), a ZOI of 120 km has been used. This ZOI accords with the ZOI adopted by the Secretary of State's 2013 DCO HRA (explained at paragraph 3.5 of the Secretary of State's 2013 DCO HRA).
- A ZOI of 2 km for terrestrial habitats[74], 10 km for terrestrial (invertebrate-eating and herbivorous) bird species[75] and 30 km for bats[76] has been used.

8.3.5 These distances have been measured 'as the crow flies', and therefore are additionally precautionary for marine / coastal qualifying features. Where the same designated site fell within the ZOI of more than one 'element' of the Project, the shortest distance has been taken as the distance for screening. Using the shortest distance in order to determine the ZOI ensures that the most precautionary approach has been taken. ZOIs have been presented on Figures 8.1 and 8.2 (Appendix 13.3).

8.3.6 The EA's AA dated 13 November 2020 for the WDA Permit inquiry (which related to two key impact pathways – entrapment of fish arising from removal of the AFD requirement and pollution arising from FRR discharges) is supported by a screening report. It is not entirely clear from the contents of the screening report how the designated sites were identified for consideration in the first instance in that screening process and whether ZOI distances were used for this purpose or not. The EA's AA 2020 itself refers to an approach to screening-in sites for AA which relied on a number of different considerations (but not distance criteria): (i) sites in direct connectivity within the Severn Estuary and Bristol Channel and their tributaries; (ii) sites for twaite and allis shad identified through fish tracking for Unlocking the Severn project; (iii) use of specific marine mammal units for three different marine mammals; and (iv) sites with piscivorous birds within a foraging range of HPC as identified in Thaxter (2012).[77]

---

74 2 km is a generally accepted ZOI for static qualifying features in HRA.

75 10 km is a precautionary ZOI for terrestrial bird species beyond which functionally linked land for these species is unlikely to be located.

76 30 km is the ZOI for bats published by the Design Manual for Roads and Bridges LA115 HRA.

77 Thaxter, C.B., Lascelles, B., Sugar, K., Cook, A.S.C.P., Roos, S., Bolton, M., Langston, R.H.W. and Burton, N.H.K Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas (2012). Biological Conservation 156: 53-61.

8.3.7 In order to make the assessment workable in this pre-application consultation HRA Report, particularly in view of the additional pathways that need to be considered in this case (beyond the two pathways that were considered by the EA in 2020), it was decided to adopt in this HRA Report's screening assessment the 'distance ZOI' approach of the Secretary of State's 2013 DCO HRA.

8.3.8 However, where this approach means that there is any designated site considered by the EA 2020 in its AA which does not fall within the ZOI adopted for this HRA Report then those additional designated sites are nevertheless also included in this HRA Report's screening assessment and, where screened-in, are subsequently considered in this HRA Report's shadow AA.

8.4 Relevant European / Ramsar sites

8.4.1 Error! Reference source not found. lists the European / Ramsar sites and associated qualifying features which are within the Project ZOI or are otherwise included within the EA's 2020 AA as set out above. The ZOI applied are presented within Figures 8-1 and 8-2 (Appendix 13.3). Figures 8-3, 8-4 and 8-5 (Appendix 13.3) show the location of the sites included within the ZOI in relation to the Project and the additional sites included due to the EA's 2020 AA. Figure 8-3 shows the location of SACs, Figure 8-4 the location of SPAs and Figure 8-5 the location of Ramsar sites.

8.4.2 Distances in Table 8-1 are given with regard to the closest aspect of the Project, i.e. the marine or terrestrial design elements, or proposed compensatory measures referred to above, having been calculated using GIS software and the latest mapping of designated sites to ensure all relevant sites are suitably captured.

Table 8-1: Designated sites included in the current shadow HRA process

Designated site	Distance from the Project[78]	Interest features
Severn Estuary SAC (UK0013030)	Within and adjacent	Qualifying features: H1110 Sandbanks which are slightly covered by seawater all the time; Subtidal sandbanks H1130 Estuaries H1140 Mudflats and sandflats not covered by seawater at low tide H1170 Reefs H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) S1095 Sea lamprey (*Petromyzon marinus*) S1099 River lamprey (*Lampetra fluvatilis*) S1103 Twaite shad (*Alosa fallax*)
Severn Estuary SPA (UK9015022)	Within and adjacent	Qualifying features: A037 Bewick's swan (*Cygnus columbianus bewickii*) A394 Greater white-fronted goose (*Anser albifrons albifrons*) A149 Dunlin (*Calidris alpina alpina*) A162 Common redshank (*Tringa totanus*) A048 Common shelduck (*Tadorna tadorna*)

78 Sites have been identified based on the ZOI distances described above. Where a designated site fell within this ZOI for more than one component of the Project (e.g. marine design element / compensation measure), the closest distance has been listed here.

Designated site	Distance from the Project[78]	Interest features
		A051 Gadwall (*Anas strepara*) Waterbird assemblage
Severn Estuary Ramsar site	Within and adjacent	See Severn Estuary Ramsar site for full list of species of importance.[79] The Severn Estuary is designated as a Ramsar site due to the following criteria: Criterion 1: immense tidal range (second-largest in the world) Criterion 3: unusual estuarine communities (i.e. reduced diversity and high productivity) Criterion 4: migratory fish assemblage (Salmon (*Salmo salar*), sea trout (*S. trutta*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluvatilis*), allis shad (*A.* alosa), twaite shad (*A. falla*) and eel (*Anguilla Anguilla*)) Criterion 5: wintering waterfowl assemblages of international importance with peak counts in winter of 70,919 waterfowl Criterion 6: regularly supports more than 1 % of the individuals in a population of Bewick's swan (*Cygnus columbianus*), greater white-fronted goose (*Anser albifrons albifrons*), dunlin (*Calidris alpina alpina*), redshank (*Tringa totanus tetanus*), shelduck (*Tadorna tadorna*) and gadwall (*Anas strepera strepera*), as well as ringed plover (*Charadrius hiaticula*), teal (*Anas crecca*), pintail (*Anas acuta*) and lesser black-backed gull (*Larus fuscus*) Criterion 8: wetland habitat is an important source of food and nursery ground for many fish species, especially allis shad (*Alosa alosa*) and twaite shad (*A. Fallax*)
River Towy / Afon Tywi SAC		Qualifying Features: 1103 Twaite shad (*Alosa fallax*)

79 JNCC (undated) Information Sheet on Ramsar Wetlands, Seven Estuary Site. Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11081.pdf. (Accessed 19 October 2023.)

Designated site	Distance from the Project[78]	Interest features
		1355 Otter (*Lutra lutra*) 1095 Sea lamprey (*Petromyzon marinus*) 1096 Brook lamprey (*Lampetra planeri*) 1099 River lamprey (*Lampetra fluviatilis*) 1102 Allis shad (*Alosa alosa*) 1163 Bullhead (*Cottus gobio*)
Afon Teifi / River Teifi SAC	Within and adjacent	Qualifying Features: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and / or of the *Isoëto-Nanojuncetea* 1096 Brook lamprey (*Lampetra planeri*) 1099 River lamprey (*Lampetra fluviatilis*) 1106 Atlantic salmon (*Salmo salar*) 1163 Bullhead (*Cottus gobio*) 1355 Otter (*Lutra lutra*) 1831 Floating water-plantain (*Luronium natans*) 1095 Sea lamprey (*Petromyzon marinus*)
River Usk / Afon Wysg SAC	Within and adjacent	Qualifying features: 1095 Sea lamprey (*Petromyzon marinus*) 1099 River lamprey (*Lampetra fluvatilis*) 1096 Brook lamprey (*Lampetra planeri*

Designated site	Distance from the Project[78]	Interest features
		1103 Twaite shad (*Alosa fallax*) 1106 Atlantic salmon (*Salmo salar*) 1163 Bullhead (*Cottus gobio*) 1355 Otter (*Lutra lutra*) 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 1102 Allis shad (*Alosa alosa*)
Exmoor and Quantocks Oakwoods SAC	5 km	Qualifying features: 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles 1308 Barbastelle (*Barbastella barbastellus*) 91E0 Alluvial forests with (*Alnus glutinosa*) and (*Fraxinus excelsior*) (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) 1323 Bechstein's bat (*Myotis bechsteinii*) 1355 Otter (*Lutra lutra*)
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	5 km	Qualifying features: 1303 Lesser horseshoe bat (*Rhinolophus hipposideros*) 1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)

Designated site	Distance from the Project[78]	Interest features
Walmore Common Ramsar	6 km	See Walmore Common Ramsar site for full list of species of importance.[80] The Walmore Common is designated as a Ramsar site due to the following criteria: Criterion 6: species / populations occurring at levels of international importance, including: Bewick's swan (*Cygnus columbianus bewickii*)
Walmore Common SPA	6 km	Qualifying Features: A037 Bewick's swan (*Cygnus columbianus bewickii*) (non-breeding)
North Somerset and Mendip Bats SAC	7 km	Qualifying Features: H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*); dry grasslands and scrublands on chalk or limestone H8310 Caves not open to the public H9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*) S1304 Greater horseshoe bat (Rhinolophus ferrumequinum)
River Wye / Afon Gwy SAC	8 km	Qualifying features: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot 7140 Transition mires and quaking bogs; Very wet mires often identified by an unstable \`quaking\` surface 1092 White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*)

80 JNCC (undated) Information Sheet on Ramsar Wetlands, Walmore Common. Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11076.pdf. (Accessed 19 October 2023.)

Designated site	Distance from the Project[78]	Interest features
		1095 Sea lamprey (*Petromyzon marinus*) 1096 Brook lamprey (*Lampetra planeri*) 1099 River lamprey (*Lampetra fluviatilis*) 1102 Allis shad (*Alosa alosa*) 1103 Twaite shad (*Alosa fallax*) 1106 Atlantic salmon (*Salmo salar*) 1163 Bullhead (*Cottus gobio*) 1355 Otter (*Lutra lutra*)
Mendip Limestone Grasslands SAC	10 km	Qualifying features: 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) 4030 European dry heaths 8310 Caves not open to the pubic 9180 *Tilio-Acerion* forests of slopes, screes and ravines 1304 Greater horseshoe bat (*Rhinolphus ferrumequinum*)
Somerset Levels and Moors Ramsar	10 km	See Somerset Levels and Moors Ramsar site for full list of species of importance.[81] The Somerset Levels & Moors is designated as a Ramsar site due to the following criteria: Criterion 2: supports 17 species of British Red Data Book invertebrates Criterion 5: waterfowl assemblages of international importance, with peak counts in winter of 97,155 waterfowl

81 JNCC (undated) Information Sheet on Ramsar Wetlands, Somerset Levels & Moors. Available online at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9010031.pdf. (Accessed 19 October 2023.)

Designated site	Distance from the Project[78]	Interest features
		Criterion 6: species / populations occurring at levels of international importance, including: Tundra swan (*Cygnus columbianus bewicki*), Eurasian teal (*Anas crecca*), Northern lapwing (*Vanellus vanellus*), Mute swan (*Cygnus olor*), Eurasian wigeon (*Anas penelope*), Northern pintail (*Anas acuta*), Northern shoveler (*Anas clypeata*)
Somerset Levels and Moors SPA	10 km	Qualifying Features: A052 Eurasian teal (*Anas crecca*) (non-breeding) A037 Bewick's swan (*Cygnus columbianus bewickii*) (non-breeding) A140 Golden plover (*Pluvialis apricaria*) (non-breeding) A142 Lapwing (*Vanellus vanellus*) (non-breeding) Waterbird assemblage (over wintering)
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	12 km	Qualifying Features: 4030 European dry heaths 7120 Degraded raised bogs still capable of natural regeneration 7130 Blanket bogs 8210 Calcareous rocky slopes with chasmophytic vegetation 8310 Caves not open to the public 9180 *Tilio-Acerion* forests of slopes, screes and ravines 1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)
Hestercombe House SAC	14 km	Qualifying features: S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)
Wye Valley Woodlands SAC	15 km	Qualifying features: 9130 *Asperulo-Fagetum* beech forests; beech forests on neutral to rich soils

Designated site	Distance from the Project[78]	Interest features
		9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes 91J0 *Taxus baccata* woods of the British Isles; yew-dominated woodland 1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	22 km	Qualifying features: 1110 Sandbanks which are slightly covered by sea water all the time 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1160 Large shallow inlets and bays 1310 Salicornia and other annuals colonizing mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1103 Twaite shad (*Alosa fallax*) 1095 Sea lamprey (*Petromyzon marinus*) 1099 River lamprey (*Lampetra fluviatilis*) 1102 Allis shad (*Alosa alosa*) 1355 Otter (*Lutra lutra*)
Burry Inlet Ramsar	27 km	See Burry Inlet Ramsar site for full list of species of importance[82]. The Burry Inlet is designated as a Ramsar site due to the following criteria: Criterion 5: waterfowl assemblages of international importance

82 Bury Inlet Ramsar Site. Available at https://rsis.ramsar.org/RISapp/files/RISrep/GB562RIS.pdf (Accessed: 11 December 2023).

Designated site	Distance from the Project[78]	Interest features
		Criterion 6: species / populations occurring at levels of international importance, including Common redshank (*Tringa totanus tetanus*), Northern pintail (*Anas acuta*), Eurasian oystercatcher (*Haematopus ostralegus ostralegus*), Red knot (*Calidris canutus islandica*), and Northern shoveler (*Anas clypeata*)
Exmoor Heaths SAC		Qualifying Features: H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H4010 Northern Atlantic wet heaths with *Erica tetralix*; wet heathland with cross-leaved heath H4030 European dry heaths H7130 Blanket bogs H7230 Alkaline fens; calcium-rich springwater-fed fens H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles; western acidic oak woodland
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	32 km	Qualifying Features: 2110 Embryonic shifting dunes 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") 2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes") 2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*) 2190 Humid dune slacks 1014 Narrow-mouthed whorl snail (*Vertigo angustior*) 1395 Petalwort (*Petalophyllum ralfsii*) 1903 Fen orchid (*Liparis loeselii*)
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	32 km	Qualifying Features:

Designated site	Distance from the Project[78]	Interest features
		1351 Harbour porpoise (*Phocoena phocoena*)
Carmarthen Bay / Bae Caerfyrddin SPA	34 km	Qualifying features: A065 Common scoter (*Melanitta nigra*)
Limestone Coast of South West Wales SAC	37 km	Qualifying Features: 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts 2130 Fixed coastal dunes with herbaceous vegetation grey dunes 4030 European dry heaths 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) 8310 Caves not open to the public 8330 Submerged or partially submerged sea caves 1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*) 1654 Early gentian (*Gentianella anglica*) 1395 Petalwort (*Petalophyllum ralfsii*)
River Axe SAC	40 km	Qualifying Features: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; Rivers with floating vegetation often dominated by water-crowfoot S1095. Sea lamprey (*Petromyzon marinus*) S1096. Brook lamprey (*Lampetra planeri*) S1163 Bullhead (*Cottus gobio*)
Kenfig / Cynffig SAC	42 km	Qualifying features: 2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes")

Designated site	Distance from the Project[78]	Interest features
		2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*) 2190 Humid dune slacks 3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1395 Petalwort (*Petalophyllum ralfsii*) 1903 Fen orchid (*Liparis loeselii*)
Cardigan Bay / Bae Ceredigion SAC	43 km	Qualifying Features: 1110 Sandbanks which are slightly covered by sea water all the time 1170 Reefs 8330 Submerged or partially submerged sea caves 1349 Bottlenose dolphin (*Tursiops truncates*) 1095 Sea lamprey (*Petromyzon marinus*) 1099 River lamprey (*Lampetra fluviatilis*) 1364 Grey seal (*Halichoerus grypus*)
West Wales Marine / Gorllewin Cymru Forol SAC	43 km	Qualifying features: 1351 Harbour porpoise (*Phocoena phocoena*)
Sidmouth to West Bay SAC	49 km	Qualifying features: H1210 Annual vegetation of drift lines H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes

Designated site	Distance from the Project[78]	Interest features
Lyme Bay and Torbay SAC	50 km	Qualifying features: H1170 Reefs H8330 Submerged or partially submerged sea caves
Afonydd Cleddau / Cleddau Rivers SAC	50 km	Qualifying features: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 7110 Active raised bogs 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) 1096 Brook lamprey (*Lampetra planeri*) 1099 River lamprey (*Lampetra fluviatilis*) 1163 Bullhead (*Cottus gobio*) 1355 Otter (*Lutra lutra*) 1095 Sea lamprey (*Petromyzon marinus*)
River Avon SAC	55 km	Qualifying Features: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot S1016 Desmoulin`s whorl snail (*Vertigo moulinsiana*) S1095 Sea lamprey (*Petromyzon marinus*) S1096 Brook lamprey (*Lampetra planeri*) S1106 Atlantic salmon (*Salmo salar*) S1163 Bullhead (*Cottus gobio*)

Designated site	Distance from the Project[78]	Interest features
Chesil and The Fleet SAC	55 km	Qualifying Features: H1150 Coastal lagoons H1210 Annual vegetation of drift lines H1220 Perennial vegetation of stony banks; Coastal shingle vegetation outside the reach of waves H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)
Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	55 km	Qualifying features: A001 Red-throated diver (*Gavia stellata*)
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	59 km	Qualifying Features: 1110 Sandbanks which are slightly covered by sea water all the time 1130 Estuaries 1150 Coastal lagoons 1160 Large shallow inlets and bays 1170 Reefs 1140 Mudflats and sandflats not covered by seawater at low tide 1310 Salicornia and other annuals colonizing mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 8330 Submerged or partially submerged sea caves 1349 Bottlenose dolphin (*Tursiops truncates*) 1355 Otter (*Lutra lutra*) 1364 Grey seal (*Halichoerus grypus*)

Designated site	Distance from the Project[78]	Interest features
Pembrokeshire Marine / Sir Benfro Forol SAC	60 km	Qualifying Features: 1130 Estuaries 1160 Large shallow inlets and bays 1170 Reefs 1110 Sandbanks which are slightly covered by sea water all the time 1140 Mudflats and sandflats not covered by seawater at low tide 1150 Coastal lagoons 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 8330 Submerged or partially submerged sea caves 1364 Grey seal (*Halichoerus grypus*) 1441 Shore dock (*Rumex rupestris*) 1095 Sea lamprey (*Petromyzon marinus*) 1099 River lamprey (*Lampetra fluviatilis*) 1102 Allis shad (*Alosa alosa*) 1103 Twaite shad (*Alosa fallax*) 1355 Otter (*Lutra lutra*)
Exe Estuary Ramsar	61 km	See Exe Estuary Ramsar site for full list of species of importance.[83] The Exe Estuary is designated as a Ramsar site due to the following criteria: Criterion 5: waterfowl assemblages of international importance with peak counts in winter of 20,263 waterfowl

83 Exe Estuary Ramsar Site. Available at https://jncc.gov.uk/jncc-assets/RIS/UK11025.pdf (Accessed: 11 December 2023).

Designated site	Distance from the Project[78]	Interest features
		Criterion 6: species / populations occurring at levels of international importance, including: Dark-bellied brent goose (*Branta bernicla bernicla*) and Black-tailed godwit (*Limosa limosa islandica*)
Exe Estuary SPA	61 km	Qualifying Features: A007 Slavonian grebe (*Podiceps auratus*) (non-breeding) A046a Dark-bellied brent goose (*Branta bernicla bernicla*) (non-breeding) A130 Eurasian oystercatcher (*Haematopus ostralegus*) (non-breeding) A132 Pied avocet (*Recurvirostra avosetta*) (non-breeding) A141 Grey plover (*Pluvialis squatarola*) (non-breeding) A149 Dunlin (*Calidris alpina alpina*) (non-breeding) A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding) Waterbird assemblage
Chesil Beach and the Fleet Ramsar	64 km	See The Chesil Beach and the Fleet Site for full list of species of importance.[84] The Chesil Beach and the Fleet is designated as a Ramsar site due to the following criteria: Criterion 2: scarce wetland plants as well as ten nationally scarce wetland animals. Chesil Bank is one of the most important UK sites for shingle habitats and species Criterion 3: The site is the largest barrier-built saline lagoon in the UK, and has the greatest diversity of habitats and of biota Criterion 4: The site is important for a number of species at a critical stage in their life cycle including post-larval and juvenile bass (*Dicentrarchus labrax*)

84 JNCC (undated) Information Sheet on Ramsar Wetlands, Chesil Beach & the Fleet Ramsar. Available online at https://jncc.gov.uk/jncc-assets/RIS/UK11012.pdf Accessed on 19 October 2023.

Designated site	Distance from the Project[78]	Interest features
		Criterion 6: species / populations occurring at levels of international importance, including: Dark-bellied brent goose (*Branta bernicla bernicla*) and Mute swan (*Cygnus olor*) Criterion 8: The site is important as a nursery for bass (*Dicentrarchus labra*)
Chesil Beach and the Fleet SPA	64 km	Qualifying Features: A050 Eurasian wigeon (*Anas Penelope*) (non-breeding) A195 Little tern (*Sterna albifrons*) (breeding)
River Lambourn SAC	65 km	Qualifying features: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho *Batrachion vegetation*; rivers with floating vegetation often dominated by water-crowfoot S1096 Brook lamprey (*Lampetra planeri*) S1163 Bullhead (*Cottus gobio*)
Dawlish Warren SAC	68 km	Qualifying Features: H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); shifting dunes with marram H2130 Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland H2190 Humid dune slacks S1395 Petalwort (*Petalophyllum ralfsii*)
Skomer, Skokholm and the Seas off Pembrokeshire SPA	70 km	Qualifying Features: European storm petrel (*Hydrobates pelagicus*) A346 Red-billed chough (*Pyrrhocorax pyrrhocorax*) A222 Short-eared owl (*Asio flammeus*) A013 Manx shearwater (*Puffinus puffinus*)

Designated site	Distance from the Project[78]	Interest features
		A204 Atlantic puffin (*Fratercula arctica*) A183 Lesser black-backed gull (*Larus fuscus*) Seabird assemblage
Isle of Portland to Studland Cliffs SAC	74 km	Qualifying Features: H1210 Annual vegetation of drift lines H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*); dry grasslands; and scrublands on chalk or limestone S1654 Early gentian (*Gentianella anglica*)
South Hams SAC	75 km	Qualifying Features: H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H4030 European dry heaths H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*) H8310 Caves not open to the public H9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)
St David's / Ty Ddewi SAC	76 km	Qualifying Features: 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts 4030 European dry heaths 1831 Floating water-plantain (*Luronium natans*)

Designated site	Distance from the Project[78]	Interest features
Studland to Portland SAC	78 km	Qualifying Features: H1170 Reefs
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	78 km	Qualifying Features: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot S1095 Sea lamprey (*Petromyzon marinus*) S1096 Brook lamprey (*Lampetra planeri*) S1099 River lamprey (*Lampetra fluviatilis*) S1106 Atlantic salmon (*Salmo salar*) S1163 Bullhead (*Cottus gobio*) S1355 Otter (*Lutra lutra*) S1831 Floating water-plantain (*Luronium natans*)
Dartmoor SAC	80 km	Qualifying Features: H4010 Northern Atlantic wet heaths with *Erica tetralix*; wet heathland with cross-leaved heath H4030 European dry heaths H7130 Blanket bogs H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles; western acidic oak woodland S1044 Southern damselfly (*Coenagrion mercuriale*) S1106 Atlantic salmon (*Salmo salar*) S1355 Otter (*Lutra lutra*)
Braunton Burrows SAC	80 km	Qualifying Features:

Designated site	Distance from the Project[78]	Interest features
		H1140 Mudflats and sandflats not covered by seawater at low tide; intertidal mudflats and sandflats H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); shifting dunes with marram H2130 Fixed dunes with herbaceous vegetation ("grey dunes"); dune grassland H2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*); dunes with creeping willow H2190 Humid dune slacks S1395 Petalwort (*Petalophyllum ralfsii*)
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	81 km	Qualifying Features: H2110 Embryonic shifting dunes H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); shifting dunes with marram H2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*); coastal dune heathland H2190 Humid dune slacks H3110 Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*); nutrient-poor shallow waters with aquatic vegetation on sandy plains H4010 Northern Atlantic wet heaths with *Erica tetralix*; wet heathland with cross-leaved heath H4020 Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*; wet heathland with Dorset heath and cross-leaved heath H4030 European dry heaths H6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*); purple moor-grass meadows H7150 Depressions on peat substrates of the *Rhynchosporion*

Designated site	Distance from the Project[78]	Interest features
		H7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; calcium-rich fen dominated by great fen sedge (saw sedge) H7230 Alkaline fens; calcium-rich springwater-fed fens H9190 Old acidophilous oak woods with *Quercus robur* on sandy plains; dry oak-dominated woodland H91D0 Bog woodland S1044 Southern damselfly (*Coenagrion mercurial*) S1166 Great crested newt (*Triturus cristatus*)
Poole Harbour Ramsar	84 km	See Poole Harbour Ramsar site for full list of species of importance.[85] The Poole Harbour is designated as a Ramsar site due to the following criteria: Criterion 1: The site is the best and largest example of a bar-built estuary with lagoonal characteristics (a natural harbour) in Britain Criterion 2: The site supports two species of nationally rare plant and one nationally rare alga. There are at least three British Red data book invertebrate species Criterion 3: The site includes examples of natural habitat types of community interest - Mediterranean and thermo Atlantic halophilous scrubs, in this case dominated by *Suaeda vera*, as well as calcareous fens with *Cladium mariscus*. Transitions from saltmarsh through to peatland mires are of exceptional conservation importance as few such examples remain in Britain. The site supports nationally important populations of breeding waterfowl including Common tern (*Sterna hirundo*) and Mediterranean gull (*Larus melanocephalus*). Over winter the site also supports a nationally important population of Avocet (*Recurvirostra avosetta*) Criterion 5: waterfowl assemblages of international importance with peak counts in winter of 24,709 waterfowl

85 JNCC (undated) Information Sheet on Ramsar Wetlands, Poole Harbour. Available online at https://jncc.gov.uk/jncc-assets/RIS/UK11054.pdf.(Accessed 19 October 2023.)

Designated site	Distance from the Project[78]	Interest features
		Criterion 6: species / populations occurring at levels of international importance including: Common shelduck (*Tadorna tadorna*), Black-tailed godwit (*Limosa limosa islandica*) and Pied avocet (*Recurvirostra avosetta*)
Poole Harbour SPA	84 km	Qualifying Features: A026 Little egret (*Egretta garzetta*) (non-breeding) A034 Eurasian spoonbill (*Platalea leucorodia*) (non-breeding) A048 Common shelduck (*Tadorna tadorna*) (non-breeding) A132 Pied avocet (*Recurvirostra avosetta*) (non-breeding) A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding) A176 Mediterranean gull (*Larus melanocephalus*) (breeding) A191 Sandwich tern (*Sterna sandvicensis*) (breeding) A193 Common tern (*Sterna hirundo*) (breeding) Waterbird assemblage
Solent and Dorset Coast SPA	85 km	Qualifying Features: A191 Sandwich tern (*Sterna sandvicensis*) (breeding) A193 Common tern (*Sterna hirundo*) (breeding) A195 Little tern (*Sternula albifrons*) (breeding)
River Mease SAC	85 km	Qualifying Features: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot S1092 White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*) S1149 Spined loach (*Cobitis taenia*) S1163 Bullhead (*Cottus gobio*)

Designated site	Distance from the Project[78]	Interest features
		S1355 Otter (*Lutra lutra*)
Lundy SAC	89 km	Qualifying Features: H1110 Sandbanks which are slightly covered by sea water all the time; subtidal sandbanks H1170 Reefs H8330 Submerged or partially submerged sea caves S1364 Grey seal (*Halichoerus grypus*)
Tintagel-Marsland-Clovelly Coast SAC	90 km	Qualifying Features: H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H4030 European dry heaths H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles; western acidic oak woodland
Pasturefields Salt Marsh SAC	92 km	Qualifying Features: H1340 Inland salt meadows; inland saltmarshes
Upper Nene Valley Gravel Pits SPA	93 km	Qualifying Features: A021 Great bittern (*Botaurus stellaris*) (non-breeding) A051 Gadwall (*Anas strepera*) (non-breeding) A140 European golden plover (*Pluvialis apricaria*) (non-breeding) Waterbird assemblage
St Albans Head to Durlston Head SAC	95 km	Qualifying Features: H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*) (important orchid sites); dry grasslands and scrublands on chalk or limestone (important orchid sites)

Designated site	Distance from the Project[78]	Interest features
		S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*) S1654 Early gentian (*Gentianella anglica*)
Afon Eden - Cors Goch Trawsfynydd SAC	95 km	Qualifying Features: 7110 Active raised bogs 1029 Freshwater pearl mussel 1831 Floating water-plantain 1106 Atlantic salmon (*Salmo salar*) 1355 Otter (*Lutra lutra*)
Morfa Harlech a Morfa Dyffryn SAC	97 km	Qualifying Features: 2110 Embryonic shifting dunes 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") 2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*) 2190 Humid dune slacks 1395 Petalwort (*Petalophyllum ralfsii*)
Aberdaron Coast and Bardsey Island / Glannau Aberdaron ac Ynys Enlli SPA	99 km	Qualifying Features: A013 Manx shearwater (*Puffinus puffinus*) A346 Red-billed chough (*Pyrrhocorax pyrrhocorax*)

Designated site	Distance from the Project[78]	Interest features
Upper Nene Valley Gravel Pits Ramsar	103 km	See Upper Nene Valley Gravel Pits Ramsar site for full list of species of importance.[86] The Upper Nene Valley Gravel Pits is designated as a Ramsar site due to the following criteria: Criterion 5: regularly supports 20,000 or more waterbirds: in the non-breeding season, the site regularly supports 23,821 individual waterbirds Criterion 6: species / populations occurring at levels of international importance including: Mute swan (*Cygnus olor*) and Gadwall (*Anas strepera*)
Grassholm SPA	104 km	Qualifying Features: A016 Northern gannet (*Morus bassanus*)
Seacliffs of Lleyn / Clogwyni Pen Llyn SAC	105 km	Qualifying Features: 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts
River Itchen SAC	108 km	Qualifying Features: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot S1044 Southern damselfly (*Coenagrion mercurial*) S1092 White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*) S1096 Brook lamprey (*Lampetra planer*) S1106 Atlantic salmon (*Salmo salar*) S1163 Bullhead (*Cottus gobio*) S1355 Otter (*Lutra lutra*)

86 Upper Nene Valley Gravel Pits Ramsar Site, available at: https://jncc.gov.uk/jncc-assets/RIS/UK11083.pdf (Accessed: 11 December 2023).

Designated site	Distance from the Project[78]	Interest features
The Dee Estuary SPA	109 km	Qualifying Features: A048 Common shelduck (*Tadorna tadorna*) (non-breeding) A052 Eurasian teal (*Anas crecca*) (non-breeding) A054 Northern pintail (*Anas acuta*) (non-breeding) A130 Eurasian oystercatcher (*Haematopus ostralegus*) (non-breeding) A141 Grey plover (*Pluvialis squatarola*) (non-breeding) A143 Red knot (*Calidris canutus*) (non-breeding) A149 Dunlin (*Calidris alpina alpina*) (non-breeding) A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding) A157 Bar-tailed godwit (*Limosa lapponica*) (non-breeding) A160 Eurasian curlew (*Numenius arquata*) (non-breeding) A162 Common redshank (*Tringa tetanus*) (non-breeding) A191 Sandwich tern (*Sterna sandvicensis*) (non-breeding) A193 Common tern (*Sterna hirundo*) (breeding) A195 Little tern (*Sterna albifrons*) (breeding) Waterbird assemblage
Dee Estuary / Aber Dyfrdwy SAC	109 km	Qualifying Features: H1130 Estuaries H1140 Mudflats and sandflats not covered by seawater at low tide; intertidal mudflats and sandflats H1210 Annual vegetation of drift lines H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; vegetated sea cliffs

Designated site	Distance from the Project[78]	Interest features
		H1310 Salicornia and other annuals colonising mud and sand; glasswort and other annuals colonising mud and sand H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); atlantic salt meadows H2110 Embryonic shifting dunes; shifting dunes H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); shifting dunes with marram H2130 Fixed dunes with herbaceous vegetation ("grey dunes"); dune grassland H2190 Humid dune slacks S1095 Sea lamprey (*Petromyzon marinus*) S1099 River lamprey (*Lampetra fluviatilis*) S1395 Petalwort (*Petalophyllum ralfsii*)
The Dee Estuary Ramsar	109 km	See The Dee Estuary Site for full list of species of importance.[87] The Dee Estuary is designated as a Ramsar site due to the following criteria: Criterion 1: Extensive intertidal mud and sand flats (20 km by 9 km) with large expanses of saltmarsh towards the head of the estuary. Habitats Directive Annex I features present on the possible SAC (pSAC) include: H1130 Estuaries H1140 Mudflats and sandflats not covered by seawater at low tide H1210 Annual vegetation of drift lines H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H1310 Salicornia and other annuals colonising mud and sand

87 JNCC (undated) Information Sheet on Ramsar Wetlands, The Dee Estuary. Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11082.pdf. (Accessed 19 October 2023.)

Designated site	Distance from the Project[78]	Interest features
		H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H2110 Embryonic shifting dunes H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Criterion 2: it supports breeding colonies of the vulnerable Natterjack Toad (*Epidalea calamita*) Criterion 5: bird assemblages of international importance with peak counts in winter of 120,726 waterbirds Criterion 6: species / populations occurring at levels of international importance, including: Redshank (*Tringa tetanus*); Teal (*Anas crecca*); Shelduck (*Tadorna tadorna*); Oystercatcher (*Haematopus ostralegus*); Curlew (*Numenius arquata*); Pintail (*Anas acuta*); Grey plover (*Pluvialis squatarola*); Knot (*Calidris canutus islandic*); Dunlin (*Calidris alpina alpina*); Black-tailed godwit (*Limosa limosa islandica*); Bar-tailed godwit (Limosa lapponica); and Redshank (*Tringa tetanus*)
Plymouth Sound and Estuaries SAC	109 km	Qualifying Features: 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 H1160 Large shallow inlets and bays H1170 Reefs H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) S1102 Allis shad (*Alosa alosa*) S1441 Shore dock (*Rumex rupestris*)
Solent and Southampton Water SPA	111 km	Qualifying Features: A046a Dark-bellied brent goose (*Branta bernicla bernicla*) (non-breeding)

Designated site	Distance from the Project[78]	Interest features
		A052 Eurasian teal (*Anas crecca*) (non-breeding) A137 Ringed plover (*Charadrius hiaticula*) (non-breeding) A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding) A176 Mediterranean gull (*Larus melanocephalus*) (breeding) A191 Sandwich tern (*Sterna sandvicensis*) (breeding) A192 Roseate tern (*Sterna dougallii*) (breeding) A193 Common tern (*Sterna hirundo*) (breeding) A195 Little tern (*Sterna albifrons*) (breeding) Waterbird assemblage
Solent Maritime SAC	112 km	Qualifying Features: H1110 Sandbanks which are slightly covered by sea water all the time H1130 Estuaries H1140 Mudflats and sandflats not covered by seawater at low tide; intertidal mudflats and sandflats H1150 Coastal lagoons H1210 Annual vegetation of drift lines H1220 Perennial vegetation of stony banks; coastal shingle vegetation outside the reach of waves H1310 Salicornia and other annuals colonising mud and sand; glasswort and other annuals colonising mud and sand H1320 Spartina swards (*Spartinion maritimae*); cord-grass swards H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); shifting dunes with marram

Designated site	Distance from the Project[78]	Interest features
		S1016 Desmoulin`s whorl snail (*Vertigo moulinsiana*)
Start Point to Plymouth Sound and Eddystone SAC	113 km	Qualifying Features: H1170 Reefs
Solent and Southampton Water Ramsar	113 km	See the Solent and Southampton Water Ramsar site for full list of species of importance.[88] The Solent and Southampton Water is designated as a Ramsar site due to the following criteria: Criterion 1: The site is one of the few major sheltered channels between a substantial island and mainland in European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs Criterion 2: The site supports an important assemblage of rare plants and invertebrates. At least 33 British Red Data Book invertebrates and at least eight British Red Data Book plants are represented on site Criterion 5: waterfowl assemblages of international importance with peak counts in winter of 51,343 waterfowl Criterion 6: species / populations occurring at levels of international importance, including: Ringed plover (*Charadrius hiaticula*), Dark-bellied brent goose (*Branta bernicla bernicla*), Eurasian teal (*Anas crecca*) and Black-tailed godwit (*Limosa limosa islandica*)
South Devon Shore Dock SAC	113 km	Qualifying Features: H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts S1441 Shore dock (*Rumex rupestris*)
South Wight Maritime SAC	115 km	Qualifying Features:

88 JNCC (undated) Information Sheet on Ramsar Wetlands, Solent and Southampton Water. Available online at: https://jncc.gov.uk/jncc-assets/RIS/UK11082.pdf (Accessed 20 October 2023.)

Designated site	Distance from the Project[78]	Interest features
		H1170 Reefs H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H8330 Submerged or partially submerged sea caves
Solent and Isle of Wight Lagoons SAC	115 km	Qualifying Features: H1150 Coastal lagoons
Mersey Estuary SPA	116 km	Qualifying Features: A048 Common shelduck (*Tadorna tadorna*) (non-breeding) A052 Eurasian teal (*Anas crecca*) (non-breeding) A054 Northern pintail (*Anas acuta*) (non-breeding) A140 European golden plover (*Pluvialis apricaria*) (non-breeding) A149 Dunlin (*Calidris alpina alpina*) (non-breeding) A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding) A162 Common redshank (*Tringa tetanus*) (non-breeding) Waterbird assemblage
Mersey Estuary Ramsar	116 km	See Mersey Estuary Ramsar site for full list of species of importance.[89] The Mersey Estuary is designated as a Ramsar site due to the following criteria: Criterion 5: waterfowl assemblages of international importance, with peak counts in winter of 89,576

89 Mersey Estuary Ramsar Site. Available at https://jncc.gov.uk/jncc-assets/RIS/UK11041.pdf (Accessed: 11 December 2023).

Designated site	Distance from the Project[78]	Interest features
		Criterion 6: species / populations occurring at levels of international importance, including: Common shelduck (*Tadorna tadorna*); Black-tailed godwit (*Limosa limosa islandica*); Common redshank (*Tringa totanus tetanus*); Eurasian teal (*Anas crecca*); Northern pintail (*Anas acuta*); and Dunlin (*Calidris alpina alpina*)
Isle of Wight Downs SAC	117 km	Qualifying Features: H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts H4030 European dry heaths H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*); dry grasslands and scrublands on chalk or limestone S1654 Early gentian (*Gentianella anglica*)
Peak District Dales SAC	119 km	Qualifying Features: H4030 European dry heaths H6130 Calaminarian grasslands of the *Violetalia calaminariae*; grasslands on soils rich in heavy metals H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*); dry grasslands and scrublands on chalk or limestone H7230 Alkaline fens; calcium-rich springwater-fed fens H8120 Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*); base rich scree H8210 Calcareous rocky slopes with chasmophytic vegetation; plants in crevices in base-rich rocks H9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes S1092 White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*)

Designated site	Distance from the Project[78]	Interest features
		S1096 Brook lamprey (*Lampetra planeri*) S1163 Bullhead (*Cottus gobio*)
Blackwater River (Cork / Waterford) SAC	N/A[90]	Qualifying Features: 1029 Freshwater Pearl Mussel (*Margaritifera margaritifera*) 1092 White-clawed Crayfish (*Austropotamobius pallipes*) 1095 Sea Lamprey (*Petromyzon marinus*) 1096 Brook Lamprey (*Lampetra planeri*) 1099 River Lamprey (*Lampetra fluviatilis*) 1103 Twaite Shad (*Alosa fallax*) 1106 Atlantic Salmon (*Salmo salar*) (only in fresh water) 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1220 Perennial vegetation of stony banks 1310 Salicornia and other annuals colonizing mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1355 Otter (*Lutra lutra*) 1410 Mediterranean salt meadows (*Juncetalia maritimi*) 1421 Killarney Fern (*Trichomanes speciosum*)

90 The designated sites listed from here onwards in this Table, including the Blackwater River (Cork / Waterford) SAC, do not fall within the ZOI adopted in this HRA Report for the purpose of the screening assessment but were covered by the EA within their 2020 Appropriate Assessment and hence, as explained earlier, they have been added to the Table and have been included within the screening and (where relevant) the AA process in this HRA Report.

Designated site	Distance from the Project[78]	Interest features
		3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) 91J0 *Taxus baccata woods of the British Isles
River Barrow and River Nore SAC	N/A	Qualifying Features: 1016 Desmoulin's whorl snail (*Vertigo moulinsiana*) 1029 Freshwater pearl mussel (*Margaritifera margaritifera*) 1092 White-clawed crayfish (*Austropotamobius pallipes*) 1095 Sea lamprey (*Petromyzon marinus*) 1096 Brook lamprey (*Lampetra planeri*) 1099 River lamprey (*Lampetra fluviatilis*) 1103 Twaite shad (*Alosa fallax*) 1106 Atlantic salmon (*Salmo salar*) (only in fresh water) 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1310 Salicornia and other annuals colonizing mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1355 Otter (*Lutra lutra*) 1410 Mediterranean salt meadows (*Juncetalia maritimi*) 1421 Killarney fern (*Trichomanes speciosum*)

Designated site	Distance from the Project[78]	Interest features
		1990 Nore freshwater pearl mussel (*Margaritifera durrovensis*) 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 4030 European dry heaths 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels 7220 * Petrifying springs with tufa formation (*Cratoneurion*) 91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles 91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
Slaney River Valley SAC	N/A	Qualifying Features: 1029 Freshwater Pearl Mussel (*Margaritifera margaritifera*) 1095 Sea Lamprey (*Petromyzon marinus*) 1096 Brook Lamprey (*Lampetra planeri*) 1099 River Lamprey (*Lampetra fluviatilis*) 1103 Twaite Shad (*Alosa fallax*) 1106 Atlantic Salmon (*Salmo salar*) (only in fresh water) 1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1355 Otter (*Lutra lutra*) 1365 Harbour Seal (*Phoca vitulina*)

Designated site	Distance from the Project[78]	Interest features
		3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles 91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
North Anglesey Marine / Gogledd Môn Forol MPA / SAC	N/A	Qualifying Features: 1351 Harbour porpoise (*Phocoena phocoena*)
Isles of Scilly Complex SAC	N/A	Qualifying Features: H1110 Sandbanks which are slightly covered by sea water all the time H1140 Mudflats and sandflats not covered by seawater at low tide; intertidal mudflats and sandflats H1170 Reefs S1364 Grey seal (*Halichoerus grypus*) S1441 Shore dock (*Rumex rupestris*)
North Channel SAC	N/A	Qualifying Features: 1351 Harbour porpoise (*Phocoena phocoena*)
Rockabill to Dalkey Island SAC	N/A	Qualifying Features: 1170 Reefs 1351 Harbour porpoise (*Phocoena phocoena*)
Roaringwater Bay and Islands SAC	N/A	Qualifying Features: 1160 Large shallow inlets and bays 1170 Reefs

Designated site	Distance from the Project[78]	Interest features
		1230 Vegetated sea cliffs of the Atlantic and Baltic coasts 1351 Harbour porpoise (*Phocoena phocoena*) 1355 Otter (*Lutra lutra*) 1364 Grey seal (*Halichoerus grypus*) 4030 European dry heaths 8330 Submerged or partly submerged sea caves
Blasket Islands SAC	N/A	Qualifying Features: 1170 Reefs 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts 1351 Harbour porpoise (*Phocoena phocoena*) 1364 Grey seal (*Halichoerus grypus*) 4030 European dry heaths 8330 Submerged or partially submerged sea caves
Saltee Islands SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) (breeding) A016 Northern gannet (*Morus bassanus*) (breeding) A018 Shag (*Phalacrocorax aristotelis*) (breeding) A188 Kittiwake (*Rissa tridactyla*) (breeding) A199 Guillemot (*Uria aalge*) (breeding) A200 Razorbill (*Alca torda*) (breeding) A204 Puffin (*Fratercula arctica*) (breeding)

Designated site	Distance from the Project[78]	Interest features
Lambay Island SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A017 Cormorant (*Phalacrocorax carbo*) A018 Shag (*Phalacrocorax aristotelis*) A043 Greylag Goose (*Anser anser*) A183 Lesser Black-backed Gull (*Larus fuscus*) A184 Herring Gull (*Larus argentatus*) A188 Kittiwake (*Rissa tridactyla*) A199 Guillemot (*Uria aalge*) A200 Razorbill (*Alca torda*) A204 Puffin (*Fratercula arctica*)
Copeland Islands SPA	N/A	Qualifying Features: A013 Manx shearwater (*Puffinus puffinus*) A194 Artic Tern (*Sterna paradisaea*)
Cliffs of Moher SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A188 Kittiwake (*Rissa tridactyla*) A199 Guillemot (*Uria aalge*) A200 Razorbill (*Alca torda*) A204 Puffin (*Fratercula arctica*) A346 Chough (*Pyrrhocorax pyrrhocorax*)

Designated site	Distance from the Project[78]	Interest features
Beara Peninsula SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A346 Chough (*Pyrrhocorax pyrrhocorax*)
Kerry Head SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A346 Chough (*Pyrrhocorax pyrrhocorax*)
Deenish Island and Scariff Island SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A013 Manx Shearwater (*Puffinus puffinus*) A014 Storm Petrel (*Hydrobates pelagicus*) A183 Lesser Black-backed Gull (*Larus fuscus*) A194 Arctic Tern (*Sterna paradisaea*)
Iveragh Peninsula SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A103 Peregrine (*Falco peregrinus*) A188 Kittiwake (*Rissa tridactyla*) A199 Guillemot (*Uria aalge*) A346 Chough (*Pyrrhocorax pyrrhocorax*)
Puffin Island SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A013 Manx Shearwater (*Puffinus puffinus*)

Designated site	Distance from the Project[78]	Interest features
		A014 Storm Petrel (*Hydrobates pelagicus*) A183 Lesser Black-backed Gull (*Larus fuscus*) A200 Razorbill (*Alca torda*) A204 Puffin (*Fratercula arctica*)
Skelligs SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A013 Manx Shearwater (*Puffinus puffinus*) A014 Storm Petrel (*Hydrobates pelagicus*) A016 Gannet (*Morus bassanus*) A188 Kittiwake (*Rissa tridactyla*) A199 Guillemot (*Uria aalge*) A204 Puffin (*Fratercula arctica*)
Dingle Peninsula SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A103 Peregrine (*Falco peregrinus*) A346 Chough (*Pyrrhocorax pyrrhocorax*)
West Donegal Coast SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A017 Cormorant (*Phalacrocorax carbo*) A018 Shag (*Phalacrocorax aristotelis*) A103 Peregrine (*Falco peregrinus*)

Designated site	Distance from the Project[78]	Interest features
		A184 Herring Gull (*Larus argentatus*) A188 Kittiwake (*Rissa tridactyla*) A200 Razorbill (*Alca torda*) A346 Chough (*Pyrrhocorax pyrrhocorax*)
Blasket Islands SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A013 Manx Shearwater (*Puffinus puffinus*) A014 Storm Petrel (*Hydrobates pelagicus*) A018 Shag (*Phalacrocorax aristotelis*) A183 Lesser Black-backed Gull (*Larus fuscus*) A184 Herring Gull (*Larus argentatus*) A188 Kittiwake (*Rissa tridactyla*) A194 Arctic Tern (*Sterna paradisaea*) A200 Razorbill (*Alca torda*) A204 Puffin (*Fratercula arctica*) A346 Chough (*Pyrrhocorax pyrrhocorax*)
Horn Head to Fanad Head SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A017 Cormorant (*Phalacrocorax carbo*) A018 Shag (*Phalacrocorax aristotelis*) A045 Barnacle Goose (*Branta leucopsis*)

Designated site	Distance from the Project[78]	Interest features
		A103 Peregrine (*Falco peregrinus*) A188 Kittiwake (*Rissa tridactyla*) A199 Guillemot (*Uria aalge*) A200 Razorbill (*Alca torda*) A346 Chough (*Pyrrhocorax pyrrhocorax*) A395 Greenland White-fronted Goose (*Anser albifrons flavirostris*)
Clare Island SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A018 Shag (*Phalacrocorax aristotelis*) A182 Common Gull (*Larus canus*) A188 Kittiwake (*Rissa tridactyla*) A199 Guillemot (*Uria aalge*) A200 Razorbill (*Alca torda*) A346 Chough (*Pyrrhocorax pyrrhocorax*)
High Island, Inishshark and Davillaun SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A045 Barnacle Goose (*Branta leucopsis*) A194 Arctic Tern (*Sterna paradisaea*)
Tory Island SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A122 Corncrake (*Crex crex*)

Designated site	Distance from the Project[78]	Interest features
		A200 Razorbill (*Alca torda*) A204 Puffin (*Fratercula arctica*)
Duvillaun Islands SPA	N/A	Qualifying Features: A009 Fulmar (*Fulmarus glacialis*) A014 Storm Petrel (*Hydrobates pelagicus*) A045 Barnacle Goose (*Branta leucopsis*)

8.5 Conservation Objectives

8.5.1 The Conservation Objectives of the designated sites listed in Table 8-1 above are presented within Table 8-2.

Table 8-2: Designated sites and associated Conservation Objectives

Designated site	Conservation Objectives
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 ('FCS') of its Qualifying Features, by maintaining or restoring: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Severn Estuary SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Severn Estuary Ramsar	See pages 112 –118 of the Severn Estuary European Marine Site NE and Countryside Council for Wales ('CCW') advice given under Regulation 33 of the Conservation (Natural Habitats) Regulations 1994 as amended (June 2009)[91]

91 Natural England (2018) European Site Conservation Objectives for Severn Estuary/Môr Hafren Ramsar Site Site code: UK0013030. Available online at: https://naturalresources.wales/media/673887/severn-estuary-sac-spa-and-ramsar-reg-33-advice-from-ne-and-ccw-june-09.pdf (Accessed 20 October 2023). The applicability of these conservation objectives is subject to the findings of the Planning Inspector and Secretary of State in relation to NNB's WDA Permit inquiry.

Designated site	Conservation Objectives
River Towy / Afon Tywi SAC	See pages 21-26 of the Core Management Plan Including Conservation Objectives for River Towy SAC[92]
River Usk / Afon Wysg SAC	See pages 31-37 of the Core Management Plan including Conservation Objectives for the River Usk SAC[93]
Afon Teifi/ River Teifi SAC	See pages 13-31 of the Core Management Plan including COnsveration Objectives for the Afon Teifi/ River Teifi SAC[94]
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	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: • The extent and distribution of the habitats of qualifying species • The structure and function of the habitats of qualifying species • The supporting processes on which the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Exmoor and Quantocks Oakwoods SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Walmore Common Ramsar	The site overlaps completely with the Walmore Common SPA which is designated for the same feature. Data from BirdLife International suggests that a

92 Natural Resources Wales / Cyfoeth Naturiol Cymru (2022) Core Management Plan Including Observation Objectives for Afon Tywi / River Towy SAC. Available online at: https://naturalresources.wales/media/682845/afon-teifi-river-teifi-management-plan.pdf (Accessed 20 October 2023).

93 Natural Resources Wales / Cyfoeth Naturiol Cymru (2022) Core Management Plan Including Observation Objectives for Afon Wysg / River Usk SAC. Available online at: https://afonyddcymru.org/wp-content/uploads/2022/11/river_usk-sac-core-plan.pdf (Accessed 20 October 2023).

94 Natural Resources Wales / Cyfoeth Naturiol Cymru (2012) Core Management Plan Including Observation Objectives for Afon Teifi/ River Teifi SAC. Available online at: https://naturalresources.wales/media/670702/Afon%20Teifi%20%20River%20Teifi%20Management%20Plan.pdf (Accessed 06 November 2023)

Designated site	Conservation Objectives
	management plan is in place. A Site Improvement Plan ('SIP') is in place for the Walmore Common SPA[95]
Walmore Common SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
North Somerset and Mendip Bats SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
River Wye / Afon Gwy SAC	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: • 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

95 BirdLife International (2023) Important Bird Area factsheet: Walmore Common. Downloaded from http://datazone.birdlife.org/site/factsheet/walmore-common-iba-united-kingdom (Accessed 11 October 2023).

Designated site	Conservation Objectives
	• The distribution of qualifying species within the site
Mendip Limestone Grasslands SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Somerset Levels and Moors Ramsar	No information currently available: management plan in preparation; official proposal as a legally protected area.
Somerset Levels and Moors SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	The vision for the Lesser Horseshoe Bat is for it to be in a FCS, where all of the following conditions are satisfied: • The site will support a sustainable population of lesser horseshoe bats in the River Usk area • The population will be viable in the long term, acknowledging the population fluctuations of the species • Buildings, structures and habitats on the site will be in optimal condition to support the populations • Sufficient foraging habitat is available, in which factors such as disturbance, interruption to flight lines, and mortality from predation or vehicle collision, changes in habitat management that would reduce the available food source are not at levels which could cause any decline in population size or range • Management of the surrounding habitats is of the appropriate type and sufficiently secure to ensure there is likely to be no reduction in

Designated site	Conservation Objectives
	population size or range, nor any decline in the extent or quality of breeding, foraging or hibernating habitat • There will be no loss or decline in quality of linear features (such as hedgerows and tree lines) which the bats use as flight lines - there will be no loss of foraging habitat use by the bats or decline in its quality, such as due to over-intensive woodland management • All factors affecting the achievement of the above conditions are under control
Hestercombe House SAC	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: • e extent and distribution of the habitats of qualifying species • The structure and function of the habitats of qualifying species • The supporting processes on which the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Wye Valley Woodlands SAC	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: • 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
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	See Pages 39-42 of the Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd European Marine Site Advice Provided by the Countryside Council for Wales in Fulfilment of Regulation 33 of the Conservation (Natural Habitats, &C.) Regulations 1994[96]
Burry Inlet Ramsar	The Burry Inlet Ramsar is located within the Carmarthen Bay and Estuaries SAC.

96 Carmarthen Bay R33 Advice February 2009.pdf (naturalresources.wales) (Accessed on 22 November 2023).

Designated site	Conservation Objectives
	There are no specific conservation objectives for the Burry Inlet Ramsar but these may be inferred from See Pages 39-42 of the Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd Special Area of Conservation including the Burry Inlet Ramsar
Exmoor Heaths SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	See Pages 14-28 of the Core Management Plan (Including Conservation Objectives) for Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC[97]
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining FCS for the UK harbour porpoise. To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term: • The species is a viable component of the site • There is no significant disturbance of the species. The supporting habitats and processes relevant to harbour porpoises and their prey are maintained
Carmarthen Bay / Bae Caerfyrddin SPA	To achieve FCS all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve FCS. • The numbers of all SPA bird species are stable or increasing • The abundance and distribution of suitable prey are sufficient and appropriate to support the numbers of all SPA bird species • All SPA birds are allowed to inhabit their feeding grounds and resting areas with minimum disturbance, and are allowed to move unhindered between them • All states of the Conservation Objectives for the supporting habitats and species, subject to natural processes, are fulfilled and maintained in the long-term • 'Large shallow inlets and bays' are the supporting habitat for the common scoter

97 Microsoft Word - Carmarthen Dunes -Management plan English.doc (naturalresources.wales) (Accessed on 22 November 2023).

Designated site	Conservation Objectives
Limestone Coast of South West Wales SAC	See Pages 17-58 of the Core Management Plan (Including Conservation Objectives) Incorporating Castlemartin Coast SPA[98]
River Axe SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Kenfig / Cynffig SAC	See Pages 14-35 of the Core Management Plan (Including Conservation Objectives) for Kenfig / Cynffig SAC[99]
Cardigan Bay / Bae Ceredigion SAC	See Pages 41-46 of the Advice provided by NRW in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017[100]
West Wales Marine / Gorllewin Cymru Forol SAC	To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for Harbour Porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that: • Harbour porpoise is a viable component of the site. There is no significant disturbance of the species. The condition of supporting habitats and processes, and the availability of prey is maintained
Sidmouth to West Bay SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely

99 2013 02 06 Kenfig - Cynffig SAC Management Plan _Eng_ (naturalresources.wales) (Accessed on 22 November 2023).

100 Contents (naturalresources.wales) (Accessed on 22 November 2023).

Designated site	Conservation Objectives
Lyme Bay and Torbay SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which the qualifying natural habitats rely
Cleddau Rivers / Afonydd Cleddau SAC	See Pages 20-28 of the Core Management Plan Including Conservation Objectives for Afonydd Cleddau / Cleddau Rivers SAC[101]
River Avon SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Chesil and The Fleet SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely
Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	See pages 16-17 of Northern Cardigan Bay / Gogledd Bae Ceredigion Special Protection Area Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulations 2017[102]
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	See pages 62-70 of Pen Llŷn a'r Sarnau / Lleyn Peninsula and the Sarnau Special Area of Conservation Advice Provided by the Countryside Council for

101 CONSERVATION OBJECTIVES FOR N2K SITES (naturalresources.wales) (Accessed on 22 November 2023).

102 Northern Cardigan Bay Special Protection Area Advice, available at https://naturalresources.wales/media/688003/eng-northern-cardigan-bay-spa-reg-37-report.pdf (Accessed: 11 December 2023).

Designated site	Conservation Objectives
	Wales in Fulfilment of Regulation 33 Of the Conservation (Natural Habitats, &C.) Regulations 1994[103]
Pembrokeshire Marine / Sir Benfro Forol SAC	See pages 77-83 of Advice Provided by the Countryside Council for Wales in Fulfilment of Regulation 33 of the Conservation (Natural Habitats, &c.) Regulations 1994[104]
Exe Estuary Ramsar	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Exe Estuary SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Chesil Beach and the Fleet Ramsar	Conservation management plan in preparation – conservation measures have been proposed but not yet allocated.
River Lambourn SAC	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: • 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

103 Pen Llyn ar Sarnau R33 Feb 2009.pdf (naturalresources.wales) (Accessed on 22 November 2023).

104 Contents (naturalresources.wales) (Accessed on 22 November 2023).

Designated site	Conservation Objectives
	• The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Dawlish Warren SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Skomer, Skokholm and the Seas off Pembrokeshire SPA	For each protected feature there are four conservation objectives: • The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term • The distribution of the population should be being maintained, or where appropriate increasing • There should be sufficient habitat, of sufficient quality, to support the population in the long term • Factors affecting the population or its habitat should be under appropriate control
Isle of Portland to Studland Cliffs SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site

Designated site	Conservation Objectives
South Hams SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
St David's / Ty Ddewi SAC	See pages 19-24 of the Core Management Plan Including Conservation Objectives for St. David's SAC[105]
Studland to Portland SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which the qualifying natural habitats rely
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site

105 Microsoft Word - St David's SAC Plan English.doc (naturalresources.wales) (Accessed on 22 November 2023).

Designated site	Conservation Objectives
Dartmoor SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Braunton Burrows SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Poole Harbour Ramsar	Management plan in preparation

Designated site	Conservation Objectives
Poole Harbour SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Chesil Beach and the Fleet SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Solent and Dorset Coast SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
River Mease SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and

Designated site	Conservation Objectives
	• The distribution of qualifying species within the site
Lundy SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Tintagel-Marsland-Clovelly Coast SAC	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; • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely
Pasturefields Salt Marsh SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely
Upper Nene Valley Gravel Pits SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site

Designated site	Conservation Objectives
St Albans Head to Durlston Head SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Afon Eden - Cors Goch Trawsfynydd SAC	See Core Management Plan for full details on each qualifying feature.[106] For habitat features: • Extent should be stable in the long term, or where appropriate increasing* • Quality (including in terms of ecological structure and function) should be being maintained, or where appropriate improving • Populations of the habitat's typical species must be being maintained or where appropriate increasing* • Factors affecting the extent and quality of the habitat and its typical species (and thus affecting the habitat's future prospects) should be under appropriate control For species features: • The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term • The distribution of the population should be being maintained • There should be sufficient habitat, of sufficient quality, to support the population in the long term • Factors affecting the population or its habitat should be under appropriate control
Morfa Harlech a Morfa Dyffryn SAC	See pages 13-34 of the Core Management Plan[107]

106 CONSERVATION OBJECTIVES FOR N2K SITES (afonyddcymru.org) (Accessed on 22 November 2023).

107 Microsoft Word - Morfa Harlech a Morfa Dyffryn SAC Management Plan 18 April 2008 _English_.doc (naturalresources.wales) (Accessed on 22 November 2023).

Designated site	Conservation Objectives
Aberdaron Coast and Bardsey Island / Glannau Aberdaron ac Ynys Enlli SPA	See pages 20-29 of the Core Management Plan[108]
Upper Nene Valley Gravel Pits Ramsar	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Grassholm SPA	The vision for the Gannet is for it to be in a FCS, where all of the following conditions are satisfied: • The population will not fall below 30,000 pairs in three consecutive years • It will not drop by more than 25 % of the previous year's figures in any one year • There will be no decline in this population significantly greater than any decline in the North Atlantic population as a whole
Seacliffs of Lleyn / Clogwyni Pen Llyn SAC	See pages 17-28 of the Core Management Plan Including Conservation Objectives for Corsydd Llyn[109]
River Itchen SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site

108 Aberdaron Coast and Bardsey Island Core Management Plan, available at https://naturalresources.wales/media/672092/Glannau%20Aberdaron%20Plan%20English.pdf (Accessed: 11 December 2023).

Designated site	Conservation Objectives
The Dee Estuary SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Plymouth Sound and Estuaries SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Dee Estuary / Aber Dyfrdwy SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
The Dee Estuary Ramsar	See pages 216-246 of The Dee Estuary European Marine Site – Ramsar site[110]

110 Dee Estuary-Reg33-Volume 1-English-091209_1.pdf (naturalresources.wales) (Accessed on 22 November 2023).

Designated site	Conservation Objectives
Solent and Southampton Water SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Solent Maritime SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
South Devon Shore Dock SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Start Point to Plymouth Sound and Eddystone SAC	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: • The extent and distribution of qualifying natural habitats

Designated site	Conservation Objectives
	• The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which the qualifying natural habitats rely
Solent and Southampton Water Ramsar	• Subject to natural change, maintain the internationally important wetland characteristic of the Atlantic biogeographical region in favourable condition, in particular, estuaries, saline lagoons, saltmarsh and intertidal reefs • Subject to natural change, maintain the wetland hosting an assemblage of rare, vulnerable or endangered species in favourable condition, in particular, saline lagoons, saltmarsh, cordgrass swards (*Spartinon* spp.) • Subject to natural change, maintain the wetland regularly supporting 20,000 waterfowl species in favourable condition, in particular, saltmarshes, intertidal mudflats and sandflats, boulder and cobble shores, and mixed sediment shores • Subject to natural change, maintain the wetland regularly supporting 1 % or more of the individuals in a population of waterfowl species in favourable condition, in particular, saltmarshes, sand and shingle, shallow coastal waters, intertidal mudflats and sandflats, and boulder and cobble shores, and mixed sediment shores
South Wight Maritime SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely
Solent and Isle of Wight Lagoons SAC	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: • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely
Mersey Estuary SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features

Designated site	Conservation Objectives
	• The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site
Mersey Estuary Ramsar	None available
Isle of Wight Downs SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Peak District Dales SAC	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
Blackwater River (Cork / Waterford) SAC	• To restore the favourable conservation condition of the Freshwater Pearl Mussel, Sea Lamprey, Twaite Shad, Atlantic salt meadows (*Glauco-Puccinellietalia*), Otter, Old sessile oak woods with Ilex and Blechnum, and Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) • To maintain the favourable conservation condition of White-clawed Crayfish, Brook Lamprey, River Lamprey, Atlantic Salmon, Salicornia and other annuals colonising mud and sand, Mediterranean salt meadows (*Juncetalia maritimi*) and Killarney Fern

Designated site	Conservation Objectives
	• To maintain the favourable conservation condition of Estuaries, Mudflats and sandflats not covered by seawater at low tide, Perennial vegetation of stony banks and Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion*
River Barrow and River Nore SAC	To maintain the favourable conservation condition of the following habitats and species in the SAC, as defined within the Conservation Objectives documentation: • Desmoulin's whorl snail • White-clawed crayfish • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Salicornia and other annuals colonising mud and sand • Killarney fern • Water courses of plain to montane levels • European dry heaths • Hydrophilous tall her fringe communities of plains and of the montane to Alpine levels • Petrifying springs with tufa formation To restore the favourable conservation condition for the following qualifying habitats and species in the SAC, as defined within the Conservation Objectives: • Sea lamprey • Brook lamprey • River lamprey • Twaite shad • Atlantic salmon • Atlantic salt meadows • Otter • Mediterranean salt meadows • Nore freshwater pearl mussel • Old sessile oak woods with Ilex and Blechnum in the British Isles • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*
Slaney River Valley SAC	To maintain the favourable conservation condition of the following habitats and species in the SAC, as defined within the Conservation Objectives documentation: • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Harbour seal • Water courses of plain to montane levels To restore the favourable conservation condition of the following habitats and species in the SAC, as defined within the Conservation Objectives documentation: • Sea lamprey

Designated site	Conservation Objectives
	• Brook lamprey • River lamprey • Twaite shad • Atlantic salmon • Otter • Old sessile oak woods with Ilex and Blechnum in the British Isles • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*
North Anglesey Marine / Gogledd Môn Forol MPA / SAC	To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that: • Harbour porpoise is a viable component of the site • There is no significant disturbance of the species, and • The condition of supporting habitats and processes, and the availability of prey is maintained The focus of the Conservation Objectives for harbour porpoise sites is on addressing pressures that affect site integrity and would include: • killing or injuring harbour porpoise (directly or indirectly) • preventing their use of significant parts of the site (disturbance / displacement) • significantly damaging relevant habitats, or • significantly reducing the availability of prey
Isles of Scilly Complex	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: • 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 the habitats of qualifying species rely • The populations of qualifying species, and • The distribution of qualifying species within the site
North Channel SAC	To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that: • Harbour porpoise is a viable component of the site • There is no significant disturbance of the species, and • The condition of supporting habitats and processes, and the availability of prey is maintained The focus of the Conservation Objectives for harbour porpoise sites is on addressing pressures that affect site integrity and would include:

Designated site	Conservation Objectives
	• killing or injuring harbour porpoise (directly or indirectly) • preventing their use of significant parts of the site (disturbance / displacement) • significantly damaging relevant habitats, or • significantly reducing the availability of prey
Rockabill to Dalkey Island SAC	To maintain the favourable conservation condition of the following habitats and species in the SAC, as defined within the Conservation Objectives documentation: • Reefs To restore the favourable conservation condition of the following habitats and species in the SAC, as defined within the Conservation Objectives documentation: • Harbour porpoise
Roaringwater Bay and Islands SAC	To maintain the favourable conservation condition of large shallow inlets and bays, Reefs, Vegetated sea cliffs of the Atlantic and Baltic coasts, Harbour Porpoise, Grey Seal, European dry heaths, Submerged or partly submerged sea caves To restore the favourable conservation condition of Otter
Blasket Islands SAC	To restore the favourable conservation condition of Vegetated sea cliffs of the Atlantic and Baltic coasts in Blasket Islands SAC To maintain the favourable conservation condition of reefs, European dry heaths, Submerged or partially submerged sea caves, Harbour porpoise and Grey Seal
Saltee Islands SPA	To maintain the favourable conservation condition of the following species: Fulmar, Gannet, Cormorant, Shag, Lesser Black-backed Gull, Herring Gull, Kittiwake, Guillemot, Razorbill and Puffin
Lambay Island SPA	To maintain the favourable conservation condition of the following species: Fulmar, Cormorant, Shag, Greylag Goose, Lesser Black-backed Gull, Herring Gull, Kittiwake, Guillemot, Razorbill and Puffin
Copeland Islands SPA	To maintain each feature in a favourable condition To maintain or enhance the population of the qualifying species Fledging success sufficient to maintain or enhance population To maintain or enhance the range of habitats utilised by the qualifying species To ensure that the integrity of the site is maintained To ensure there is no significant disturbance of the species, and To ensure that the following are maintained in the long term: - Population of the species as a viable component of the site - Distribution of the species within site - Distribution and extent of habitats supporting the species

Designated site	Conservation Objectives
	- Structure, function and supporting processes of habitats supporting the species
Cliffs of Moher SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Kittiwake, Guillemot, Razorbill, Puffin and Chough)
Beara Peninsula SPA	To maintain the favourable conservation condition of Fulmar and Chough
Kerry Head SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar and Chough)
Deenish Island and Scariff Island SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Manx Shearwater, Storm Petrel, Lesser Black-backed Gull and Arctic Tern)
Iveragh Peninsula SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Peregrine, Kittiwake, Guillemot and Chough)
Puffin Island SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Manx Shearwater, Storm Petrel, Lesser Black-backed Gull, Razorbill and Puffin)
Skelligs SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Manx Shearwater, Storm Petrel, Gannet, Kittiwake, Guillemot and Puffin)
Dingle Peninsula SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Peregrine and Chough)
West Donegal Coast SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Cormorant, Shag, Peregrine, Herring Gull, Kittiwake, Razorbill and Chough)
Blasket Islands SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Manx Shearwater, Storm Petrel, Shag, Lesser Black-backed Gull, Herring Gull, Kittiwake, Arctic Tern, Razorbill, Puffin and Chough)
Horn Head to Fanad Head SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Cormorant, Shag, Barnacle Goose, Peregrine, Kittiwake, Guillemot, Razorbill, Chough and Greenland White-fronted Goose)
Clare Island SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Shag, Common Gull, Kittiwake, Guillimot, Razorbill and Chough)

Designated site	Conservation Objectives
High Island, Inishshark and Davillaun SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Barnacle Goose and Arctic Tern)
Tory Island SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Corncrake, Razorbill and Puffin)
Duvillaun Islands SPA	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (Fulmar, Storm Petrel and Barnacle Goose)

8.6 Screening outcomes in relation to LSE of the Project alone

8.6.1 The designated sites, associated qualifying features and impact pathways set out in Sections 8.2, 8.3 and 8.4 have been subject to a HRA screening process to determine whether they are subject to any LSE from the Project alone. The results are in Table 8-3.

8.6.2 Following the process of site identification through the selected ZOI together with the additional sites identified by the EA in 2020, as described above, resulting in the list of relevant European / Ramsar sites and qualifying features in Table 8-1, the screening assessment was undertaken, to establish whether there is or is not an LSE on each European / Ramsar site's qualifying features through the different elements of the Project alone.

8.6.3 The screening assessment is precautionary in the sense that a site / feature / pathway in Table 8-3- is only screened-out in relation to the Project alone if one of the following reasons applies:

(i) there is no impact pathway from the Project alone to that qualifying feature; or

(ii) there is no risk of any effect on that qualifying feature due to one of the three reasons below:

(a) for static features, the distance of the relevant European / Ramsar site (for which the static feature is a designated feature) from known locations of the Project elements; or

(b) for mobiles species, the distance of the relevant European / Ramsar site (for which the mobile species is a designated feature) from known locations of the Project elements; or

(c) the scale of habitat loss by comparison to the scale of suitable habitat being available.

8.6.4 If none of these reasons applies then the site / feature / pathway is automatically screened-in and is then subjected to a shadow AA.

8.6.5 The application of this approach is based on precautionary ecological judgment. For example, SACs with habitat qualifying features beyond 10 km from the nearest element of the Project are considered to have no potential for the Project to cause any effect. By contrast SPAs with piscivorous bird qualifying features are screened-in as having a risk of significant effect from the Project alone through indirect effects on prey resources, through fish entrapment.

8.6.6 The term 'Project alone' incorporates all the separate elements of the Project and hence the risk of cumulative effects between the elements is automatically considered in making any decision to screen out a site / qualifying feature / pathway.

8.6.7 The outcome of the screening assessment is presented in Table 8-3.

Table 8-3: Screening outcome for the Project 'alone' (red shading indicates "screened-in"; green shading indicates "screened out")

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Severn Estuary SAC	H1110: Sandbanks which are slightly covered by seawater all the time; Subtidal sandbanks.	Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries.	Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries.	Habitat loss and physical damage	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries.	Habitat loss and physical damage	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries (with typical fish species assemblage)	Entrapment of organisms	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries (with typical waterfowl species assemblage)	Impact pathways as outlined for bird qualifying features of the Severn Estuary SPA	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries (with typical fish species assemblage)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries.	Changes to water quality through release of contaminants / nutrients	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries.	Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1130: Estuaries.	Disruption of migratory routes	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1140: Mudflats and sandflats not covered by seawater at low tide.	Habitat loss and physical damage	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1140: Mudflats and sandflats not covered by seawater at low tide.	Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1140: Mudflats and sandflats not covered by seawater at low tide.	Changes to water quality through release of contaminants / nutrients	Compensatory measures	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Severn Estuary SAC	H1170: Reefs.	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Severn Estuary SAC	H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Changes to water quality through release of contaminants / nutrients	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Habitat loss and physical damage	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1095: Sea lamprey (*Petromyzon marinus*)	Indirect: Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	S1095: Sea lamprey (*Petromyzon marinus*)	Indirect: Changes to water quality through release of contaminants / nutrients	Compensatory Measures	Risk of SE – screened-in
Severn Estuary SAC	S1095: Sea lamprey (*Petromyzon marinus*)	Entrapment of organisms	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	S1095: Sea lamprey (*Petromyzon marinus*)	Mortality / injury through construction activities	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1095: Sea lamprey (*Petromyzon marinus*)	Disturbance (noise, vibration, light) and temporary displacement through construction activities	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1095: Sea lamprey (*Petromyzon marinus*)	Indirect: Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1095: Sea lamprey (*Petromyzon marinus*)	Disruption of migratory routes	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1099: River lamprey (*Lampetra fluvatilis*)	Indirect: Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Severn Estuary SAC	S1099: River lamprey (*Lampetra fluvatilis*)	Indirect: Changes to water quality through release of contaminants / nutrients	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1099: River lamprey (*Lampetra fluvatilis*)	Entrapment of organisms	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	S1099: River lamprey (*Lampetra fluvatilis*)	Mortality / injury through construction activities	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1099: River lamprey (*Lampetra fluvatilis*)	Disturbance (noise, vibration, light) and temporary displacement through construction activities	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1099: River lamprey (*Lampetra fluvatilis*)	Indirect: Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1099: River lamprey (*Lampetra fluvatilis*)	Disruption of migratory routes	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1103: Twaite shad (*Alosa fallax*)	Indirect: Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	S1103: Twaite shad (*Alosa fallax*)	Indirect: Changes to water quality through release of contaminants / nutrients	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1103: Twaite shad (*Alosa fallax*)	Entrapment of organisms	Marine design element	Risk of SE – screened-in
Severn Estuary SAC	S1103: Twaite shad (*Alosa fallax*)	Mortality / injury through construction activities	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1103: Twaite shad (*Alosa fallax*)	Disturbance (noise, vibration, light) and temporary displacement through construction activities	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1103: Twaite shad (*Alosa fallax*)	Indirect: Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary SAC	S1103: Twaite shad (*Alosa fallax*)	Disruption of migratory routes	Compensatory measures	Risk of SE – screened-in
Severn Estuary SPA	A037: Bewick's swan (Cygnus columbianus bewickii) A394: Greater white-fronted goose (*Anser albifrons albifrons*)	Disturbance (noise, vibration, light) and temporary displacement through construction activities	Compensatory measures	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	A149: Dunlin (*Calidris alpina alpina*) A162: Common redshank (*Tringa totanus*) A048: Common shelduck (*Tadorna tadorna*) A051: Gadwall (*Anas strepara*) Waterbird assemblage			
Severn Estuary SPA	A037: Bewick's swan (Cygnus columbianus bewickii) A394: Greater white-fronted goose (*Anser albifrons albifrons*) A149: Dunlin (*Calidris alpina alpina*) A162: Common redshank (*Tringa totanus*) A048: Common shelduck (*Tadorna tadorna*) A051: Gadwall (*Anas strepara*) Waterbird assemblage	Temporary loss of habitat during construction activities	Compensatory measures	Risk of LSE – screened-in
Severn Estuary SPA	A037: Bewick's swan (Cygnus columbianus bewickii) A394: Greater white-fronted goose (*Anser albifrons albifrons*) A149: Dunlin (*Calidris alpina alpina*) A162: Common redshank (*Tringa totanus*) A048: Common shelduck (*Tadorna tadorna*) A051: Gadwall (*Anas strepara*) Waterbird assemblage	Permanent modification of bird habitat and permanent displacement of species	Compensatory measures	Risk of LSE – screened-in
Severn Estuary SPA	A037: Bewick's swan (Cygnus columbianus bewickii)	Indirect: Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of LSE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	A394: Greater white-fronted goose (*Anser albifrons albifrons*) A149: Dunlin (*Calidris alpina alpina*) A162: Common redshank (*Tringa totanus*) A048: Common shelduck (*Tadorna tadorna*) A051: Gadwall (*Anas strepara*) Waterbird assemblage			
Severn Estuary SPA	A037: Bewick's swan (Cygnus columbianus bewickii) A394: Greater white-fronted goose (*Anser albifrons albifrons*) A149: Dunlin (*Calidris alpina alpina*) A162: Common redshank (*Tringa totanus*) A048: Common shelduck (*Tadorna tadorna*) A051: Gadwall (*Anas strepara*) Waterbird assemblage	Indirect: Effects on bird species through changes to water quality	Marine design element	Risk of SE – screened-in
Severn Estuary SPA	A037: Bewick's swan (Cygnus columbianus bewickii) A394: Greater white-fronted goose (*Anser albifrons albifrons*) A149: Dunlin (*Calidris alpina alpina*) A162: Common redshank (*Tringa totanus*) A048: Common shelduck (*Tadorna tadorna*) A051: Gadwall (*Anas strepara*) Waterbird assemblage	Indirect: Effects on bird species through changes to water quality	Compensatory measures	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Severn Estuary Ramsar site	Criterion 1: immense tidal range (second-largest in the world)	Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 1: immense tidal range (second-largest in the world)	Habitat loss and physical damage	Compensatory measures	No LSE – Screened out; due to the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Severn Estuary Ramsar site	Criterion 1: immense tidal range (second-largest in the world)	Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 3: unusual estuarine communities (i.e. reduced diversity)	Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 3: unusual estuarine communities (i.e. reduced diversity)	Habitat loss and physical damage	Marine design element	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 3: unusual estuarine communities (i.e. reduced diversity)	Habitat loss and physical damage	Compensatory measures	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 3: unusual estuarine communities (i.e. reduced diversity)	Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 4: migratory fish species assemblage (Salmon (*Salmo salar*), sea trout (*S. trutta*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluvatilis*), allis shad (*A.* alosa), twaite shad (*A. fallax*) and eel (*Anguilla Anguilla*))	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Severn Estuary Ramsar site	Criterion 5: wintering waterfowl assemblages of international importance with peak counts in winter of 70,919 waterfowl	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Compensatory measures	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 6: regularly supports more than 1 % of the individuals in a population of Bewick's swan (*Cygnus columbianus*), European white-fronted goose (*Anser albifrons albifrons*), dunlin (*Calidris alpina alpina*), redshank (*Tringa totanus tetanus*), shelduck (*Tadorna tadorna*) and gadwall (*Anas strepera strepera*), as well as ringed plover (*Charadrius hiaticula*), teal (*Anas crecca*), pintail (*Anas acuta*) and lesser black-backed gull (*Larus fuscus*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Compensatory measures	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 6: regularly supports more than 1 % of the individuals in a population of Bewick's swan (*Cygnus columbianus*), European white-fronted goose (*Anser albifrons albifrons*), dunlin (*Calidris alpina alpina*), redshank (*Tringa totanus tetanus*), shelduck (*Tadorna tadorna*) and gadwall (*Anas strepera strepera*), as well as ringed plover (*Charadrius hiaticula*), teal (*Anas crecca*), pintail (*Anas acuta*) and lesser black-backed gull (*Larus fuscus*)	Relating to lesser black-backed gull only: Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design elements	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Severn Estuary Ramsar site	Criterion 8[111]: wetland habitat is an important source of food and nursery ground for many fish species, especially allis shad (*Alosa alosa*) and twaite shad (*A. Fallax*)	Changes to water quality through release of contaminants / nutrients	Marine design element	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 8: wetland habitat is an important source of food and nursery ground for many fish species, especially allis shad (*Alosa alosa*) and twaite shad (*A. Fallax*)	Habitat loss and physical damage	Marine design element	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 8: wetland habitat is an important source of food and nursery ground for many fish species, especially allis shad (*Alosa alosa*) and twaite shad (*A. Fallax*)	Habitat loss and physical damage	Compensatory measures	Risk of SE – screened-in
Severn Estuary Ramsar site	Criterion 8: wetland habitat is an important source of food and nursery ground for many fish species, especially allis shad (*Alosa alosa*) and twaite shad (*A. Fallax*)	Changes in hydrodynamics and sediment transport	Compensatory measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1103 Twaite shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in

111 It was confirmed by the Inspector in the WDA Permit inquiry and the Secretary of State's decision letter of 2 September 2022 that fish species are not part of this Criterion 8.

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Towy / Afon Tywi SAC	1355 Otter (*Lutra lutra*)	Indirect effect through changes to prey resources	Marine element	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1355 Otter (*Lutra lutra*)	Disturbance and displacement	Compensatory Measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1355 Otter (*Lutra lutra*)	Indirect: Changes to water quality through release of contaminants / nutrients	Compensatory Measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1355 Otter (*Lutra lutra*)	Disruption of commuting corridors	Compensatory Measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1355 Otter (*Lutra lutra*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1096 Brook lamprey (*Lampetra planeri*)	Mortality / injury through construction activities	Compensatory measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1096 Brook lamprey (*Lampetra planeri*)	Disturbance (noise, vibration, light) and temporary displacement through construction activities	Compensatory measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1096 Brook lamprey (*Lampetra planeri*)	Indirect: Changes to water quality through release of contaminants / nutrients	Compensatory measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Towy / Afon Tywi SAC	1102 Allis shad (*Alosa alosa*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1163 Bullhead (*Cottus gobio*)	Mortality / injury through construction activities	Compensatory measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1163 Bullhead (*Cottus gobio*)	Disturbance (noise, vibration, light) and temporary displacement through construction activities	Compensatory measures	Risk of SE – screened-in
River Towy / Afon Tywi SAC	1163 Bullhead (*Cottus gobio*)	Indirect: Changes to water quality through release of contaminants / nutrients	Compensatory measures	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1099 River lamprey (*Lampetra fluvatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1096 Brook lamprey (*Lampetra planeri*)	Impact pathways as outlined for brook lamprey of the River Towy SAC	Compensatory Measures	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1103 Twaite shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			Severn Estuary SAC	
River Usk / Afon Wysg SAC	1106 Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1163 Bullhead (*Cottus gobio*)	Impact pathways as outlines for bullhead of the River Towy SAC	Compensatory Measures	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1355 Otter (*Lutra lutra*)	Indirect effects through changes to prey resources	Marine Design Element	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1355 Otter (*Lutra lutra*)	Disturbance and displacement	Compensatory Measures	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1355 Otter (*Lutra lutra*)	Indirect: Changes to water quality through release of contaminants / nutrients	Compensatory Measures	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1355 Otter (*Lutra lutra*)	Disruption of commuting corridors	Compensatory Measures	Risk of SE – screened-in
River Usk / Afon Wysg SAC	1355 Otter (*Lutra lutra*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	Risk of SE – screened-in
River Usk / Afon Wysg SAC	3260 water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Habitat loss and physical damage	Compensation measures	No LSE – Screened out; due to the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Usk / Afon Wysg SAC	1102 Allis shad (*Alosa alosa*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Teifi / Afon Teifi SAC	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	No pathways identified	Not applicable	No LSE; there is no impact pathway from the Project alone to that qualifying feature
River Teifi / Afon Teifi SAC	3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and / or of the *Isoëto-Nanojuncetea*	No pathways identified	Not applicable	No LSE; there is no impact pathway from the Project alone to that qualifying feature
River Teifi / Afon Teifi SAC	1831 Floating water-plantain (*Luronium natans*)	No pathways identified	Not applicable	No LSE; there is no impact pathway from the Project alone to that qualifying feature
River Teifi / Afon Teifi SAC	1096 Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE; there is no impact pathway from the Project alone to that qualifying feature
River Teifi / Afon Teifi SAC	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Teifi / Afon Teifi SAC	1106 Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			Severn Estuary SAC	
River Teifi / Afon Teifi SAC	1163 Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE; there is no impact pathway from the Project alone to that qualifying feature
River Teifi / Afon Teifi SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Teifi / Afon Teifi SAC	1355 Otter (*Lutra lutra*)	Indirect effects through changes to prey resources	Marine Design Element	Risk of SE – screened-in
Exmoor and Quantocks Oakwoods SAC	91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to that qualifying feature
Exmoor and Quantocks Oakwoods SAC	1308 Barbastelle (*Barbastella barbastellus*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Exmoor and Quantocks	1308 Barbastelle (*Barbastella barbastellus*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Oakwoods SAC				known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Exmoor and Quantocks Oakwoods SAC	1308 Barbastelle (*Barbastella barbastellus*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Exmoor and Quantocks Oakwoods SAC	1323 Bechstein's bat (*Myotis bechsteinii*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Exmoor and Quantocks	1323 Bechstein's bat (*Myotis bechsteinii*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Oakwoods SAC				known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Exmoor and Quantocks Oakwoods SAC	1323 Bechstein's bat (*Myotis bechsteinii*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Exmoor and Quantocks Oakwoods SAC	91E0 Alluvial forests with (*Alnus glutinosa*) and (*Fraxinus excelsior*) (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to that qualifying feature
Exmoor and Quantocks Oakwoods SAC	1355 Otter (*Lutra lutra*)	Indirect effects through changes to prey resources	Marine Design	Risk of SE – screened-in
Exmoor and Quantocks Oakwoods SAC	1355 Otter (*Lutra lutra*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	Risk of SE – screened-in
Exmoor and Quantocks	1355 Otter (*Lutra lutra*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Oakwoods SAC				
Exmoor and Quantocks Oakwoods SAC	1355 Otter (*Lutra lutra*)	Disruption of commuting corridors	Compensatory Measures	Risk of SE – screened-in
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a	S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Fforest y Ddena SAC				the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Fforest y Ddena SAC				the scale of suitable habitat being available and therefore the absence of risk of any effect
Walmore Common Ramsar	Criterion 6: species / populations occurring at levels of international importance, including: Tundra Bewick's swan (*Cygnus columbianus bewickii*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and therefore the absence of risk of any effect
Walmore Common SPA	A037 Bewick's swan (*Cygnus columbianus bewickii*) (non-breeding)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and therefore the absence of risk of any effect
North Somerset and Mendip Bats SAC	H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia);* dry grasslands and scrublands on chalk or limestone	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to that qualifying feature
North Somerset and Mendip Bats SAC	H8310 Caves not open to the public	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to that qualifying feature
North Somerset and Mendip Bats SAC	H9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	soils associated with rocky slopes			alone to that qualifying feature
North Somerset and Mendip Bats SAC	S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
North Somerset and Mendip Bats SAC	S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
North Somerset and Mendip Bats SAC	S1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				absence of risk of any effect
North Somerset and Mendip Bats SAC	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
North Somerset and Mendip Bats SAC	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
North Somerset and Mendip Bats SAC	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				absence of risk of any effect
River Wye / Afon Gwy SAC	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Wye / Afon Gwy SAC	7140 Transition mires and quaking bogs; Very wet mires often identified by an unstable `quaking` surface	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Wye / Afon Gwy SAC	1092 White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Wye / Afon Gwy SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Wye / Afon Gwy SAC	1096 Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Wye / Afon Gwy SAC	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			Severn Estuary SAC.	
River Wye / Afon Gwy SAC	1102 Allis shad (*Alosa alosa*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Wye / Afon Gwy SAC	1103 Twaite shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Wye / Afon Gwy SAC	1106 Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC	Risk of SE – screened-in
River Wye / Afon Gwy SAC	1163 Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Wye / Afon Gwy SAC	1355 Otter (*Lutra lutra*)	Indirect effects through changes to prey resources	Marine element	Risk of SE – screened-in
River Wye / Afon Gwy SAC	1355 Otter (*Lutra lutra*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	Risk of SE – screened-in
River Wye / Afon Gwy SAC	1355 Otter (*Lutra lutra*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Wye / Afon Gwy SAC	1355 Otter (*Lutra lutra*)	Disruption of commuting corridors	Compensatory Measures	Risk of SE – screened-in
Mendip Limestone Grasslands SAC	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mendip Limestone Grasslands SAC	4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mendip Limestone Grasslands SAC	8310 Caves not open to the pubic	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mendip Limestone Grasslands SAC	9180 *Tilio-Acerion* forests of slopes, screes and ravines	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mendip Limestone Grasslands SAC	1304 Greater horseshoe bat (*Rhinolphus ferrumequinum*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Mendip Limestone Grasslands SAC	1304 Greater horseshoe bat (*Rhinolphus ferrumequinum*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Mendip Limestone Grasslands SAC	1304 Greater horseshoe bat (*Rhinolphus ferrumequinum*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Somerset Levels and Moors Ramsar	Criterion 2: supports 17 species of British Red Data Book invertebrates	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Somerset Levels and Moors Ramsar	Criterion 5: waterfowl assemblages of international importance, with peak counts in winter of 97,155 waterfowl	Disturbance and displacement during construction activities	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and	Criterion 5: waterfowl assemblages of international	Permanent modification of bird habitat and permanent displacement of species	Compensatory Measures	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Moors Ramsar	importance, with peak counts in winter of 97,155 waterfowl			
Somerset Levels and Moors Ramsar	Criterion 5: waterfowl assemblages of international importance, with peak counts in winter of 97,155 waterfowl	Indirect: Effects on bird species through changes to water quality	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and Moors Ramsar	Criterion 5: waterfowl assemblages of international importance, with peak counts in winter of 97,155 waterfowl	Indirect: Effects on bird species through changes to water quality	Marine design element	Risk of SE – screened-in
Somerset Levels and Moors Ramsar	Criterion 5: waterfowl assemblages of international importance, with peak counts in winter of 97,155 waterfowl	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Somerset Levels and Moors Ramsar	Criterion 6: species / populations occurring at levels of international importance: Eurasian teal (*Anas crecca*) and Northern lapwing (*Vanellus vanellus*).	Disturbance and displacement during construction activities	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and Moors Ramsar	Criterion 6: species / populations occurring at levels of international importance: Eurasian teal (*Anas crecca*) and Northern lapwing (*Vanellus vanellus*)	Permanent modification of bird habitat and permanent displacement of species	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and Moors Ramsar	Criterion 6: species / populations occurring at levels of international importance: Eurasian teal (*Anas crecca*) and Northern lapwing (*Vanellus vanellus*)	Indirect: Effects on bird species through changes to water quality	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and Moors Ramsar	Criterion 6: species / populations occurring at levels of international importance: Eurasian teal (*Anas crecca*) and Northern lapwing (*Vanellus vanellus*)	Indirect: Effects on bird species through changes to water quality	Marine design element	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Somerset Levels and Moors SPA	A037: Eurasian teal (*Anas crecca*) A052: Bewick's swan (*Cygnus columbianus bewickii*) A140: Golden plover (*Pluvialis apricaria*) A142: Northern lapwing (*Vanellus vanellus*) Waterbird assemblage	Disturbance and displacement during construction activities	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and Moors SPA	A037: Eurasian teal (*Anas crecca*) A052: Bewick's swan (*Cygnus columbianus bewickii*) A140: Golden plover (*Pluvialis apricaria*) A142: Northern lapwing (*Vanellus vanellus*) Waterbird assemblage	Permanent modification of bird habitat and permanent displacement of species	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and Moors SPA	A037: Eurasian teal (*Anas crecca*) A052: Bewick's swan (*Cygnus columbianus bewickii*) A140: Golden plover (*Pluvialis apricaria*) A142: Northern lapwing (*Vanellus vanellus*) Waterbird assemblage	Indirect: Effects on bird species through changes to water quality	Compensatory Measures	Risk of SE – screened-in
Somerset Levels and Moors SPA	A037: Eurasian teal (*Anas crecca*) A052: Bewick's swan (*Cygnus columbianus bewickii*) A140: Golden plover (*Pluvialis apricaria*) A142: Northern lapwing (*Vanellus vanellus*) Waterbird assemblage	Indirect: Effects on bird species through changes to water quality	Marine design element	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Somerset Levels and Moors SPA	A037: Eurasian teal (*Anas crecca*) A052: Bewick's swan (*Cygnus columbianus bewickii*) A140: Golden plover (*Pluvialis apricaria*) A142: Northern lapwing (*Vanellus vanellus*) Waterbird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Usk Bat Sites / Safleodd	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Ystlumod Wysg SAC				the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	7120 Degraded raised bogs still capable of natural regeneration	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	7130 Blanket bogs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	8210 Calcareous rocky slopes with chasmophytic vegetation	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	8310 Caves not open to the public	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	9180 *Tilio-Acerion* forests of slopes, screes and ravines	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Hestercombe House SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Hestercombe House SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Hestercombe House SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley Woodlands SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disturbance (noise, vibration, light) through construction activities	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley Woodlands SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Habitat loss and fragmentation of foraging habitat	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley Woodlands SAC	1303 Lesser horseshoe bat (*Rhinolophus hipposideros*)	Disruption of commuting corridors	Compensatory Measures	No LSE – screened out; due to the distance from known locations of the Project elements and the scale of habitat loss by comparison to

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				the scale of suitable habitat being available and therefore the absence of risk of any effect
Wye Valley Woodlands SAC	9130 *Asperulo-Fagetum* beech forests; beech forests on neutral to rich soils	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Wye Valley Woodlands SAC	9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Wye Valley Woodlands SAC	91J0 *Taxus baccata* woods of the British Isles; yew-dominated woodland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1110 Sandbanks which are slightly covered by sea water all the time	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1140 Mudflats and sandflats not covered by seawater at low tide	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1160 Large shallow inlets and bays	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1310 Salicornia and other annuals colonizing mud and sand	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1103 Twaite shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Carmarthen Bay and Estuaries /	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn	Sources of impact as outlined for fish	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Bae Caerfyrddin ac Aberoedd SAC		Estuary SAC for the marine elements of the Project	qualifying species of the Severn Estuary SAC for the marine elements of the Project	
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1102 Allis shad (*Alosa alosa*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	1355 Otter (*Lutra lutra*)	Indirect effect through changes to prey resources	Marine element	Risk of SE – screened-in
Burry Inlet Ramsar	Criterion 5: waterfowl assemblages of international importance	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Burry Inlet Ramsar	Criterion 6: species / populations occurring at levels of international importance: including Common redshank	No pathways identified	Not applicable	No LSE – there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	(*Tringa totanus tetanus*), Northern pintail (*Anas acuta*), Eurasian oystercatcher (*Haematopus ostralegus ostralegus*), Red knot (*Calidris canutus islandica*), and Northern shoveler (*Anas clypeata*).			alone to the qualifying feature
Exmoor Heaths SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exmoor Heaths SAC	H4010 Northern Atlantic wet heaths with *Erica tetralix*; wet heathland with cross-leaved heath	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exmoor Heaths SAC	H4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exmoor Heaths SAC	H7130 Blanket bogs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exmoor Heaths SAC	H7230 Alkaline fens; calcium-rich springwater-fed fens	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exmoor Heaths SAC	H91A0 Old sessile oak woods with Ilex and Blechnum in the	No pathways identified	Not applicable	No LSE – Screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	British Isles; western acidic oak woodland			impact pathway from the Project alone to the qualifying feature
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	2110 Embryonic shifting dunes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes")	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	2190 Humid dune slacks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	1014 Narrow-mouthed whorl snail (*Vertigo angustior*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	1395 Petalwort (*Petalophyllum ralfsii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Carmarthen Bay Dunes / Twyni Bae Caerfyrddin SAC	1903 Fen orchid (*Liparis loeselii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	Harbour porpoise (*Phocoena phocoena*)	Indirect effects on marine mammals through changes to prey resources.	Marine design element	Risk of SE – screened-in
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	Harbour porpoise (*Phocoena phocoena*)	Indirect effects on marine mammals through changes to water quality (contaminant / nutrient release)	Marine design element	Risk of SE – screened-in
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	Harbour porpoise (*Phocoena phocoena*)	Disturbance and displacement	Compensatory measures	Risk of SE – screened-in
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	Harbour porpoise (*Phocoena phocoena*)	Bioaccumulation	Marine design element	Risk of SE – screened-in
Carmarthen Bay / Bae Caerfyrddin SPA	A065 Common scoter (*Melanitta nigra*)	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Limestone Coast of South West Wales SAC	1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Limestone Coast of South West Wales SAC	2130 Fixed coastal dunes with herbaceous vegetation grey dunes	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Limestone Coast of South West Wales SAC	4030 European dry heaths	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Limestone Coast of South West Wales SAC	6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Limestone Coast of South West Wales SAC	8310 Caves not open to the public	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Limestone Coast of South West Wales SAC	8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Limestone Coast of	1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	No pathways identified	Not applicable	No LSE – screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
South West Wales SAC				impact pathway from the Project alone to the qualifying feature
Limestone Coast of South West Wales SAC	1654 Early gentian (*Gentianella anglica*)	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
Limestone Coast of South West Wales SAC	1395 Petalwort (*Petalophyllum ralfsii*)	No pathways identified	Not applicable	No LSE – screened out; there is no impact pathway from the Project alone to the qualifying feature
River Axe SAC	3260. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; Rivers with floating vegetation often dominated by water-crowfoot	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Axe SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Axe SAC	S1096. Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Axe SAC	S1163. Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Kenfig / Cynffig SAC	2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes")	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Kenfig / Cynffig SAC	2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Kenfig / Cynffig SAC	2190 Humid dune slacks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Kenfig / Cynffig SAC	3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Kenfig / Cynffig SAC	1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Kenfig / Cynffig SAC	1395 Petalwort (*Petalophyllum ralfsii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Kenfig / Cynffig SAC	1903 Fen orchid (*Liparis loeselii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Cardigan Bay / Bae Ceredigion SAC	1110 Sandbanks which are slightly covered by sea water all the time	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Cardigan Bay / Bae Ceredigion SAC	1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Cardigan Bay / Bae Ceredigion SAC	8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Cardigan Bay / Bae Ceredigion SAC	1349 Bottlenose dolphin (*Tursiops truncatus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Cardigan Bay / Bae Ceredigion SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			species of the Severn Estuary SAC for the marine elements of the Project	
Cardigan Bay / Bae Ceredigion SAC	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SA for the marine elements of the Project	Risk of SE – screened-in
Cardigan Bay / Bae Ceredigion SAC	1364 Grey seal (*Halichoerus grypus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
West Wales Marine / Gorllewin Cymru Forol SAC	1351 Harbour porpoise (*Phocoena phocoena*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Sidmouth to West Bay SAC	H1210 Annual vegetation of drift lines	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Sidmouth to West Bay SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Sidmouth to West Bay SAC	H9180 Tilio-Acerion forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lyme Bay and Torbay SAC	H1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lyme Bay and Torbay SAC	H8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afonydd Cleddau / Cleddau Rivers SAC	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afonydd Cleddau / Cleddau Rivers SAC	7110 Active raised bogs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afonydd Cleddau /	91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus*	No pathways identified	Not applicable	No LSE – Screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Cleddau Rivers SAC	*excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)			impact pathway from the Project alone to the qualifying feature
Afonydd Cleddau / Cleddau Rivers SAC	1096 Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afonydd Cleddau / Cleddau Rivers SAC	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Afonydd Cleddau / Cleddau Rivers SAC	1163 Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afonydd Cleddau / Cleddau Rivers SAC	1355 Otter (*Lutra lutra*)	Indirect effect through changes to prey resources	Marine element	Risk of SE – screened-in
Afonydd Cleddau / Cleddau Rivers SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Avon SAC	H3260. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Avon SAC	S1016. Desmoulin`s whorl snail (*Vertigo moulinsiana*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Avon SAC	S1095.Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Avon SAC	S1096. Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Avon SAC	S1106. Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Avon SAC	S1163. Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				impact pathway from the Project alone to the qualifying feature
Chesil and The Fleet SAC	H1150 Coastal lagoons	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil and The Fleet SAC	H1210 Annual vegetation of drift lines	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil and The Fleet SAC	H1220 Perennial vegetation of stony banks; Coastal shingle vegetation outside the reach of waves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil and The Fleet SAC	H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil and The Fleet SAC	H1420 Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	A001 Red-throated diver (*Gavia stellata*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			Severn Estuary SPA	
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1110 Sandbanks which are slightly covered by sea water all the time	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1150 Coastal lagoons	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1160 Large shallow inlets and bays	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1140 Mudflats and sandflats not covered by seawater at low tide	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1310 Salicornia and other annuals colonizing mud and sand	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1349 Bottlenose dolphin (*Tursiops truncatus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC	1364 Grey seal (*Halichoerus grypus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			Bristol Channel Approaches SAC	
Pembrokeshire Marine / Sir Benfro Forol SAC	1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	1160 Large shallow inlets and bays	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	1110 Sandbanks which are slightly covered by sea water all the time	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	1140 Mudflats and sandflats not covered by seawater at low tide	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	1150 Coastal lagoons	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Pembrokeshire Marine / Sir Benfro Forol SAC	1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	1364 Grey seal (*Halichoerus grypus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Pembrokeshire Marine / Sir Benfro Forol SAC	1441 Shore dock (*Rumex rupestris*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pembrokeshire Marine / Sir Benfro Forol SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC from the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC from the marine elements of the Project	Risk of SE – screened-in
Pembrokeshire Marine / Sir	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn	Sources of impact as outlined for fish	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Benfro Forol SAC		Estuary SAC from the marine elements of the Project	qualifying species of the Severn Estuary SAC from the marine elements of the Project	
Pembrokeshire Marine / Sir Benfro Forol SAC	1102 Allis shad (*Alosa alosa*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC from the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC from the marine elements of the Project	Risk of SE – screened-in
Pembrokeshire Marine / Sir Benfro Forol SAC	1103 Twaite shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC from the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC from the marine elements of the Project	Risk of SE – screened-in
Pembrokeshire Marine / Sir Benfro Forol SAC	1355 Otter (*Lutra lutra*)	Indirect effect through changes to prey resources	Marine element	Risk of SE – screened-in
Exe Estuary Ramsar	Criterion 5: waterfowl assemblages of international importance with peak counts in winter of 20,263 waterfowl.	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Exe Estuary Ramsar	Criterion 6 – species / populations occurring at levels of international importance, including: Dark-bellied brent goose (*Branta bernicla bernicla*) and Black-tailed	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	godwit (*Limosa limosa islandica*)			
Exe Estuary SPA	A007 Slavonian grebe (*Podiceps auratus*) (non-breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Exe Estuary SPA	A046a Dark-bellied brent goose (*Branta bernicla bernicla*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exe Estuary SPA	A130 Eurasian oystercatcher (*Haematopus ostralegus*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exe Estuary SPA	A132 Pied avocet (*Recurvirostra avosetta*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exe Estuary SPA	A141 Grey plover (*Pluvialis squatarola*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exe Estuary SPA	A149 Dunlin (*Calidris alpina alpina*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Exe Estuary SPA	A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Exe Estuary SPA	Waterbird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Chesil Beach and the Fleet Ramsar	Criterion 2: scarce wetland plants as well as ten nationally scarce wetland animals. Chesil Bank is one of the most important UK sites for shingle habitats and species	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil Beach and the Fleet Ramsar	Criterion 3: The site is the largest barrier-built saline lagoon in the UK, and has the greatest diversity of habitats and of biota	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil Beach and the Fleet Ramsar	Criterion 4: The site is important for a number of species at a critical stage in their life cycle including post-larval and juvenile bass (*Dicentrarchus labrax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil Beach and the Fleet Ramsar	Criterion 6: species / populations occurring at levels of international importance, including: Dark-bellied brent goose (*Branta bernicla bernicla*), and Mute swan (*Cygnus olor*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil Beach and the Fleet Ramsar	Criterion 8: The site is important as a nursery for bass (*Dicentrarchus labra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Chesil Beach and the Fleet SPA	A050 Eurasian wigeon (*Anas Penelope*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Chesil Beach and the Fleet SPA	A195 Little tern (*Sterna albifrons*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
River Lambourn SAC	H3260. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Lambourn SAC	S1096. Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Lambourn SAC	S1163. Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dawlish Warren SAC	H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with marram	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Dawlish Warren SAC	H2130 Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dawlish Warren SAC	H2190 Humid dune slacks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dawlish Warren SAC	S1395 Petalwort (*Petalophyllum ralfsii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Skomer, Skokholm and the Seas off Pembrokeshire SPA	European storm petrel (*Hydrobates pelagicus*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Skomer, Skokholm and the Seas off Pembrokeshire SPA	A346 Red-billed chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Skomer, Skokholm and the Seas off Pembrokeshire SPA	A222 Short-eared owl (*Asio flammeus*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Skomer, Skokholm and the Seas off	A013 Manx shearwater (*Puffinus puffinus*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Pembrokeshire SPA			qualifying species of the Severn Estuary SPA	
Skomer, Skokholm and the Seas off Pembrokeshire SPA	Atlantic puffin (*Fratercula arctica*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Skomer, Skokholm and the Seas off Pembrokeshire SPA	Lesser black-backed gull (*Larus fuscus*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Skomer, Skokholm and the Seas off Pembrokeshire SPA	Seabird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Isle of Portland to Studland Cliffs SAC	H1210 Annual vegetation of drift lines	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isle of Portland to Studland Cliffs SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isle of Portland to Studland Cliffs SAC	H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*); dry grasslands	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	and scrublands on chalk or limestone			alone to the qualifying feature
Isle of Portland to Studland Cliffs SAC	S1654 Early gentian (*Gentianella anglica*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Hams SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Hams SAC	H4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Hams SAC	H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Hams SAC	H8310 Caves not open to the public	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Hams SAC	H9180 *Tilio-Acerion* forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
South Hams SAC	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
St David's / Ty Ddewi SAC	1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
St David's / Ty Ddewi SAC	4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
St David's / Ty Ddewi SAC	1831 Floating water-plantain (*Luronium natans*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Studland to Portland SAC	H1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Dee and Bala Lake / Afon Dyfrdwy	S1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn	Sources of impact as outlined for fish	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
a Llyn Tegid SAC		Estuary SAC for the marine elements of the Project	qualifying species of the Severn Estuary SAC for the marine elements of the Project	
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	S1096 Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	S1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	S1106 Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	S1163 Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Dee and Bala Lake /	S1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Afon Dyfrdwy a Llyn Tegid SAC				impact pathway from the Project alone to the qualifying feature
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	S1831 Floating water-plantain (*Luronium natans*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dartmoor SAC	H4010 Northern Atlantic wet heaths with *Erica tetralix*; wet heathland with cross-leaved heath	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dartmoor SAC	H4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dartmoor SAC	H7130 Blanket bogs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dartmoor SAC	H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles; western acidic oak woodland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dartmoor SAC	S1044 Southern damselfly (*Coenagrion mercuriale*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Dartmoor SAC	S1106 Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project.	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project.	Risk of SE – screened-in
Dartmoor SAC	S1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Braunton Burrows SAC	H1140 Mudflats and sandflats not covered by seawater at low tide; intertidal mudflats and sandflats	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Braunton Burrows SAC	H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); shifting dunes with marram	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Braunton Burrows SAC	H2130 Fixed dunes with herbaceous vegetation ("grey dunes"); dune grassland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Braunton Burrows SAC	H2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*); dunes with creeping willow	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Braunton Burrows SAC	H2190 Humid dune slacks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Braunton Burrows SAC	S1395 Petalwort (*Petalophyllum ralfsii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H2110 Embryonic shifting dunes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H2120 Shifting dunes along the shoreline with Ammophila arenaria ("white dunes"); shifting dunes with marram	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*); coastal dune heathland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H2190 Humid dune slacks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham)	H3110 Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*); nutrient-poor shallow	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
and Studland Dunes SAC	waters with aquatic vegetation on sandy plains			alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H4010 Northern Atlantic wet heaths with Erica tetralix; wet heathland with cross-leaved heath	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H4020 Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*; wet heathland with Dorset heath and cross-leaved heath	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*); purple moor-grass meadows	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H7150 Depressions on peat substrates of the Rhynchosporion	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; calcium-rich fen dominated by great fen sedge (saw sedge)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and	H7230 Alkaline fens; calcium-rich springwater-fed fens	No pathways identified	Not applicable	No LSE – Screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Wareham) and Studland Dunes SAC				impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H9190 Old acidophilous oak woods with *Quercus robur* on sandy plains; dry oak-dominated woodland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	H91D0 Bog woodland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	S1044 Southern damselfly (*Coenagrion mercurial*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC	S1166 Great crested newt (*Triturus cristatus*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Poole Harbour Ramsar	Criterion 1: The site is the best and largest example of a bar-built estuary with lagoonal characteristics (a natural harbour) in Britain.	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Poole Harbour Ramsar	Criterion 2: The site supports two species of nationally rare plant and one nationally rare alga. There are at least three British Red data book invertebrate species.	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Poole Harbour Ramsar	Criterion 3: The site includes examples of natural habitat types of community interest - Mediterranean and thermo Atlantic halophilous scrubs, in this case dominated by *Suaeda vera*, as well as calcareous fens with *Cladium mariscus*. Transitions from saltmarsh through to peatland mires are of exceptional conservation importance as few such examples remain in Britain. The site supports nationally important populations of breeding waterfowl including Common tern (*Sterna hirundo*) and Mediterranean gull (*Larus melanocephalus*). Over winter the site also supports a nationally important population of Avocet (*Recurvirostra avosetta*).	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Poole Harbour Ramsar	Criterion 5: waterfowl assemblages of international importance with peak counts in winter of 24,709 waterfowl	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Poole Harbour Ramsar	Criterion 6: species / populations occurring at levels of international importance including: Common shelduck (*Tadorna tadorna*), Black-tailed godwit (*Limosa limosa islandica*) and Pied avocet (*Recurvirostra avosetta*).	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Poole Harbour SPA	A026 Little egret (*Egretta garzetta*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Poole Harbour SPA	A034 Eurasian spoonbill (*Platalea leucorodia*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Poole Harbour SPA	A048 Common shelduck (*Tadorna tadorna*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Poole Harbour SPA	A132 Pied avocet (*Recurvirostra avosetta*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Poole Harbour SPA	A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Poole Harbour SPA	A176 Mediterranean gull (*Larus melanocephalus*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Poole Harbour SPA	A191 Sandwich tern (*Sterna sandvicensis*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Poole Harbour SPA	A193 Common tern (*Sterna hirundo*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Poole Harbour SPA	Waterbird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Solent and Dorset Coast SPA	A191 Sandwich tern (*Sterna sandvicensis*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Solent and Dorset Coast SPA	A193 Common tern (*Sterna hirundo*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Solent and Dorset Coast SPA	A195 Little tern (*Sternula albifrons*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
River Mease SAC	H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Mease SAC	S1092 White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Mease SAC	S1149 Spined loach (*Cobitis taenia*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Mease SAC	S1163 Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Mease SAC	S1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lundy SAC	H1110 Sandbanks which are slightly covered by sea water all the time; subtidal sandbanks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lundy SAC	H1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Lundy SAC	H8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Lundy SAC	S1364 Grey seal (*Halichoerus grypus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Tintagel-Marsland-Clovelly Coast SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Tintagel-Marsland-Clovelly Coast SAC	H4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Tintagel-Marsland-Clovelly Coast SAC	H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles; western acidic oak woodland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Pasturefields Salt Marsh SAC	H1340 Inland salt meadows; inland saltmarshes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Upper Nene Valley Gravel Pits SPA	A021 Great bittern (*Botaurus stellaris*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Upper Nene Valley Gravel Pits SPA	A051 Gadwall (*Anas strepera*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Upper Nene Valley Gravel Pits SPA	A140 European golden plover (*Pluvialis apricaria*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Upper Nene Valley Gravel Pits SPA	Waterbird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
St Albans Head to Durlston Head SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
St Albans Head to Durlston Head SAC	H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*) (important orchid sites); dry grasslands and scrublands on chalk or limestone (important orchid sites)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
St Albans Head to Durlston Head SAC	S1304 Greater horseshoe bat (*Rhinolophus ferrumequinum*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
St Albans Head to Durlston Head SAC	S1654 Early gentian (*Gentianella anglica*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afon Eden - Cors Goch Trawsfynydd SAC	7110 Active raised bogs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afon Eden - Cors Goch Trawsfynydd SAC	1029 Freshwater pearl mussel	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afon Eden - Cors Goch Trawsfynydd SAC	1831 Floating water-plantain	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Afon Eden - Cors Goch Trawsfynydd SAC	1106 Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project.	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project.	Risk of SE – screened-in
Afon Eden - Cors Goch Trawsfynydd SAC	1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Morfa Harlech a Morfa Dyffryn SAC	2110 Embryonic shifting dunes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Morfa Harlech a Morfa Dyffryn SAC	2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Morfa Harlech a Morfa Dyffryn SAC	2170 Dunes with *Salix repens* ssp. argentea (*Salicion arenariae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Morfa Harlech a Morfa Dyffryn SAC	2190 Humid dune slacks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Morfa Harlech a Morfa Dyffryn SAC	1395 Petalwort (*Petalophyllum ralfsii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Glannau Aberdaron ac Ynys Enlli / Aberdaron Coast and Bardsey Island SPA	A013 Manx shearwater (*Puffinus puffinus*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Glannau Aberdaron ac Ynys Enlli /	A346 Red-billed chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Aberdaron Coast and Bardsey Island SPA				from the Project alone to the qualifying feature
Upper Nene Valley Gravel Pits Ramsar	Criterion 5: regularly supports 20,000 or more waterbirds: in the non-breeding season, the site regularly supports 23,821 individual waterbirds	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Upper Nene Valley Gravel Pits Ramsar	Criterion 6: species / populations occurring at levels of international importance including: Mute swan (*Cygnus olor*), and Gadwall (*Anas strepera*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Grassholm SPA	A016 Northern gannet (*Morus bassanus*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Clogwyni Pen Llyn / Seacliffs of Lleyn SAC	1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Itchen SAC	H3260. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho Batrachion* vegetation; rivers with floating vegetation often dominated by water-crowfoot	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Itchen SAC	S1044. Southern damselfly (*Coenagrion mercurial*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
River Itchen SAC	S1092. White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Itchen SAC	S1096. Brook lamprey (*Lampetra planer*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Itchen SAC	S1106. Atlantic salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Itchen SAC	S1163. Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Itchen SAC	S1355. Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A048 Common shelduck (*Tadorna tadorna*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
The Dee Estuary SPA	A052 Eurasian teal (*Anas crecca*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A054 Northern pintail (*Anas acuta*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A130 Eurasian oystercatcher (*Haematopus ostralegus*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A141 Grey plover (*Pluvialis squatarola*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A143 Red knot (*Calidris canutus*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A149 Dunlin (*Calidris alpina alpina*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
The Dee Estuary SPA	A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A157 Bar-tailed godwit (*Limosa lapponica*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A160 Eurasian curlew (*Numenius arquata*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A162 Common redshank (*Tringa tetanus*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
The Dee Estuary SPA	A191 Sandwich tern (*Sterna sandvicensis*) (non-breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
The Dee Estuary SPA	A193 Common tern (*Sterna hirundo*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
The Dee Estuary SPA	A195 Little tern (*Sterna albifrons*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
The Dee Estuary SPA	Waterbird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Dee Estuary / Aber Dyfrdwy SAC	H1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H1140 Mudflats and sandflats not covered by seawater at low tide; intertidal mudflats and sandflats	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H1210 Annual vegetation of drift lines	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts; vegetated sea cliffs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H1310 Salicornia and other annuals colonising mud and sand; glasswort and other annuals colonising mud and sand	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Dee Estuary / Aber Dyfrdwy SAC	H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); atlantic salt meadows	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H2110 Embryonic shifting dunes; shifting dunes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); shifting dunes with marram	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H2130 Fixed dunes with herbaceous vegetation ("grey dunes"); dune grassland	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	H2190 Humid dune slacks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary / Aber Dyfrdwy SAC	S1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Dee Estuary / Aber Dyfrdwy SAC	S1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Dee Estuary / Aber Dyfrdwy SAC	S1395 Petalwort (*Petalophyllum ralfsii*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary Ramsar	Criterion 1: Extensive intertidal mud and sand flats (20 km by 9 km) with large expanses of saltmarsh towards the head of the estuary.	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary Ramsar	Criterion 2: it supports breeding colonies of the vulnerable Natterjack Toad (*Epidalea calamita*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Dee Estuary Ramsar	Criterion 5: bird assemblages of international importance with peak counts in winter of 120,726 waterbirds.	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Dee Estuary Ramsar	Criterion 6: species / populations occurring at levels of international importance, including: Redshank (*Tringa tetanus*); Teal (*Anas crecca*); Shelduck (*Tadorna tadorna*); Oystercatcher (*Haematopus ostralegus*); Curlew (*Numenius arquata*); Pintail (*Anas acuta*);	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	Grey plover (*Pluvialis squatarola*); Knot (*Calidris canutus islandic*); Dunlin (*Calidris alpina alpina*); Black-tailed godwit (*Limosa limosa islandica*); Bar-tailed godwit (*Limosa lapponica*); and Redshank (*Tringa tetanus*)			
Plymouth Sound and Estuaries SAC	H1110 Sandbanks which are slightly covered by sea water all the time; subtidal sandbanks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Plymouth Sound and Estuaries SAC	H1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Plymouth Sound and Estuaries SAC	H1140 Mudflats and sandflats not covered by seawater at low tide; intertidal mudflats and sandflats	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Plymouth Sound and Estuaries SAC	H1160 Large shallow inlets and bays	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Plymouth Sound and Estuaries SAC	H1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Plymouth Sound and Estuaries SAC	H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Plymouth Sound and Estuaries SAC	S1102 Allis shad (*Alosa alosa*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Plymouth Sound and Estuaries SAC	S1441 Shore dock (*Rumex rupestris*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent and Southampton Water SPA	A046a Dark-bellied brent goose (*Branta bernicla bernicla*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent and Southampton Water SPA	A052 Eurasian teal (*Anas crecca*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent and Southampton Water SPA	A137 Ringed plover (*Charadrius hiaticula*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Solent \nx Southampton Water SPA	A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent and Southampton Water SPA	A176 Mediterranean gull (*Larus melanocephalus*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Solent and Southampton Water SPA	A191 Sandwich tern (*Sterna sandvicensis*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Solent and Southampton Water SPA	A192 Roseate tern (*Sterna dougallii*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Solent and Southampton Water SPA	A193 Common tern (*Sterna hirundo*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Solent and Southampton Water SPA	A195 Little tern (*Sterna albifrons*) (breeding)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Solent and Southampton Water SPA	Waterbird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Solent Maritime SAC	H1110 Sandbanks which are slightly covered by sea water all the time	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	H1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	H1150 Coastal lagoons	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	H1210 Annual vegetation of drift lines	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying
Solent Maritime SAC	H1220 Perennial vegetation of stony banks; coastal shingle vegetation outside the reach of waves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Solent Maritime SAC	H1310 Salicornia and other annuals colonising mud and sand; glasswort and other annuals colonising mud and sand	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	H1320 Spartina swards (*Spartinion maritimae*); cord-grass swards	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	H2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with marram	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent Maritime SAC	S1016 Desmoulin`s whorl snail (*Vertigo moulinsiana*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Start Point to Plymouth Sound and Eddystone SAC	H1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent and Southampton Water Ramsar	Criterion 1: The site is one of the few major sheltered channels between a substantial island and mainland in	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs			alone to the qualifying feature
Solent and Southampton Water Ramsar	Criterion 2: The site supports an important assemblage of rare plants and invertebrates. At least 33 British Red Data Book invertebrates and at least eight British Red Data Book plants are represented on site	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent and Southampton Water Ramsar	Criterion 5: waterfowl assemblages of international importance with peak counts in winter of 51,343 waterfowl.	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Solent and Southampton Water Ramsar	Criterion 6: species / populations occurring at levels of international importance, including: Ringed plover (*Charadrius hiaticula*), Dark-bellied brent goose (*Branta bernicla bernicla*), Eurasian teal (*Anas crecca*) and Black-tailed godwit (*Limosa limosa islandica*)	No pathways identified	Not applicable	LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Devon Shore Dock SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
South Devon Shore Dock SAC	S1441 Shore dock (*Rumex rupestris*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Wight Maritime SAC	H1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Wight Maritime SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
South Wight Maritime SAC	H8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Solent and Isle of Wight Lagoons SAC	H1150 Coastal lagoons	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mersey Estuary SPA	A048 Common shelduck (*Tadorna tadorna*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mersey Estuary SPA	A052 Eurasian teal (*Anas crecca*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Mersey Estuary SPA	A054 Northern pintail (*Anas acuta*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mersey Estuary SPA	A140 European golden plover (*Pluvialis apricaria*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mersey Estuary SPA	A149 Dunlin (*Calidris alpina alpina*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mersey Estuary SPA	A156 Black-tailed godwit (*Limosa limosa islandica*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mersey Estuary SPA	A162 Common redshank (*Tringa tetanus*) (non-breeding)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Mersey Estuary SPA	Waterbird assemblage	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in
Mersey Estuary Ramsar	Criterion 5: waterfowl assemblages of international importance, with peak counts in winter of 89,576	Indirect: effects on piscivorous (fish eating) birds through changes to prey resources	Marine design element	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Mersey Estuary Ramsar	Criterion 6: species / populations occurring at levels of international importance, including: Common shelduck (*Tadorna tadorna*); Black-tailed godwit (*Limosa limosa islandica*); Common redshank (*Tringa totanus tetanus*); Eurasian teal (*Anas crecca*); Northern pintail (*Anas acuta*); and Dunlin (*Calidris alpina alpina*).	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isle of Wight Downs SAC	H1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isle of Wight Downs SAC	H4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isle of Wight Downs SAC	H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*); dry grasslands and scrublands on chalk or limestone	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isle of Wight Downs SAC	S1654 Early gentian (*Gentianella anglica*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	H4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Peak District Dales SAC	H6130 Calaminarian grasslands of the Violetalia calaminariae; grasslands on soils rich in heavy metals	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco Brometalia*); dry grasslands and scrublands on chalk or limestone	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	H7230 Alkaline fens; calcium-rich springwater-fed fens	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	H8120 Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*); base rich scree	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	H8210 Calcareous rocky slopes with chasmophytic vegetation; plants in crevices in base-rich rocks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	H9180 Tilio-Acerion forests of slopes, screes and ravines; mixed woodland on base-rich soils associated with rocky slopes	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Peak District Dales SAC	S1092 White-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	S1096 Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Peak District Dales SAC	S1163 Bullhead (*Cottus gobio*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1029 Freshwater Pearl Mussel (*Margaritifera margaritifera*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1092 White-clawed Crayfish (*Austropotamobius pallipes*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1095 Sea Lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Blackwater River (Cork / Waterford) SAC	1096 Brook Lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1099 River Lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Blackwater River (Cork / Waterford) SAC	1103 Twaite Shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Blackwater River (Cork / Waterford) SAC	1106 Atlantic Salmon (*Salmo salar*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Blackwater River (Cork / Waterford) SAC	1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1140 Mudflats and sandflats not covered by seawater at low tide	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1220 Perennial vegetation of stony banks	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1310 Salicornia and other annuals colonizing mud and sand	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	1410 Mediterranean salt meadows (*Juncetalia maritimi*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork /	1421 Killarney Fern (*Trichomanes speciosum*)	No pathways identified	Not applicable	No LSE – Screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Waterford) SAC				impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blackwater River (Cork / Waterford) SAC	91J0 *Taxus baccata woods of the British Isles	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1016 Desmoulin's whorl snail (*Vertigo moulinsiana*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1029 Freshwater pearl mussel (*Margaritifera margaritifera*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
River Barrow and River Nore SAC	1092 White-clawed crayfish (*Austropotamobius pallipes*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1095 Sea lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Barrow and River Nore SAC	1096 Brook lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1099 River lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Barrow and River Nore SAC	1103 Twaite shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			elements of the Project	
River Barrow and River Nore SAC	1106 Atlantic salmon (*Salmo salar*) (only in fresh water)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
River Barrow and River Nore SAC	1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1140 Mudflats and sandflats not covered by seawater at low tide	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1310 Salicornia and other annuals colonizing mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	1410 Mediterranean salt meadows (*Juncetalia maritimi*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
River Barrow and River Nore SAC	1421 Killarney fern (*Trichomanes speciosum*) 1990 Nore freshwater pearl mussel (*Margaritifera durrovensis*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	7220 * Petrifying springs with tufa formation (*Cratoneurion*) 91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
River Barrow and River Nore SAC	91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	1029 Freshwater Pearl Mussel (*Margaritifera margaritifera*)	No pathways identified	Not applicable	No LSE – Screened out; there is no

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	1095 Sea Lamprey (*Petromyzon marinus*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Slaney River Valley SAC	1096 Brook Lamprey (*Lampetra planeri*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	1099 River Lamprey (*Lampetra fluviatilis*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Slaney River Valley SAC	1103 Twaite Shad (*Alosa fallax*)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Slaney River Valley SAC	1106 Atlantic Salmon (*Salmo salar*) (only in fresh water)	Impact pathways as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Sources of impact as outlined for fish qualifying species of the Severn Estuary SAC for the marine elements of the Project	Risk of SE – screened-in
Slaney River Valley SAC	1130 Estuaries	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	1140 Mudflats and sandflats not covered by seawater at low tide	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	1365 Harbour Seal (*Phoca vitulina*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			Bristol Channel Approaches SAC	
Slaney River Valley SAC	3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Slaney River Valley SAC	91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae, Salicion albae*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
North Anglesey Marine / Gogledd Môn Forol MPA / SAC	1351 Harbour porpoise (*Phocoena phocoena*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Isles of Scilly Complex SAC	H1110 Sandbanks which are slightly covered by sea water all the time	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isles of Scilly Complex SAC	H1140 Mudflats and sandflats not covered by seawater at low	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	tide; Intertidal mudflats and sandflats			from the Project alone to the qualifying feature
Isles of Scilly Complex SAC	H1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Isles of Scilly Complex SAC	S1364 Grey seal (*Halichoerus grypus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Isles of Scilly Complex SAC	S1441 Shore dock (*Rumex rupestris*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
North Channel SAC	1351 Harbour porpoise (*Phocoena phocoena*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Rockabill to Dalkey Island SAC	1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Rockabill to Dalkey Island SAC	1351 Harbour porpoise (*Phocoena phocoena*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Roaringwater Bay and Islands SAC	1160 Large shallow inlets and bays	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Roaringwater Bay and Islands SAC	1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Roaringwater Bay and Islands SAC	1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Roaringwater Bay and Islands SAC	1351 Harbour porpoise (*Phocoena phocoena*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Roaringwater Bay and Islands SAC	1355 Otter (*Lutra lutra*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				from the Project alone to the qualifying feature
Roaringwater Bay and Islands SAC	1364 Grey seal (*Halichoerus grypus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Roaringwater Bay and Islands SAC	4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Roaringwater Bay and Islands SAC	8330 Submerged or partly submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blasket Islands SAC	1170 Reefs	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blasket Islands SAC	1230 Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blasket Islands SAC	1351 Harbour porpoise (*Phocoena phocoena*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			marine mammal qualifying features of the Bristol Channel Approaches SAC	
Blasket Islands SAC	1364 Grey seal (*Halichoerus grypus*)	Impact pathways as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Sources of impact as outlined for marine mammal qualifying features of the Bristol Channel Approaches SAC	Risk of SE – screened-in
Blasket Islands SAC	4030 European dry heaths	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blasket Islands SAC	8330 Submerged or partially submerged sea caves	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Saltee Islands SPA	Piscivorous bird species: A009 *Fulmar Fulmarus glacialis* breeding; A016 *Gannet Morus bassanus* breeding; A018 Shag *Phalacrocorax aristotelis* breeding; A188 Kittiwake *Rissa tridactyla* breeding; A199 Guillemot *Uria aalge* breeding; A200 Razorbill *Alca torda* breeding; A204 Puffin *Fratercula arctica* breeding	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SP	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Lambay Island SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A017 *Cormorant Phalacrocorax carbo*; A018 Shag *Phalacrocorax aristotelis*; A183 Lesser Black-backed Gull *Larus fuscus*; A184 Herring Gull *Larus argentatus*; A188 Kittiwake *Rissa tridactyla*; A199 Guillemot *Uria aalge*; A200 Razorbill *Alca torda*; A204 Puffin *Fratercula arctica*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA.	Risk of SE – screened-in
Lambay Island SPA	A043 Greylag Goose (*Anser anser*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Copeland Islands SPA	Piscivorous bird species: A013 Manx shearwater (*Puffinus puffinus*); Artic Tern (*Sterna paradisaea*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Cliffs of Moher SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A188 Kittiwake *Rissa tridactyla*; A199 Guillemot *Uria aalge*; A200 Razorbill *Alca torda*; A204 Puffin *Fratercula arctica*;	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Cliffs of Moher SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Beara Peninsula SPA	A009 Fulmar (*Fulmarus glacialis*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
			qualifying species of the Severn Estuary SPA	
Beara Peninsula SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Kerry Head SPA	A009 Fulmar (*Fulmarus glacialis*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Kerry Head SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Deenish Island and Scariff Island SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A013 Manx Shearwater *Puffinus puffinus*; A014 Storm Petrel *Hydrobates pelagicus*; A183 Lesser Black-backed Gull *Larus fuscus*; A194 Arctic Tern *Sterna paradisaea*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Iveragh Peninsula SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A188 Kittiwake *Rissa tridactyla*; A199 Guillemot *Uria aalge*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Iveragh Peninsula SPA	A103 Peregrine (*Falco peregrinus*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Iveragh Peninsula SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Puffin Island SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A013 Manx Shearwater *Puffinus puffinus*; A014 Storm Petrel *Hydrobates pelagicus*; A183 Lesser Black-backed Gull *Larus fuscus*; A200 Razorbill *Alca torda*; A204 Puffin *Fratercula arctica*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Skelligs SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A013 Manx Shearwater *Puffinus puffinus*; A014 Storm Petrel *Hydrobates pelagicus*; A016 Gannet *Morus bassanus*; A188 Kittiwake *Rissa tridactyla*; A199 Guillemot *Uria aalge*; A204 Puffin *Fratercula arctica*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Dingle Peninsula SPA	A009 Fulmar (*Fulmarus glacialis*)	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Dingle Peninsula SPA	A103 Peregrine (*Falco peregrinus*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
				alone to the qualifying feature
Dingle Peninsula SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
West Donegal Coast SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A017 Cormorant *Phalacrocorax carbo*; A018 Shag *Phalacrocorax aristotelis*; A184 Herring Gull *Larus argentatus*; A188 Kittiwake *Rissa tridactyla*; A200 Razorbill *Alca torda*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
West Donegal Coast SPA	A103 Peregrine (*Falco peregrinus*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
West Donegal Coast SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Blasket Islands SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A013 Manx Shearwater *Puffinus puffinus*; A014 Storm Petrel *Hydrobates pelagicus*; A018 Shag *Phalacrocorax aristotelis*; A183 Lesser Black-backed Gull *Larus fuscus*; A184 Herring Gull *Larus argentatus*; A188 Kittiwake *Rissa tridactyla*; A194 Arctic Tern *Sterna paradisaea*; A200	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
	Razorbill *Alca torda*; A204 Puffin *Fratercula arctica*			
Blasket Islands SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Horn Head to Fanad Head SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A017 Cormorant *Phalacrocorax carbo*; A018 Shag *Phalacrocorax aristotelis*; A188 Kittiwake *Rissa tridactyla*; A199 Guillemot *Uria aalge*; A200 Razorbill *Alca torda*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Horn Head to Fanad Head SPA	A045 Barnacle Goose (*Branta leucopsis*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Horn Head to Fanad Head SPA	A103 Peregrine (*Falco peregrinus*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Horn Head to Fanad Head SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Horn Head to Fanad Head SPA	A395 Greenland White-fronted Goose (*Anser albifrons flavirostris*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Clare Island SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A018 Shag *Phalacrocorax aristotelis*; A182 Common Gull *Larus canus*; A188 Kittiwake *Rissa tridactyla*; A199 Guillemot *Uria aalge*; A200 Razorbill *Alca torda*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Clare Island SPA	A346 Chough (*Pyrrhocorax pyrrhocorax*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
High Island, Inishshark and Davillaun SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A194 Arctic Tern *Sterna paradisaea*;	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
High Island, Inishshark and Davillaun SPA	A045 Barnacle Goose (*Branta leucopsis*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature
Tory Island SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A200 Razorbill *Alca torda*; A204 Puffin *Fratercula arctica*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Tory Island SPA	A122 Corncrake (*Crex crex*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

Designated site	Qualifying feature	Impact pathway(s), if any	Source of impact pathway(s), if any	No LSE (screened out) / Risk of SE (screened-in)
Duvillaun Islands SPA	Piscivorous bird species: A009 Fulmar *Fulmarus glacialis*; A014 Storm Petrel *Hydrobates pelagicus*	Impact pathways as outlined for bird qualifying species of the Severn Estuary SPA	Sources of impact as outlined for bird qualifying species of the Severn Estuary SPA	Risk of SE – screened-in
Duvillaun Islands SPA	A045 Barnacle Goose (*Branta leucopsis*)	No pathways identified	Not applicable	No LSE – Screened out; there is no impact pathway from the Project alone to the qualifying feature

8.6.8 As outlined above, there are pathways in relation to qualifying features of a number of European / Ramsar sites for which it has been determined that LSE cannot be ruled out. These pathways and sites (and the related listed qualifying features) are therefore taken through to HRA Stage 2: AA (**Section 9**).

8.7 Screening outcomes in relation to LSE of the Project 'in combination with other plans or projects'

8.7.1 For this pre-application consultation version of this HRA Report a high-level and precautionary approach has been taken to the consideration of in-combination effect assessment for the purposes of screening. There will be further consideration given to this, in conjunction with NE and NRW where possible, in preparing the assessment that will accompany the formal DCO Material Change application.

8.7.2 The qualifying features and impact pathways in the above screening table that are screened-in on a Project alone basis are taken through to the next stage of AA in this HRA Report (and therefore, in respect of these, there is no need to carry out an in-combination assessment to check if an AA is needed). At the AA stage in this HRA Report further consideration is given to the potential for in combination effects with other plans and projects.

8.7.3 There are other qualifying features and impact pathways which have been screened out in the above screening table and therefore need not be subjected to an AA on a Project alone basis. For the purposes of preparing the HRA Report to accompany the DCO Material Change application these judgments will be revisited and where appropriate made subject to an in-combination screening assessment to address any potential in combination effects with other plans or projects.

8.7.4 There are two key reasons why no sites have been screened-in on the basis of in-combination effects at this stage, and why it is also considered unlikely that, in due course, further sites will be screened-in beyond those identified in Table 8-3, having regard to potential in-combination effects.

8.7.5 First the reasons given for screening out sites (see Section 8.6.3 above) reflect a highly precautionary approach with the result that any effect of the Project with any potential at all to act in combination with another plan or project has automatically already been screened-in on a Project alone basis so as to require an AA, where further consideration to in combination effects with other plans and project is then given. This means that, in the case of those sites which have been screened out on a Project alone basis, there is no effect from the Project with which an effect from another plan or project could potentially combine.

8.7.6 Secondly, by comparison with the Secretary of States's 2013 DCO HRA (which used a ‘distance ZOI approach, as is used in this HRA Report, to scope in the designated sites for consideration at screening and screened-in only 9 European / Ramsar sites), this HRA Report's screening assessment has resulted in the screening in of 39 such sites for AA as a result of Project alone impact pathways (leaving aside the pathways relating to the Project's proposed compensatory measures which would not have been considered in 2013).

9 HRA STAGE 2: SHADOW APPROPRIATE ASSESSMENT

9.1 Introduction

9.1.1 The following sections consider the screened-in aspects of the Project and pathways and related qualifying features of relevant European / Ramsar sites which require Stage 2 AA since it has not been possible to exclude them pursuant to the Stage 1 Screening assessment. This shadow AA therefore considers the rows in Table 8-3 which are shaded red.

9.2 Shadow AA of the Project

Marine design element of the Project

9.2.1 The marine design element of the Project considered in this shadow AA is the removal from the 2013 DCO of the requirement to fit and operate an AFD system. An AFD system would use sound to repel hearing-sensitive fish species, such as herring, sprat and shad, as well as moderately hearing-sensitive fish, including cod and whiting, from the CWS intake head. Accordingly, removal of the requirement to fit an AFD system has the potential to have a direct effect only on fish as a result of entrapment (impingement and entrainment). If effects on fish populations were to result from the removal of the requirement to fit an AFD system, then this could potentially result in secondary or indirect effects on piscivorous fish species, piscivorous bird species and marine mammals. Further, there may be indirect effects on qualifying habitats and species associated with removal of the requirement to fit an AFD system through changes to water quality arising from changes in the levels of dead / decaying fish matter released through the FRR system, leading to changes in the levels of contaminants and / or nutrients, or through changes in dissolved oxygen levels.

9.2.2 The text below details the current results of data analysis that have been used to determine the effects on fish and other ecological receptors via fish impingement from the removal of the requirement to fit an AFD system and the overall entrapment effects. As noted above, the evidence base has been developed following the collection and analysis of fish impingement data at HPB through the RIMP and CIMP. This HRA Report presents the current evidence base which includes drawing on the following sources:

- The Environment Agency's Appropriate Assessment of the application to vary the WDA Permit for Hinkley Point C (13 November 2020)[112];
- The Removal of Acoustic Fish Deterrent Conditions from WDA Permit, Inspector's Report (7 December 2021)[113]; and
- The decision letter dated 2 September 2022 of the Secretary of State in relation to the Appeal by NNB regarding removal of acoustic fish deterrent conditions from the WDA Permit[114].

Terrestrial design elements of the Project

9.2.3 As noted above in the screening section of this HRA Report (where the HRA Report sets out the possible impact pathways for the Project), no impact pathway to any European / Ramsar site was identified from the *terrestrial* design elements of the Project. As such these do not feature in this shadow AA.

Compensatory habitat measures

9.2.4 The proposed potential compensatory measures included in this shadow AA are those that would (if selected) be within the Order Limits for the DCO Material Change (Maisemore Weir, River Severn; Upper Lode Weir, River Severn; Mousenatch / Eyton / Coxall, River Lugg; and marine habitat creation / enhancement sites for saltmarsh at Pawlett Hams; and The Island) and those that would (if selected) be outside the Order Limits for the DCO Material Change (Trostrey Weir, River Usk; Manorafon Weir, River Towy) and other marine habitat creation / enhancement sites for native oyster reefs, seagrass beds and kelp forest.

9.2.5 It is important to note that, for the compensatory measures sites to be delivered outside the DCO Material Change Order Limits (and indeed in some cases in relation to compensatory measures sites to be delivered inside the DCO Material Change Order Limits), there will need to be, where appropriate, further HRAs undertaken by the relevant competent authorities

112 Environment Agency (2020) Appropriate assessment of the application to vary the water discharge activity permit for Hinkley Point C. Available online at: https://consult.environment-agency.gov.uk/psc/ta5-1ud-nnb-generation-company-hpc-limited-2/supporting_documents/EA7 %20 %20Environment%20Agencys%20Appropriate%20Assessment%20finalNovember%202020.pdf Accessed 17 November 2023.

113 Removal of Acoustic Fish Deterrent Conditions from Water Discharge Activity (WDA) Permit, Inspectors Report: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1101903/environmental-permit-appeal-app-epr-573-hinkley-point-c.pdf Accessed 17 November 2023.

114 Department for Environment, Food & Rural Affairs (2022) Environmental permit appeal: removal of acoustic fish deterrent conditions from water discharge activity (WDA) permit decision letter. Available online at: Removal of acoustic fish deterrent conditions from Water Discharge Activity (WDA) Permit (publishing.service.gov.uk) Accessed 17 November 2023.

when those competent authorities determine applications for the relevant authorisations needed for delivery of those measures.

9.2.6 At the time of writing this HRA Report it has been possible to assess at a high level and in a qualitative manner the effects of the potential marine compensatory habitat elements.

Cumulative effects of the different Project elements appropriately assessed

9.2.7 The risk of cumulative effects between the different Project elements in this shadow AA (marine design element and compensatory habitat elements, since they are the elements considered in this shadow AA) is automatically considered in drawing any conclusion below in relation to a designated site that the Project alone will or will not risk an adverse effect on the integrity on that site.

9.3 Designated sites subject to shadow AA

9.3.1 Within the following sub-sections, the potential for adverse effect on the integrity of identified designated sites, through the associated qualifying features and pathways from the relevant Project elements which have been screened-into the shadow AA, are assessed. The assessments are first made on a Project alone basis. An overview approach to the consideration of in combination effects is then given (with full details on this to be provided with the formal DCO Material Change application).

9.3.2 In relation to the Project's impact pathways to European / Ramsar sites relating to *fish entrapment*, the assessment below considers the potential effects taking into account the mitigation measures (being the capped head of the LVSE; and the FRR system). This is because these two mitigation measures are embedded within the design of HPC and it would be artificial to present an assessment of potential effects without the benefit of these measures and then later to provide an assessment of potential effects with the mitigation measures.

9.3.3 In this assessment, impacts on migratory fish from compensatory weir removal / modification works relate to the designated river site where those weir works are proposed and the Severn Estuary only. Therefore, for example, weir works on the River Severn are not considered when assessing impacts on the River Usk SAC due to an absence of impact pathway to migratory fish on the River Usk.

9.3.4 This assessment has been undertaken focussing on the current baseline (see Section 5.1.1), although it has also considered the original baseline (see Section 5.1.1) where relevant (such as with fish entrapment predictions, taking account of findings from CIMP1, CIMP2 and the RIMP datasets).

9.3.5 The future baseline is taken to be the current baseline updated to take into account changes to the baseline that are expected to have been made by the time Hinkley Point C is operational (assume to be 2027), including as a result of the currently consented Hinkley Point C project in the absence of the proposed changes that will be the subject of the material change DCO application. The temporal proximity between the current baseline assessment, and the Project beginning cooling water abstraction in 2027, allows for assessments to represent a reasonable future baseline for the start of operations. Substantial changes in the baseline (for example through climate change) are not anticipated by 2027, and any differences in the baseline would be subject to interannual variability. On this basis, it is considered that a detailed, separate assessment of the future baseline for the beginning of the Project operation is not required, and that the conclusions presented for each of the designated sites screened-into the shadow AA are sufficient. Nevertheless as a result of the long-term operation of the HPC station, an overview of the potential implications for climate change on the fish species assemblage and other ecological receptors of the Severn Estuary is described in Section 7.

9.4 Severn Estuary / Môr Hafren SAC

Introduction

9.4.1 The Severn Estuary SAC covers an area of approximately 73,715 ha, extending along the River Severn up to Frampton on Severn and covers the estuary out into Bridgwater Bay. The tidal range in the Severn Estuary is one of the highest in the world and the scouring of the seabed and strong tidal streams result in natural erosion of the habitats and the presence of high sediment loads. Two thirds of the site is composed of subtidal habitats and one third of intertidal habitats.

9.4.2 Throughout the assessment below for the Severn Estuary SAC, particular attention has been paid to the conservation objectives of the Severn Estuary SAC, as described in Table 8-2.

River lamprey

9.4.3 River lamprey is found in coastal waters, estuaries and accessible rivers across western Europe, from southern Norway to the western Mediterranean, and is widespread throughout catchments in the UK, other than north-west Scotland and in industrial areas, where water quality is poor, or obstacles prevent upstream migration of spawning adults. Within the UK, the rivers of the Severn Estuary are considered to be the most important for both river and sea lamprey. River lamprey do not have a swim bladder and they 'hear' by particle motion detection, the species is not a hearing specialist.

9.4.4 As well as being a qualifying feature of the Severn Estuary SAC in its own right, the river lamprey species also forms part of the typical fish species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC (as assessed below). It is also part of the Severn Estuary Ramsar site Criterion 4 migratory fish species assemblage which is considered below.

9.4.5 Only two river lamprey were recorded within the CIMP1 dataset, and none in CIMP2 at HPB, therefore accurately predicting impingement levels at HPC is difficult. However, impingement mortality has been estimated at 14 equivalent adults per annum. Losses are contextualised against a population estimate from within the Severn Estuary of 116,109, to determine potential levels of significance.

Marine design element

Fish entrapment:

9.4.6 As outlined above, there were limited records of river lamprey within the CIMP datasets. However, it was still possible to estimate impingement levels for the species, with these values presented below (Table 9-1).

Table 9-1: Predictions of entrapment effects of HPC (without AFD but with the capped head and FRR mitigation measures) on river lamprey, compared to the EA AA (2020) predictions. The results of the lower and upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	EA-AA predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment L95 %-U95 % CI population effect
CIMP1	116,109	<0.1 %	0.01 %	0.01 %	<0.01 %-0.02 %

Dataset	Population estimate (adult numbers)	EA-AA predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment L95 %-U95 % CI population effect
CIMP2	116,109	N/A	N/A	N/A	N/A

9.4.7 There are uncertainties in the predicted entrapment effects as an unknown proportion of transformer river lamprey may be too small to be impinged and subject to entrainment at HPB. The application of a 5 mm mesh at HPC will increase the proportion of entrapped transformers being impinged and directed through the FRR system thereby incurring lower mortality rates than entrained fish. However, a proportion of transformers will be entrained.

9.4.8 Notwithstanding the uncertainty in entrainment predictions, on the above basis of the low impingement rates, it is concluded that river lamprey total entrapment at HPC during operation will, in view of the relevant conservation objectives, lead to no adverse effect from the Project alone on the integrity of the Severn Estuary SAC. For approximately 4 years during HPC defueling (decommissioning phase) there will be a much smaller effect via entrapment than during operation via this pathway due to the reduced abstraction of sea water during that time. There will also be no effect on river lamprey during HPC construction via this pathway.

9.4.9 This conclusion is supported by the EA's 2020 AA, which concluded that predicted losses of <0.1 % of the Severn Estuary SAC river lamprey population would have no adverse effect on the integrity of the Severn Estuary SAC. It is also consistent with the Inspector in the WDA Permit inquiry who noted in his report (paragraph IR11.47) that the EA had agreed that mitigation in the form of the LVSE with AFD and FRR would (as had been the case in the context of the 2013 DCO) represent sufficient mitigation to ensure that there would not be an adverse effect on the integrity of any of the designated sites concerned. It must have been the case therefore that, since river lamprey are not hearing specialists, the mitigation measures other than the AFD were at that time regarded as sufficient.

9.4.10 The EA further concluded that river lamprey impingement would lead to no adverse effect on site integrity of the River Wye / Afon Gwy SAC; River Usk / Afon Wysg SAC; River Towy / Afon Tywi SAC; Pembrokeshire Marine / Sir Benfro Forol SAC; Cleddau Rivers / Afonydd Cleddau SAC; and Carmarthen Bay / Bae Caerfyrddin ac Aberoedd SAC. These sites are considered in further sections of the HRA Report below.

9.4.11 The EA further concluded that river lamprey is not a species of concern for the typical fish species assemblage of the Severn Estuary SAC Estuaries qualifying habitat feature.

9.4.12 The CIMP1 impingement assessments, using the EA methodology, and new data from CIMP2, provides no evidence to alter the conclusions in the EA 2020 AA.

Indirect: Effects on fish populations through changes to water quality (contaminants / nutrients):

9.4.13 Through changes to the marine design element (i.e., the removal of the requirement to install an AFD) there is the potential for water quality to be altered during HPC operation as a result of changes to the level of dead / decaying fish matter released through the FRR system, causing changes to contaminants, nutrient levels and dissolved oxygen levels in the water column. These changes to water quality have the potential to affect fish populations, in particular those of migratory fish, which can rely on good water quality conditions to enable passage through an estuary to / from their natal rivers, and where, for example, reduced levels of dissolved oxygen can act as a physical block against such passage.

9.4.14 Potential effects of the HPC FRR discharge on nutrient concentrations, BOD, un-ionised ammonia and phytoplankton production have been assessed based on levels of dead and moribund biomass of fish and invertebrates predicted to be discharged from the FRR, derived from impingement estimates from the CIMP datasets. Effects have been determined based on the estimated maximum total wet dead and moribund biomass, including fish, crustaceans and gelatinous zooplankton; an annual average total of 194 kg/day based on CIMP2 values and a quarterly average not expected to exceed 410 kg/day.

9.4.15 The findings of this analysis, based on the latest impingement values, are:

- Nutrient inputs from discharged fish matter remain negligible and would not change the nutrient status of local water bodies. Phytoplankton production levels are not predicted to increase due to FRR discharges.
- Decaying fish matter released from the FRR would have a negligible impact on dissolved oxygen levels of local water bodies.
- Whilst a small area of water in the immediate vicinity of the FRR outfall (measured in metres) might experience levels of un-ionised ammonia above the EQS, this will likely be rapidly mixed and dispersed within the water column, and negligible areas would be affected by un-ionised ammonia levels at or above the EQS.

- Further, as presented in Section 6 of this HRA Report, calculations of the levels of total organic carbon input from FRR discharges were undertaken, resulting in an estimated 46 kg/day (based on CIMP1 data) and 42 kg/day (based on CIMP2 data). Whilst there is no formal EQS for organic carbon enrichment, the area in excess of the derived daily benchmark (see Section 3) of 0.3 g organic carbon/m^2/day is 0.17 km^2 (based on CIMP1 data) and 0.15 km^2 (based on CIMP2 data). When compared to the overall size of the SAC, this is a tiny proportion with the potential to be affected, and effects are not anticipated to be significant.

9.4.16 On the above basis it is concluded that, in view of the relevant conservation objectives, there will be no adverse effect from the Project alone during HPC operation on the integrity of the Severn Estuary SAC through this pathway (water quality effects on the river lamprey qualifying species). For approximately 4 years during HPC defueling (decommissioning phase) there will be a much smaller effect via this pathway than during HPC operation due to the reduced abstraction of sea water during that period. There will also be no effect on river lamprey during HPC construction through this pathway.

9.4.17 Consideration of changes to water quality was also presented within the EA's 2020 HRA. This looked at the elements including a detailed analysis of the potential for smothering by dead and decaying fish matter. The HRA concluded that there was no adverse effect on the integrity of the Severn Estuary SAC (via the Annex II migratory fish species / toxic contamination, bioaccumulation and nutrient enrichment pathway). This was also the conclusion reached for more distant designated sites for which migratory fish species are qualifying features.

9.4.18 This conclusion was further supported by the EA's 2023 HRA of the HPC Operational WDA Permit Variation, which considered the same effects as described above[115].

115 Environment Agency (2023) HPC operational water discharge activity permit variation, EPR/HP3228XT/V005, Habitats Regulations Assessment. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1172565/Hinkley-Point-C-permit-variation-Habitats-Regulations-assessment-report-June-2023.pdf. (Accessed: 19 October 2023.)

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.4.19 Fish can be sensitive to construction generated noise, vibration and light, even if those potentially disturbing activities are undertaken on intertidal and terrestrial habitats. It is possible that river lamprey present within existing aquatic habitats at Pawlett Hams or The Island could be disturbed by groundworks and other construction activities during the creation / enhancement of habitats resulting in displacement from their habitats, with potential subsequent effect on migration, feeding and breeding success.

9.4.20 However, works at Pawlett Hams / The Island will be temporary in nature. In addition, works, whether in the intertidal or terrestrial environments, will be completed under an appropriate Construction Environmental Management Plan ('CEMP'), which will stipulate suitable environmental control measures, including a Lighting Strategy, noise reduction measures and the control / prevention of sediment and / or contaminants entering the River Parrett.

9.4.21 Through the measures outlined above, it is considered that there will be no adverse impact on populations of river lamprey as a result of works at either Pawlett Hams or The Island.

9.4.22 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the Severn Estuary SAC through construction generated disturbance on river lamprey as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Mortality / injury through construction during habitat works:

9.4.23 Construction works, e.g., excavation to deepen tidal creeks, within habitats that could support river lamprey could result in accidental mortality or injury of individuals.

9.4.24 At this stage, optioneering is still ongoing with regards to the final design of works at Pawlett Hams / The Island; however, mitigation measures will be identified and employed so as to minimise potential effects on river lamprey (and wider fish communities, including other qualifying species of the SAC). Such measures revolve around the exclusion of water during periods of construction activity, thereby minimising the risk of fish being in the vicinity whilst construction activities are being undertaken.

9.4.25 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the Severn Estuary SAC through construction generated mortality on river lamprey as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.4.26 Groundworks, for example breaking sea defences or lowering ground levels could release sediment into the estuary waters. The impact can be reduced by timing the excavation works to avoid high tide. However, any release of sediment would be limited to within the River Parrett / Bridgwater Bay estuary, and due to the highly turbid and active nature of the Severn Estuary, any temporary changes in sediment load would be rapidly subsumed into background levels and natural levels of variation.

9.4.27 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on river lamprey as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Indirect effects on fish populations due to changes to hydrodynamics and sediment transport during habitat works:

9.4.28 The creation / enhancement of habitat at Pawlett Hams and The Island has the potential to affect hydrodynamics and sediment transport in the immediate vicinity of the works. As described above, river lamprey (and other migratory fish species) can be susceptible to changes in these conditions, potentially acting as blockers to migration, either up or downstream.

9.4.29 However, in the case of the proposed managed realignment works at Pawlett Hams, and saltmarsh enhancement at The Island, it is predicted that any changes to hydrodynamics or the sediment regime will be limited to within the River Parrett / Bridgwater Bay estuary and, due to the highly turbid and active nature of the Severn Estuary, any changes would be rapidly subsumed into background levels and natural levels of variation.

9.4.30 It is therefore concluded, in view of the relevant conservation objectives, that there will be no adverse effect from the Pawlett Hams / The Island works of the Project alone on the integrity of the Severn Estuary SAC via the river lamprey qualifying species and this impact pathway.

Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye): Disruption of migratory routes:

9.4.31 Temporary construction works (within the DCO Material Change Order Limits) to remove / modify the weirs on the River Severn and River Lugg would likely require dewatering of the river at the weirs to facilitate works. During the anticipated four months of construction, the water flow in the river would be maintained through other means, e.g., via a flume. Whilst there is potential for this to disrupt the pathways of migratory fish such as river lamprey, such flumes can be designed to enable the movement of fish past the works. An alternative method of working could include phasing of weir works using coffer dams to exclude sections of the weir and river width to provide a continued water flow and fish passage at all times.

9.4.32 Disruption of migratory routes can also occur through changes in water quality, for example increased suspended sediment and associated reductions in dissolved oxygen. However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, fish passage will not be affected, and adverse effects on river lamprey populations through disruption of migratory routes are not anticipated.

9.4.33 On the above basis and in view of the conservation objectives, there will be no adverse effect from the construction of weir removal / easement aspects of the Project alone on the integrity of the Severn Estuary SAC via the river lamprey qualifying species via this impact pathway.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.4.34 Even though the proposed locations of seagrass beds, kelp forests and native oyster reefs are not at present known, it is possible to provide a high-level assessment.

9.4.35 All habitat types have the potential to cause local changes to hydrodynamics and sediment transport, predominantly by capturing sediment, or by slowing water flows within the direct area of habitat creation / enhancement, and potentially in the immediate vicinity. This may result in sediment build-up in these areas.

9.4.36 However the presence of seagrass, kelp and oysters will also aid in the maintenance of sediment levels within the Severn Estuary, rather than causing material to potentially leave the system, thereby also supporting the maintenance of sediment-based habitats within the wider estuaries feature, and the SAC.

9.4.37 On the above basis (a high-level, qualitative assessment), but subject to further more detailed assessment when further details are known (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), and in view of the conservation objectives, there will be no adverse effect from the marine habitat compensation works of the Project alone on the integrity of the Severn Estuary SAC via the river lamprey qualifying species and this impact pathway.

Weir removal / easement: Trostrey Weir, River Usk and Manorafan Weir, River Towy: Disruption of migratory routes:

9.4.38 See the assessment and conclusions for river lamprey qualifying species for the compensation measures within the DCO Material Change Order Limits which apply equally here.

9.4.39 On the above basis and in view of the conservation objectives, there will be no adverse effect from the weir removal / easement aspects of the Project alone on the integrity of the Severn Estuary SAC via the river lamprey qualifying species via this impact pathway.

Sea lamprey

9.4.40 Like the river lamprey, sea lamprey adults are found throughout the coastal waters of western Europe, from southern Norway to the western Mediterranean, with genetic studies suggesting a single, pan-European population, with widespread distribution. To a large extent, this is determined by the movement of fish hosts, on which lampreys feed, and the fact that adult lamprey do not display any specific homing behaviour during spawning migrations.

9.4.41 In addition to being a qualifying feature of the Severn Estuary SAC in its own right (and other riverine SACs in the vicinity), sea lamprey species form part of the typical fish species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC (as assessed below). It is also part of the Severn Estuary Ramsar site Criterion 4 migratory fish species assemblage which will be considered below.

Marine design element

Fish entrapment:

9.4.42 Table 9-2 presents the predicted levels of impingement for sea lamprey during HPC operation within the wider Severn Estuary in the absence of an AFD. The updated CIMP1 results indicate a predicted annual loss of 71 sea lamprey with the application of mitigation measures (as outlined within Section 6.2, i.e., capped head mitigation[116], and the FRR system mitigation). No sea lamprey were recorded in the core CIMP2 samples.

Table 9-2: Predictions of entrapment effects of HPC (without AFD but with the capped head and FRR mitigation measures) on sea lamprey, compared to the EA AA (2020). The results of the lower and upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	EA-AA predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment L95 %-U95 % CI population effect
CIMP1	15,269	0.3 %	0.46 %	0.43 %	0.15 %-0.99 %
CIMP2	15,269		N/A	N/A	N/A

9.4.43 Mean entrapment effects are predicted to be 0.43 % of the conservative population estimate. An EAV of 1, the maximum value for a semelparous fish, has been applied to all lamprey impinged adding precaution to the assessment as impingement would affect a mixture of transformers, sub-adults and adult fish. However, as with river lamprey an unquantified proportion of transformers would be subject to entrainment.

9.4.44 On the above basis (taking into account the identified uncertainties and inbuilt precaution in the assessment) it is concluded that during HPC operation, in view of the Severn Estuary SAC's conservation objectives, there will be no adverse effect from the Project alone on the integrity of the Severn Estuary SAC through entrapment of the sea lamprey qualifying species. There will be no effect on sea lamprey during HPC construction through this pathway. For approximately 4 years during HPC defueling (decommissioning phase) there will

116 Assessments assume no benefit of the capped head mitigation for lamprey.

be a much smaller effect on sea lamprey via entrapment than during HPC operation due to the reduced abstraction of sea water during defueling.

9.4.45 This conclusion is supported by the EA's 2020 AA, which found that losses at the level predicted (0.3 % of the population) would have no adverse effect on the integrity of the Severn Estuary SAC. It is also consistent with the Inspector in the WDA Permit inquiry who noted in his report that the EA had agreed that mitigation in the form of the LVSE with AFD and FRR would (as had been the case in the context of the 2013 DCO) represent sufficient mitigation to ensure that there would not be an adverse effect on the integrity of any of the designated sites concerned. It must have been the case therefore that, since sea lamprey are not hearing specialists, the mitigation measures other than the AFD were at that time regarded as sufficient.

9.4.46 The EA also concluded that that there would be no adverse effect on site integrity via this qualifying species of the River Wye / Afon Gwy SAC; River Usk / Afon Wysg SAC; River Towy / Afon Tywi SAC; Pembrokeshire Marine / Sir Benfro Forol SAC; Cleddau Rivers / Afonydd Cleddau SAC; and Carmarthen Bay / Bae Caerfyrddin ac Aberoedd SAC. These sites are considered further below.

9.4.47 The EA further concluded that the sea lamprey is not a species of concern for the Severn Estuary / Môr Hafren SAC Estuaries qualifying habitat feature's typical fish species assemblage, also considered below.

Indirect: Effects on fish populations through changes to water quality (nutrients / contaminants):

9.4.48 See the assessment of effects on fish populations through changes to water quality presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.13 et. seq.), the conclusions of which apply equally here.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.4.49 See the assessment of disturbance presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.19 et. seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction during habitat works:

9.4.50 See the assessment of mortality / injury presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.23 et. seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.4.51 See the assessment of effects on fish populations through changes to water quality presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.26 et. seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport during habitat works:

9.4.52 See the assessment of changes to hydrodynamics and sediment transport under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.28 et. seq.), the conclusions of which apply equally here.

Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye): Disruption of migratory routes:

9.4.53 See the assessment of disruption of migratory routes for the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.31 et. seq.), the conclusions of which apply equally here.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.4.54 See the assessment of changes to hydrodynamics and sediment transport under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.34 et. seq.), the conclusions of which apply equally here.

Weir removal / easement: Trostrey Weir, River Usk and Manorafan Weir, River Towy: Disruption of migratory routes:

9.4.55 See the assessment of disruption of migratory routes for the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.38 et. seq.) for the compensation measures *within* the DCO Material Change Order Limits, the conclusions of which apply equally here.

Twaite shad

9.4.56 Twaite shad populations are distributed along most of the west coast of Europe, from the eastern Mediterranean Sea to southern Norway and in the lower reaches of large rivers along these coasts that are accessible to the fish, although the species has declined substantially across Europe. In the UK, the Severn River Basin District ('RBD') is one of only two areas the species is known to breed in, within the Severn, Wye and Usk, the other being the Solway Firth.

9.4.57 There are non-breeding populations in the UK off the southern and eastern coasts.

9.4.58 In addition to being a qualifying species of the Severn Estuary SAC in its own right (and other SACs in the vicinity), the twaite shad species forms part of the typical fish species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC (as assessed below). It is also part of the Severn Estuary Ramsar site Criterion 4 migratory fish species assemblage also assessed below.

Marine design element

Fish entrapment:

9.4.59 Impingement losses of twaite shad during HPC operation (without the AFD) were raised as a concern for the species during the WDA Permit inquiry, with predicted annual losses of 84 equivalent adult twaite shad. Updated impingement calculations based on CIMP1 predict annual losses of 48 adult fish. The number of 48 is reduced from 84 due to a minor reduction in impingement rates based on the correction of flows, and a correction in the calculated EAV-SPF factor identified during consultation with the EA. During CIMP2, a larger number of small juvenile fish were observed in the impingement record and the estimated losses of equivalent adults was estimated at 104 twaite shad.

9.4.60 It is not possible to determine from which spawning population the predominantly juvenile (0+ group) impinged twaite shad originate, however, the likelihood is that these impinged small fish at HPB are emigrants from the Rivers Severn, Usk and Wye that drain into the Severn Estuary upstream of HPB. Accordingly, the precautionary approach adopted in this HRA Report is to apportion total losses relative to each SAC individually. The Planning Inspector concluded in his report, that this was a "*reasonable worst case scenario*".

9.4.61 Predicted impingement and entrapment values for twaite shad are presented below (Table 9-3).

Table 9-3: Predictions of entrapment effects of HPC (without AFD but with the capped head and FRR mitigation measures) on twaite shad populations of the Severn Estuary SAC, compared to the EA predictions presented at the WDA Permit inquiry. The results of the lower and upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	EA-WDA Permit inquiry predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment L95 %-U95 % CI population effect
CIMP1	86,696	0.1 %	0.06 %	0.08 %	0.02 %-0.34 %
CIMP2	N/A	N/A	N/A	N/A	N/A

9.4.62 The population estimate for twaite shad in CIMP1 was based on a population model for the River Severn that incorporated impingement data of 0+ group twaite shad from the RIMP time series. The River Severn population estimate is used to estimate population sizes in the rivers Usk and Wye, that collectively provide a Severn Estuary estimate. The population model and recent declining twaite shad count data collected at Upper Lode Weir by the Unlocking the Severn project do not converge for the years of relevance for CIMP2, therefore it has not been possible to generate a Severn Estuary population estimate for CIMP2.

9.4.63 The population of twaite shad in the River Severn (and therefore the Severn Estuary, given relative numbers in the Wye and Usk populations are estimated based on the River Severn) has shown a declining trend for the last 40 years. The Planning Inspector at the WDA Permit inquiry considered the declining population, the uncertainties in the assessment of impacts and recent tagging evidence suggesting that adult twaite shad spend a greater proportion of time in inshore waters and concluded that an adverse effect on the integrity of the Severn Estuary SAC from the predicted HPC impingement of the twaite shad could not be excluded beyond reasonable doubt.

9.4.64 Emerging evidence from telemetry surveys within the Severn Estuary and Inner Bristol Channel has identified the potential risk of impingement of adult shad by HPC. Preliminary data collected as part of a collaborative project between Swansea University and the Unlocking the Severn project shows the presence of twaite shad in the Estuary throughout much of the year and occur in in Bridgwater Bay. Impingement predictions for HPC have been derived on the basis of impingement monitoring at HPB. Therefore, to provide further information on the utilisation of Bridgwater Bay by post-spawning twaite shad and determine the relative risk between the HPC and HPB intake locations, acoustic receivers have been deployed on the HPC construction site marker buoys by the University of Swansea in May 2023.

9.4.65 Preliminary data from the HPC receiver array and from other receivers in the Severn Estuary, Swansea Bay and Carmarthen Bay, show that mature adult twaite shad are present in the Severn Estuary / Bristol Channel, including in Bridgwater Bay, during the summer and autumn[117]. Twaite shad tagged in the Rivers Towy, Severn and Wye were recorded in the immediate area of HPC between May and July 2023. A total of 37 individual fish were detected by the HPC array, and all receivers detected twaite shad, with more detections at the receivers furthest offshore. In addition, preliminary sensor data of the depth distribution of twaite shad from 12 individuals, suggests that twaite shad swim throughout the water column, with individuals recording depths at or below the height of the HPC intakes.

9.4.66 Acoustic receivers remain deployed in Bridgwater Bay. The data being gathered will provide additional context in relation to the relative risk of impingement of twaite shad at HPC relative to HPB. Developing data sources will be applied, where appropriate, to support the DCO Material Change application and the AMMP to elucidate potential increases in the risk of abstraction of adult fish.

9.4.67 Taking the impingement predictions into account using the EA approach, it cannot be excluded beyond reasonable scientific doubt, in view of the relevant conservation objectives, that there will be no adverse effect from the Project alone on the integrity of the Severn Estuary SAC from the predicted HPC impingement of the twaite shad qualifying species.

9.4.68 This is consistent with the conclusions of the Secretary of State in his letter dated 2 September 2022 in relation to the WDA Inquiry. The Secretary of State stated *"it cannot be demonstrated that the conservation objective for twaite shad can be met"* and *"adverse*

---

117 Clarke, D., Rees, C., Franconi, N., Blow, G., Davies, P., Britton, R., Yeldham, M., Nunn, A., Dodd, J., Velterop, R., Crundwell, C., Neilsen, I. and J. Bolland. 2023. Twaite Shad Movements Near Hinkley Point C Abstraction. Report prepared for Environment Agency UK. Swansea University. 31pp.

effects on the integrity of the Severn Estuary SAC cannot be excluded beyond reasonable doubt".

9.4.69 On the basis of the above impingement predictions, using the EA approach, and the emerging telemetry data, there is no evidence to alter the conclusions of the WDA Permit inquiry.

9.4.70 There will be no effect on twaite shad during HPC construction through this pathway. For approximately 4 years during HPC defueling (decommissioning phase) there will be a much smaller effect via this pathway on twaite shad than during HPC operation due to the reduced abstraction of sea water during defueling.

Indirect: Effects on fish populations through changes to water quality (nutrients / contaminants):

9.4.71 A detailed description of the potential changes to water quality as a result of the marine build element is presented in Section 9.4.13 et. seq., in relation to the river lamprey qualifying species of the Severn Estuary SAC. That description applies equally here, however, given the sensitivity of twaite shad populations, further consideration of the potential impacts of those changes is presented here.

9.4.72 Poor water quality is known to be a compromising factor for twaite shad[118], and with emerging telemetry data showing adult shad to be present within the Bridgwater Bay area more than originally considered, there is the potential for individuals to be present within the area affected by reduced water quality, i.e. around the FRR outfall head.

9.4.73 However, the area over which reduced water quality might be experienced is small compared to the wider area of both Bridgwater Bay and the Severn Estuary. Also, it was the conclusion of the EA's 2020 AA that there would be no adverse effect on the integrity of the Severn Estuary SAC as a result of water quality effects (including toxic contamination, bioaccumulation and nutrient enrichment) on migratory fish during HPC operation. This

118 JNCC (2019) European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC). Fourth Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2013 to December 2018. Conservation status assessment for the species: S1103 – Twaite Shad (Alosa fallax). Available online at: https://jncc.gov.uk/jncc-assets/Art17/S1103-UK-Habitats-Directive-Art17-2019.pdf. (Accessed 30 October 2023)

conclusion was further supported by the EA's 2023 HRA of the HPC Operational WDA Permit Variation, which considered the same effects as described above[119].

9.4.74 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the Severn Estuary SAC through this impact pathway on twaite shad during HPC operation. For approximately four years during HPC defueling (decommissioning phase) there will be a much smaller effect than during HPC operation due to reduced abstraction of sea water during that period. There will be no effect on twaite shad during HPC construction through this pathway.

Compensation measures within the DCO Material Change Outer Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.4.75 Fish can be sensitive to construction noise, vibration and light, including those generated in the intertidal or terrestrial zones. Therefore, there is the possibility that construction works at Pawlett Hams and The Island could generate disturbance affecting twaite shad during groundworks and other activities; this is of particular note given twaite shad's sensitivity to noise. Such disturbance may result in displacement of fish, and subsequent effects on migration, feeding and breeding success.

9.4.76 However, as described in the assessment and conclusions for river lamprey qualifying species of the Severn Estuary SAC, potential construction impacts can be mitigated against using standard environmental control measures, to be outlined within the CEMP, and associated plans as required, e.g. Lighting Strategy and noise reduction measures.

9.4.77 Through application of these measures, it is considered that there will be no adverse effect on the integrity of the Severn Estuary SAC from the Project alone via the twaite shad qualifying species as a result of works at either Pawlett Hams or The Island during construction. There will be no adverse effect during HPC operation or defueling (decommissioning phase) via this pathway.

119 Environment Agency (2023) HPC operational water discharge activity permit variation, EPR/HP3228XT/V005, Habitats Regulations Assessment. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1172565/Hinkley-Point-C-permit-variation-Habitats-Regulations-assessment-report-June-2023.pdf. (Accessed 19 October 2023).

Pawlett Hams / The Island: Mortality / injury through construction:

9.4.78 Construction works, e.g., excavation to deepen tidal creeks, within habitats that could already support twaite shad, could result in accidental mortality or injury of individuals.

9.4.79 At this stage, optioneering is still ongoing with regards to the final design of works at Pawlett Hams / The Island; however, mitigation measures will be identified and employed so as to minimise potential effects on twaite shad (and wider fish communities, including other qualifying species of the SAC). Such measures revolve around the exclusion of water during periods of construction activity, thereby lowering the risk of fish being in the vicinity whilst construction activities are being undertaken.

9.4.80 Through application of these measures, it is considered that there will be no adverse effect on the integrity of the Severn Estuary SAC from the Project alone via the twaite shad qualifying species as a result of mortality at either Pawlett Hams or The Island, during construction. There will be no adverse effect during HPC operation or defueling (decommissioning phase) via this pathway.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.4.81 Groundworks, for example breaking sea defences or lowering ground levels could release sediment into the estuary waters. The impact can be reduced by timing the excavation works to avoid high tide. However, any release of sediment would be limited to within the River Parrett / Bridgwater Bay estuary. Due to the highly turbid and active nature of the Severn Estuary, any temporary changes in sediment load would be rapidly subsumed into background levels and natural levels of variation.

9.4.82 Whilst emerging telemetry data indicates the presence of twaite shad within Bridgwater Bay, and therefore potentially in the vicinity of any changes to water quality, the application of mitigation measures described above, coupled with the highly variable background levels of suspended sediment within the Severn Estuary, means that there will be no adverse effect on integrity of the Severn Estuary SAC from the Project alone via the twaite shad qualifying species as a result of Pawlett Hams / The Island construction works, and associated changes to water quality.

Pawlett Hams / The Island: Indirect effects on fish populations due to changes to hydrodynamics and sediment transport during habitat works:

9.4.83 The creation / enhancement of habitat at Pawlett Hams and The Island has the potential to affect hydrodynamics and sediment transport in the immediate vicinity of the works. Such changes, in particular to the sediment transport regime, have the potential to alter water quality conditions, as well as potentially cause smothering of habitats, indirectly affecting fish populations.

9.4.84 Whilst emerging telemetry data indicates the presence of twaite shad within Bridgwater Bay, and therefore potentially in the vicinity of any changes to water quality, in the case of the proposed managed realignment works at Pawlett Hams, and saltmarsh enhancement at The Island, it is predicted that any changes to hydrodynamics or the sediment regime will be limited to within the River Parrett / Bridgwater Bay estuary and, due to the highly turbid and active nature of the Severn Estuary, any changes would be rapidly subsumed into background levels and natural levels of variation.

9.4.85 It is therefore concluded, in view of the relevant conservation objectives, that there will be no adverse effect from the Project alone on the integrity of the Severn Estuary SAC via the twaite shad qualifying species and this impact pathway.

Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye): Disruption of migratory routes:

9.4.86 Temporary construction works within the DCO Material Change Order Limits to remove / modify the weirs on the River Severn and River Lugg would likely require dewatering of the river at the weirs to facilitate works. During the anticipated four months of construction, the water flow in the river would be maintained through other means, e.g. via a flume. Whilst there is potential for this to disrupt the pathways of migratory fish such as twaite shad, such flumes can be designed to enable the movement of fish past the works. Disruption of migratory routes can also occur through changes in water quality, for example increased suspended sediment and associated reductions in dissolved oxygen. However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, fish passage will not be affected, and adverse effects on twaite shad populations through disruption of migratory routes are not anticipated.

9.4.87 On the above basis, and in view of the conservation objectives, there will be no adverse effect from the Project alone on the integrity of the Severn Estuary SAC via the twaite shad qualifying species via this impact pathway.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.4.88 See the assessment of changes in hydrodynamics and sediment transport for the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.34 et. seq.), the conclusions of which apply equally here.

Weir removal / easement: Trostrey Weir, River Usk and Manorafan Weir, River Towy: Disruption of migratory routes:

9.4.89 See the assessment and conclusions for twaite shad immediately above at Section 9.4.86 et seq. under "Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye): Disruption of migratory routes" which apply equally here.

Subtidal sandbanks

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Habitat loss and physical damage:

9.4.90 Subtidal sandbanks are unlikely to be present at either Pawlett Hams or The Island, due to these two locations' inland nature, and existing status as either terrestrial habitat (Pawlett Hams) or saltmarsh (The Island). Therefore, creation / enhancement of saltmarsh habitat at these locations is not expected to affect the subtidal sandbank qualifying habitat feature of the Severn Estuary SAC.

9.4.91 On this basis, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on sandbanks which are slightly covered by seawater at all times as a result of the Pawlett Hams or The Island compensation elements of the Project alone.

Pawlett Hams / The Island: Changes to hydrodynamics and sediment transport:

9.4.92 Subtidal sandbanks are unlikely to be present at either Pawlett Hams or The Island, due to these two locations' inland nature, and existing status as either terrestrial habitat (Pawlett Hams) or saltmarsh (The Island). Therefore, no harm to this qualifying feature is expected. In any event see the assessment of changes to hydrodynamics and sediment transport presented under Atlantic salt meadows as a qualifying habitat of the Severn Estuary SAC (Section 9.4.190 et. seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Changes to water quality (contaminant / nutrient release):

9.4.93 Subtidal sandbanks are unlikely to be present at either Pawlett Hams or The Island, due to these two locations' inland nature, and existing status as either terrestrial habitat (Pawlett Hams) or saltmarsh (The Island). Therefore, no harm to this qualifying feature is expected. In any event see the assessment of changes to water quality (contaminant / nutrient release) presented under the Atlantic salt meadows qualifying habitat of the Severn Estuary SAC (Section 9.4.193 et. seq.), the conclusions of which apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp forest / seagrass beds: Changes to hydrodynamics and sediment transport:

9.4.94 See the assessment of changes to hydrodynamics and sediment transport presented under the Atlantic salt meadows qualifying habitat of the Severn Estuary SAC (Section 9.4.197 et. seq.), the conclusions of which apply equally here.

Native oyster reefs / kelp forest / seagrass beds: Habitat loss and physical damage:

9.4.95 See the assessment of habitat loss and physical damage presented for Atlantic salt meadows as a qualifying habitat of the Severn Estuary SAC (Section 9.4.200 et. seq.), the conclusions of which apply equally here.

Estuaries

9.4.96 Estuaries (qualifying habitat feature H1130) are habitat complexes which can comprise a mosaic of intertidal and subtidal habitats, including close associations with adjacent terrestrial habitats. According to the Severn Estuary European Marine Site NE and CCW Regulation 33 Conservation (Natural Habitats) Regulations 1994 advice dated June 2009, this habitat feature as a whole incorporates other qualifying habitats namely intertidal mudflats and sandflats (1140), Atlantic salt meadows (1330), subtidal sandbanks (1110) which are slightly covered by seawater all the time' (1110) and reefs (1170). It also includes hard substrate habitats (including eel grass beds).

9.4.97 The Severn Estuary's large tidal range and funnel-shaped nature creates unique conditions giving rise to communities characteristic of extreme physical conditions (including extremely high turbidity levels, rapid changes in salinity, periods of exposure and fast currents). These conditions result in relatively low diversity within the benthic community.

9.4.98 Riverine influences on the Severn Estuary include inputs from the River Severn itself, alongside the Rivers Usk, Wye, Avon, Parrett and Taff, all affecting the salinity range through their freshwater inputs.

9.4.99 This assessment addresses potential Project alone effects on the Severn Estuary SAC Estuaries qualifying habitat feature (H1130).

9.4.100 The conservation objectives for the Severn Estuary SAC published by NE include "*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 habitats*".

9.4.101 The term 'typical species' is not defined in the conservation objectives. Under CJEU caselaw (Case C-461/17, Brian Holohan and Others v An Bord Pleanala, paragraph 39) "*typical habitats or species must be included in the appropriate assessment if they are necessary to the conservation of the habitat types and species listed for the protected area*".

9.4.102 The European Commission's Natura 2000 Interpretation Manual of European Union Habitats dated April 2013 provides a description of each Annex I Habitats Directive qualifying habitat. It sets out, for each qualifying habitat, the plants and animals associated with that habitat. In the case of the Estuaries habitat H1130 the animals listed are "*Animals: invertebrate benthic communities; important feeding areas for many birds*". There is no mention of fish species or of any fish assemblage.

9.4.103 Nevertheless, the Secretary of State's letter dated 2 September 2022 setting out his determination of NNB's WDA Permit inquiry, having made reference to the Inspector's report which in turn had considered the NE conservation objectives for the Estuaries feature of the Severn Estuary SAC, concluded:

"9. Your client disagreed with the Environment Agency that the 'notable estuarine assemblage' of fish species forms part of the Severn Estuary SAC Annex I qualifying habitat. For the reasons given at IR11.26-38, the Secretary of State agrees with the Inspector 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. He also agrees with the Inspector that the 'health' of the estuary feature can only realistically be assessed through the maintenance or restoration of its habitats. These are a function of both its geomorphology and its ecology, of which a notable sub-feature is identified as the assemblage of typical species".

9.4.104 This HRA Report reflects the approach of the Secretary of State and accordingly includes, within the assessment of the potential impacts of the Project on the Estuaries habitat feature, consideration of potential effects on the typical fish species assemblage of the Severn Estuary.

9.4.105 The Severn Estuary European Marine Site NE and CCW advice (given under Regulation 33 of the Conservation (Natural Habitats) Regulations 2010 as amended and dated June 2009) refers to a fish species assemblage, a waterfowl species assemblage, and a vascular plant species assemblage as being relevant to the Estuaries qualifying habitat feature. This assessment also considers potential effects on these two other assemblages.

Marine design element

Changes to water quality (contaminants / nutrients) (potential impacts on habitats including on the typical vascular plant species assemblage):

9.4.106 See the assessment at Section 9.4.13 et. seq. for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) which describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. The assessment and conclusions presented there apply equally here.

Habitat loss and physical damage (potential impacts on habitats including on the typical vascular plant species assemblage of the Estuaries qualifying habitat feature):

9.4.107 There is the potential, through the FRR system during HPC operation, for smothering effects to arise as a result of increased organic carbon enrichment. This has been assessed with particular reference to smothering of *Sabellaria* reef, littoral rock and intertidal soft sediment habitats.

9.4.108 The assessment at Section 9.4.13 et. seq. for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients) describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. Results showed that the area estimated to be in excess of the derived daily benchmark of 0.3 g organic carbon/m^2/day was 0.17 km^2 (using 2009-10 data) and 0.15 km^2 (using 2021-22 data). On the basis of this, compared to the overall size of the Severn Estuaries SAC, and the scale of estuarine habitats contained within, no effect on sensitive habitats is predicted.

9.4.109 It is concluded that, in view of the relevant conservation objectives, there will be no adverse effect from the Project alone on the Estuaries qualifying habitat feature through this pathway. For approximately 4 years during HPC defueling (decommissioning phase) any effect will be a much smaller effect than during HPC operation due to the reduced abstraction of sea water during defueling. There will also be no effect on habitats via this pathway during HPC construction.

Fish entrapment (potential impacts on the typical fish species assemblage of the Estuaries qualifying habitat):

9.4.110 The Severn Estuary / Bristol Channel is a large and complex water body that is utilised by over 100 species of marine, freshwater and estuarine fish (Bird, 2008[120]). The area is used by fish for a variety of purposes such as feeding, spawning, nursery areas and as a migration route for diadromous species. Some fish species spend their whole lives within the estuary environment, while other species are more transitory, and use the estuary for one or more functions depending on their life history stage.

120 Bird, D.J., 2008. The biology and conservation of the fish assemblage of the Severn Estuary (cSAC). Report CCW Report No: CCW/SEW/08/1. 79 pp.

9.4.111 The assessment in this HRA Report on the potential effects of HPC operation (without AFD mitigation, however including the benefits of the capped head and FRR mitigation measures) on the Estuaries qualifying habitat feature via its typical fish species assemblage considers both:

(i) The effects on the populations of typical fish species, and then

(ii) The potential for effects on the structure and function (including typical species) of the Estuaries qualifying habit feature.

Fish entrapment: Introduction:

9.4.112 As described within Section 6.2, extensive work has been undertaken into the potential entrapment of fish species as a result of cooling water abstraction at HPC (without an AFD).

9.4.113 Over the full time series of impingement monitoring, over 90 species of fish have been identified during sampling at HPB. However, most of these species occur infrequently in low numbers. The annual CIMP datasets identified 64 fish species in CIMP1 (2009/10) and 62 fish species in CIMP2 (2021/2022). Despite this high species richness, few species dominated impinged abundance. Five species accounted for the top 90 % of impingement numbers in CIMP1 (sprat, whiting, Dover sole, Atlantic cod, thin-lipped grey mullet), whereas eight taxa contributed to the top 90 % of numbers in CIMP2; sprat, Atlantic herring, whiting, gobies of the genus *Pomatoschistus* spp., Dover sole, poor cod, five-beard rockling and thin-lipped grey mullet.

Fish entrapment: First stage of the assessment: selecting species representative of the typical fish species assemblage of the Estuaries qualifying habitat:

9.4.114 The first stage of the assessment requires selection of those species that are representative of the typical fish species assemblage. For these species analytical assessments of effects can be undertaken and used as a proxy for other species within the typical fish species assemblage.

9.4.115 Key taxa were selected from over 90 species recorded during sampling at HPB (noting that many of these occur in very low numbers, infrequently, and are not sufficiently abundant to play an important role in the trophic functioning of the Severn Estuary's ecosystem). Species were therefore selected for assessment if they met one or more of the following three criteria, in either CIMP dataset, or the RIMP dataset for conservation species:

- Ecological importance: This reflects abundant species that potentially play an important role within the ecosystem and contribute to ecological function within the assemblage. Species include: sprat, whiting, Dover sole, thin lipped grey mullet, five bearded rockling, sand goby[121], European flounder, bib (pouting), poor cod and common sea snail that contributed over 1 % of numbers in at least one of the CIMP data series. Brown shrimp *Crangon crangon* were included due to their importance as a prey species.
- Conservation importance: This reflects species drawn from the 'section 41 Priority Species' spreadsheet, from NE and Defra[122]. Species include: Allis shad, twaite shad, European eel, Atlantic herring, Atlantic cod, whiting, blue whiting, European plaice, Dover sole, Atlantic salmon, sea trout, river lamprey and sea lamprey.
- Socio-economic value: Species that contributed to 95 % of the ranked cumulative first sale value of commercially-landed finfish in the area off Hinkley Point and contributed to 95 % of the ranked cumulative total impingement abundance in CIMP1 were included in the 2013 DCO NNB HRA report. Species include: Dover sole, Atlantic cod and thornback ray. Note: European sea bass and thornback ray were added after the granting of the 2013 DCO due to the locally important recreational fisheries for both species and the recent international decline in the European sea bass population.

9.4.116 These three criteria produce a list of 25 fish species (Table 9-4 below), plus brown shrimp. These species are representative of the typical fish species assemblage susceptible to entrapment at Hinkley Point because:

- the 25 finfish species represent 99.0 % and 98.8 % of the total numbers of fish impinged at HPB during CIMP1 and CIMP2, respectively;
- the 25 finfish species represent 99.7 % of impingement biomass at HPB in CIMP1 and 98.3 % of impingement biomass in CIMP2;
- all of the conservation species designated as Annex II qualifying features and Ramsar Criterion 4 migratory species are included as are the commonly impinged species listed in

121 In CIMP1 the term sand goby is applied to the single species of sand goby, Pomatoschistus minutus. A second species in the genus Pomatoschistus, the painted goby P. pictus was also identified. Of the two species in the genus, P. pictus accounted for 1.3 % of the numbers. In CIMP2 gobies in the genus Pomatoschistus were not speciated. The term 'sand gobies' is therefore applied to describe a taxon comprising gobies of the genus Pomatoschistus spp., of which the complex of species of sand goby (P. minutus) is the predominant morphotype.

122 Natural England and Defra (2022) Habitats and species of principal importance in England. Available online at: https://www.gov.uk/government/publications/habitats-and-species-of-principal-importance-in-england. (Accessed 08 October 2023)

accordance with Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006;

- they contain examples from all functional guilds with the exception of freshwater species which, as would be expected, are rarely impinged at Hinkley Point;
- they contain examples from all feeding guilds and habitat groups; and
- they contain all the indicator species impinged at Hinkley Point in the RIMP or CIMP dataset that are assessed in the WFD "fish" biological quality element in transitional waters. Including: twaite shad, Allis shad, European eel, river lamprey, sea lamprey, Atlantic salmon and sea trout.

9.4.117 Two additional species, conger eel and lesser spotted dogfish were selected as being of potential ecological importance based on their contribution to the impinged biomass. While neither species is numerically abundant in the CIMP datasets, conger eel was ranked fourth and first by weight in CIMP1 and CIMP2, respectively, while lesser spotted dogfish ranked ninth in both datasets.

Table 9-4: Representative species and selection criteria for the assessment of entrapment effects. For the functional guilds: MS = Marine seasonal; MJ = Marine juvenile; CA = Diadromous; ER = Estuarine resident; MA = Marine adventitious. For the feeding guilds: Z = Zooplankton feeding; P = Piscivorous feeding; B = Benthic invertebrate feeding; D = Detritus feeding.

Species	Scientific name	Ecological	Conservation	Socio-economic	Functional guild	Feeding guild
Sprat	*Sprattus sprattus*	Top 95 % in CIMP1 & 2			MS	Z
Whiting	*Merlangius merlangus*	Top 95 % in CIMP1 & 2	CIMP1 & 2		MJ	P
Dover sole	*Solea solea*	Top 95 % in CIMP1 & 2	CIMP1 & 2	CIMP1 & 2	MJ	B
Atlantic cod	*Gadus morhua*	>1 % in CIMP1	CIMP1 & 2	CIMP1 & 2	MJ	P
Thin-lipped grey mullet	*Chelon ramada*	Top 95 % in CIMP1 & 2			CA	D
European flounder	*Platichthys flesus*	>1 % in CIMP1 & 2			ER	B
Five-bearded rockling	*Ciliata mustela*	Top 95 % in CIMP1 & 2			MS	B
Atlantic herring	*Clupea harengus*	Top 95 % in CIMP1 & 2	CIMP1 & 2		MJ	Z
Sand goby	*Pomatoschistus spp.*	Top 95 % in CIMP1 & 2			ER	B
Poor cod	*Trisopterus minutus*	>1 % in CIMP2			MA	B
Common sea snail	*Liparis liparis*	>1 % in CIMP2			ER	B
Bib (pout)	*Trisopterus luscus*	>1 % in CIMP2			MJ	B
European sea bass	*Dicentrarchus labrax*	Top 95 % in CIMP1 & 2		CIMP1 & 2	MJ	P
European plaice	*Pleuronectes platessa*		CIMP1 & 2		MJ	B
Thornback ray	*Raja clavata*		CIMP1 & 2	CIMP1 & 2	MA	B
Twaite shad	*Alosa fallax*		CIMP1 & 2		CA	Z

Species	Scientific name	Ecological	Conservation	Socio-economic	Functional guild	Feeding guild
European eel	*Anguilla anguilla*		CIMP1 & 2		CA	P
Blue whiting	*Micromesistius poutassou*		CIMP1 & 2		N/A	N/A
Sea lamprey	*Petromyzon marinus*		CIMP1		CA	P
River lamprey	*Lampetra fluviatalis*		CIMP1		CA	P
Allis shad	*Alosa alosa*		CIMP1		CA	Z
Atlantic salmon	*Salmo salar*		RIMP data set		CA	P
Sea trout	*Salmo trutta*		RIMP data set only		CA	P
Conger eel	*Conger conger*	Ranked 4th & 1st for biomass in CIMP1 & 2, respectively			MA	P
Lesser spotted dogfish	*Scyliorhinus canicula*	Ranked 9 th for biomass in CIMP1 and CIMP2.			MA	P
Brown shrimp	*Crangon crangon*	CIMP1 & 2: most commonly impinged invertebrate (along with ghost shrimp *Pasiphaea sivado* in CIMP2.			-	-

Fish entrapment: First stage of assessment: Estimates of impingement and entrainment for the typical fish species of the Estuaries qualifying habitat:

9.4.118 The unmitigated number and weight of fish that would be impinged by HPC (without an AFD) is given in Table 9-5 below. For each species, the estimated numbers that would be impinged at HPC are given, based on CIMP1 and CIMP2 sampling at HPB. Note that these are raw numbers and represent fish that are predominantly juveniles. Next, the EA EAV-SPF factor and mean spawner weight has been applied to the raw unmitigated numbers impinged to give the equivalent number and weight of adults that would be impinged by HPC (without an AFD) (Table 9-6).

9.4.119 The mitigated number and weight of fish that would be impinged at HPC (without an AFD) is given in Table 9-7. For each species, the mean EAV-SPF number and weight of fish that would be impinged at HPC was multiplied by the capped head, LVSE and FRR factors. For simplicity, only the mean mitigated numbers and weights are given. For completeness, the EA EAV-SPF adult equivalent additional numbers of fish lost to entrainment and on a 5 mm mesh are also given to allow full entrapment to be calculated.

9.4.120 The modelled entrapment effect with lower and upper 95 % CIs (as a % of the population comparator) derived from the uncertainty analyses are given in the relevant species tables for river lamprey (Table 9-1), sea lamprey (Table 9-2) and twaite shad (Table 9-4) and for the remaining species in Table 9-8.

Fish entrapment: First stage of assessment: Effects on the populations of the typical fish species of the Estuaries qualifying habitat:

9.4.121 Full quantitative assessments are possible for data-rich species for which population information is available. These include commercially targeted marine species and Annex II species. In these cases, quantitative assessments have been undertaken, and entrapment losses have been contextualised relative to population estimates. Further uncertainty analyses have been undertaken which provide a mean and upper 95 % CIs of predicted effects (%). Table 9-8 below, presents the outputs from uncertainty analysis. For the four marine species which were the focus of the WDA Permit inquiry (Atlantic cod, Atlantic herring, European sea bass and whiting) the values used by the EA at the WDA Permit inquiry are provided alongside the updated assessments of CIMP1 and new data from CIMP2. For the species that were not the focus of the WDA Permit inquiry and for which quantitative assessments can be made (sprat, Dover sole, European plaice, thornback ray and blue whiting), the values given by the EA in their 2020 AA are provided alongside the updated assessments of CIMP1 and new data from CIMP2.

9.4.122 For the remaining nine fish species (thin-lipped grey mullet, European flounder, five-beard rockling, sand goby *Pomatoschistus* sp., poor cod, bib, common sea snail, conger eel and lesser spotted dogfish) and brown shrimp, where quantitative analysis was not achievable, for example where data on population size / landings was not available, a qualitative assessment has been undertaken, on the basis of available evidence around the species biology, entrapment rates and trends analysis from the RIMP dataset.

Table 9-5: Raw unmitigated and mitigated mean numbers and weight (kg) of fish impinged at HPC in CIMP1 and CIMP2.

Species	Species designation				Numbers				Biomass (kg)			
					CIMP1		CIMP2		CIMP1		CIMP2	
					Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Twaite shad	Inquiry species	Typical fish species assemblage	Criteria 4	Annex II	2,131	491	12,843	2,954	24	6	23	5
Atlantic salmon	Inquiry species	Typical fish species assemblage	Criteria 4	Annex II	-	-	-	-	-	-	-	-
Allis shad	Inquiry species	Typical fish species assemblage	Criteria 4	Annex II	70	16	-	-	19	4	-	-
River lamprey		Typical fish species assemblage	Criteria 4	Annex II	70	14	-	-	2	0	-	-
Sea lamprey		Typical fish species assemblage	Criteria 4	Annex II	171	70	-	-	65	27	-	-
European eel		Typical fish species assemblage	Criteria 4		1,099	219	542	108	213	43	86	17
Sea trout		Typical fish species assemblage	Criteria 4		-	-	-	-	-	-	-	-
Atlantic cod	Inquiry species	Typical fish species assemblage			315,571	177,540	26,915	15,143	7,660	4,309	366	206
Atlantic herring	Inquiry species	Typical fish species assemblage			108,714	25,004	1,765,847	406,145	668	154	2,054	472
Whiting	Inquiry species	Typical fish species assemblage			1,949,645	1,075,424	423,077	233,369	27,642	15,248	5,140	2,835
European sea bass	Inquiry species	Typical fish species assemblage			29,671	18,043	11,330	6,889	2,535	1,542	857	521
Sprat		Typical fish species assemblage			3,641,032	837,437	1,786,803	410,965	26,432	6,079	2,037	469
Dover sole		Typical fish species assemblage			457,527	91,506	392,360	78,472	7,778	1,556	3,660	732
European plaice		Typical fish species assemblage			4,183	836	5,944	1,189	183	37	244	49
Thornback ray		Typical fish species assemblage			2,560	1,395	2,041	1,112	1,000	545	625	341
Blue whiting		Typical fish species assemblage			1,082	716	242	160	39	26	9	6

Species	Species designation	Numbers				Biomass (kg)			
		CIMP1		CIMP2		CIMP1		CIMP2	
		Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Thin-lipped grey mullet		215,568	215,568	137,567	137,569	6,871	6,871	2,352	2,352
European flounder		180,139	36,028	60,148	12,030	9,752	1,950	2,993	599
Five-bearded rockling		125,022	25,005	163,924	32,785	2,895	579	2,858	572
Sand goby (*Pomatoschistus* spp.)		66,666	13,333	407,748	81,550	52	10	588	118
Poor cod		10,071	10,071	185,583	185,582	127	127	596	596
Bib		7,097	7,097	118,792	118,793	257	257	812	812
Common sea snail		28,843	15,719	126,419	68,899	110	60	562	306
Conger eel		4,657	2,538	7,849	4,278	9,110	4,965	11,471	6,252
Lesser spotted dogfish		4,600	2,507	2,839	1,547	2,722	1,484	1,373	748
Sub-total		**7,156,190**	**2,556,577**	**5,638,814**	**7,799,379**	**67,328**	**24,546**	**30,180**	**13,952**
Total (all species)		**7,225,786**	**2,593,362**	**5,705,437**	**1,832,905**	**106,513**	**45,836**	**39,382**	**18,060**

Table 9-6: Unmitigated adult equivalent mean number and weight (kg) of fish impinged at HPC (without AFD) in CIMP1 and CIMP2. For simplicity, only the mean impingement numbers and weights are given. WDA Permit inquiry species are shown in bold.

Species	CIMP1				CIMP2			
	EAV-SPF	Mean spawner weight (kg)	Unmitigated EAV-SPF number	Unmitigated EAV-SPF weight (kg)	EAV-SPF	Mean spawner weight (kg)	Unmitigated EAV-SPF number	Unmitigated EAV-SPF weight (kg)
Twaite shad	**0.098**	**N/A**	**209**	**N/A**	**0.035**	**N/A**	**450**	**N/A**
Atlantic salmon	**0.453**	**N/A**	**-**	**N/A**	**0.502**	**N/A**	**-**	**N/A**
Allis shad	**0.663**	**N/A**	**46**	**N/A**	**-**	**N/A**	**-**	**N/A**
River lamprey	1	N/A	70	N/A	1	N/A	-	N/A
Sea lamprey	1	N/A	171	N/A	1	N/A	-	N/A
European eel	1	0.329	1,099	361.571	1	0.329	542	178.318
Sea trout	1	N/A	-	N/A	1	N/A	-	N/A
Atlantic cod	**0.214**	**4.739**	**67,532**	**320,035**	**0.221**	**2.54**	**5,948**	**15,108**
Atlantic herring	**1.272**	**0.065**	**138,284**	**8,988**	**0.228**	**0.084**	**402,613**	**33,820**
Whiting	**0.938**	**0.298**	**1,828,767**	**544,973**	**0.615**	**0.158**	**260,192**	**41,110**
European sea bass	**0.489**	**1.124**	14,509	16,308	**0.397**	**1.204**	4,498	5,416
Sprat	1.55	0.0155	5,643,600	87,476	0.535	0.009	955,940	8,603
Dover sole	1.075	0.353	491,842	173,620	1.227	0.223	481,426	107,358
European plaice	0.672	0.32	2,811	900	1.255	0.228	7,460	1,701
Thornback ray	0.526	3.28	1,347	4,417	0.581	2.693	1,186	3,193
Blue whiting	0.938	0.298	1,015	302	0.615	0.315	149	47
Thin-lipped grey mullet	1	N/A	215,568	N/A	1	N/A	137,567	N/A
European flounder	1	N/A	180,139	N/A	1	N/A	60,148	N/A

Species	CIMP1				CIMP2			
	EAV-SPF	Mean spawner weight (kg)	Unmitigated EAV-SPF number	Unmitigated EAV-SPF weight (kg)	EAV-SPF	Mean spawner weight (kg)	Unmitigated EAV-SPF number	Unmitigated EAV-SPF weight (kg)
Five-bearded rockling	1	N/A	125,022	N/A	1	N/A	163,924	N/A
Sand goby (*Pomatoschistus* spp.)	1	N/A	66,666	N/A	1	N/A	407,748	N/A
Poor cod	1	N/A	10,071	N/A	1	N/A	185,583	N/A
Bib	1	N/A	7,097	N/A	1	N/A	118,792	N/A
Common sea snail	1	N/A	28,843	N/A	1	N/A	126,419	N/A
Conger eel	1	N/A	4,657	N/A	1	N/A	7,849	N/A
Lesser spotted dogfish	1	N/A	4,600	N/A	1	N/A	2,839	N/A

*Note that the estimated number of sea trout impinged annually is the value given by the EA in their 2020 AA.

Table 9-7: Mitigated adult equivalent mean number and weight (kg) of fish impinged at HPC (without AFD) in CIMP1 and CIMP2. For simplicity, only the mean impingement numbers and weights are given. Also given are the estimated adult equivalent (EAV-SPF) numbers of fish entrained or additional fish retained on a 5 mm mesh from the EA AA. WDA Permit inquiry species are shown in bold.

Species	Mitigations			CIMP1		CIMP2		Entrainment – EAV-SPF numbers	Impingement on a 5 mm mesh – EAV-SPF numbers
	Capped head	LVSE	FRR mortality	Mitigated EAV-SPF number	Mitigated EAV-SPF weight (kg)	Mitigated EAV-SPF number	Mitigated EAV-SPF weight (kg)		
Twaite shad	0.23	1	1	48	N/A	103	N/A	-	-
Atlantic salmon	0.23	1	1	12*	N/A	22*	N/A	-	-
Allis shad	0.23	1	1	11	N/A	N/A	N/A	-	-
River lamprey	1	1	0.2	14	N/A	-	N/A	-	-
Sea lamprey	1	1	0.4071	70	N/A	-	N/A	-	-
European eel	1	1	0.2	220	72	108	36	1,581,697 (glass eel)‡	-
Sea trout	1	1	1	8*	N/A	-	N/A	-	-
Atlantic cod	1	1	0.5626	37,994	180,052	3,346	8,500	-	-
Atlantic herring	0.23	1	1	31,797	2,067	92,438	7,778	267	49,090
Whiting	1	1	0.5516	1,008,748	300,607	143,522	22,676	-	-
European sea bass	1	1	0.6081	8,823	9,917	2,735	3,293	-	651

Species	Mitigations			CIMP1		CIMP2		Entrainment – EAV-SPF numbers	Impingement on a 5 mm mesh – EAV-SPF numbers
	Capped head	LVSE	FRR mortality	Mitigated EAV-SPF number	Mitigated EAV-SPF weight (kg)	Mitigated EAV-SPF number	Mitigated EAV-SPF weight (kg)		
Sprat	0.23	1	1	1,298,028	20,119	219,866	1,979	124,500	1,376,618
Dover sole	1	1	0.2	98,368	34,724	96,285	21,472	-	1,299
European plaice	1	1	0.2	562	180	1,492	340	15	11,609
Thornback ray	1	1	0.545	734	2,407	646	1,740	-	-
Blue whiting	1	1	0.6614	671	200	98	31	-	-
Thin-lipped grey mullet	1	1	1	215,568	N/A	137,567	N/A	-	-
European flounder	1	1	0.2	36,028	N/A	12,030	N/A	-	-
Five-bearded rockling	1	1	0.2	25,004	N/A	32,785	N/A	-	-
Sand goby (*Pomatoschistus* spp.)	1	1	0.2	13,333	N/A	81,550	N/A	-	-
Poor cod	1	1	1	10,071	N/A	185,583	N/A	-	-
Bib	1	1	1	7,097	N/A	118,792	N/A	-	-
Common sea snail	1	1	0.545	15,719	N/A	68,898	N/A	-	-

Species	Mitigations			CIMP1		CIMP2		Entrainment – EAV-SPF numbers	Impingement on a 5 mm mesh – EAV-SPF numbers
	Capped head	LVSE	FRR mortality	Mitigated EAV-SPF number	Mitigated EAV-SPF weight (kg)	Mitigated EAV-SPF number	Mitigated EAV-SPF weight (kg)		
Conger eel	1	1	0.545	2,538	N/A	4,278	N/A	-	-
Lesser-spotted dogfish	1	1	0.545	2,507	N/A	1,547	N/A	-	-

*For Atlantic salmon, the number of adults given for CIMP1 is the number calculated by the EA and used in the WDA Permit inquiry, based on analysis of RIMP data from 1997-2017. The value given for CIMP2 was updated using RIMP data from 1997-2019 and CIMP1 and CIMP2 data, using the EA method.

†For sea trout, no benefit is assumed for the capped head design.

‡For European eel, the number of entrained glass eels is the raw number that would be abstracted, based on eel densities from the surveys. Accounting for entrainment survival results in an entrained estimate of 538,410 glass eels (approximately 180 kg).

Table 9-8: Predictions of mean, lower and upper 95 % entrapment effects of HPC (without AFD) (and with capped head and FRR mitigation measures) on selected fish species populations of the typical fish species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC. Values are presented alongside the EA AA (2020) / WDA Permit inquiry.

Species	Dataset	Re-scaled population estimate (weight or numbers)	EA-WDA Permit inquiry or EA-AA predicted population effects	Current assessment entrapment mean population effect	Current assessment entrapment Lower 95 %-Upper 95 % population effect
Atlantic cod	CIMP1	1,195 t	15.7 %	10.03 %	3.12 %-23.56 %
Atlantic cod	CIMP2	278 t		2.09 %	0.76 %-4.37 %
Atlantic herring	CIMP1 (landings)	157 t	4.0 %	2.99 %	2.37 %-3.90 %
Atlantic herring	CIMP2 (landings)	23 t		48.36 %	29.74 %-80.66 %
Atlantic herring ‡	CIMP1 (PELTIC biomass)	1,723 t		0.12 %	0.01 %-0.51 %
Atlantic herring ‡	CIMP2 (PELTIC biomass)	2,198 t		0.18 %	0.02 %-0.69 %
Whiting	CIMP1	2,917 t	6.5 %	13.23 %	7.05 %-21.29 %
Whiting	CIMP2	1,840 t		1.61 %	0.70 %-3.09 %
European sea bass	CIMP1	650 t	2.1 %	1.70 %	0.85 %-2.78 %
European sea bass	CIMP2	368 t		1.18 %	0.51 %-2.39 %
Sprat ≠	CIMP1 (PELTIC SSB)	7,704t	0.7 %	0.54 %	0.40 %-0.76 %
Sprat ≠	CIMP2 (PELTIC SSB)	3,348 t		0.42 %	0.38 %-0.48 %

Species	Dataset	Re-scaled population estimate (weight or numbers)	EA-WDA Permit inquiry or EA-AA predicted population effects	Current assessment entrapment mean population effect	Current assessment entrapment Lower 95 %-Upper 95 % population effect
Sprat ≠	CIMP1 (PELTIC biomass)	21,422 t		0.10 %	0.05 %-0.18 %
Sprat ≠	CIMP2 (PELTIC biomass)	129,060 t		0.003 %	0.002 %-0.004 %
Dover sole	CIMP1	884t	7.4 %	2.53 %	0.94 %-5.08 %
Dover sole	CIMP2	1,716 t		0.81 %	0.27 %-1.77 %
European plaice	CIMP1	308 t	0.4 %	0.57 %	0.14 %-1.04 %
European plaice	CIMP2	240 t		0.57 %	0.15 %-1.03 %
Thornback ray	CIMP1	122 t	3.21 %	1.73 %	0.97 %-2.84 %
Thornback ray	CIMP2	157 t		0.97 %	0.30 %-2.37 %
Blue whiting	CIMP1	509,095 t	0.00 %	<0.001 %	<0.001 %-<0.001 %
Blue whiting	CIMP2	868,406 t		<0.001 %	<<0.001 %-0.001 %
Allis shad	CIMP1	1,083	0.6 %	1.48 %	0.29 %-6.24 %
Allis shad	CIMP2		N/A	N/A	N/A
Atlantic salmon	RIMP	17,616	0.07 %		
Atlantic salmon	RIMP & CIMP	17,616		0.06 %	<0.01 %-0.36 %
Sea trout	CIMP1	8,750	<0.1 %	0.1 %	0.4 %
Sea trout	CIMP2		N/A	N/A	N/A

Species	Dataset	Re-scaled population estimate (weight or numbers)	EA-WDA Permit inquiry or EA-AA predicted population effects	Current assessment entrapment mean population effect	Current assessment entrapment Lower 95 %-Upper 95 % population effect
European eel	CIMP1 impingement	214t	3.27 %	2.86 %	1.32 %-7.47 %
European eel	CIMP1 entrainment	331 t			
European eel	CIMP2 impingement	35 t		2.91 %	1.36 %-7.50 %
European eel	CIMP2 entrainment	331 t			

ǂ The weight of impinged Atlantic herring is compared directly against the estimated biomass for the Bristol Channel based on the PELTIC survey data (PELTIC biomass) in addition to the landings estimate used by the EA in their 2020 AA and at the WDA Permit inquiry.

≠ The weight of impinged sprat is compared directly against the estimated biomass for the Bristol Channel based on the PELTIC survey data (PELTIC biomass) and the impinged EAV weight is compared to the estimated SSB from the same data source (PELTIC SSB).

9.4.123 Consideration has been given to the entrapment effects of each of the key marine taxa and conclusions on these assessments are summarised in Table 9-9 below:

Table 9-9: Further consideration in relation to impingement and entrapment assessments

Species	Conclusions
Species of focus in the WDA Permit inquiry	
Atlantic cod	Atlantic cod was identified as a key species for the WDA Permit inquiry. It was one of the 4 marine fish species (of the Estuaries qualifying habitat's fish species assemblage) which led the Inspector to conclude, at IR11.208 "*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 Appropriate Assessment 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*." The current predicted level of effect for CIMP1 (of 10.0 % of the re-scaled spawning population) is less than that calculated by the EA for the WDA Permit inquiry (15.7 %). The predicted effect for CIMP2 indicates a five-fold decrease on CIMP1 (2.1 % of the re-scaled spawning population). During the WDA Permit inquiry, the Planning Inspector concluded that due to the size of the re-scaled stock area used by the EA, the entrapment effects represent the very upper limit of losses. It is noted that CIMP1 data collection coincided with an exceptional recruitment year for Atlantic cod, and the effects of fishing mortality are not included in the CIMP1 or CIMP2 assessment, thereby giving highly inflated population effects estimates. Fishing and other drivers of recruitment are predicted to be the overriding factors on determining the occurrence of juvenile Atlantic cod in inshore waters of Bridgwater Bay. The stock is currently in poor condition and despite the high degree of precaution the evidence from CIMP1 means it is not possible to alter the conclusions of the EA 2020 AA and WDA Permit inquiry.
Atlantic herring	Atlantic herring was one of the 4 marine fish species (of the Estuaries qualifying habitat's fish species assemblage) which led the Inspector to conclude, at IR11.208 "*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*." Revision of the CIMP1 entrapment effect (3.0 % of landings) results in a reduction of the mean entrapment effect used by the EA in the WDA Permit inquiry (4.0 % of landings). The CIMP2 entrapment effects are higher than those of CIMP1 (48.4 % of landings). However, these effects are compared against landings from a small-scale fishery and which only represent part of the total Atlantic herring biomass in the Bristol Channel. Contextualising entrapment losses against a small-scale fishery may lead to spurious conclusions on the level of effects in the case that fishery landings are not directly related to the size of the stock. For Atlantic herring, although the adult equivalent weight of fish that would be impinged increased threefold from ~2,000 kg in CIMP1 to ~7,800 kg, in CIMP2 the calculated entrapment effect increased over 16-fold compared to landings, because of the low level of landings by the Atlantic herring fishery in ICES division 7.f.

Species	Conclusions
	In comparison, the Atlantic herring biomass estimated in the Bristol Channel increased from a mean of 1,723 t in 2013-2015 to 2,198 t in 2021. When compared against the biomass of Atlantic herring in the Bristol Channel estimated from Cefas PELTIC surveys, the entrapment effects are well below 1 % of total biomass. In their 2020 AA, the EA noted evidence of local spawning grounds within the Bristol Channel as well as genetically differentiated sub-populations. The Planning Inspector considered several studies indicating that there may be local recruitment and sub-populations within the Bristol Channel and the Welsh Coast area. He concluded 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…*" (IR11.168). Whilst contextualising losses against the biomass of Atlantic herring in the Bristol Channel points to very low entrapment rates, evidence of sub-populations of Atlantic herring within the Bristol Channel[123] mean that there is uncertainty around how those losses affect components of the sub-population structure, and there is no further evidence to alter the conclusions of the EA 2020 AA and WDA Permit inquiry.
Whiting	Whiting was one of the 4 marine fish species (of the Estuaries qualifying habitat's fish species assemblage) which led the Inspector to conclude, at IR11.208 "*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*." Based on CIMP1 analysis, effects are predicted to be 7.1 % of the re-scaled spawning population. This reflects an increase in the entrapment effect value compared to the EA prediction in the WDA Permit inquiry (6.5 %) because of changes to advice on whiting maturity. The predicted effects in CIMP2 (1.6 % of the re-scaled spawning population) is a notable decrease on that of CIMP1. This assessment is considered precautionary because of excluding fishing mortality from the assessment and the Planning Inspector's conclusion that the EA stock area represents the upper limit of loss. Fishing and other drivers of recruitment are predicted to be the overriding drivers on stock dynamics. The stock is currently in poor condition and the RIMP analyses reflect recent declines in whiting impingement. Whilst the new evidence points to lower entrapment rates, the application of the EA assessment approaches means that there is no further evidence to alter the conclusions of the EA 2020 AA and WDA Permit inquiry.
European sea bass	European sea bass was one of the 4 marine fish species (of the Estuaries qualifying habitat's fish species assemblage) which led the Inspector to conclude, at IR11.208 "*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*

123 Clarke, D., Davies, C.E., Allen, C., Blow, G., Furness, E., Franconi, N., Gwilliam, M., Naylor, K., Rees, S., Robinson, M., Farrell, E.D., 2021. Preliminary Report for Devon and Severn Inshore Fisheries and Conservation Authority. 2018-2020 Sampling and Morphological data Irish and Celtic Seas Herring Project. Swansea University, 34 pp.

Species	Conclusions
	2020 Appropriate Assessment 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." The updated results from CIMP1 analysis indicates an effect of HPC entrapment without an AFD of 1.7 % of the re-scaled spawning population. This represents a reduction of the entrapment effect value estimated by the EA in the WDA Permit inquiry (2.1 %). Mean predicted entrapment losses from CIMP2 (1.2 % of the re-scaled spawning population) are less than CIMP1. The Planning Inspector concluded that the re-scaling factor applied by the EA to the ICES stock area was too restrictive and suggested a revised area. When the Planning Inspector's proposed area is applied, the predicted entrapment effect is decreased by over 5-fold. This suggests the assessment, that also discounts fishing mortality, is precautionary. Whilst the new evidence points to lower entrapment rates, the application of the EA assessment approach means that there is no further evidence to alter the conclusions of the EA 2020 AA and WDA Permit inquiry.
Twaite shad	As assessed (Section 9.4.56 et. seq. and in Section 9.6.19 et. seq.) as part of the Ramsar Criteria 4 assemblage of migratory species.
Allis shad	Allis shad is not a qualifying species of the Severn Estuary SAC in its own right but is included as part of the typical fish species assemblage, and forms part of the assemblage of migratory species designated under Criterion 4 of the Severn Estuary Ramsar site. Evidence for self-sustaining populations of Allis shad in the Severn Estuary catchments is limited. During the WDA Permit inquiry, the EA concluded that annual Allis shad losses at HPC would equate to 6 equivalent adults, which corresponds to 0.6 % of the Severn Estuary SAC and Ramsar population proposed by the EA. Following the updates to the CIMP1 data and a recalculation of the Allis shad EA EAV-SPF factor, mitigated losses are estimated at 11 equivalent adult fish per annum. This would result in a predicted loss of 1.48 % for the Severn Estuary SAC and Ramsar population. No Allis shad were recorded in CIMP2, or the additional 2 years of RIMP data. Therefore, on a precautionary basis there is no reason to alter the conclusions of the EA 2020 AA and WDA Permit inquiry in relation to this species based on results from CIMP1. Effects on Allis shad as part of the Ramsar Criteria 4 assemblage of migratory species is assessed in Section 9.6.19 et. seq.
Atlantic salmon	Atlantic salmon is not a qualifying species of the Severn Estuary SAC in its own right but is included as part of the typical fish species assemblage, and forms part of the assemblage of migratory species designated under Criterion 4 of the Severn Estuary Ramsar site. The EA considered in its 2020 AA that this species was a species of concern for the Severn Estuary SAC Estuaries qualifying habitat feature. Atlantic salmon are infrequently impinged and only 9 individuals from different life-history stages were impinged in the 39-year RIMP. No Atlantic salmon were caught in the core CIMP1 period, although two individuals were caught in additional samples collected outside the period of assessment. In their 2020 AA, the EA applied RIMP data to estimate the number of equivalent adult Atlantic salmon that may be impinged annually. During the WDA Permit inquiry, the EA estimated that 12 equivalent adult salmon each year would be lost due to the operation of HPC, which were estimated to be 0.07 % of the population of the Severn Estuary SAC and Ramsar site. Since the WDA Permit inquiry an additional year of intensive CIMP sampling and two additional years of RIMP data for 2018 and 2019 are available, during which a pre-spawning adult fish occurred in a sub-sample of the RIMP. This data, coupled with the two fish impinged in CIMP1 has been used to update the annual estimate for Atlantic salmon impingement to a mean of 22 adults per annum. Whilst predicted losses of Atlantic salmon

Species	Conclusions
	are low and prone to stochastic events, the updated impingement data provides no additional evidence to alter the conclusions of the EA 2020 AA and WDA Permit inquiry. Effects on Atlantic salmon as part of the Ramsar Criteria 4 assemblage of migratory species is assessed in Section 9.6.19 et. seq.
Quantitatively assessed species	
Sea trout	Sea trout are not a qualifying species of the Severn Estuary SAC in their own right but are considered in relation to the species being part of the typical fish assemblage species of the Estuaries qualifying habitat of the SAC. The species is one of the species within the migratory species assemblage under Criteria 4 of the Severn Estuary Ramsar site (see Section 9.6.19 et. seq.. No sea trout were recorded in either CIMP sampling programme, and occurrences are therefore very uncommon events, resulting in uncertainty in impingement predictions. The EA 2020 AA used an estimate of sea trout abundance (as annual spawners) from a simple model of abundance relative to river size. The EA calculated impingement effect based on a single occurrence in the RIMP and estimated annual losses of 8 adult equivalent fish per annum accounting for <0.1 % of the Severn Estuary SAC and Ramsar population. When considering the conservation objectives, the EA concluded the sea trout was not a species of concern for the Severn Estuary SAC or Ramsar site. No additional sea trout were caught in the RIMP in 2018 and 2019, or in CIMP2. Therefore, there is no further evidence to change the conclusions in the EA 2020 AA.
Sea lamprey	As assessed above (as it is a qualifying species of the Severn Estuary SAC in its own right) and in Section 9.6.19 et. seq. as part of the Ramsar Criteria 4 assemblage of migratory species.
River lamprey	As assessed above (as it is a qualifying species of the Severn Estuary SAC in its own right) and in Section 9.6.19 et. seq. as part of the Ramsar Criteria 4 assemblage of migratory species.
European eel	European eel are subject to two routes of impact from HPC, entrainment of juvenile stages, principally glass eels and smaller individuals of yellow eels, and impingement of larger fish. In the assessments supporting the 2013 DCO, it was concluded that there would be no adverse effects on eel with the installation of mitigation measures (AFD and FRR). The AFD was assumed to have zero benefit for European eel that are not hearing specialists. However, since the original 2013 DCO, European eel has continued to decline across its range and the species is failing its management target in the Severn and south-west River Basin District (RDB) management units. The EA in their 2020 AA concluded that European eel was a species of concern for the Severn Estuary SAC and Ramsar site. The overwhelming contribution towards the assessment of effects in the EA 2020 AA was losses of glass eel stages due to entrainment. Effects on eel are considered in greater detail in Section 9.6.19 et. seq. as part of the Ramsar Criteria 4 assemblage of migratory species.
Sprat	Updated entrapment predictions indicate entrapment effects for sprat of less than 1 % of the spawning population for CIMP1 and CIMP2. Furthermore, entrapment losses compared against the total biomass of sprat in the Bristol Channel estimated from Cefas PELTIC surveys, are also well below 1 %. In their 2020 AA, the EA concluded that sprat was not a species of concern. Based on the findings above the same conclusion is now reached.
Dover sole	Updated CIMP1 analysis results in a reduction of the entrapment effect of 7.5 % of the re-scaled spawning population) used by the EA in the 2020 AA. Mean predicted losses from CIMP2 (0.6 % of the spawning population) are less than the updated CIMP1 predictions (2.5 %). The stock is

Species	Conclusions
	currently being harvested sustainably, and stock biomass is well above the precautionary level. Furthermore, Dover sole have shown an increasing abundance trend in the RIMP dataset. In their 2020 AA, the EA concluded that Dover sole was not a species of concern. Based on the updated CIMP1 and new CIMP2 findings above the same conclusion is now reached.
European plaice	Updated entrapment effects based on CIMP1 (0.6 %) and CIMP2 (0.6 %) result in are similar re-scaled population-level entrapment effects predicted in the EA's 2020 AA (0.4 %). Losses are compared against fishery landings and are therefore a conservative population indicator. In their 2020 AA, the EA concluded that European plaice was not a species of concern. Based on the findings above the same conclusion is now reached.
Thornback ray	Thornback ray is a coastal and shelf species, commonly found in the Bristol Channel and Severn Estuary. This species makes up 0.04 % of finfish impinged in both CIMP1 and CIMP2. Analysis of the RIMP dataset showed a positive trend in abundance between 2000 and 2019. Updated CIMP1 (1.7 %) and CIMP2 (1.0 %) effects from entrapment are lower than that estimated in the EA's 2020 AA (3.2 %). Losses are compared against fishery landings and are therefore a conservative population indicator. In their 2020 AA, the EA did not specifically assess effects on thornback ray, but this species is not considered to be of concern.
Blue whiting	Blue whiting is a pelagic gadoid that is widely distributed in the eastern part of the North Atlantic and the species has a large population size. The species makes up 0.02 % and <0.01 % of finfish impinged in CIMP1 and CIMP2, respectively. Updated entrapment effects indicate extremely low population level effects (<0.001 % of the spawning population for both CIMP1 and CIMP2). The stock is currently being harvested sustainably, and stock biomass is well above the precautionary level. In their 2020 AA, the EA did not specifically assess effects on blue whiting, but the species is not considered to be of concern.
Qualitatively assessed species	
Thin-lipped grey mullet	Thin-lipped grey mullet are abundant within the Severn Estuary, feeding on microphytobenthos and detritus. Analysis of RIMP data indicated a significantly positive trend in the abundance of impinged thin-lipped grey mullet between 1981-2019. In their 2020 AA, the EA concluded that thin-lipped grey mullet was not a species of concern. Based on the findings above the same conclusion is now reached.
European flounder	European flounder are widely distributed through inshore areas along north-east Atlantic coasts, from the White Sea to the Mediterranean Sea and Black Sea, with European flounder and Dover sole being the predominant flatfish species within Bridgwater Bay. European flounder makes up 2.5 % of the impingement numbers of CIMP1, and 1.1 % of CIMP2. Analysis of RIMP data showed no clear signal in European flounder between 1981-2019, although between 2000-2019 a significantly negative biomass trend was observed. The EA, in their 2020 AA concluded that European flounder were not a species of concern. Based on the findings above the same conclusion is now reached.
Five-bearded rockling	Five-bearded rockling makes up 1.7 % and 2.9 % by number of finfish impinged in CIMP1 and CIMP2, respectively, with analysis of the RIMP dataset showing a significant positive trend in abundance between 1981 and 2019, and a positive but not significant trend from 2000 to 2019. The conclusion from the EA's 2020 AA was that it is not a species of concern. Based on the findings above the same conclusion is now reached.

Species	Conclusions
Sand goby	Sand gobies (*Pomatoschistus minutus*) accounted for 0.9 % of finfish impinged in CIMP1, and gobies of the genus *Pomatoschistus* spp. accounted for 7.1 % by number in CIMP2. In their 2020 AA, the EA concluded that sand goby was not a species of concern, based on their stable population trend, and ubiquity across inshore waters. The same conclusion is now reached.
Poor cod	Poor cod is impinged in relatively low numbers contributing 0.1 % and 3.3 % by number of finfish impinged in CIMP1 and CIMP2. The EA concluded that although the RIMP data suggests a slight reduction in abundance over time, there is too much variability in the data to be confident of a decrease in species abundance. The stock is not exploited commercially. In their 2020 AA, the EA concluded that poor cod was not a species of concern. There is no new evidence to change this conclusion.
Bib (pout, pouting)	Bib is another member of the gadoid family that is impinged in relatively low numbers contributing 0.1 % and 2.1 % by number of finfish impinged in CIMP1 and CIMP2, respectively. Like poor cod, the EA concluded that although the RIMP data suggests a slight reduction in abundance over time, there is too much variability in the data to be confident of a decrease in species abundance. A lack of commercial interest means that the species is not subject to overfishing locally. Bib was noted by the EA in their 2020 AA as not being a species of concern in relation to HPC impacts. There is no new evidence to change this conclusion.
Common sea snail	Common sea snail contributed 0.4 % and 2.2 % by number, of finfish impinged in CIMP1 and CIMP2, respectively. Analysis of RIMP data indicated stable levels of impingement with no significant trends in abundance or biomass. In their 2020 AA, the EA concluded that common sea snail was not a species of concern. This was due to its relatively low predicted impingement rates, and because its preference for benthic habitats meant that the likelihood of abstraction would likely be reduced by the raised base of the intake apertures. There is no new evidence to change this conclusion.
Conger eel	Although conger eel were not impinged in high numbers, making up just 0.06 % and 0.14 % by number of finfish impinged in CIMP1 and CIMP2, respectively, the species was assessed by the EA in their 2020 AA because of their large size, and notable contribution to overall impingement biomass. It is estimated that with FRR mitigation, impingement losses of conger at HPC may amount to 4.97 t based on CIMP1 and 6.25 t in CIMP2. The EA concluded that the species has a large stock area and juveniles migrating into the Bristol Channel are probably part of a single, North Atlantic stock and that it is difficult to draw conclusions on how the species may be impacted in the Bristol Channel. Further, the International Union for Conservation of Nature ('IUCN') does not consider European conger eel to be of conservation concern. Consequently, the EA concluded that conger eel was not a species of concern, although the relatively large biomass losses should be considered relative to the predator-prey interactions. There is no new evidence to change the EA's conclusion.
Lesser-spotted dogfish	Lesser spotted dogfish were not assessed by the EA in their 2020 AA. Although lesser spotted dogfish were not impinged in high numbers, making up 0.06 % and 0.05 % by number of finfish impinged in CIMP1 and CIMP2, respectively, the species has been assessed here because of their large size, and notable contribution to overall impingement biomass. Analysis of RIMP data indicated significantly positive trends in the abundance of impinged lesser-spotted dogfish in 1981-2019 and 2000-2019. In terms of impinged biomass, RIMP data indicated a positive trend in 2000-2019. Indices of lesser spotted dogfish relative abundance derived from four research

Species	Conclusions
	surveys in the Celtic Seas Ecoregion also indicate an increase since 2005. Consequently, there is no new evidence to suggest this is a species of concern due to impingement by HPC.
Brown shrimp	Brown shrimp is a key species in the estuarine ecosystem, where it is prey for many species. Brown shrimp are highly abundant at HPB. In their 2020 AA, the EA noted that the population in the Bristol Channel has remained stable and abundant over the last 35 years. Analysis of RIMP data indicated a significantly positive trend in the abundance of impinged brown shrimp in 1981-2019 and positive but non-significant trends between 2000-2019. In their 2020 AA, the EA concluded that, while HPC would entrap large numbers of brown shrimp, these would be replenished from other areas within the Bristol Channel and neighbouring estuaries and that brown shrimp was not a species of concern. Given that RIMP trends for this species remain positive, there is no reason to alter the EA's conclusions.

Fish impingement: Second stage of assessment: Potential effects on the structure and function (including typical fish species) of the Estuaries qualifying habitat: Relevant conservation objective:

9.4.124 As mentioned above, the relevant NE conservation objective of the Estuaries qualifying habitat feature with regard to the typical fish species assemblage is: *"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 habitats".*

9.4.125 The conservation objective therefore focuses on maintaining / restoring the structure and function of Estuaries qualifying feature. Typical species are relevant to / form part of that Estuaries habitat structure and function.

9.4.126 The Planning Inspector explained the distinction between the assessment of the fish species assemblage and the assessment of fish species which are qualifying species in their own right. The inspector noted at IR11.36[124] that:

"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

---

124 Removal of Acoustic Fish Deterrent Conditions from Water Discharge Activity (WDA) Permit, Inspectors Report (accessed 11 December 2023): Removal of Acoustic Fish Deterrent Conditions from Water Discharge Activity (WDA) Permit (publishing.service.gov.uk).

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."

9.4.127 The Planning Inspector again at IR11.207 explained how the fish species assemblage relates to the Estuaries qualifying habitat feature:

IR11.207 "*The relevant question having identified impacts of significance to the populations of the four species of interest [Atlantic cod, Atlantic herring, whiting and European sea bass], is whether that has implications for the assemblage as a whole and its role in assessing the FCS of the Estuaries feature*".

Fish entrapment: Second stage of assessment: Background: The EA's view in 2020:

9.4.128 The EA in their 2020 AA outlined the complexity of the estuarine system with both biotic and abiotic factors making changes in the fish species assemblage challenging to predict.

9.4.129 The EA explained that ecosystem modelling was an approach that may help identify changes in food web interactions. However, whilst ecosystem models provide a mechanism to understand food web dynamics, the baseline information to parameterise the model at the level of the fish species assemblage is not sufficiently advanced.

9.4.130 As a result, the EA applied a qualitative assessment approach based on grouping similar species together using feeding and functional guild information to explore how the species within the group could react to changes in mortality rates as a result of entrapment losses. The EA cautioned that the approach could not resolve the detailed interactions in a complex system but would allow an appropriate level of assessment for ecosystem effects.

9.4.131 The EA assessment found that "*A screening process resulted in the potential impacts of the cooling water system being assessed for 16 fish species within the marine fish assemblage as well as brown shrimp. Our quantitative analyses identified cause for concern over the impacts of the cooling water system on Atlantic cod, European seabass, Atlantic herring, and whiting, with further species being identified as being of concern through qualitative analysis or analysis by proxy. When examining the use of fishes within the estuary, Marine Migrant (MM), Marine Straggler (MS) and Estuarine* [Resident] *Species (ES)* [ER in Table 9-4] *are unlikely* *to be impacted as a whole and will still be represented within the fish assemblage once HPC commences operation, although the proportions of individual species within each guild may be subject to change. Considering feeding guilds, the responses of the piscivore (PV) guild are difficult to predict and it is not possible to rule out an effect on the structure of the assemblage resulting from entrapment losses of PV fish. The impact of losses of prey fish on the migratory component of the fish assemblage are not considered to be of concern*".

9.4.132 In relation to the piscivore feeding guilds the EA noted that "*Piscivores (PV) are the second most abundantly recorded feeding guild in the CIMP dataset, although species are assigned to a feeding guild based on their adult diet. Of those dominant PV species, whiting and European seabass are present as juveniles in the estuary. At this stage, whiting are likely to be feeding on small crustacea, small gobies and clupeids while European seabass will be feeding on small crustacea and shrimp. Atlantic cod will also be feeding on smaller fish, including other small piscivorous and planktivorous fish. The removal of these piscivores from the system will reduce the pressure on other fish populations (such as gobies and small sprat) but it will also remove the fish that provide a core role in the higher trophic levels. Given the current pressures on European seabass and Atlantic cod fishery stocks, it is not clear that if whiting were to be removed in significant numbers that another piscivorous fish species would take over the function that whiting plays within the trophic web. Additionally, European seabass would be less likely to fulfil the role of whiting since their prey focus in Bridgwater Bay has been shown to be invertebrates. In addition to potential interaction between piscivores being difficult to predict once HPC becomes operational, it is also difficult to predict how removal of piscivores could affect their prey, or in turn, the prey of these lower trophic levels. One of the most important predators in the marine fish assemblage present within the site is the European conger. The species is not considered to be of conservation concern and so we have concluded that impacts are not of concern for European conger in its own right. However, annual losses of around 10 tonnes could have a deleterious impact upon the entire assemblage in ways that are not possible to predict*".

Fish entrapment: Second stage of assessment: Background: Planning Inspector's findings in 2021:

9.4.133 The Planning Inspector found that, due to HPC predicted impingement impacts on 4 marine fish species of the fish species assemblage of the Estuaries feature (Atlantic cod, whiting, Atlantic herring and European sea bass), he could not conclude no adverse effect on the integrity of the Severn Estuary SAC:

IR11.208 *"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."*

IR11.209 *"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*[125]*. 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."*

IR11.210 *"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.".*

9.4.134 The Planning Inspector's primary concern, as set out in IR11.209, was therefore the risk of the losses of Atlantic cod, Atlantic herring, whiting and European sea bass on predator-prey relationships and the influence on the structure of the typical fish species assemblage.

Fish entrapment: Second stage of assessment: Background: The Secretary of State's findings in 2022:

9.4.135 The Secretary of State in his decision letter dated 2 September 2022 concluded that due to Estuaries qualifying habitat feature and the conservation objective for that feature (as set out above) the Inspector was correct to conclude that an adverse effect on the integrity of the Severn Estuary SAC could not be excluded beyond reasonable scientific doubt.

125 Based on the deflecting efficiencies reported from the literature in the Environment Agency (2005) guidance report we believe this should read "up to 95 % for herring".

Fish entrapment: Second stage of assessment: purpose

9.4.136 The population assessment explained above reflects the first stage of the assessment of potential effects of HPC (without an AFD) on the Estuaries qualifying habitat feature via entrapment of fish from its typical fish species assemblage.

9.4.137 The second stage of the assessment is to consider the risk of effects specifically on the fish species assemblage and from there the risk of effects on the Estuaries qualifying habitat.

9.4.138 For the second stage of the assessment, and consistent with the approaches applied by the EA in their 2020 AA, the potential for impingement of fish to adversely affect the integrity of the Severn Estuary SAC site by affecting the structure and function (including typical species) of the Estuaries habitat feature has been considered in relation to the feeding and functional guilds of those species that incur impingement mortality. However, in this HRA Report additional information from the CIMP records and alternative data sources have been applied to consider interannual variability in fish abundance, dietary overlap and ontogenetic dietary composition to further establish the potential risk to the typical fish species assemblage.

9.4.139 The integration in this HRA Report of this additional information for a wider range of species into the assessment of the assemblage is important. This is because impingement typically involves the juvenile stages of fish species identified by the EA and Planning Inspector as being of concern, and these juvenile stages only spend a portion of their life cycle within the estuary environment during which time they have seasonal presence and ontogenetic dietary shifts. To determine population level effects, the EA re-scaled the ICES population units for the species assessed as part of their 2020 AA. However, even these re-scaled population units cover large geographic scales relative to the Severn Estuary SAC. Therefore, there is potentially a disconnect between population effects and the potential of risk to the Estuaries qualifying feature's fish species assemblage mediated through perturbation (impacts) in predator-prey relationships that occurs primarily at the juvenile stage. It is therefore informative to consider data on impingement losses of fish together with information on natural variability and dietary composition of the species impinged to provide a qualitative assessment of the potential for effects on the structure and function (including typical species) of the Estuaries qualifying habitat feature.

Fish entrapment Second stage of assessment outcome: summary

9.4.140 It is concluded that it is not possible to exclude beyond reasonable scientific doubt the risk of an adverse effect from the Project alone on the Severn Estuary SAC via the Estuaries qualifying feature from entrapment of fish within the typical fish species assemblage during HPC operation. This is due to the risk of change in fish feeding interactions between the different fish species of the typical fish species assemblage which is relevant to the assessment of impacts on the Estuaries habitat feature. The impact will be less during defueling (decommissioning phase) due to the much-reduced seawater intake over 4 years of defueling. There is no effect via this pathway during HPC construction.

9.4.141 However, it is important to recognise the following factors which put this conclusion into context:

- At the population level, the scale of predicted effects of HPC entrapment (in the absence of an AFD) is not predicted to cause a risk to the viability of any species from the typical fish species assemblage.
- The assessment of population level effects for the four marine species of concern is precautionary in terms of the scale of the population comparator and due to the fact that fishing mortality is not factored into the assessment (Table 9-9).
- Annual entrapment rates would be driven by external factors acting on the population such as fishing pressure and environmental conditions that determine the supply of juvenile stages to the estuary.
- The structure of the assemblage is characterised by substantial seasonal and interannual changes, with natural variability in recruitment leading to order of magnitude differences in the annual abundance of different species in estuarine habitats. The scale of entrapment losses means that any change to the structure of the typical fish species assemblage is likely to be minor relative to natural variability.
- The estuarine food-web is diverse and adapted to variability in relative species abundance through dietary overlap and feeding plasticity.
- The qualitative assessment undertaken points to the complexity of the food-web and multitude of feeding interactions which would be expected to dampen effects to fish predator-prey pathways. This in turn would provide food-web resilience to any changes in the relative abundance of individual species resulting from HPC entrapment (in the absence of an AFD).
- The no adverse effect on integrity test must be considered as against the relevant qualifying feature and conservation objectives. In this case, the qualifying feature is the Estuaries qualifying habitat and its relevant conservation objective is: *"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 the Estuaries qualifying habitat". The focus of the assessment, therefore, is the risk of adverse effect in relation to the structure and function of the Estuaries qualifying habitat as a whole, of which the typical fish species assemblage is just one component amongst many other ecological components. It is against the structure and function of the Estuaries feature as a whole that the effect of entrapment of fish from the typical fish species assemblage must be judged.

9.4.142 This outcome summary is explained in full below.

Fish entrapment: Second stage of assessment outcome: Overview of losses from the typical fish species assemblage

9.4.143 Impingement estimates generated from HPB and scaled to HPC with proposed mitigation measures (FRR and capped head) have been applied to predict annual losses of 2.59 million fish based on CIMP1 and 1.83 million fish based on CIMP2. Eight species are predicted to contribute to the top 95 % of mitigated impingement mortality in CIMP1, including whiting, sprat, thin-lipped grey mullet, Atlantic cod, Dover sole, European flounder, Atlantic herring and five-bearded rockling. In CIMP2, ten species contributed to the top 95 % of impingement mortality numbers, including sprat, Atlantic herring, whiting, poor cod, thin-lipped grey mullet, bib, sand gobies, Dover sole, common sea snail and five-bearded rockling.

9.4.144 In addition to impingement numbers, biomass is also considered here as biomass forms an important component of understanding energy flows through marine food webs. The impingement mortality equates to total annual losses of approximately 45.85 t in CIMP1 and 18.06 t in CIMP2, driven by reductions in impingement of several high biomass species in CIMP2 including sprat, whiting and Atlantic cod. The contribution of the species to the top 95 % of biomass differs to those species' contribution to the top 95 % of numbers. In CIMP1, eight species contribute to the top 95 % of mitigated biomass loss including whiting, thin-lipped grey mullet, sprat, conger eel, Atlantic cod, European flounder, Dover sole, European sea bass and lesser-spotted dogfish. In CIMP2, thirteen species contribute to the top 95 % of mitigated biomass loss including conger eel, whiting, thin-lipped grey mullet, bib, Dover sole, lesser spotted dogfish, European flounder, poor cod, five-bearded rockling, European sea bass, Atlantic herring, sprat and thornback ray.

Fish entrapment: Second stage of assessment outcome: Functional guilds and estuary utilisation during impingement by HPC

9.4.145 When assessing the functional guilds of fish subject to HPC impingement in their 2020 AA, the EA concluded that "*When examining the use of fishes within the estuary, Marine Migrant (MM), Marine Straggler (MS) and Estuarine Species (ES) are unlikely to be impacted as a whole and will still be represented within the fish assemblage once HPC commences operation, although the proportions of individual species within each guild may be subject to change*". Analysis of the CIMP1 data and CIMP2 data supports this conclusion.

9.4.146 Marine Migrants, comprising the Marine Straggler and Marine Juvenile functional groups dominate the predicted mortality of fish in CIMP1 and CIMP2. In terms of numbers and weight, this has been found to primarily consist of sprat, whiting, Dover sole, Atlantic cod, five-bearded rockling, European sea bass and Atlantic herring.

9.4.147 The Marine Adventurous group have been found to represent a small proportion of the fish impinged in CIMP1 (1.6 %) and CIMP2 (10.9 %) by number, but a notably greater proportion by weight (CIMP1 = 15.3 %, CIMP2 = 43.9 %). This group is diverse and includes the large-bodied conger eel and lesser spotted dogfish as well as poor cod and three-bearded rockling, all of which were impinged by weight to a greater relative extent in CIMP2 than in CIMP1. This group of species are associated with coastal marine waters and may enter estuaries to feed.

9.4.148 Estuarine Residents are those species that may breed in the estuary and are able to complete their whole life in the estuarine environment. This group has been found to contribute relatively little numerically (2.6 % and 8.9 %) and by weight (4.4 % and 5.6 %) to CIMP1 and CIMP2, respectively.

9.4.149 The numbers and biomass losses of diadromous species have been found to be largely driven by thin-lipped grey mullet but are also affected by several other migratory species that utilise the estuary for feeding and as a migration route. Freshwater species are uncommonly impinged at HPC due to the location in the outer Estuary and high salinity environment.

9.4.150 The new data provided by CIMP2 indicates the variability in the assemblage but with different estuarine user groups contributing different proportions between years, however, each user group is represented by multiple species in both data series. Therefore, the data supports the conclusions of the EA's 2020 AA.

Fish entrapment: Second stage of assessment outcome: Feeding interactions within fish assemblage species during HPC impingement

9.4.151 Summarising the fish assemblage, Bird (2008)[126] notes that "*The picture that emerges for the fish assemblage in the Severn Estuary and Bristol Channel is one of complex interactions between different species of fish, their predators and prey. The system is characterised by remarkably consistent and robust seasonal cycles in the fish composition, but highly variable inter-annual patterns of abundance that are affected and influenced by a range of environmental variables*". This section specifically addresses the concerns in relation to feeding interactions and the loss of predatory species from the typical fish species assemblage. Whilst it is not possible to conclude that the operation of HPC without an AFD would not result in changes in the structure of the assemblage and predatory-prey dynamics it is demonstrated that the food web is complex with dietary overlap and multiple feeding interactions (fish have a range of prey items and feeding types). These factors would be expected to dampen effects to predator-prey pathways, so providing a degree of food-web resilience to any changes in the relative abundance of individual species in the typical fish species assemblage resulting from HPC impingement. The diverse fish assemblage within the Severn Estuary is comprised of species from a range of feeding guilds including detritivores, benthic invertebrate feeding taxa, zooplankton feeding taxa and piscivorous species (Table 9-4), and that occupy different trophic levels. The pelagic capped head and FRR mitigation measures are predicted to have species-specific efficiencies which will alter the relative mortality rates owing to impingement in comparison to the abundance of the species within the assemblage. The implications of impingement mortality on the feeding interactions of the fish assemblage is dependent upon the scale of the losses relative to natural variability and the resilience of the assemblage to the perturbation. However, the fish assemblage is also controlled by environmental conditions and wider biotic factors resulting in top-down and bottom-up effects.

9.4.152 Detritivores, primarily thin-lipped grey mullet, are abundant in the Severn Estuary and feed on microphytobenthos and detritus. Rates of mortality predicted for this group of species is unlikely to alter the feeding interactions of the fish assemblage due to the species role in feeding on material generated from primary production.

9.4.153 Zooplanktivores include species such as sprat and Atlantic herring and are numerically abundant in the assemblage. Zooplankton feeding taxa account for approximately 34.3 % of

126 Bird, D.J., 2008. The biology and conservation of the fish assemblage of the Severn Estuary (cSAC). Report CCW Report No: CCW/SEW/08/1. 79 pp.

mortality based on CIMP1 and 45.3 % based on CIMP2. The small body size of these taxa means that their relative contribution to biomass losses is lower. Zooplankton feeding taxa feed predominantly on zooplankton (e.g., hydroids and planktonic crustaceans), but start to feed on juvenile stages of fish as they grow. These abundant taxa are an important food source for a range of fish and other species in the estuarine food web. Sprat is the most abundant species and shows high levels of interannual availability (Table 9-10), but RIMP data indicates the population has remained stable over time (Henderson and Bird, 2010[127]). Effects of impingement mortality on the representation and ecological function of this group is therefore unlikely.

Table 9-10: Coefficient of variation ('CV'[128]) for the thirteen species accounting for the top 95 % of numbers in the RIMP timeseries (1981-2019).

Year	Month	Rank: mean annual numbers	CV
Sprat	*Sprattus sprattus*	1	91 %
Whiting	*Merlangius merlangus*	2	52 %
Sand goby	*Pomatoschistus minutus*	3	77 %
Dover sole	*Solea solea*	4	87 %
Poor cod	*Trisopterus minutus*	5	135 %
Atlantic herring	*Clupea harengus*	6	221 %
Bib (pout, pouting)	*Trisopterus luscus*	7	171 %
Common Sea snail	*Liparis liparis*	8	88 %
European flounder	*Platichthys flesus*	9	64 %
European sea bass	*Dicentrarchus labrax*	10	131 %
Five-Beard rockling	*Ciliata mustela*	11	109 %
Atlantic cod	*Gadus morhua*	12	183 %
Thin-lipped grey mullet	*Chelon ramada*	13	128 %

127 Henderson, P.A., Bird, D.J., 2010. Fish and macro-crustacean communities and their dynamics in the Severn Estuary. Mar. Pollut. Bull. 61, 100–114. https://doi.org/10.1016/j.marpolbul.2009.12.017. (Accessed: 11 December 2023)

128 The CV provides a metric describing the variation in the data and is calculated as the standard deviation ÷ mean. The CV is expressed as a %, the higher the percentage the greater the interannual variability in the abundance.

9.4.154 Many species that will be impinged by HPC feed on benthic invertebrates either above, on or in the sediment. Benthic invertebrate feeders are a diverse group with 32 species represented in CIMP1 and CIMP2. The abundance of benthic invertebrate feeding fish changes seasonally. Henderson and Holmes (1991)[129] suggested that the seasonal dynamics in the abundance of the flatfish; dab, Dover sole and European flounder in Bridgwater Bay reduces competition. The abundance and diversity of species within the benthic invertebrate feeding group indicates that effects of impingement mortality on the representation and ecological function of this group is therefore unlikely.

9.4.155 The primary feeding mode of fishes predicted to be subject to HPC mortality are piscivorous taxa. In CIMP1 numerically (49.3 %) and by biomass (59.9 %) piscivorous taxa contribute the highest proportion of losses. In CIMP2, a similar contribution of piscivorous fish to the total biomass was seen (57.9 %), but the contribution declined numerically (14.1 %) with the biomass largely driven by large bodied species such as conger eel. Piscivores predominantly feed on finfish but may also predate large nektonic invertebrates. 20 species assigned as piscivorous were impinged at HPB during both CIMP periods; however, the group was dominated by five species – whiting, Atlantic cod, European sea bass, conger eel and lesser-spotted dogfish. Other species assigned to piscivorous feeding guilds were impinged in smaller numbers and included European eel, pollack, sea lamprey, river lamprey, turbot, horse mackerel, garfish, John Dory and gilthead sea bream and Atlantic salmon (in the RIMP only).

9.4.156 Feeding guild information can provide an insight into the primary dietary components of adult fish and the potential effects of declines in one group of fish on the overall assemblage. However, feeding guild classifications provide a snapshot of the dietary composition of adult fish and mask the complexity in feeding interactions in fish assemblages. The fish impinged at HPC may have a range of feeding types and functional roles within the assemblage that change with life history.

9.4.157 One concern for the EA was the reduction in predation pressure on gobies and sprat. However, sprat and gobies are highly abundant components of the fish species assemblage and provide a feeding resource to a range of species of fish from different trophic levels. In the case of fish, the Cefas gut content analysis database (Pinnegar, 2014[130]) provides insights

129 Henderson, P.A., Holmes, R.H.A., 1991. On the population dynamics of dab, sole and flounder within Bridgewater Bay in the lower Severn Estuary, England. Netherlands J. Sea Res. 27, 337–344.

130 Pinnegar, J.K., 2014. DAPSTOM – An Integrated Database & Portal for Fish Stomach Records. Version 4.7. Centre for Environment, Fisheries & Aquaculture Science, Lowestoft, UK. February 2014, 39pp (Accessed 11 December 2023). Available at: Fish Stomach Records - Cefas (Centre for Environment, Fisheries and Aquaculture Science)

into predator prey relationships. In the Irish Sea and Celtic Sea, gobies are predated on by a wide range of fish taxa including those commonly impinged at HPB, such as conger eel, European plaice, European flounder, Dover sole, Atlantic herring, lesser-spotted dogfish, thornback ray and gadoids (Atlantic cod, whiting, bib and poor cod). Factors other than impingement of predatory species by HPC are likely to be the primary drivers in the seasonal abundance of sprat and gobies.

9.4.158 Furthermore, the fish species classified as piscivorous that contribute the greatest impingement biomass mortality (Atlantic cod, whiting, European sea bass, lesser-spotted dogfish and conger eel), have a diet that consists of a range of prey items including fish and benthic invertebrates (Pinnegar, 2014).

9.4.159 Gut contents analysis of fish impinged at Hinkley Point B identified that the four gadoid species (Atlantic cod, whiting, bib and poor cod) regularly occurring in Bridgwater Bay as juvenile stages fed primarily on epibenthic fauna. *Crangon crangon* was an important prey resource for each of the gadoid species which showed varying degrees of prey selectivity. Whiting was shown to be a generalist feeder of crustaceans, whereas juvenile Atlantic cod primarily fed on small crustaceans such as *Corophium volutator* and shrimps (Henderson et al., 1992[131]). Therefore, concerns about the entrapment of whiting due to their piscivorous role may be reduced. Once gadoid species attain a size at which fish become a larger component of the diet they display feeding plasticity. Juvenile whiting and Atlantic cod feed on a range of fish species including gobies, juvenile clupeids, rocklings, sandeels, flatfishes, dragonets and other gadoids (Armstrong, 1982; Bromley et al., 1997; Hamerlynck and Hostens, 1993[132]).

9.4.160 The dietary composition of European sea bass changes as it grows and fish form a small component of the diet for individuals of the size range impinged at Hinkley Point. The diet of 0-group European sea bass utilising the realigned saltmarshes at Steart Marshes consisted predominantly of the amphipods *Orchestia gammarel* and *Sphaeromatidae* isopods in

---

131 Henderson, P.A., James, D., Holmes, R.H.A., 1992. Trophic structure within the Bristol Channel: seasonality and stability in Bridgewater Bay. J. Mar. Biol. Assoc. UK 72, 675–690.

132 Armstrong, M.J., 1982. The predator-prey relationships of Irish Sea poor-cod (Trisopterus minutus L.), pouting (Trisopterus luscus L.), and cod (Gadus morhua L.). J. du Cons. - Cons. Int. pour l'Exploration la Mernal du 40, 135–152.

Bromley, P.J., Watson, T., Hislop, J.R.G., 1997. Diel feeding patterns and the development of food webs in pelagic 0-group cod (Gadus morhua L.), haddock (Melanogrammus aeglefinus L.), whiting (Merlangius merlangus L.), saithe (Pollachius virens L.), and Norway pout (Trisopte. ICES J. Mar. Sci. 54, 846–853.

Hamerlynck, O., Hostens, K., 1993. Growth, feeding, production, and consumption in 0-group bib (Trisopterus luscus L.) and whiting (Merlangius merlangus L.) in a shallow coastal area of the south-west Netherlands. ICES J. Mar. Sci. 50, 81–91.

summer (Stamp et al., 2023[133]). In the Blackwater Estuary, small 0-group sea bass feed predominantly on calanoid and harpacticoid copepods, whilst larger 0-group individuals feed on amphipods, calanoid copepods and the crab *Carcinus maenas* (Fonseca et al., 2011[134]). As European sea bass grow, fish including juveniles of their own species form a larger contribution towards their diet.

9.4.161 The dietary composition of fish depends on fluctuations in food abundance, predation pressure and competition with dietary shifts occurring seasonally and through ontogeny. Where there is greater diversity and overlap in feeding pathways, the food web may be more resistant and resilient to perturbation due to alternative feeding pathways and ecological redundancy (e.g., Staniczenko et al., 2010[135]). The classification of the predominantly juvenile fish impinged at Hinkley Point as piscivorous and benthic invertebrate feeders masks the range in diet with juvenile stages consuming a range of prey items including benthic invertebrates and small fish. Food webs in marine ecosystems are adapted to seasonal and interannual changes in relative species abundance and food availability through plasticity in feeding behaviour and prey selectivity. This interannual variability is apparent in the large CV observed between RIMP years meaning predator-prey interactions and the predator-prey dynamics within the assemblage is variable.

9.4.162 The Planning Inspector noted at paragraph IR11.47 (above) 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*". Impingement losses in the absence of an AFD are not predicted to impact the viability of any given species within the assemblage; however, impacts would occur across a range of species with impingement rates fluctuating based on annual abundance. In any system subject to perturbation, natural or anthropogenic, some species will benefit whilst others decline. The fish assemblage is diverse and the multitude of feeding interactions and overlapping prey resources leads to a complex food web that provides resilience to changes in the relative abundance of individual species dampening direct predator-prey oscillations. This is the case even though it is not possible to conclude beyond reasonable scientific doubt that changes in the structure of the assemblage and predatory-prey dynamics would not be adversely affected.

133 Stamp, T., West, E., Colclough, S., Plenty, S., Ciotti, B., Robbins, T., Sheehan, E., 2023. Suitability of compensatory saltmarsh habitat for feeding and diet of multiple estuarine fish species. Fish. Manag. Ecol. 30, 44–55.

134 Fonseca, L., Colclough, S., Hughes, R.G., 2011. Variations in the feeding of 0-group bass Dicentrarchus labrax (L.) in managed realignment areas and saltmarshes in SE England. Hydrobiologia 672, 15–31.

135 Staniczenko, P.P.A., Lewis, O.T., Jones, N.S., Reed-Tsochas, F., 2010. Structural dynamics and robustness of food webs. Ecol. Lett. 13, 891–899.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Changes in hydrodynamics and sediment transport:

9.4.163 There is a temporary risk of sediment release during groundworks in the creation / enhancement of habitats at Pawlett Hams and The Island which could affect hydrodynamics and sediment transport and thereby water quality in the immediate vicinity of the works although these works could be timed to avoid high tide so as to minimise this.

9.4.164 Furthermore, once established, the habitat creation / enhancement at Pawlett Hams and The Island will aid in the maintenance of sediment levels within the Severn Estuary, rather than causing material to potentially leave the system. Whilst material may move in and out of the areas at a superficial level, it will overall remain within the Severn Estuary system, thereby supporting the maintenance of sediment-based habitats within the wider estuaries feature, and SAC.

9.4.165 The compensatory habitat measures at Pawlett Hams and The Island will also bring substantial benefits for the ecological function of the estuaries feature, including through direct and indirect benefits to the typical species of the habitat, for example through supporting juveniles of a range of fish species, and increasing prey availability for predatory groups, such as larger / adult fish, birds and marine mammals.

9.4.166 On this basis, there will be no adverse effect on the integrity of the SAC via the Estuaries qualifying habitat feature through changes to the hydrodynamics and sediment transport as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Changes to water quality (contaminant / nutrient release)

9.4.167 There is the potential for sediment to be disturbed during construction works at Pawlett Hams and The Island. Increased suspended sediment levels have the potential to alter water quality, for example through the introduction of contaminants or nutrients into the system. These in turn may affect features such as Estuaries habitat. In addition, there may be run-off of polluting materials from the works, which could enter the estuarine environment.

9.4.168 With regards to the introduction of sediment into the estuarine system, the Severn Estuary, as noted, is a highly turbid and dynamic environment, with variable background levels. Changes as a result of works at Pawlett Hams / The Island will be subsumed into these background levels, and no noticeable alteration in suspended sediment concentrations is anticipated.

9.4.169 Further, through implementation of standard pollution-control best practice measures, the release of contaminants / other pollutants can be mitigated against, further reducing the potential for adverse changes in water quality.

9.4.170 On this basis, there will be no adverse effect on the integrity of the Severn Estuary SAC via the Estuaries qualifying habitat feature through this pathway as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: effects on the typical waterfowl species assemblage of the Estuaries qualifying habitat feature

9.4.171 See the assessment provided below at Section 9.5.42 and 9.5.11 et. seq. for the Severn Estuary SPA waterbird assemblage. This applies equally here since the typical waterfowl species assemblage of the Estuaries habitat feature of the Severn Estuary SAC is made up of the same 16 bird species as fall within the SPA's waterbird assemblage qualifying feature.

Pawlett Hams / The Island: effect on the typical fish species assemblage of the Estuaries qualifying habitat feature

9.4.172 See the following assessment categories in relation to this pathway for the river lamprey qualifying species of the Severn Estuary SAC above. These assessments apply equally here to the typical fish species assemblage of the Estuaries qualifying habitat feature:

- Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities at Section 9.4.18 et seq.
- Pawlett Hams / The Island: Mortality / injury through construction during habitat works at 9.4.23 et seq.
- Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works at 9.4.26 et seq.
- Pawlett Hams / The Island: Indirect effects on fish populations due to changes to hydrodynamics and sediment transport during habitat works at 9.4.28 et seq.

Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye): effect on the typical fish species assemblage of the Estuaries qualifying habitat feature: Disruption of migratory routes:

9.4.173 The weirs which may be the subject of works within the DCO Material Change Order Limits are the Maisemore Weir, River Severn; the Upper Lode Wier, River Severn; and the Mousenatch / Eyton / Coxall weirs on the River Lugg.

9.4.174 These works could potentially affect migratory fish within the typical fish species assemblage.

9.4.175 Temporary construction works to remove / modify these weirs would likely require dewatering of the river at the weir to facilitate works. During the anticipated four months of construction, the water flow in the river would be maintained through other means, e.g. via a flume. Whilst there is potential for this to disrupt the pathways of migratory fish, such flumes can be designed to enable the movement of fish past the works. Disruption of migratory routes can also occur through changes in water quality, for example increased suspended sediment and associated reductions in dissolved oxygen. However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, fish passage will not be affected, and adverse effects on populations through disruption of migratory routes are not anticipated.

9.4.176 On the above basis and in view of the conservation objectives, there will be no adverse effect from the Project alone on the integrity of the Severn Estuary SAC via the Estuaries habitat feature (typical fish species assemblage) via this impact pathway.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / Kelp / seagrass: Changes in hydrodynamics and sediment transport:

9.4.177 Even though the proposed locations of seagrass beds, kelp forests and native oyster reefs are not at present known, it is possible to provide a high-level, qualitative assessment.

9.4.178 All habitat types have the potential to cause local changes to hydrodynamics and sediment transport, predominantly by capturing sediment, or by slowing water flows within the direct area of habitat creation / enhancement, and potentially in the immediate vicinity. This may result in sediment build-up in these areas.

9.4.179 However, the presence of seagrass, kelp and oysters will also aid in the maintenance of sediment levels within their immediate vicinity, rather than causing material to potentially leave the wider Severn Estuary system, thereby also supporting the maintenance of sediment-based habitats within the estuaries feature, and the SAC.

9.4.180 On the above basis (a high-level, qualitative assessment), but subject to further, more detailed assessment when additional information is available (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), and in view of the conservation objectives, there will be no adverse effect from the Project alone on the integrity of the Severn Estuary SAC via this impact pathway.

Native oyster reefs / Kelp / seagrass: Habitat loss and physical damage:

9.4.181 Even though the proposed locations of seagrass beds, kelp forests and native oyster reefs are not at present known, it is possible to provide a high-level, qualitative assessment.

9.4.182 Whilst not a direct 'loss' of habitat, the creation / enhancement of seagrass beds, kelp forests and native oyster reefs will result in a habitat change within their direct area, and potential indirect changes on the habitats immediately adjacent, for example through natural spread of organisms from within the habitat creation / enhancement area or changes to hydrodynamics, as described above. The installation of new habitats may also result in short-term physical damage to the area whilst installation is being undertaken. Mitigation measures are likely to be available to minimise any impacts.

9.4.183 In addition, the introduction of seagrass beds in particular will bring about an increase in the vascular plant populations of the Severn Estuary (noted as including saltmarsh species), thereby increasing diversity and abundance within these assemblages, which form part of the Estuaries qualifying habitat. Indirectly, the general increase in habitat diversity will also benefit those species relying on the estuary for prey resources, such as the waterfowl species assemblage which also forms part of the Estuaries qualifying habitat feature.

9.4.184 On the above basis (a high-level, qualitative assessment), but subject to further more detailed assessment when further details are known (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), and in view of the conservation objectives, there will be no adverse effect on the integrity of the Severn Estuary SAC from the Project alone via this pathway on the Estuaries qualifying habitat feature of the SAC.

Weir removal / easement: Trostrey Weir, River Usk and Manorafan Weir, River Towy: effect on the typical fish species assemblage of the Estuaries qualifying habitat feature: Disruption of migratory routes:

9.4.185 The weirs which may be the subject of works outside the DCO Order Limits are the Trostrey Weir, River Usk; and the Manaforan Weir, River Towy. These works could potentially affect migratory fish within the typical fish species assemblage of the Estuaries qualifying habitat.

9.4.186 Temporary construction works to remove / modify these weirs would likely require dewatering of the river at the weir to facilitate works. During the anticipated four months of construction, the water flow in the river would be maintained through other means, e.g. via a flume. Whilst there is potential for this to disrupt the pathways of migratory fish, such flumes can be designed to enable the movement of fish past the works. Disruption of migratory routes can also occur through changes in water quality, for example increased suspended sediment and associated reductions in dissolved oxygen. However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, fish passage will not be affected, and adverse effects on fish populations through disruption of migratory routes are not anticipated.

9.4.187 On the above basis and in view of the conservation objectives, there will be no adverse effect from the Project alone on the integrity of the Severn Estuary SAC via the Estuaries habitat feature (typical fish species assemblage) via this impact pathway.

Atlantic salt meadows

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Habitat loss and physical damage:

9.4.188 Saltmarsh habitat which is likely to consist of Annex I habitat Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) is likely to be present at The Island and may also be present on the boundaries of Pawlett Hams. The proposed compensation measures at these locations would likely result in temporary damage to the habitat during construction activities. However, this would be in order to enhance existing and create additional salt marsh habitat.

9.4.189 On that basis, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on Atlantic salt meadows as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Changes to hydrodynamics and sediment transport:

9.4.190 Works to create / enhance saltmarsh habitat at Pawlett Hams / The Island have the potential to result in the release of sediment into the waters of the Severn Estuary.

9.4.191 However, through timing activities such as breaking sea defences or lowering ground levels to avoid low tide, this impact can be reduced. Further, the release of any sediment would be limited to the immediate vicinity of the River Parrett and Bridgwater Bay estuary, with levels rapidly subsumed into the turbid and highly variable background levels of suspended sediment present within the wider Severn Estuary system.

9.4.192 On that basis, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on Atlantic salt meadows as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Changes to water quality (contaminant / nutrient release):

9.4.193 There is the potential for sediment to be disturbed during construction works at Pawlett Hams and The Island. Increased suspended sediment levels have the potential to alter water quality, for example through the introduction of contaminants or nutrients into the system. These in turn may affect features such as Atlantic salt meadows. In addition, there may be run-off of polluting materials from the works, which could enter the estuarine environment.

9.4.194 With regards to the introduction of sediment into the estuarine system, the Severn Estuary, as noted, is a highly turbid and dynamic environment, with variable background levels. Changes as a result of works at Pawlett Hams / The Island will be subsumed into these background levels, and no noticeable alteration in suspended sediment concentrations is anticipated.

9.4.195 Further, through implementation of standard pollution-control best practice measures, the release of contaminants / other pollutants can be mitigated against, further reducing the potential for adverse changes in water quality.

9.4.196 On that basis, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on Atlantic salt meadows as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp forest / seagrass beds: Changes to hydrodynamics and sediment transport:

9.4.197 At the time of writing, the locations of proposed compensation habitat creation / enhancement beyond the DCO Material Change Order Limits are not confirmed and therefore a high-level, qualitative assessment is provided.

9.4.198 Each of the proposed habitat types has the potential to alter hydrodynamics and sediment transport within their boundaries, and the immediate vicinity. However, based on the size of the areas planned for each of the habitats, compared to the wider estuary, it is not considered that these changes will be noticeable beyond this immediate area, primarily due to the highly dynamic sediment regime within the Severn Estuary and strong tidal flows.

9.4.199 On this basis, and subject to further assessment when more details are known, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on Atlantic salt meadows as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Native oyster reefs / kelp forest / seagrass beds: Habitat loss and physical damage:

9.4.200 As above, with locations of habitat creation / enhancement not yet confirmed, a high-level, qualitative assessment is provided. With the intention of habitat development being to support the overall conservation objectives of the Severn Estuary SAC, habitat locations will be subject to detailed siting and feasibility studies. Part of this work will include consideration of the habitat sites' proximity to other qualifying habitats within the Severn Estuary SAC, to ensure no adverse effects arise from their placement.

9.4.201 On this basis, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on Atlantic salt meadows as a result of the marine habitat compensation elements of the Project alone.

Mudflats and sandflats not covered by seawater at low tide

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Habitat loss and physical damage:

9.4.202 Mudflats and sandflats are likely to be present at both Pawlett Hams and The Island. The proposed compensation measures at these locations would likely result in permanent loss of some habitat and temporary damage to retained habitats during construction activities. However, the retained area would be reinstated or allowed to naturally regenerate and the area lost would be so small in comparison the area within the wider SAC that no adverse effect is anticipated.

9.4.203 For these reasons, there will be no adverse effect on the integrity of the Severn Estuary SAC through this pathway on mudflats and sand flats not covered by seawater at low tide as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Changes to hydrodynamics and sediment transport:

9.4.204 See the assessment of changes to hydrodynamics and sediment transport under the Atlantic salt meadows qualifying feature of the Severn Estuary SAC (Section 9.4.190 et. seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Changes to water quality (contaminant / nutrient release):

9.4.205 See the assessment of changes to water quality presented under the Atlantic salt meadows qualifying feature of the Severn Estuary SAC (Section 9.4.193 et. seq.), the conclusions of which apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp forest / seagrass beds: Changes to hydrodynamics and sediment transport:

9.4.206 See the assessment of changes to hydrodynamics and sediment transport presented under the Atlantic salt meadows qualifying feature of the Severn Estuary SAC (Section 9.4.197 et. seq.), the conclusions of which apply equally here.

Native oyster reefs / kelp forest / seagrass beds: Habitat loss and physical damage:

9.4.207 See the assessment of habitat loss and physical damage presented under the Atlantic salt meadows qualifying feature of the Severn Estuary SAC (Section 9.4.200 et. seq.), the conclusions of which apply equally here.

Mitigation measures

9.4.208 The section above on the impact pathways "*Fish entrapment*" has already taken into account the mitigation measures (being the capped head and the FRR), as described in detail within Section 6.2.

9.4.209 As regards the sections above on further impact pathways, best practice mitigation measures will be applied to avoid and minimise any potential impacts.

Conclusions on integrity from the Project alone

9.4.210 Based on the assessment above it is not possible to exclude beyond reasonable scientific doubt, in view of the conservation objectives, a risk that the Project alone during HPC operation could give rise to an adverse effect on the integrity of the Severn Estuary SAC due to the fish entrapment pathway of impact on:

- the twaite shad qualifying species; and
- the Estuaries qualifying habitat feature (resulting from a risk of change in fish feeding interactions between the different fish species of the typical fish species assemblage of the Estuaries qualifying habitat).

9.4.211 The effects during approximately 4 years of defueling (decommissioning phase) will be much less due to the reduced sea water abstraction during that period of defueling.

9.4.212 The HRA derogation tests therefore apply.

9.4.213 There will be no effect on the Severn Estuary SAC via the entrapment pathway during HPC construction.

9.4.214 There will be no risk of an adverse effect from the Project alone during construction, operation and the four defueling years (decommissioning phase) on the integrity of the River Severn SAC via other qualifying features in relation to any pathway; or via twaite shad or the Estuaries qualifying habitat feature via any other pathway.

Conclusions on integrity from the Project in combination with other plans and projects

9.4.215 It is also necessary to consider the effects of the Project "in combination with other plans or projects"[136]. For the current pre-application consultation version of this HRA Report an overview approach to the in-combination effect assessment is taken.

9.4.216 It is considered at this stage unlikely that the above conclusions reached for the Project alone would change significantly as a result of the "in combination with other plans or projects assessment". This is because any mitigation measures which are relevant to the "other plans or projects" assessed in combination with the Project would first be taken into account and so only any residual effects (after the positive effect of mitigation measures are taken into account) would be relevant to the in-combination assessment. As an example, the EA in 2020 conducted its own AA of HPC's operation without an AFD for the WDA Permit inquiry. In this 2020 AA the EA drew similar conclusions for the Project alone as have been drawn above. The EA then conducted an "in combination with other plans and projects" assessment in respect of the features / pathways for which it had concluded there was no Project alone adverse effect on integrity (whilst leaving aside any Project alone residual inconsequential effects). For these features / pathways the EA concluded that, in combination with other plans or projects which it had identified, there was also no adverse effect on site integrity of any European or Ramsar site.

9.4.217 A more detailed "in combination with other plans and projects assessment" will be provided with the formal DCO Material Change application. The in-combination assessment to be provided will consider whether, after taking into account any Project mitigation measures and leaving aside any residual inconsequential effect from the Project alone, there arises any risk of adverse effect on integrity of any of the screened-in European / Ramsar sites from the Project in combination with any other plan or project.

Consideration of original, current and future baselines

9.4.218 As described within paragraph 9.3.4, the assessment presented above is focused on the current baseline, with consideration of the original baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of

136 Habitats Regulations, Regulation 63(1)

2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.4.219 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.5 Severn Estuary / Môr Hafren SPA

Introduction

9.5.1 The Severn Estuary SPA covers an area 24,487.91 ha and includes areas of the intertidal in a zone along the south coast of the mid estuary and the entirety of the upper Severn estuary where extensive mud flats are exposed at low tide. The SPA also includes terrestrial land along the coast (above mean high water), much of which is agricultural but has a function in supporting the birds that are the qualifying interest features of the site.

9.5.2 The six individual qualifying species of the SPA are all non-breeding and are migratory winter visitors to the SPA. These are:

- Bewick's swan (*Cygnus columbianus bewickii*) (non-breeding)
- Greater white-fronted goose (*Anser albifrons albrifons*) (non-breeding)
- Dunlin (*Calidris alpina alpina*) (non-breeding)
- Common Redshank (*Tringa tetanus*) (non-breeding)
- Common Shelduck (*Tadorna tadorna*) (non-breeding)
- Gadwall (*Anas strepera*) (non-breeding)

9.5.3 The seventh qualifying feature of the SPA, the waterbird assemblage, is not defined in the NE Conservation Objectives document. However, NE and Countryside Council for Wales' advice given under Regulation 33 of the Conservation (Natural Habitats Etc) Regulations 1994 dated June 2009 lists the 16 birds within the assemblage as being the six species above, together with the following: wigeon, teal, pintail, pochard, tufted duck, ringed plover, grey plover, whimbrel, curlew and spotted redshank.

9.5.4 According to the Regulation 33 advice, the same 16 bird species make up (i) the typical waterfowl species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC; and (ii) the Severn Estuary Ramsar site Criterion 5 waterfowl assemblage. The assessment below for the Severn Estuary SPA therefore applies equally to these two other assemblages.

9.5.5 The ecological preferences of the individual qualifying species of the Severn Estuary SPA and the waterbird assemblage of the Severn Estuary SPA fall into two main categories.

9.5.6 The first group are wildfowl (Anseriforms) which are mostly herbivorous species usually associated with salt marsh, grazing marsh and pastures and freshwater habitats such as lakes and ponds. These include the following 9 species: (i) the individual qualifying species: Bewick's Swan, Common Shelduck, Gadwall, Greater white fronted goose; and (ii) the assemblage species: Wigeon, Teal, Pintail, Pochard and Tufted Duck.

9.5.7 The second group are waders (Charadriiformes) which mainly feed on invertebrates and small animals of shoreline intertidal typically mud habitats. These include the remaining 7 species: (i) the individual qualifying species: Dunlin, Common redshank; and (ii) the assemblage species: Ringed Plover, Grey Plover, Whimbrel, Curlew and Spotted Redshank.

9.5.8 The AA carried out by the EA in 2020 in relation to the WDA Permit inquiry found no adverse effect on the integrity of the Severn Estuary SPA in relation to the removal of the AFD requirement and discharges from the FRR system either alone or in-combination with other plans and project. However, the EA's AA did not, of course, consider the proposed compensatory habitat measures that will be part of NNB's DCO Material Change application. Key elements of these compensatory habitat measures are the proposed managed retreat at Pawlett Hams and the enhancement of the habitats within The Island. Both of these areas are within the Severn Estuary SPA and therefore potential impacts on the SPA of these elements (as the other compensatory habitat elements) are considered in this assessment.

9.5.9 The EA has already carried out a managed retreat compensation project immediately to the north of Pawlett Hams at Steart Marshes. The Steart Marsh managed retreat scheme was also partially within the Severn Estuary SPA and was also therefore the subject of an AA. Accordingly this AA has been reviewed when carrying out the assessment of the Project on the Severn Estuary SPA as it is highly relevant to the Pawlett Hams and The Island proposed compensatory habitat measures.

9.5.10 Throughout the assessment below for the Severn Estuary SPA, particular attention has been paid to the conservation objectives of the Severn Estuary SPA, as described in Table 8-2.

Gadwall (Anas strepera)

Marine design element

Indirect: Indirect effects on bird species through changes to water quality

9.5.11 See the assessment at Section 9.4.13 et. seq. for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) which describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. The description there applies equally here and as such, there is no risk to birds through any related bioaccumulation impact pathway.

9.5.12 There is also the potential, through FRR discharge during HPC operation, to generate smothering effects on habitats (as a result of increased organic carbon enrichment) with subsequent indirect effects on the bird species that use those habitats. This potential impact has been assessed with particular reference to smothering of intertidal soft sediment habitats (an important habitat for wading birds and wildfowl bird species). The assessment at Section 9.4.13 et. seq. for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. Results there showed that the area estimated to be in excess of the derived daily benchmark of 0.3 g organic carbon/m^2/day was 0.17 km^2 (using 2009-10 data) and 0.15 km^2 (using 2021-22 data). On the basis of this, and in particular compared to the overall size of the intertidal habitats within the Severn Estuaries SPA used by the qualifying feature bird species and the waterbird assemblage, no effect is predicted.

9.5.13 The analysis there also means that, in view of relevant conservation objectives of the SPA, there will be no adverse effect from the Project alone through the FRR system during HPC operation on the Severn Estuary SPA via the gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway. During defueling (decommissioning phase) of HPC any effect will be even less due to the reduced abstraction of seawater during 4 years of defueling. There is also no impact during construction.

9.5.14 The EA in its 2020 AA for the WDA Permit inquiry also came to the conclusion that there would be no adverse effect on integrity of the Severn Estuary SPA from the FRR system operating at HPC.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.5.15 The Severn Estuary SPA is classified for the overwintering species it supports i.e. the 6 individual qualifying species and the waterbird assemblage. Pawlett Hams and The Island are within the Severn Estuary SPA. If construction works for the delivery of the compensatory habitat measures at Pawlett Hams or The Island were to be carried out during the winter it is possible that the SPA birds would be temporarily disturbed and displaced from those sites during construction. Any disturbance to the wintering birds that are the interest features of the SPA can be avoided by timing work to avoid the winter and thereby avoiding any potential for disturbance.

9.5.16 On that basis, no effect on the gadwall population of the Severn Estuary SPA is predicted through disturbance / temporary displacement as a result of the construction of the Pawlett Hams or Island compensation elements of the Project.

9.5.17 There will therefore be no adverse effect from the Project alone on the Severn Estuary SPA via the gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release)

9.5.18 Groundworks associated with the delivery of the compensatory habitat measures at Pawlett Hams or The Island, for example breaking sea defences or lower ground levels, could release sediment into the estuary waters. The impact can be reduced by timing the excavation works to avoid high tide. However, any release of sediment would be limited to within the River Parrett / Bridgwater Bay estuary, and due to the highly turbid and active nature of the Severn Estuary, any temporary changes in sediment load would be rapidly subsumed into background levels and natural levels of variation.

9.5.19 There will therefore be no adverse effect from the Project alone on the Severn Estuary SPA via the gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway.

Pawlett Hams: Temporary loss of habitat during construction activities

9.5.20 The Severn Estuary is classified for the overwintering species it supports for both individual qualifying species and the waterfowl assemblage. If works were to be carried out during the winter, there would be a highly probability the SPA birds would be temporarily disturbed and displaced from the sites during construction. Any disturbance to the wintering birds that are the interest features of the SPA can be avoided by timing work to avoid the winter and thereby avoiding any potential for disturbance. There will therefore be no adverse effect from the Project alone on the Severn Estuary SPA via the gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway

Pawlett Hams / The Island: Permanent modification of bird habitat and permanent displacement of species

9.5.21 In relation to the proposed compensatory habitat measures at Pawlett Hams, Pawlett Hams is currently an area of agricultural land, of more than 300 ha, located in the incised meander towards the mouth of the River Parrett (see Section 3.7). The area is entirely within the Severn Estuary SPA and currently supports permanent semi improved and neutral grassland (pasture) and arable production. The fields are drained by a network of rhynes which in areas support fresh to brackish water. There are recent records for SPA qualifying species shelduck and redshank as well as for some species that are part of the waterbird assemblage (see Pawlett Hams Current Baseline – Section 7.2).

9.5.22 Like the Steart Marshes managed retreat project referred to above, the proposed compensatory measures at Pawlett Hams will result in a change in the habitats present within Pawlett Hams from predominantly permanent pasture and arable land to saltmarsh, intertidal mudflat and saltwater lagoons flooded at all stages of the tide. These changes in habitat will however mean that the carrying capacity of Pawlett Hams for the interest features of the SPA, both the six qualifying species and the waterbird assemblage, will be increased.

9.5.23 There will therefore be no adverse effect from the Project alone on the Severn Estuary SPA via the Pawlett Hams compensatory habitat element affecting gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway. Indeed, the proposed compensation measures at Pawlett Hams will be beneficial to gadwall (and other bird species).

9.5.24 In relation to the proposed compensatory habitat measures at the area known as The Island (see Section 3.7), The Island is also located within the Severn Estuary SPA. Unlike Pawlett Hams, The Island site currently already supports saltmarsh, intertidal mud and saltwater creeks. All six of the SPA's qualifying species are recorded as being present within The Island site along with some of the other wildfowl and waders that are part of the SPA waterbird assemblage (see baseline Section 7.2 above). The compensation proposal at The Island is to deepen some of the existing channels within The Island in order to provide additional habitat for fish that would remain flooded at low tide. As a consequence, there would be a small change in mudflat within this part of the SPA. However, the extent of change would be tiny in the context of the entire SPA. Taken together with the creation of new intertidal habitat at Pawlett Hams the overall resource of mudflat habitats available to the SPA birds would be significantly increased as a consequence of the compensatory habitat measures at The Island.

9.5.25 There is the potential for the excavation works at The Island to adversely affect saltmarsh habitat during the construction phase through the movement of machinery and excavation spoil from the channels. However, such impacts would be highly localised and short lived. Saltmarsh is habitat that responds rapidly to disturbance of the substate and would rapidly recolonise following the construction work. Mitigation measures will also be put in place to minimise any adverse effects (see below).

9.5.26 There will therefore be no adverse effect from the Project alone on the Severn Estuary SPA via The Island compensatory habitat element affecting gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway.

Pawlett Hams / The Island: Indirect effects on bird species through changes in hydrodynamics and sediment transport:

9.5.27 The creation of the managed retreat at Pawlett Hams and the deepening of channels within The Island have the potential to result in changes to the hydrodynamics and sediment transport within the locality. This impact pathway was considered in detail in the HRA relating to the Steart Marshes managed retreat scheme[137] which concluded that changes in water levels and flow speeds would not adversely affect the habitat on which the SPA birds rely.

9.5.28 As a similar project in the same estuary, it is concluded at this stage that there will be no adverse effect from the Project alone on the Severn Estuary SPA via this pathway. Indeed, there would be no adverse effect from the Pawlett Hams or The Island compensatory habitat elements affecting gadwall (or through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway.

Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye): disturbance and displacement during construction activities, and temporary habitat loss during construction activities:

9.5.29 The weirs that are being considered either for removal or modification (e.g. installation of fish passes) are located some distance (c10 km in the case of Maisemore weir) from the boundary of the SPA. The weirs are located within river corridors, which are often fringed with woodland. These locations do not support habitat which would support the wintering SPA qualifying species or the SPA waterbird assemblage. Therefore, the habitats in the vicinity of the weirs do not provide suitable winter-feeding habitat for waders that could be considered functionally linked to the SPA.

9.5.30 There will be no adverse effect from the Project alone on the Severn Estuary SPA via the weir compensatory habitat elements affecting gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway.

Compensation measures outside DCO Material Change Order Limits

Weir removal / easement: Trostrey Weir, River Usk and Manorafan Weir, River Towy: disturbance and displacement during construction activities, and temporary habitat loss during construction activities:

9.5.31 The weirs that are being considered either for removal or modification (e.g. installation of fish passes) are located some distance from the boundary of the SPA. The weirs are located within river corridors, which are often fringed with woodland. These locations do not support

137 Environment Agency (undated), internal document - FORM HR02: PROFORMA FOR STAGE 3 APPROPRIATE ASSESSMENT

habitat which would support the wintering SPA qualifying species or the SPA waterbird assemblage. Therefore, the habitats in the vicinity of the weirs do not provide suitable winter-feeding habitat for waders that could be considered functionally linked to the SPA.

9.5.32 There will be no adverse effect from the Project alone on the Severn Estuary SPA via the weir compensatory habitat elements affecting gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway.

Native oyster reef, Kelp and Seagrass creation:

9.5.33 These are considered together because the creation / enhancement of these habitats requires similar procedures to establish these new habitats e.g. the seeding of species from boats. Even though the proposed locations of seagrass beds, kelp forests and native oyster reefs are not at present known, it is possible to provide a high-level assessment.

9.5.34 The precise locations of these new habitats are yet to be finalised. They may be outwith the boundary of Severn Estuary SPA. If the habitat creation / enhancement works are within or close to the SPA then they could have the potential to cause disturbance and / or displacement of SPA bird species temporarily. However, the combined areas of habitat creation / enhancement planned for the kelp, native oyster reefs and seagrass, compared with the wider SPA as a whole, means that, should birds be temporarily displaced from areas, there will be sufficient habitat in the wider estuary for them to use during the works.

9.5.35 It is expected that mitigation measures can and will be designed to further minimise any SPA impacts. Further detailed assessments will be undertaken when more details of the proposed locations of these compensatory measures are known.

9.5.36 On the above basis (a high-level, qualitative assessment), but subject to further more detailed assessment when further details are known (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), there will be no adverse effect from the Project alone on the Severn Estuary SPA via the creation / enhancement of the native oyster reef, kelp or seagrass habitats affecting gadwall (or indeed through any of the other 6 qualifying species of the SPA or via the SPA waterbird assemblage) through this impact pathway.

Greater white-fronted goose (*Anser albifrons albifrons*)

9.5.37 See the assessment and conclusions for gadwall (Section 9.5.11 et. seq.) which apply equally here.

Dunlin (*Calidris alpina alpina*)

9.5.38 See the assessment presented for gadwall of the Severn Estuary SPA (Section 9.5.11 et. seq.), the conclusions of which apply equally here.

Bewick's swan (*Cygnus columbianus bewickii*)

9.5.39 See the assessment presented for gadwall of the Severn Estuary SPA (Section 9.5.11 et. seq.), the conclusions of which apply equally here.

Shelduck (*Tadorna tadorna*)

9.5.40 See the assessment presented for gadwall of the Severn Estuary SPA (Section 9.5.11 et. seq.), the conclusions of which apply equally here.

Redshank (*Tringa tetanus*)

9.5.41 See the assessment presented for gadwall of the Severn Estuary SPA (Section 9.5.11 et. seq.), the conclusions of which apply equally here.

Waterbird assemblage

9.5.42 See the assessment presented for gadwall of the Severn Estuary SPA (Section 9.5.11 et. seq.), the conclusions of which apply equally here.

Mitigation measures

9.5.43 In general, best practice mitigation measures will be adopted.

9.5.44 The extent of any damage to saltmarsh at The Island arising from the deepening for the creeks can be minimised by careful planning of the excavation works implemented through a CEMP.

9.5.45 As set out above, disturbance to SPA birds at the Pawlett Hams managed retreat site and at The Island can be avoided by carrying out the works during the summer period when the wintering birds are not present.

9.5.46 As set out above groundworks associated with the delivery of the compensatory habitat measures at Pawlett Hams or The Island, for example breaking sea defences or lower ground levels, can be timed to avoid high tide.

9.5.47 It is expected that mitigation measures could address potential impacts arising from the native oyster reef, kelp or seagrass habitat creation / enhancement elements of the compensatory package.

Conclusions on integrity from the Project alone

9.5.48 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four defueling years (decommissioning phase) will have no adverse effect on the integrity on the Severn Estuary SPA.

Conclusions on integrity from the Project in combination with other plans and projects

9.5.49 See the text provided for the "*in combination with other plans and projects*" section (Section 9.4.215 et seq.) of the Severn Estuary SAC above.

Consideration of past, current and future baselines

9.5.50 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.5.51 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.6 Severn Estuary / Môr Hafren Ramsar site

Introduction

9.6.1 The Severn Estuary Ramsar site covers an area of 16,492 ha wetland. There is substantial overlap between the qualifying features of the Severn Estuary SAC and the Ramsar site even though the area of the estuarine ecosystem designated as Ramsar site is smaller than that of the Severn Estuary SAC as the Ramsar site is restricted to the terrestrial and intertidal area and excludes all subtidal areas.

9.6.2 The Severn Estuary Ramsar site has been screened-into this shadow AA on the basis of:

- Criterion 1: immense tidal range (second-largest in the world);
- Criterion 3: unusual estuarine communities (i.e. reduced diversity);
- Criterion 4: migratory fish assemblage (consisting of Salmon (*Salmo salar*), sea trout (*S. trutta*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluvatilis*), Allis shad (*Alosa alosa*), twaite shad (*A. fallax*) and European eel (*Anguilla anguilla*));
- Criterion 5: a wintering waterfowl assemblages of international importance with peak counts in winter of 70,919 waterfowl;
- Criterion 6: regularly supports more than 1 % of the individuals in a population of Bewick's swan (*Cygnus columbianus*), European white-fronted goose (*Anser albifrons albifrons*), dunlin (*Calidris alpina alpina*), redshank (*Tringa tetanus tetanus*), shelduck (*Tadorna tadorna*) and gadwall (*Anas strepera strepera*), as well as ringed plover (*Charadrius hiaticula*), teal (*Anas crecca*), pintail (*Anas acuta*) and lesser black-backed gull (*Larus fuscus*); and
- Criterion 8: wetland habitat is an important source of food and nursery ground for fish species, such as allis shad (*A. alosa*) and twaite shad (*A. fallax*).

9.6.3 Throughout the assessment below for the Severn Estuary Ramsar site, particular attention has been paid to the conservation objectives of the Ramsar site, as described in Table 8-2.

Criterion 1: Immense tidal range

9.6.4 The Severn Estuary Ramsar site qualifies under Criterion 1 due to its status as having the second-largest tidal range in the world, affecting both the physical environment and biological communities. The tidal regime determines not only the structure of the estuary and individual habitats within it, but also the wider conditions, therefore directly influencing the ecological communities which can develop. Based on the conclusions of the inspector at the WDA Permit inquiry and the Secretary of State's decision letter this criterion does not incorporate any fish species assemblage (note that the Criterion 4 migratory fish species assemblage is addressed below).

9.6.5 The area of the estuarine ecosystem designated as Ramsar site is smaller than that of the Severn Estuary SAC as the Ramsar site is restricted to the terrestrial and intertidal area and excludes all subtidal areas.

Marine design element:

Changes to water quality through release of contaminants / nutrients

9.6.6 With respect to this pathway during HPC operation, the assessment and conclusions are as presented for river lamprey of the Severn Estuary SAC at Section 9.4.13 et. seq. because they apply equally here.

9.6.7 There will, in view of the relevant conservation objectives, accordingly be no adverse effect on the integrity of the Ramsar site via this Criterion and this pathway from the Project alone during HPC operation and (since any effect would be even less during defueling (decommissioning phase)) also during defueling. There is no effect through this pathway during HPC construction.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Changes in hydrodynamics and sediment transport:

9.6.8 The creation / enhancement of habitat at Pawlett Hams and The Island has the potential to affect hydrodynamics and sediment transport in the immediate vicinity of the works. The assessment and conclusions of these potential effects are as presented for the Estuaries qualifying feature of the Severn Estuary SAC at Section 9.4.163 et. seq., because these apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reef, Kelp and Seagrass bed creation / enhancement: Changes in hydrodynamics and sediment transport

9.6.9 See the assessment presented under the Estuaries feature of the Severn Estuary SAC (Section 9.4.177 et. seq.), the conclusions of which apply equally here.

Native oyster reef, Kelp and Seagrass bed creation / enhancement: Habitat loss and physical damage:

9.6.10 See the assessment presented under the Estuaries feature of the Severn Estuary SAC (Section 9.4.181 et. seq.), the conclusions of which apply equally here.

Criterion 3: Unusual estuarine communities

9.6.11 The Severn Estuary Ramsar site qualifies under Criterion 3 due to its unusual estuarine communities, reduced diversity and high productivity. Again, based on the conclusions of the WDA Permit inquiry and the Secretary of State's decision letter, this criterion does not incorporate any fish species assemblage (note that the Criterion 4 migratory fish species assemblage is addressed below).

Marine design element:

Changes to water quality through release of contaminants / nutrients:

9.6.12 See the assessment at Section 9.4.13 et. seq. for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) which describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. The description there applies equally here.

9.6.13 There will accordingly, in view of the relevant conservation objectives, be no adverse effect on the integrity of the Ramsar site via this Criterion and this pathway from the Project alone during HPC operation and (since any effect would be even less during the defueling (decommissioning phase)) also during defueling. There is no effect through this pathway during HPC construction.

Habitat loss and physical damage:

9.6.14 In addition to the potential effects on water quality of increased discharge through the FRR system, there is the potential during HPC operation for smothering effects to arise as a result of increased organic carbon enrichment. This has been assessed with particular reference to smothering of *Sabellaria* reef, littoral rock and intertidal soft sediment habitats. The assessment at Section 9.4.13 et. seq. for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. Results there showed that the area estimated to be in excess of the derived daily benchmark of 0.3 g organic carbon/m^2/day was 0.17 km^2 (using 2009-10 data) and 0.15 km^2 (using 2021-22 data). On the basis of this, compared to the overall size of the Ramsar site, no effect on Criterion 3 is predicted. It is concluded that, in view of the relevant conservation objectives, there will be no adverse effect from the Project alone on this Criterion 3 feature through this pathway.

9.6.15 For approximately 4 years during HPC defueling (decommissioning phase) any effect will be a much smaller effect than during HPC operation due to the reduced abstraction of sea water during defueling. There will be no effect on habitats via this pathway during HPC construction.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Changes in hydrodynamics and sediment transport:

9.6.16 The creation / enhancement of saltmarsh habitat at Pawlett Hams and The Island has the potential to affect hydrodynamics and sediment transport in the immediate vicinity of the works. The assessment and conclusions of these potential effects presented under the Estuaries feature of the Severn Estuary SAC at Section 9.4.163 et. seq., as these apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Habitat loss and physical damage:

9.6.17 See the assessment of habitat loss and physical damage presented under the Estuaries feature of the Severn Estuary SAC (Section 9.4.181 et. seq.), the conclusions of which apply equally here.

Native oyster reefs / kelp / seagrass: Changes in hydrodynamics and sediment transport:

9.6.18 See the assessment of changes in hydrodynamics and sediment transport presented under the Estuaries feature of the Severn Estuary SAC (Section 9.4.177 et. seq.), the conclusions of which apply equally here.

Criterion 4: Assemblage of seven migratory fish species

9.6.19 According to the Severn Estuary European Marine Site NE and CCW advice given under Regulation 33 of the Conservation (Natural Habitats) Regulations 1994 (dated 2009), the Ramsar Criterion 4 migratory fish assemblage comprises seven fish species:

- Sea lamprey;
- River lamprey;
- Twaite shad;
- Allis shad;
- Atlantic salmon;
- Sea trout; and
- European eel.

Marine design element

Fish entrapment:

9.6.20 Of the seven species making up the Severn Estuary Ramsar site Criterion 4 migratory fish assemblage, three are also qualifying species for the Severn Estuary SAC (and indeed of other screened-in European sites) and are considered in respect of the Severn Estuary SAC within

Section 9.4.3, 9.4.40 and 9.4.56 et. seq. above, namely: river lamprey, sea lamprey, and twaite shad.

9.6.21 The baseline populations, analyses and assessment presented for river lamprey, sea lamprey and twaite shad in those earlier sections of this HRA Report also apply here and are summarised in Table 9-11 below along with assessments of the entrapment effects of HPC without an AFD on the other Ramsar site 4 migratory fish assemblage species.

9.6.22 In the context of the assessment below, it is important to note that the Planning Inspector in the WDA Permit inquiry noted in his report dated 2021 (for example at paragraph IR11.47[138]) that the EA had agreed that mitigation in the form of the LVSE with AFD and FRR would (as had been the case in the context of the 2013 DCO) represent sufficient mitigation to ensure that there would not be an adverse effect on the integrity of any of the designated European or Ramsar sites concerned. It follows therefore that, for species which are not hearing specialists, the mitigation measures other than the AFD were regarded as sufficient to avoid any adverse effect on integrity of the Ramsar site via the fish entrapment impact pathway.

Table 9-11: Entrapment effects of HPC (without AFD) on species that form part of the migratory fish assemblage under Criterion 4 of the Severn Estuary Ramsar site.

Species	Assessment
Twaite shad	Twaite shad form part of the Ramsar Criterion 4 assemblage of migratory species (they are also a qualifying species of the Severn Estuary SAC (see above) and of the River Usk SAC and the River Wye SAC (considered below). The Planning Inspector and Secretary of State were unable to exclude the risk of an adverse effect on the integrity of the River Severn SAC and the Severn Estuary Ramsar due to potential impacts on (respectively) twaite shad and the migratory assemblage including twaite shad due to the operation of HPC without an AFD. The predicted population effects and associated assessment conclusions for twaite shad, given the available up to date data, are presented in Section 9.4.56 et. seq..
Sea lamprey	Sea lamprey form part of the Ramsar Criterion 4 assemblage of migratory species (and are also a qualifying species of the Severn Estuary SAC and other screened-in European sites). The EA in their 2020 AA concluded that the sea lamprey is not a species of concern for the Severn

138 IR11.47 "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".

Species	Assessment
	Estuary / Môr Hafren SAC assemblage or the Ramsar site. The predicted population effects and associated assessment conclusions for sea lamprey are presented in Section 9.4.40 et. seq..
River lamprey	River lamprey form part of the Ramsar Criterion 4 assemblage of migratory species (and are also a qualifying species of the Severn Estuary SAC and other screened-in European sites). The EA in their 2020 AA concluded that the river lamprey is not a species of concern for the Severn Estuary / Môr Hafren SAC assemblage or the Ramsar site. The predicted population effects and associated assessment conclusions for river lamprey are presented in Section 9.4.3 et. seq..
Allis shad	Allis shad form part of the Ramsar Criterion 4 assemblage of migratory species (they are also a qualifying species of the River Wye SAC and the River Usk SAC (although in the WDA Permit inquiry no assessment was undertaken for the River Usk SAC due to no evidence for their presence in the river), see further assessment below). Evidence for self-sustaining populations of Allis shad in the Severn Estuary catchments is limited. During the WDA Permit inquiry, the EA concluded that annual Allis shad losses at HPC would equate to 6 equivalent adults, which corresponds to 0.6 % of the Severn Estuary SAC and Ramsar population. Allis shad were a species of concern in the EA 2020 AA. The Planning Inspector and Secretary of State were unable to exclude the risk of an adverse effect on the integrity of the Severn Estuary Ramsar due to potential impacts on the migratory assemblage including Allis shad due to the operation of HPC without an AFD. Following the updates to the CIMP1 data and a recalculation of the Allis shad EA EAV-SPF factor, mitigated losses are estimated at 11 equivalent adult fish per annum. This would result in a predicted loss of 1.48 % for the proposed Severn Estuary SAC and Ramsar population. Based on the updated estimates from CIMP1, there is no reason to alter the conclusions of the EA 2020 AA and WDA Permit inquiry. No Allis shad were recorded in CIMP2, or the additional 2 years of RIMP data. In total, only 2 confirmed Allis shad records are available from the two CIMPs and the 39-year RIMP datasets. Such infrequent occurrence in the impingement record means annual impingement estimates are uncertain and driven by stochastic events.
Atlantic salmon	Atlantic salmon form part of the Ramsar Criterion 4 assemblage of migratory species (they are also a qualifying species of the River Usk SAC and the River Wye SAC, see further below). Atlantic salmon are infrequently impinged and only 9 individuals from different life-history stages were recorded in the 39-year RIMP. No Atlantic salmon were caught in the core CIMP1 period, although two individuals were caught in additional samples collected outside the period of assessment. In their 2020 AA, the EA applied RIMP data to estimate the number of equivalent adult Atlantic salmon that may be impinged annually. During the WDA Permit inquiry, the EA estimated that 12 equivalent adult salmon each year would be lost due to the operation of HPC, which were estimated to be 0.07 % of the population of the Severn Estuary SAC and Ramsar site. The Planning Inspector and Secretary of State were unable to exclude the risk of an adverse effect on the integrity of the Severn Estuary Ramsar due to potential impacts on the migratory assemblage including Atlantic salmon due to the operation of HPC without an AFD. Since the WDA Permit inquiry an additional year of intensive CIMP sampling and two additional years of RIMP data for 2018 and 2019 are available, during which a pre-spawning adult fish occurred in a sub-sample of the RIMP. This data, coupled with the two fish impinged in CIMP1 has been used to update the annual estimate for Atlantic salmon impingement to a mean of 22

Species	Assessment
	adults per annum (0.08 % of the Severn Estuary population estimate). Whilst predicted losses of Atlantic salmon are low and prone to stochastic events, the updated impingement data provides no additional evidence to alter the conclusions of the EA 2020 AA and WDA Permit inquiry.
Sea trout	Sea trout form part of the Ramsar Criterion 4 assemblage of migratory species. No sea trout were recorded in either CIMP sampling programme, and occurrences are therefore very uncommon events, resulting in uncertainty in impingement predictions. The EA 2020 AA used an estimate of sea trout abundance (as annual spawners) from a simple model of abundance relative to river size. The EA calculated impingement effects based on a single occurrence in the RIMP and estimated annual losses of 8 adult equivalent fish per annum accounting for <0.1 % of the Severn Estuary SAC and Ramsar population. When considering the conservation objectives, the EA concluded the sea trout was not a species of concern for the Severn Estuary SAC or Ramsar site. No additional sea trout were caught in the RIMP in 2018 and 2019, or in CIMP2. Therefore, there is no further evidence to change the conclusions in the EA 2020 AA.
European eel	European eel form part of the Ramsar Criterion 4 assemblage of migratory species. European eel are subject to two routes of impact from HPC: entrainment of juvenile (glass eel) stages, and impingement of larger fish. In the assessments supporting the 2013 DCO, it was concluded that there would be no adverse effects on European eel with the installation of mitigation measures (AFD and FRR). European eel are not hearing specialists, and studies from other sites using AFDs have not shown significant reductions in impingement of adult eels (Maes et al., 2004)[139]. The AFD was assumed to have zero benefit for eels. The overwhelming contribution towards the assessment of effects from HPC using the EA approaches for European eel is losses of glass eel stages due to entrainment. These small life-history stages are anticipated to have negligible benefits from the installation of the AFD. It was common ground during the WDA Permit inquiry that the removal of the AFD would not have a material bearing on European eel. Since the 2013 DCO, European eel has continued to decline across its range. This has led to ICES advising zero anthropogenic mortality across the European panmictic level (ICES, 2022)[140]. The European eel has been globally assessed as Critically Endangered ('CR') using the IUCN Red List criteria since 2008 (Jacoby et al., 2015; Pike et al., 2020)[141], and the recent

139 Maes, J., Turnpenny, A.W.H., Lambert, D.R., Nedwell, J.R., Parmentier, A., Ollevier, F., 2004. Field evaluation of a sound system to reduce estuarine fish intake rates at a power plant cooling water inlet. J. Fish Biol. 64, 938–946.

140 ICES (2022a). European eel (Anguilla anguilla) throughout its natural range. ICES Advice: Recurrent Advice. Report (Accessed 11 December 2023). https://doi.org/10.17895/ices.advice.19772374.v1.

141 Jacoby, D., Gollock, M., 2014. Anguilla anguilla. The IUCN Red List of Threatened Species 2014: e.T60344A45833138 (Accessed 11 December 2023). http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T60344A45833138.en

Pike, C., Crook, V., Gollock, M., 2020. Anguilla anguilla. The IUCN Red List of Threatened Species 2020: e.T60344A152845178 (Accessed 11 December 2023). https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T60344A152845178.en- 2.RLTS.T60344A152845178.en.

Species	Assessment
	Great Britain red listing found it to be CR in England, Wales and Scotland (Nunn et al., 2023)[142]. To address the decline in European eel stocks, the European Council established an Eel Regulation (No 1100/2007), aimed at providing measures for recovery. The Regulation requires that all member states with natural European eel habitats establish Eel Management Plans at the river basin level. The objective of these plans is to "*permit with high probability the escapement to the sea of at least 40% of the silver eel biomass relative to the best estimate of escapement that would have existed if no anthropogenic influences had impacted the stock*". In the UK, eel populations are managed at the River Basin District level (RBD). HPC has the potential to affect the Severn and the South-west RBDs. Both RBDs are failing their management objectives in terms of silver eel biomass. The overwhelming influence of HPC on silver eel escapement biomass is attributed to entrainment of glass eel stages during the period they migrate through the estuary from the sea in search of freshwater habitat. Based on density estimates from dedicated glass eel surveys and estimated HPC entrainment mortality rates, it is estimated that approximately 180 kg of glass eel would incur mortality annually through HPC. The Severn Estuary has relatively high glass eel recruitment that exceeds the target set within the Non-Detriment Finding ('NDF') of the local RDBs resulting in a recruitment surplus. This has meant the EA has continued to licence glass eel fisheries on the Rivers Parrett and Severn post-EU Exit. The mean annual total glass eel catches have been approximately 4,000 kg for each of the two RBD's over the last decade (Defra, 2021)[143]. The predicted losses owing to entrainment from HPC are approximately a 20 t[h] of the decade average of the fishery up to 2020. After 2020, Britain's exit from the EU meant that the glass eel market collapsed. Since 2021, 100 % of glass eel catches have been used for restocking purposes in the UK or internationally. Restocking has centred on three UK Eel Management Units (EMUs) since 2009 (some minor restocking took place in other EMUs but these were prior to 2015). Most restocking activities are reported for Loch Neagh, Northern Ireland. Currently, minor restocking takes place in England, in the Severn and South-west RDBs, of which most can be classified as assisted migration done under the Sustainable Eel Group programme (ICES, 2022b)[144]. In Northern Ireland, a total of 1,123 kg of glass eel from the Severn RBD were transported to Loch Neagh for restocking purposes in 2022 (ICES, 2022b). Despite the predicted small contribution of HPC entrainment to glass eel losses relative to the ongoing licenced fishery, the assessment approach used by the EA in their 2020 AA indicates that losses from HPC represent a concern relative to the two RDB biomass estimates, with effects equating to approximately 3 % of the equivalent silver eel biomass (Table 9-8). There are recognised uncertainties associated with methodologies used in the assessment approaches applied by the EA in the AA. These include, but are not limited to, the calculation of

142 Nunn, A.D., Ainsworth, R.F., Walton,S., Bean, C.W., Hatton-Ellis, T.W., Brown, A. et al., 2023. Extinction risks and threats facing the freshwater fishes of Britain. Aquatic Conservation: Marine and Freshwater Ecosystems, 1–17. https://doi.org/10.1002/aqc.4014. (Accessed 11 December 2023)

143 Defra, 2021. Implementation of UK Eel Management Plans (2017–2020). Progress report prepared for the Department for Environment, Food & Rural Affairs, December 2021.

144 ICES (2022b). Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.20418840.v1. Country Report submitted to the WGEEL expert group. (Accessed 11 December 2023)

Species	Assessment
	suitable population comparators (B_{best} and $B_{current}$)[145] under the extrapolation model SMEP II. These include the assumption of productivity being proportional to surface area throughout the catchment, the choice of life history parameters and associated assumptions (such as growth, natural mortality and sex ratio) and generation of non-fisheries related mortality estimates based on limited studies and aggregated at EMU level (ICES, 2022c)[146]. Given the assumption on local recruitment surplus used in the NDF (Fleming et al., 2023 (in prep))[147] and taking into account a study by Aprahamian and Wood (2021)[148] estimating the size of the glass eel run in the Severn, it would appear that the recruitment to the Severn RBD is not a limiting factor to subsequent silver eel escapement biomass. Therefore, non-fisheries impacts during the freshwater phase could have a relatively greater contribution to the overall mortality than is currently estimated (Defra, 2021). This in turn means that the EA's methodology, in the case of eels, represents a highly precautionary estimate of the risk of HPC on equivalent silver eel escapement biomass when compared to other anthropogenic losses.

9.6.23 The qualifying feature in this case is the migratory fish species assemblage. It is in relation to the migratory fish species assemblage against which the no adverse effect on integrity test must be judged in view of the conservation objectives.

9.6.24 In view of the HPC entrapment effects noted above and the Ramsar site conservation objectives it cannot be excluded beyond reasonable doubt that there could be a risk of an adverse effect from the Project alone on the integrity of the Severn Estuary Ramsar site through this impact pathway during HPC operation. During the approximately 4 years of defueling (decommissioning phase) any effect will be much less due to the reduced abstraction of sea water. The HRA derogation tests therefore need to be addressed.

9.6.25 There will be no effect on the Criterion 4 migratory species assemblage during HPC construction via this pathway.

145 Bbest is the best achievable present-day silver eel escapement in the absence of human impacts. It is estimated for index rivers within each RBD. The model approach to calculation Bbest is explained within Defra (2021).

Bcurrent accounts for losses from anthropogenic factors that are estimated in terms of silver eel equivalent biomass, and these are subtracted from Bbest to estimate the present-day silver eel escapement to the sea.

146 ICES (2022c). Workshop for the Technical evaluation of EU Member States' Progress Reports for submission in 2021 (WKEMP3). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.19768585.v1 (Accessed 11 December 2023)

147 Fleming, L.V., Walker, A., Evans, D., Aprahamian, M., James, M., Bašić, T., Watts, S., Horsburgh, G., Allin, R., Blake, K., Connor, S. & Littlewood, A.H.L. 2023 (in prep.). Non-detriment finding assessment for the export from the United Kingdom of CITES-listed European eel Anguilla anguilla (2023-26). JNCC Report, JNCC, Peterborough.

148 Aprahamian, M., Wood, P., 2021. Estimation of glass eel (Anguilla anguilla) exploitation in the Severn Estuary, England. Fish. Manag. Ecol. 28, 65–75.

Indirect: Changes to water quality through release of contamination / nutrients:

9.6.26 See the assessment of changes to water quality through release of contamination / nutrients presented under the river lamprey feature of the Severn Estuary SAC (Section 9.4.13 et. seq.), the conclusions of which apply equally here with regard to the migratory fish species assemblage.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.6.27 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.19 et. seq.), the conclusions of which apply equally here with regard to the migratory fish species assemblage. Whilst it is noted that fish within the migratory fish assemblage have different sensitivities to noise, vibration and light, best practice mitigation measures (for example, implementation of a Lighting Strategy, and timing of works, as appropriate) will be adopted.

Pawlett Hams / The Island: Mortality / injury through construction during habitat works:

9.6.28 See the assessment of mortality / injury through construction during habitat works presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.23 et. seq.), the conclusions of which are also applicable here with regard to the migratory fish species assemblage. Best practice mitigation measures will be adopted.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.6.29 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented for the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.26 et. seq.), the conclusions of which are also applicable here with regard to the migratory fish species assemblage. Best practice mitigation measures will be adopted.

Pawlett Hams / The Island: Indirect: Changes to hydrodynamics and sediment transport during habitat works:

9.6.30 See the assessment of changes to hydrodynamics and sediment transport during habitat works presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.28 et. seq.), the conclusions of which are also applicable here with regards to the migratory fish species assemblage. Best practice mitigation measures will be adopted.

Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye): Disruption of migratory routes:

9.6.31 See the assessment of disruption of migratory routes presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.31 et. seq.), the conclusions of which apply equally here to the migratory fish species assemblage.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.6.32 See the assessment of changes to hydrodynamics and sediment transport presented under the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.34 et. seq.), the conclusions of which are also applicable here to the migratory fish species assemblage. Best practice mitigation measures will be adopted.

Weir removal / easement: Trostrey Weir, River Usk and Manorafan Weir, River Towy: Disruption of migratory routes:

9.6.33 See the assessment of disruption of migratory routes presented under the river lamprey qualifying species of the Severn Estuary SAC (for the compensation measures *within* the DCO Material Change Order Limits) (Section 9.4.31 et. seq.), the conclusions of which apply equally here to the migratory fish assemblage.

Criterion 5: Wintering waterfowl assemblage of international importance

9.6.34 According to the Severn Estuary European Marine Site NE and CCW advice given under Regulation 33 of the Conservation (Natural Habitats) Regulations 1994 (dated 2009), the Ramsar Criterion 5 assemblage of internationally important waterfowl includes 70,919 waterfowl based on a 5-year peak mean 1998/99-2002/2005.

9.6.35 This assemblage is made up of the same bird species as the Severn Estuary SPA waterbird assemblage. Therefore, the assessment and conclusions above for the Severn Estuary SPA waterbird assemblage (Section 9.5.42 and 9.5.11 et. seq.) applies equally here.

Criterion 6: Internationally important assemblage of waterfowl (including Lesser black-backed gull)

9.6.36 According to the Severn Estuary European Marine Site NE and CCW advice given under Regulation 33 of the Conservation (Natural Habitats) Regulations 1994 (dated 2009), Criterion 6 relates to species where 1 % of the individuals in a population of a species or a sub species of waterbird are supported by the Ramsar site. The species listed under Criterion 6 of the Severn Estuary Ramsar site are:

- Tundra / Bewick's swan;
- Greater white-fronted goose;
- Dunlin;
- Common redshank;
- Common shelduck;
- Gadwall;
- Lesser black-backed gull, *Larus fuscus graellsii*;
- Ringed plover, Charadrius hiaticula;
- Eurasian teal, *Anas crecca*; and
- Northern pintail, *Anas acuta*.

9.6.37 For all of these species, apart from the Lesser black-backed gull, the assessment and conclusions provided above for the Severn Estuary SPA applies. This is because all these Criterion 6 species fall within the SPA either as individual qualifying species of the SPA or as part of the SPA waterbird assemblage. Please therefore refer to the SPA assessment (Section 9.5.42 and 9.5.11 et. seq.).

9.6.38 Therefore, the following assessment considers the lesser black-backed gull only.

Marine design element

Indirect: effects on piscivorous (fish eating) birds through changes to prey resources:

9.6.39 The lesser black-backed gull is piscivorous in nature. Fish comprise the majority of the gull's diet but it does not prey exclusively on an individual species, rather is opportunistic, feeding on prey items including squid, crustaceans, small marine organisms and surface offal. They have also been known to feed in the terrestrial environment, taking other birds' eggs and rodents as prey.

9.6.40 On this basis, it is concluded that, despite potential entrapment effects predicted on some fish species, there are sufficient alternative prey resources for the lesser black-backed gull.

9.6.41 Therefore, no adverse effect on the integrity of the Ramsar site from the Project alone is anticipated in relation to the Criterion 6 bird species through this impact pathway. This applies to HPC operation and defueling (decommissioning phase). There is also no effect via this pathway from HPC construction.

Indirect: Effect on bird species through the changes to water quality through release of contamination / nutrients

9.6.42 Please see the assessment presented for the Severn Estuary SPA for the gadwall (Section 9.5.11 et. seq.) in relation to this pathway, the conclusions of which also apply to the lesser black backed gull. In addition, as an opportunist feeding species, lesser black-backed gulls are not similarly dependent upon the intertidal soft sediment habitats that would be potentially affected by the FRR discharges. Indeed, as opportunity feeders, lesser black-backed gulls are likely to scavenge upon discharged material once deposited.

9.6.43 The EA in its 2020 AA for the WDA Permit inquiry also came to the conclusion that there would be no adverse effect on integrity of the Severn Estuary Ramsar site Criterion 6 from the FRR system operating at HPC.

Compensation measures within Material Change DCO Order Limits

9.6.44 Please refer to the Severn Estuary SPA assessment of various pathways for the gadwall (Section 9.5.11 et. seq.), the conclusions of which apply equally to the lesser black backed gull.

Compensation measures outside Material Change DCO Order Limits

9.6.45 Please refer to the Severn Estuary SPA assessment of various pathways for the gadwall (Section 9.5.11 et seq.), the conclusions of which apply equally to the lesser black backed gull.

Criterion 8: Wetland habitat as important source of food and nursery ground

9.6.46 According to the Severn Estuary Information Sheet on Ramsar Wetlands, the Ramsar Criterion 8 habitat is an important source of food as well as a nursery ground for many fish species, especially allis shad (*Alosa alosa*) and twaite shad (*A. Fallax*). It was confirmed by the Inspector in the WDA Permit inquiry and the Secretary of State's decision letter of 2 September 2022 that fish species are not part of / incorporated into Criterion 8.

Marine design element

Changes to water quality through release of contaminants / nutrients:

9.6.47 See the assessment at Section 9.4.13 et seq. above for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) which describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. The description there applies equally here.

9.6.48 There will, accordingly, be no adverse effect on the integrity of the Ramsar site via this Criterion 8 and this pathway from the Project alone during HPC operation, and (since any effect would be even less during the (defueling (decommissioning phase)) also during defueling. There is no effect through this pathway during HPC construction.

Habitat loss and physical damage (potential impacts on habitats):

9.6.49 In addition to the potential effects on water quality of increased discharge through the FRR system, there is the potential during HPC operation for smothering effects to arise as a result of increased organic carbon enrichment. This has been assessed with particular reference to smothering of *Sabellaria* reef, littoral rock and intertidal soft sediment habitats. The assessment at Section 9.4.13 et seq. above for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. Results there showed that the area estimated to be in excess of the derived daily benchmark of 0.3 g organic carbon/m^2/day was 0.17 km^2 (using 2009-10 data) and 0.15 km^2 (using 2021-22 data). On the basis of this, compared to the overall size of the Ramsar site, no effect on Criterion 8 is predicted. It is concluded that, in view of the relevant conservation objectives, there will be no adverse effect from the Project alone on this Criterion 8 feature through this pathway.

9.6.50 There will also be no effect on Criterion 8 via this pathway during HPC construction. For approximately 4 years during HPC defueling (decommissioning stage) any effect will be a much smaller effect than during HPC operation due to the reduced abstraction of sea water during defueling.

Compensation measures within Material Change DCO Order Limits

Pawlett Hams / The Island: Changes in hydrodynamics and sediment transport and associated impact on water quality:

9.6.51 See the assessment presented for this pathway under the Estuaries qualifying feature of the Severn Estuary SAC (Section 9.4.163) for this pathway, the conclusions of which apply equally here.

9.6.52 On this basis, and taking into account the relevant conservation objectives, there will be no effect on the Criterion 8 feature of the Severn Estuary SAC through changes to the hydrodynamics and sediment transport as a result of the Pawlett Hams or The Island compensation elements of the Project alone. It is therefore concluded that there will be no adverse effect on the integrity of the Ramsar via this impact pathway from the Project alone.

Pawlett Hams / The Island: Changes to water quality (contaminant / nutrient release):

9.6.53 See the assessment presented for this pathway under the Estuaries qualifying feature of the Severn Estuary SAC (Section 9.4.167 et seq.) for this pathway, the conclusions of which apply equally here.

9.6.54 On this basis, and taking into account the relevant conservation objectives, no effect on the Criterion 8 habitat feature of the Ramsar site is predicted through habitat loss and physical damage as a result of the Pawlett Hams or Island compensation elements of the Project. It is therefore concluded that there will be no adverse effect on the integrity of the Ramsar site via this impact pathway.

Compensation measures outside Material Change DCO Order Limits

Native oyster reefs / kelp / seagrass: Changes to hydrodynamics and sediment transport:

9.6.55 See the assessment presented for this pathway under the Estuaries feature of the Severn Estuary SAC (Section 9.4.177 et seq.), the conclusions of which apply equally here.

Native oyster reefs / Kelp / seagrass: Habitat loss and physical damage:

9.6.56 Even though the proposed location of seagrass beds, kelp forests and native oyster reefs is not at present known, it is possible to provide a high-level assessment.

9.6.57 Whilst not a direct 'loss' of habitat, the creation / enhancement of seagrass beds, kelp forests and native oyster reefs will result in a habitat change within their direct area, and potential indirect changes on the habitats immediately adjacent, for example through natural spread of organisms from within the habitat creation / enhancement area. The installation of new habitats may also result in short-term physical damage to the area whilst installation is being undertaken. Mitigation measures are likely to be available to minimise any impacts.

9.6.58 In addition, the introduction of seagrass beds and kelp forests in particular will bring about an increase in diversity and abundance of species.

9.6.59 On the above basis (a high-level, qualitative assessment), but subject to further, more detailed assessment when further details are known (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), and in view of the conservation objectives, there will be no adverse effect on the integrity of the Ramsar site via this pathway.

Mitigation measures

9.6.60 The section above on the impact pathway "*Indirect: effects on piscivorous* (*fish eating*) *birds through changes to prey resources*" have already taken into account the mitigation measures, being the capped head and the FRR system since these have been taken into account in the Fish entrapment analysis above.

9.6.61 With regards to above sections on further impact pathways, standard best practice mitigation measures will be applied to avoid and minimise any potential impacts.

Conclusions on integrity from the Project alone

9.6.62 In view of the assessment above it cannot be excluded beyond reasonable scientific doubt that the Project alone during HPC operation could risk an adverse effect on the integrity of the Severn Estuary Ramsar due to the fish entrapment pathway of impact on the Criterion 4 migratory fish species assemblage. Any effects during approximately 4 years of defueling (decommissioning phase) will be much less since there will be reduced sea water abstraction during that time.

9.6.63 The HRA derogation tests therefore apply.

9.6.64 There will be no effect on the Ramsar site via this pathway during HPC construction.

9.6.65 There will be no risk of an adverse effect from the Project alone during construction, operation and the four defueling years (decommissioning phase) on the integrity of the Severn Estuary Ramsar site via other qualifying features in relation to any pathway; or via the Criterion 4 assemblage via any other pathway.

Conclusions on integrity from the Project in combination with other plans and projects

9.6.66 See the text provided for the Severn Estuary SAC (Section 9.4.215 et seq.), which applies equally here.

Consideration of past, current and future baselines

9.6.67 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past (original) baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.6.68 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.7 River Usk / Afon Wsyg SAC

9.7.1 The River Usk SAC in south Wales protects a medium-sized catchment (the SAC covering 967.97 ha), important for its populations of a number of migratory fish species due to the good quality habitat present within the river. Flowing through the city of Newport and exiting into the Severn Estuary, the Usk flows over predominantly Devonian Old Red Sandstone, resulting in waters that are generally well buffered against acidity. The geology also results in a generally low to moderate nutrient status.

9.7.2 Throughout the assessment below for the River Usk SAC, particular attention has been paid to the conservation objectives of the River Usk SAC, as described in Table 8-2.

River lamprey

9.7.3 Baseline populations for river lamprey are as presented within Table 9-1. Within the River Usk SAC, the species is a primary reason for site selection, but despite being acknowledged as a good area for the species, river lamprey were noted as being in unfavourable condition in 2012.

Marine design element

Fish entrapment:

9.7.4 Only nine river lamprey were recorded within the 39-year RIMP dataset, two in CIMP1, and none in CIMP2 at HPB, therefore accurately predicting impingement levels at HPC is difficult.

9.7.5 In the EA 2020 AA the population estimate for each of the catchments draining into the Severn Estuary SAC was based on the combined population for the Rivers Wye and Usk that was modelled by APEM (APEM Ltd., 2010)[149] as part of the Severn Tidal Power Feasibility Study and Strategic Environmental Assessment ('SEA'). The population comparator was deemed appropriate because river lamprey do not home to natal rivers and are considered panmictic. The combined Usk and Wye adult numbers provides a conservative Severn Estuary estimate of fish that could ascend the rivers to spawn. Impingement rates of river lamprey have been contextualised relative to a population estimate of 116,109 fish, to determine potential levels

149 APEM Ltd., 2010. Severn Tidal Power Feasibility Study Strategic Environmental Assessment, Final Reports – Sea Topic Paper, Migratory and Estuarine Fish, Annex 4 – Migratory Fish Life Cycle, Models.

of significance. As such the results are consistent with those for the Severn Estuary SAC presented in Table 9-1, with mean annual losses of 14 equivalent adults equating to an annual effect of HPC (without an AFD) of 0.01 % of the population.

9.7.6 There are uncertainties in the predicted entrapment effects as an unknown proportion of transformer river lamprey may be too small to be impinged and subject to entrainment at HPB. The application of a 5 mm mesh at HPC will increase the proportion of entrapped transformers being impinged and directed through the FRR system thereby incurring lower mortality rates than entrained fish. However, an unestablished proportion of transformers will still be entrained.

9.7.7 On the above basis of the low impingement rates and precautionary approach of assuming all impinged fish were adults (EAV = 1), whilst noting the uncertainty in entrainment predictions, it is concluded that total entrapment during HPC operation (without an AFD) will lead to no adverse effect from the Project alone on the integrity of the River Usk SAC, through this impact pathway.

9.7.8 This was also the conclusion of the EA's 2020 AA, which noted that river lamprey was not a species of concern for the River Usk SAC.

9.7.9 Any effect will be much less for HPC defueling (decommissioning phase) due to the reduced abstraction of sea water during approximately 4 years during that phase. There will also be no effect via this pathway during HPC construction.

Indirect: effects on fish populations through changes to water quality (contaminants / nutrients):

9.7.10 Detailed consideration of potential changes to water quality through release of contaminants, altered nutrient levels, and changes to dissolved oxygen levels in the water column, primarily in the vicinity of the FRR outfall is presented in the assessment of effects on fish populations through changes to water quality (contaminants / nutrients) for the river lamprey qualifying species of the Severn Estuary SAC at Section 9.4.13 et seq. above.

9.7.11 Analysis of these potential changes concluded that there will be no adverse effect from the Project alone during HPC operation on the integrity of the Severn Estuary SAC due to effects on river lamprey and the same conclusion applies to the integrity of the River Usk SAC in relation to river lamprey, through this impact pathway.

9.7.12 Any effect via this pathway will be much less for HPC defueling (decommissioning phase) due to the reduced abstraction of sea water during approximately 4 years during that phase. There will also be no effect via this pathway during HPC construction.

Compensation measures within the Material Change DCO Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.7.13 See the assessment presented for disturbance (noise, vibration, light) and temporary displacement through construction activities under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.19 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction

9.7.14 See the assessment presented for mortality / injury through construction under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.23 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release)

9.7.15 See the assessment presented for indirect effects on fish populations through changes to water quality (contaminant / nutrient release) under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.26 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect: Changes to hydrodynamics and sediment transport:

9.7.16 See the assessment presented for indirect effects of changes to hydrodynamics and sediment transport under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.28 et seq.), the conclusions of which apply equally here.

Compensation measures outside the Material Change DCO Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.7.17 See the assessment presented for indirect effects of changes to hydrodynamics and sediment transport under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.34 et seq.), the conclusions of which apply equally here.

Trostrey Weir (River Usk): disruption of migratory routes:

9.7.18 Temporary construction works to remove / modify the weirs on the River Usk would likely require dewatering of the river at the weir to facilitate works. During the anticipated four months of construction, the water flow in the river would be maintained through other means, e.g. via a flume. Whilst there is potential for this to disrupt the pathways of migratory fish such as river lamprey, such flumes can be designed to enable the movement of fish past the works. An alternative method of working could include phasing of weir works using coffer dams to exclude sections of the weir to provide a continued water flow and fish passage at all times. Through these measures, fish passage will not be affected, and adverse effects on river lamprey populations through disruption of migratory routes are not anticipated.

9.7.19 On the above basis and in view of the conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the river lamprey qualifying species and this impact pathway.

Trostrey Weir (River Usk): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.7.20 Fish can be sensitive to construction generated noise, vibration and light, even if those potentially disturbing actions are generated on terrestrial habitats. It is possible that river lamprey present within aquatic habitats in the River Usk could be disturbed by construction activities during the removal/modification of the Trostrey Weir resulting in displacement from their habitats, with potential subsequent effect on migration, feeding and breeding success.

9.7.21 However, works at Trostrey Weir would be temporary in nature. In addition, works, whether in the aquatic or terrestrial environment, would be completed under an appropriate CEMP which would stipulate suitable environmental control measures, including a Lighting Strategy, noise reduction measures and the control / prevention of sediment and / or contaminants entering the River Usk. Through these measures, construction disturbance to fish and adverse effects on river lamprey populations are not anticipated.

9.7.22 On the above basis and in view of the relevant conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the river lamprey qualifying species and this impact pathway.

Trostrey Weir (River Usk): Mortality / injury through construction during habitat works:

9.7.23 Construction activities e.g., installation of dams, dewatering, excavation and reinstatement of the riverbed post works within the River Usk could lead to potential mortality / injury of fish species present. However, well stablished methods of fish rescue prior to dewatering to remove and exclude fish from the working area (which would be detailed within a Fish Rescue Plan and secured in the DCO via the CEMP), with associated EA consents, would avoid potential impacts. On the above basis and in view of the relevant conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the river lamprey qualifying species and this impact pathway

Trostrey Weir (River Usk): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.7.24 Changes in water quality, from changes in increased suspended sediment, nutrient levels and / or pollutants, can result in adverse effects on fish (including their respective different life stages), resulting in lower survival and fecundity rates and disruption to migration activities.

9.7.25 However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, fish passage will not be affected, and adverse effects on river lamprey populations through disruption of migratory routes are not anticipated.

9.7.26 On the above basis and in view of the relevant conservation objectives, there will be no adverse effect from the Project alone on the integrity of the River Usk SAC via the river lamprey qualifying species via this impact pathway.

Sea lamprey

9.7.27 Baseline populations for sea lamprey are as presented within Table 9-2. Within the River Usk, sea lamprey was noted as being in Unfavourable condition in 2012, predominantly based on monitoring of sea lamprey ammocoetes' presence at identified sites in the river. Factors thought to influence this include levels of suspended solids, soluble reactive phosphorus and flow rates.

Marine design element

Fish entrapment:

9.7.28 In the EA 2020 AA the population estimate of sea lamprey was based on the combined population for the Rivers Wye and Usk that was modelled by APEM (APEM Ltd., 2010)[150] as part of the Severn Tidal Power Feasibility Study and Strategic Environmental Assessment (SEA). The population comparator was deemed appropriate because sea lamprey do not home to natal rivers and are considered panmictic. The combined Usk and Wye adult numbers provides a conservative Severn Estuary estimate of fish that could ascend the rivers to spawn. Impingement rates of sea lamprey have been contextualised relative to a population estimate of 15,269 fish, to determine potential levels of significance. As such the results are consistent with those for the Severn Estuary SAC presented in Table 9-2**.**

9.7.29 In CIMP1 mean annual losses of 71 equivalent adults equates to an annual entrapment effect of HPC (without an AFD) of 0.46 % of the conservative population estimate. No sea lamprey were impinged in the core CIMP2 period.

9.7.30 Estimates of impingement of sea lamprey at HPC, based on the CIMP datasets, are presented within Table 9-2.

9.7.31 The application of an EAV of 1, the maximum value for a semelparous fish, has been applied to all sea lamprey impinged adding precaution to the assessment as impingement would affect a mixture of transformers, sub-adults and adult fish, not all of which will survive to maturity. However, as with river lamprey an unquantified proportion of transformers would be subject to entrainment. On the above basis, of the identified uncertainties and inbuilt precaution in

---

150 APEM Ltd., 2010. Severn Tidal Power Feasibility Study Strategic Environmental Assessment, Final Reports – Sea Topic Paper, Migratory and Estuarine Fish, Annex 4 – Migratory Fish Life Cycle, Models.

the assessment, entrapment effects of sea lamprey through this pathway during HPC operation are predicted to have no adverse effect from the Project alone on the integrity of the River Usk SAC.

9.7.32 This was also the conclusion of the EA's 2020 AA, which noted that sea lamprey was not a species of concern for the River Usk SAC.

9.7.33 Any effect via this pathway will be much less for HPC defueling (decommissioning phase) due to the reduced abstraction of sea water during approximately 4 years during that phase. There will also be no effect via this pathway during HPC construction.

Indirect: effects on fish populations through changes to water quality (contaminants / nutrients):

9.7.34 See the assessment of effects on fish populations through changes to water quality (contaminants / nutrients) presented for river lamprey as a qualifying species of the River Usk SAC (Section 9.7.10 et seq. above), the conclusions of which apply equally here.

Compensation measures within the Material Change DCO Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.7.35 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented for river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.19 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.7.36 See the assessment of mortality / injury through construction presented for river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.23 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.7.37 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented for river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.26), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect: Changes to hydrodynamics and sediment transport:

9.7.38 See the assessment of indirect effects of changes to hydrodynamics and sediment transport presented for river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.28 et seq.), the conclusions of which apply equally here.

Compensation measures outside the Material Change DCO Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport

9.7.39 See the assessment of indirect effects of changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.34 et seq.), the conclusions of which apply equally here.

Trostrey Weir (River Usk): disruption of migratory routes

9.7.40 See the assessment of disruption of migratory routes presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.18 et seq. above), the conclusions of which apply equally here.

Trostrey Weir (River Usk): Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.7.41 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.20 et seq, above), the conclusions of which apply equally here.

Trostrey Weir (River Usk): Mortality / injury through construction during habitat works

9.7.42 See the assessment of mortality / injury through construction during habitat works presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.23, above), the conclusions of which apply equally here.

Trostrey Weir (River Usk): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.7.43 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented for river lamprey as a qualifying species of the River Usk SAC (Section 9.7.24 et seq. above), the conclusions of which apply equally here.

Twaite shad

9.7.44 Baseline numbers for twaite shad are as presented within Table 9-3. Within the River Usk SAC, the status of twaite shad in 2012 was noted as being Unfavourable, having failed to meet the target for spawning distribution[151] based on monitoring in 2007-2012. This is considered to have been related to the partial barrier across the river at Llanfoist bridge.

Marine design element

Fish entrapment:

9.7.45 Predicted entrapment effects for twaite shad are presented in Table 9-12, noting that based on updated calculations, there was the potential for annual losses of 48 equivalent adult fish based on CIMP1, and up to 104 adult fish based on CIMP2.

9.7.46 It is not possible to determine from which spawning population the predominantly juvenile (0+ group) impinged twaite shad originate, however, the likelihood is that these impinged small fish at HPB are emigrants from the Rivers Severn, Usk and Wye that drain into the Severn Estuary upstream of HPB. Accordingly, the precautionary approach adopted in the HRA is to apportion total losses relative to each SAC individually. The Planning Inspector concluded in his report that this was a "*reasonable worst case scenario*".

Table 9-12: Predictions of impingement and entrapment for the effects of HPC (without AFD) on twaite shad populations of the River Usk SAC, compared to the EA predictions presented at the WDA Permit inquiry. The results of the upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	EA-WDA Permit inquiry predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment U95 % CI population effect
CIMP1	21,674	0.4 %	0.22 %	0.33 %	1.35 %

151 Spawning distribution is assessed by completion of kick-sampling for eggs in suitable habitat, to confirm the distribution of eggs (and therefore spawning) within the river system.

Dataset	Population estimate (adult numbers)	EA-WDA Permit inquiry predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment U95 % CI population effect
CIMP2	N/A	N/A	N/A	N/A	N/A

9.7.47 Based on predicted entrapment effects of 0.33 % of the River Usk population (Table 9-12), and emerging telemetry survey data within the Severn Estuary (as described in the Severn Estuary / Môr Hafren SAC section on twaite shad) (Section 9.4), it cannot be concluded that there will be no significant effect on the populations of twaite shad from the River Usk. A population estimate for the River Usk is not available against which to contextualise losses from CIMP2.

9.7.48 As such it is concluded that there is a risk to the integrity of the River Usk SAC from the Project alone during HPC operation through entrapment of the twaite shad qualifying species through the marine design element of the Project. This conclusion is consistent with the findings of the Planning Inspector in 2021 and the Secretary of State in 2022. The risk during HPC defueling (decommissioning phase) will be much less due to the reduced sea water abstraction for approximately 4 years during the defueling phase. The HRA derogation tests must therefore be met.

9.7.49 There will be no effect via this pathway on twaite shad during HPC construction.

Indirect: effects on fish populations through changes to water quality through release of contaminants / nutrients:

9.7.50 See the assessment of indirect effects on fish populations through changes to water quality through release of contaminants / nutrients presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.10 et seq. above), the conclusions of which apply equally here.

Compensation measures within the Material Change DCO Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.7.51 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under twaite shad as a qualifying feature of the Severn Estuary SAC (Section 9.4.75 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction

9.7.52 See the assessment of mortality / injury through construction presented under twaite shad as a qualifying feature of the Severn Estuary SAC (Section 9.4.78 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release)

9.7.53 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under twaite shad as a qualifying feature of the Severn Estuary SAC (Section 9.4.81 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect: Changes to hydrodynamics and sediment transport:

9.7.54 See the assessment of indirect effects of changes to hydrodynamics and sediment transport presented under twaite shad as a qualifying feature of the Severn Estuary SAC (Section 9.4.83 et seq.), the conclusions of which apply equally here.

Compensation measures outside the Material Change DCO Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.7.55 See the assessment of changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.34 et seq.), the conclusions of which apply equally here.

Trostrey Weir (River Usk): disruption of migratory routes

9.7.56 See the assessment of disruption of migratory routes presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.18 et seq. above), the conclusions of which apply equally here.

Trostrey Weir (River Usk): Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.7.57 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.20 et seq. above), the conclusions of which apply equally here.

9.7.58 Trostrey Weir (River Usk): Mortality / injury through construction during habitat works

9.7.59 See the assessment of mortality / injury through construction during habitat works presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.23 above), the conclusions of which apply equally here.

9.7.60 Trostrey Weir (River Usk): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works

9.7.61 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.24 et seq above), the conclusions of which apply equally here.

Allis shad

9.7.62 Allis shad is the larger of the UK's two shad species, reaching up to around 50 cm total length, with historic distribution along the eastern Atlantic coasts from Norway to North Africa, and in the western Mediterranean. Populations have declined significantly throughout the species' range. Adult fish spend most their lives in the marine environment, migrating through estuaries in April and May to spawn from mid-May to mid-July, with most individuals spawning only once in their lifetime, although around 13.5 % may spawn again.

Marine design element

Fish entrapment:

9.7.63 Two Allis shad were impinged during CIMP1, with none positively recorded during CIMP2 surveys.

9.7.64 During their review of population estimates for their 2020 HRA, the EA found no evidence of Allis shad in the River Usk.

9.7.65 On the basis of the low numbers reported from the impingement record, and no direct link to the River Usk SAC, there will be no adverse effect on the integrity of the River Usk SAC through the marine design element of the Project during HPC operation or defueling (decommissioning phase) on Allis shad. There is also no effect on Allis shad during HPC construction via this pathway.

9.7.66 This was also the conclusion of the EA's 2020 AA, which noted that Allis shad was not a species of concern for the River Usk SAC.

Indirect: effects on fish populations through changes in water quality through release of contaminants / nutrient release:

9.7.67 Through changes to the marine design element (i.e. the removal of the requirement to install an AFD), there is the potential for water quality to be altered during HPC operation as a result of changes to the level of dead / decaying fish matter released through the FRR system, causing changes to contaminants, nutrient levels and dissolved oxygen levels in the water column. These changes to water quality have the potential to affect fish populations, in particular those of migratory fish, which can rely on good water quality conditions to enable passage through an estuary to / from their natal rivers, and where, for example, reduced levels of dissolved oxygen can act as a physical block against such passage.

9.7.68 Potential effects of the HPC FRR discharge on nutrient concentrations, BOD, un-ionised ammonia and phytoplankton production have been assessed based on levels of dead and moribund biomass of fish and invertebrates predicted to be discharged from the FRR, derived from impingement estimates from the CIMP datasets. Effects have been determined based on the estimated maximum total wet dead and moribund biomass, including fish, crustaceans and gelatinous zooplankton; an annual average total of 194 kg/day based on CIMP2 values, and a quarterly average not expected to exceed 410 kg/day.

9.7.69 The findings of this analysis, based on the latest impingement values, are:

- Nutrient inputs from discharged fish matter remain negligible and would not change the nutrient status of local water bodies. Phytoplankton production levels are not predicted to increase due to FRR discharges.
- Decaying fish matter released from the FRR would have a negligible impact on dissolved oxygen levels of local water bodies.
- Whilst a small area of water in the immediate vicinity of the FRR outfall (measured in meters) might experience levels of un-ionised ammonia above the EQS, this will likely be rapidly mixed and dispersed within the water column, and negligible areas would be affected by un-ionised ammonia levels at or above the EQS.

9.7.70 On the above basis, coupled with the conclusion of the EA's 2020 AA that there was no evidence of Allis shad within the River Usk, it is concluded that there will be no adverse effect on the integrity of the Risk Usk SAC via this qualifying species and pathway during HPC operation. When sea water abstraction levels reduce during HPC defueling (decommissioning phase), this will also remain the case. There will be no effect on Allis shad of the River Usk during HPC construction via this pathway.

Compensation measures within the Material Change DCO Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.7.71 Fish can be sensitive to construction generated noise, vibration and light, even if those potentially disturbing activities are undertaken on intertidal and terrestrial habitats. With the possibility that Allis shad may be present within existing aquatic habitats at Pawlett Hams or The Island, there is the potential that they may be disturbed by groundworks and other construction activities during the creation / enhancement of habitats, resulting in their displacement from these habitats, with potential subsequent effect on migration, feeding and breeding success.

9.7.72 However, works at Pawlett Hams / The Island will be temporary in nature. In addition, works, whether in the intertidal or terrestrial environments, will be completed under an appropriate CEMP, which will stipulate suitable environmental control measures, including a Lighting Strategy, noise reduction measures, and the control / prevention of sediment and / or contaminants entering the River Parrett.

9.7.73 Whilst Allis shad exhibits sensitivity to disturbance, through the measures outlined above it is considered that there will be impacts on populations of Allis shad as result of works at either Pawlett Hams or The Island. There will be no effects during HPC operation and defueling (decommissioning phase).

9.7.74 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the River Usk SAC through construction generated disturbance on Allis shad as a result of the Pawlett Hams or The Island compensation of the Project alone.

Pawlett Hams / The Island: Mortality / injury through construction during habitat works:

9.7.75 Construction works, e.g. excavation to deepen tidal creeks, within habitats that could support Allis shad could result in accidental mortality or injury of individuals.

9.7.76 At this stage, optioneering is still ongoing with regards to the final design of works at Pawlett Hams / The Island; however, mitigation measures will be identified and employed so as to minimise potential effects on Allis shad (taking into account the higher sensitivity / vulnerability of shad, compared to some other species). Such measures revolve around the exclusion of water during periods of construction activity, thereby minimising the risk of fish being in the vicinity whilst construction activities are being undertaken.

9.7.77 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the River Usk SAC through construction generated mortality on Allis shad as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.7.78 Groundworks, for example breaking sea defences or lowering ground levels could release sediment into the estuary waters. The impact can be reduced by timing the excavation works to avoid high tide, and adherence to standard pollution control measures. However, any release of sediment would be limited to within the River Parrett / Bridgwater Bay estuary, and due to the highly turbid and active nature of the Severn Estuary, any temporary changes in sediment load would be rapidly subsumed into background levels and natural levels of variation.

9.7.79 Whilst Allis shad is sensitive to adverse changes in water quality, through implementation of the measures described above, and in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the River Usk SAC through this pathway on Allis shad as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.7.80 The creation / enhancement of habitat at Pawlett Hams and The Island has the potential to affect hydrodynamics and sediment transport in the immediate vicinity of the works. As described above, Allis shad (and other migratory fish species) can be susceptible to changes in these conditions, potentially acting as blockers to migration, either up or downstream.

9.7.81 However, in the case of the proposed managed realignment works at Pawlett Hams, and saltmarsh enhancement at The Island, it is predicted that any changes to hydrodynamics or the sediment regime will be limited to within the River Parrett / Bridgwater Bay estuary and, due to the highly turbid and active nature of the Severn Estuary, any changes would be rapidly subsumed into background levels and natural levels of variation.

9.7.82 It is therefore concluded, in view of the relevant conservation objectives, that there will be no adverse effect from the Pawlett Hams / The Island works of the Project alone on the integrity of the River Usk SAC via the Allis shad qualifying species and this impact pathway.

Compensation measures outside the Material Change DCO Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.7.83 Even though the proposed locations of seagrass beds, kelp forests and native oyster reefs are not at present known, it is possible to provide a high-level, qualitative assessment.

9.7.84 All habitat types have the potential to cause local changes to hydrodynamics and sediment transport, predominantly by capturing sediment, or by slowing water flows within the direct area of habitat creation / enhancement, and potentially in the immediate vicinity. This may result in sediment build-up in these areas.

9.7.85 However, the presence of seagrass, kelp and oysters will also aid in the maintenance of sediment levels within the Severn Estuary, rather than causing material to potentially leave the system, thereby also supporting the maintenance of sediment-based habitats within the wider estuaries feature, and the SAC.

9.7.86 On the above basis (a high-level, qualitative assessment), but subject to further more detailed assessment when further details are known (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), and in view of the conservation objectives, there will be no adverse effect from the marine habitat compensation works of the Project alone on the integrity of the River Usk SAC via the Allis shad qualifying species and this impact pathway.

Trostrey Weir (River Usk): disruption of migratory routes:

9.7.87 Temporary construction works to remove / modify the weirs on the River Usk would likely require dewatering of the river at the weir to facilitate works. During the anticipated four months of construction, the water flow in the river would be maintained through other means, e.g. via a flume. Whilst there is potential for this to disrupt the pathways of migratory fish such as Allis shad, such flumes can be designed to enable the movement of fish past the works. An alternative method of working could include phasing of weir works using coffer dams to exclude sections of the weir to provide a continued water flow and fish passage at all times. Through these measures, fish passage will not be affected, and adverse effects on Allis shad populations through disruption of migratory routes are not anticipated.

9.7.88 On the above basis and in view of the conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the Allis shad qualifying species and this impact pathway.

Trostrey Weir (River Usk): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.7.89 Fish can be sensitive to construction generated noise, vibration and light, even if those potentially disturbing actions are generated on terrestrial habitats. It is possible that Allis shad present within aquatic habitats in the River Usk could be disturbed by construction activities during the removal / modification of the Trostrey Weir resulting in displacement from their habitats, with potential subsequent effect on migration, feeding and breeding success.

9.7.90 However, works at Trostrey Weir would be temporary in nature. In addition, works, whether in the aquatic or terrestrial environment, would be completed under an appropriate CEMP which would stipulate suitable environmental control measures, including a Lighting Strategy, noise reduction measures, and the control / prevention of sediment and / or contaminants entering the River Usk. Through these measures, construction disturbance to fish and adverse effects on Allis shad populations are not anticipated.

9.7.91 On the above basis and in view of the relevant conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the Allis shad qualifying species and this impact pathway.

Trostrey Weir (River Usk): Mortality / injury through construction during habitat works:

9.7.92 Construction activities e.g., installation of dams, dewatering, excavation and reinstatement of the riverbed post works within the River Usk could lead to potential mortality / injury of fish species present. However, well stablished methods of fish rescue prior to dewatering to remove and exclude fish from the working area (which would be detailed within a Fish Rescue Plan and secured in the DCO via the CEMP), with associated EA consents, would avoid potential impacts.

Trostrey Weir (River Usk): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.7.93 Changes in water quality, from changes in increased suspended sediment, nutrient levels and / or pollutants, can result in adverse effects on fish (including their respective different life stages), resulting in lower survival and fecundity rates and disruption to migration activities.

9.7.94 However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, fish passage will not be affected, and adverse effects on Allis shad populations through disruption of migratory routes are not anticipated.

9.7.95 On the above basis and in view of the relevant conservation objectives, there will be no adverse effect from the Project alone on the integrity of the River Usk SAC via the Allis shad qualifying species via these impact pathways.

Atlantic salmon

9.7.96 Historically, Atlantic salmon were widely distributed in all countries with rivers entering the North Atlantic. However, its current distribution is restricted, largely as a result of anthropogenic influences, particularly the creation of artificial barriers to movement, and deteriorations in water quality. Within the Severn Estuary and its contributing rivers, individual stock assessments are undertaken to assess whether a river is meeting its

Conservation Limits[152]. A review of status in 2012 found Atlantic salmon to be Unfavourable (2012).

Marine design element

Fish entrapment:

9.7.97 No Atlantic salmon were impinged during the CIMP1 study period, although two individuals were caught in additional samples outside the core assessment period. No Atlantic salmon were observed during CIMP2. Ten Atlantic salmon were recorded during the 39-year RIMP. For the purposes of establishing entrapment rates, data from both the CIMP (including the additional samples in CIMP1) and RIMP studies were collated.

9.7.98 Within their 2020 AA for the WDA Permit inquiry, the EA estimated that 12 equivalent adult Atlantic salmon would be lost each year, based on RIMP data from 1997-2017. Using RIMP data from 1997-2019 and all available CIMP data and applying the EA calculation method, a revised estimate of 22 equivalent adult Atlantic salmon would be lost each year.

9.7.99 There are predicted losses, from the marine design element of the Project, based on the method described in Section 6, of 0.2 % for the River Usk population estimate; these are summarised below (Table 9-13).

Table 9-13: Predictions of entrapment for the effects of HPC on Atlantic salmon populations of the River Usk SAC, compared to the EA predictions presented at the WDA Permit inquiry. The results of the upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	WDA Permit inquiry EA value	Current assessment impingement prediction	Current assessment entrapment mean	Current assessment entrapment U95 % CI population effect
RIMP	6,269	0.2 %			
CIMP & RIMP	N/A		0.21 %	0.20 %	1.09 %

[152] The CL for each river is set as a stock size below which further reductions in spawner numbers are likely to result in significant reductions in the number of juvenile fish produced in future generations.

9.7.100 On the basis of the predicted impingement rates before the EA in 2020, the EA noted within their 2020 AA that it was not possible to conclude no adverse effect on the integrity of the River Usk SAC through potential entrapment effects on salmon populations.

9.7.101 Analysis of updated entrapment data from the HPB station has provided no additional evidence to alter this conclusion.

9.7.102 As such it is concluded that there is a risk to the integrity of the River Usk SAC from the Project alone during HPC operation through entrapment of the Atlantic salmon qualifying species through the marine design element of the Project. This conclusion is consistent with the findings of the Planning Inspector in 2021 and the Secretary of State in 2022. The risk during HPC defueling (decommissioning phase) will be much less due to the reduced sea water abstraction for approximately 4 years during the defueling phase. The HRA derogation tests must therefore be met.

9.7.103 There will be no effect via this pathway on Atlantic salmon during HPC construction.

Indirect: effects on fish populations through changes to water quality through release of contaminants / nutrient release:

9.7.104 Through changes to the marine design element (i.e. the removal of the requirement to install an AFD), there is the potential for water quality to be altered during HPC operation as a result of changes to the level of dead / decaying fish matter released through the FRR system, causing changes to contaminants, nutrient levels and dissolved oxygen levels in the water column. These changes to water quality have the potential to affect fish populations, in particular those of migratory fish, which can rely on good water quality conditions to enable passage through an estuary to / from their natal rivers, and where, for example, reduced levels of dissolved oxygen can act as a physical block against such passage.

9.7.105 Potential effects of the HPC FRR discharge on nutrient concentrations, BOD, un-ionised ammonia and phytoplankton production have been assessed based on levels of dead and moribund biomass of fish and invertebrates predicted to be discharged from the FRR, derived from impingement estimates from the CIMP datasets. Effects have been determined based on the estimated maximum total wet dead and moribund biomass, including fish, crustaceans and gelatinous zooplankton; an annual average total of 194 kg/day based on CIMP2 values, and a quarterly average not expected to exceed 410 kg/day.

9.7.106 The findings of this analysis, based on the latest impingement values, are:

- Nutrient inputs from discharged fish matter remain negligible and would not change the nutrient status of local water bodies. Phytoplankton production levels are not predicted to increase due to FRR discharges.
- Decaying fish matter released from the FRR would have a negligible impact on dissolved oxygen levels of local water bodies.
- Whilst a small area of water in the immediate vicinity of the FRR outfall (measured in meters) might experience levels of un-ionised ammonia above the EQS, this will likely be rapidly mixed and dispersed within the water column, and negligible areas would be affected by un-ionised ammonia levels at or above the EQS.
- Further, as presented in Section 6 of this HRA Report, calculations of the levels of total organic carbon input from FRR discharges were undertaken, resulting in an estimated 46 kg/day (based on CIMP1 data) and 42 kg/day (based on CIMP2 data). Whilst there is no formal EQS for organic carbon enrichment, the area in excess of the derived daily benchmark (see Section 3) of 0.3 g organic carbon/m^2/day is 0.17 km^2 (based on CIMP1 data) and 0.15 km^2 (based on CIMP2 data). When compared to the overall size of the SAC, this is a tiny proportion with the potential to be affected, and effects are not anticipated to be significant.

9.7.107 On the above basis it is concluded that, in view of the relevant conservation objectives, there will be no adverse effect from the Project alone during HPC operation on the integrity of the River Usk SAC through this pathway (water quality effects on the Atlantic salmon qualifying species). For approximately 4 years during HPC defueling (decommissioning phase) there will be a much smaller effect via this pathway than during HPC operation due to the reduced abstraction of sea water during that period. There will also be no effect on Atlantic salmon during HPC construction via this pathway.

9.7.108 Consideration of changes to water quality was also presented within the EA's 2020 HRA. This looked at the elements including a detailed analysis of the potential for smothering by dead and decaying fish matter. The HRA concluded that there was no adverse effect on the integrity of the River Usk SAC (via the Annex II migratory fish species / toxic contamination, bioaccumulation and nutrient enrichment pathway). This was also the conclusion reached for more distant designated sites for which migratory fish species are qualifying features.

9.7.109 This conclusion was further supported by the EA's 2023 HRA of the HPC Operational WDA Permit Variation, which considered the same effects as described above.

Compensation measures within DCO Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.7.110 Fish can be sensitive to construction generated noise, vibration and light, even if those potentially disturbing activities are undertaken on intertidal and terrestrial habitats. With the possibility that Atlantic salmon may be present within existing aquatic habitats at Pawlett Hams or The Island, there is the potential that they may be disturbed by groundworks and other construction activities during the creation / enhancement of habitats, resulting in their displacement from these habitats, with potential subsequent effect on migration, feeding and breeding success.

9.7.111 However, works at Pawlett Hams / The Island will be temporary in nature. In addition, works, whether in the intertidal or terrestrial environments, will be completed under an appropriate CEMP, which will stipulate suitable environmental control measures, including a Lighting Strategy, noise reduction measures and the control / prevention of sediment and / or contaminants entering the River Parrett.

9.7.112 Whilst Atlantic salmon may exhibit sensitivity to disturbance, through the measures outlined above it is considered that there will be impacts on populations of Atlantic salmon as result of works at either Pawlett Hams or The Island. There will be no effects during HPC operation and defueling (decommissioning phase).

9.7.113 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the River Usk SAC through construction generated disturbance on Atlantic salmon as a result of the Pawlett Hams or The Island compensation of the Project alone.

Pawlett Hams / The Island: Mortality / injury through construction during habitat works:

9.7.114 Construction works, e.g. excavation to deepen tidal creeks, within habitats that could support Atlantic salmon could result in accidental mortality or injury of individuals.

9.7.115 At this stage, optioneering is still ongoing with regards to the final design of works at Pawlett Hams / The Island; however, mitigation measures will be identified and employed so as to minimise potential effects on Atlantic salmon (taking into account the higher sensitivity / vulnerability of salmon, compared to some other species). Such measures revolve around the exclusion of water during periods of construction activity, thereby minimising the risk of fish being in the vicinity whilst construction activities are being undertaken.

9.7.116 On that basis, in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the River Usk SAC through construction generated mortality on Atlantic salmon as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release)

9.7.117 Groundworks, for example breaking sea defences or lowering ground levels could release sediment into the estuary waters. The impact can be reduced by timing the excavation works to avoid high tide, and adherence to standard pollution control measures. However, any release of sediment would be limited to within the River Parrett / Bridgwater Bay estuary, and due to the highly turbid and active nature of the Severn Estuary, any temporary changes in sediment load would be rapidly subsumed into background levels and natural levels of variation.

9.7.118 Whilst Atlantic salmon is sensitive to adverse changes in water quality, through implementation of the measures described above, and in view of the relevant conservation objectives, there will be no adverse effect on the integrity of the River Usk SAC through this pathway on Atlantic salmon as a result of the Pawlett Hams or Island compensation elements of the Project alone.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.7.119 The creation / enhancement of habitat at Pawlett Hams and The Island has the potential to affect hydrodynamics and sediment transport in the immediate vicinity of the works. As described above, Atlantic salmon (and other migratory fish species) can be susceptible to changes in these conditions, potentially acting as blockers to migration, either up or downstream.

9.7.120 However, in the case of the proposed managed realignment works at Pawlett Hams, and saltmarsh enhancement at The Island, it is predicted that any changes to hydrodynamics or the sediment regime will be limited to within the River Parrett / Bridgwater Bay estuary and, due to the highly turbid and active nature of the Severn Estuary, any changes would be rapidly subsumed into background levels and natural levels of variation.

9.7.121 It is therefore concluded, in view of the relevant conservation objectives, that there will be no adverse effect from the Pawlett Hams / The Island works of the Project alone on the integrity of the River Usk SAC via the Atlantic salmon qualifying species and this impact pathway.

Compensation measures outside DCO Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.7.122 Even though the proposed locations of seagrass beds, kelp forests and native oyster reefs are not at present known, it is possible to provide a high-level, qualitative assessment.

9.7.123 All habitat types have the potential to cause local changes to hydrodynamics and sediment transport, predominantly by capturing sediment, or by slowing water flows within the direct area of habitat creation / enhancement, and potentially in the immediate vicinity. This may result in sediment build-up in these areas.

9.7.124 However, the presence of seagrass, kelp and oysters will also aid in the maintenance of sediment levels within the Severn Estuary, rather than causing material to potentially leave the system, thereby also supporting the maintenance of sediment-based habitats within the wider estuaries feature, and the SAC.

9.7.125 On the above basis (a high-level, qualitative assessment), but subject to further more detailed assessment when further details are known (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), and in view of the conservation objectives, there will be no adverse effect from the marine habitat compensation works of the Project alone on the integrity of the River Usk SAC via the Atlantic salmon qualifying species and this impact pathway.

Trostrey Weir (River Usk): disruption of migratory routes:

9.7.126 Temporary construction works to remove / modify the weirs on the River Usk would likely require dewatering of the river at the weir to facilitate works. During the anticipated four months of construction, the water flow in the river would be maintained through other means, e.g. via a flume. Whilst there is potential for this to disrupt the pathways of migratory fish such as Atlantic salmon, such flumes can be designed to enable the movement of fish past the works. An alternative method of working could include phasing of weir works using coffer dams to exclude sections of the weir to provide a continued water flow and fish passage at all times. Through these measures, fish passage will not be affected, and adverse effects on Atlantic salmon populations through disruption of migratory routes are not anticipated.

9.7.127 On the above basis and in view of the conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the Atlantic salmon qualifying species and this impact pathway.

Trostrey Weir (River Usk): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.7.128 Fish can be sensitive to construction generated noise, vibration and light, even if those potentially disturbing actions are generated on terrestrial habitats. It is possible that Atlantic salmon present within aquatic habitats in the River Usk could be disturbed by construction activities during the removal/modification of the Trostrey Weir resulting in displacement from their habitats, with potential subsequent effect on migration, feeding and breeding success.

9.7.129 However, works at Trostrey Weir would be temporary in nature. In addition, works, whether in the aquatic or terrestrial environment, would be completed under an appropriate CEMP which would stipulate suitable environmental control measures, including a Lighting Strategy, noise reduction measures and the control / prevention of sediment and / or contaminants entering the River Usk. Through these measures, construction disturbance to fish and adverse effects on Atlantic salmon populations are not anticipated.

9.7.130 On the above basis and in view of the relevant conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the Atlantic salmon qualifying species and this impact pathway.

Trostrey Weir (River Usk): Mortality / injury through construction during habitat works:

9.7.131 Construction activities e.g. installation of dams, dewatering, excavation and reinstatement of the riverbed post works within the River Usk could lead to potential mortality / injury of fish species present. However, well stablished methods of fish rescue prior to dewatering to remove and exclude fish from the working area (which would be detailed within a Fish Rescue Plan and secured in the DCO via the CEMP), with associated EA consents, would avoid potential impacts.

Trostrey Weir (River Usk): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.7.132 Changes in water quality, from changes in increased suspended sediment, nutrient levels and / or pollutants, can result in adverse effects on fish (including their respective different life stages), resulting in lower survival and fecundity rates and disruption to migration activities.

9.7.133 However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, fish passage will not be affected, and adverse effects on Atlantic salmon populations through disruption of migratory routes are not anticipated.

9.7.134 On the above basis and in view of the relevant conservation objectives, there will be no adverse effect from the Project alone on the integrity of the River Usk SAC via the Atlantic salmon qualifying species via these impact pathways.

Brook Lamprey

Compensation measures outside the Material Change DCO Order Limits

Trostrey Weir, River Usk: Mortality / injury through construction activities:

9.7.135 See the assessment of mortality / injury through construction activities under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.23), the conclusions of which apply equally here in relation to the compensatory measures.

Trostrey Weir, River Usk: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.7.136 Fish can be sensitive to construction generated noise, vibration and light, even if those potentially disturbing actions are generated on terrestrial habitats. It is possible that brook lamprey present within freshwater habitats in the River Usk could be disturbed by construction activities during the removal/modification of the Trostrey Weir resulting in displacement from their habitats, with potential subsequent effect on feeding and breeding success.

9.7.137 However, works at Trostrey Weir would be temporary in nature. In addition, works, whether in the aquatic or terrestrial environment, would be completed under an appropriate CEMP which would stipulate suitable environmental control measures, including a Lighting Strategy, noise reduction measures and the control / prevention of sediment and / or contaminants entering the River Usk. Through these measures, construction disturbance to fish and adverse effects on brook lamprey populations will be avoided.

9.7.138 On the above basis and in view of the conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the brook lamprey qualifying species and this impact pathway.

Trostrey Weir, River Usk: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.7.139 Changes in water quality, from changes in increased suspended sediment, nutrient levels and / or pollutants, can result in adverse effects on fish (including their respective different life stages), resulting in lower survival and fecundity rates.

9.7.140 However, through the application of standard construction best practice methods, such releases into the river are preventable, thereby avoiding associated reductions in water quality. Through these measures, and in view of the conservation objectives, there will be no adverse effect from the Project alone on the integrity of the River Usk SAC via the brook lamprey qualifying species via these impact pathways.

9.7.141 On the above basis and in view of the conservation objectives, there will be no adverse effect from the Trostrey Weir compensation works of the Project alone on the integrity of the River Usk SAC via the brook lamprey qualifying species and this impact pathway.

Bullhead

Compensation measures outside the Material Change DCO Order Limits

Trostrey Weir, River Usk: Mortality / injury through construction activities:

9.7.142 See the assessment of mortality / injury through construction activities presented under river lamprey as a qualifying species of the River Usk SAC (Section 9.7.23), the conclusions of which apply equally here in relation to the compensatory measures.

Trostrey Weir, River Usk: Disturbance (noise, vibration, light) and temporary displacement through construction activities during habitat works:

9.7.143 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities during habitat works presented under brook lamprey as a qualifying species of the River Usk SAC (Section 9.7.134), the conclusions of which apply equally here in relation to the compensatory measures.

Trostrey Weir, River Usk: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.7.144 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under brook lamprey as a qualifying species of the River Usk SAC (Section 9.7.137 et seq.), the conclusions of which apply equally here in relation to the compensatory measures.

Otter

Marine design element

Indirect effect on otter through changes to prey resources

9.7.145 Otter of the River Usk SAC are likely to prey upon Annex II migratory fish species functionally linked to the Severn Estuary. However, the diet of otters will vary depending on the availability of prey, which in turn varies with the time of year. Prey species also include amphibians, invertebrates even young birds and mammals. Otter are unlikely to be dependent upon migratory Annex II fish; the decline over previous decades in the population of migratory fish has not been replicated for otter.

9.7.146 Therefore, there will be no adverse effect, in view of the relevant conservation objectives, from the marine design element of the Project alone during HPC operation on the integrity of the River Usk SAC, through this impact pathway via otter. For approximately 4 years during HPC defueling (decommissioning phase) there will be an even smaller effect via this pathway than during HPC operation due to the reduced abstraction of sea water during that period. There will also be no effect on otter via this pathway during HPC construction.

Compensation measures outside the Material Change DCO Order Limits

Trostrey Weir, River Usk: Disturbance and displacement:

9.7.147 Otter are found along the entire length of the River Usk and its main tributaries[153]. Construction activities within or adjacent the River Usk required to remove or modify the existing weir have the potential to disturb and displace otter from this section of the river (which is within the River Usk SAC).

9.7.148 Otter in freshwater habitats are largely nocturnal and as construction activities are unlikely to be required overnight (and so artificial lighting would not be necessary) the impact pathways relate to noise, vibration and human presence. Construction activities are temporary and anticipated to last no longer than four months. As such, any disturbance would be short-term and restricted to a single location. All works will be completed under an appropriate CEMP which will stipulate suitable environmental control measures, including noise reduction measures.

9.7.149 There are no operational pathways (i.e. meaning pathways once the weir works are complete) to effect otter.

9.7.150 Therefore, there will be no adverse effect, in view of the relevant conservation objectives, from the compensatory measures of the Project alone on the integrity of the River Usk SAC, through this impact pathway via otter.

Trostrey Weir, River Usk: Indirect effects through changes to water quality (contaminant / nutrient release):

9.7.151 Construction activities within or adjacent the River Usk required to remove or modify the existing weir have the potential to release sediment and / or contaminants into the water with subsequent impacts on habitat and prey quality / quantity for otter. However, the implementation of best practice construction methods to avoid potential impacts on watercourses would avoid this potential effect through a CEMP, secured by a requirement of the DCO. The CEMP could include temporary piling and dewatering of the in channel working area and buffer zones around watercourses for terrestrial storage of plant and materials.

---

153 Natural Resources Wales (2022) Core Management Plan including Conservation Objectives for Afon Wysg / River Usk SAC https://afonyddcymru.org/wp-content/uploads/2022/11/river_usk-sac-core-plan.pdf (Accessed: 11 December 2023).

9.7.152 No operational impact pathways (i.e., meaning pathways once the weir works are complete) to affect otter have been identified.

9.7.153 Therefore, there will be no adverse effect, in view of the relevant conservation objectives, from the compensatory measures of the Project alone on the integrity of the River Usk SAC, through this impact pathway via otter.

Trostrey Weir, River Usk: Disruption of commuting corridors:

9.7.154 Temporary construction works to remove/modify the weir on the River Usk would likely require dewatering of the river at the weir to facilitate works. During the anticipated four months of construction, the water flow would be maintained through other means e.g. via a flume. As such, otter would need to use alternative terrestrial habitat links to commute through the area. It is likely that otter already use the linear woodland on both sides of the weir to traverse the barrier. Alternatively it is possible that the works would be done in stages with partial sections of the weir undergoing exclusion, e.g. using coffer dams, and dewatering to ensure continued water flow within the watercourse.

9.7.155 It is possible that some trees on the riverbanks either side of the weir would require removal for machinery access. However, this would be sufficient to allow passage of machines only and the commuting function of the linear woodland on the banks would not be impacted.

9.7.156 No operational impact pathways (i.e. meaning pathways once the weir works are complete) have been identified.

9.7.157 Therefore, there will be no adverse effect, in view of the relevant conservation objectives, from the Trostrey Weir compensatory measures on the integrity of the River Usk SAC, through this impact pathway via otter.

Trostrey Weir (River Usk): Habitat loss and fragmentation of foraging habitat:

9.7.158 Habitat loss and fragmentation of foraging habitat would be restricted to the aquatic environment where temporary, short-term exclusion of water within the River Usk would be required to facilitate works on the weir. This impact would be short-term and of such a small area in comparison to the wider river that would continue to support a variety of prey species that no effect is anticipated on otter. Foraging habitat would be maintained even if the river were to be flumed as the adjacent riparian habitat would be retained. The riverbed would be reinstated post works.

9.7.159 Therefore, there will be no adverse effect, in view of the relevant conservation objectives, from the Trostrey Weir compensatory measures of the Project alone on the integrity of the River Usk SAC, through this impact pathway via otter.

Mitigation measures

9.7.160 No further mitigation is anticipated for the qualifying fish species of the River Usk SAC other than those measures described in Section 9.7 above.

9.7.161 Mitigation measures to address potential impacts on otter during compensatory habitat works at the Trostrey Weir will be required, as described above.

Conclusions on integrity from the Project alone

9.7.162 On the basis of the above assessments, it is not possible to exclude beyond reasonable scientific doubt a risk that the Project alone during HPC operation could lead to an adverse effect on the integrity of the River Usk SAC due to the fish entrapment pathway of impact on Twaite shad and Atlantic salmon.

9.7.163 Any effects during approximately 4 years of defueling (decommissioning phase) will be much less since there will be reduced sea water abstraction during that time. The HRA derogation tests therefore apply.

9.7.164 There will also be no effect on the River Usk SAC during HPC construction via this pathway.

9.7.165 There will be no risk of an adverse effect from the Project alone during construction, operation and the four defueling years (decommissioning phase) on the integrity of the River Usk SAC via any other qualifying features in relation to any pathway; or via Twaite shad / Atlantic salmon via any other pathway.

Conclusions on integrity from the Project in combination with other plans and projects

9.7.166 See the text provided within Section 9.4.215 et seq. for the Severn Estuary SAC above.

Consideration of past, current and future baselines

9.7.167 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past (original) baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.7.168 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.8 River Wye / Afon Gwy SAC

9.8.1 The River Wye, on the English-Welsh border, is noted for populations of migratory fish. It has relatively good water quality, adequate flows through a largely unobstructed main channel, and a wide range of aquatic habitats to support the fish populations it contains.

9.8.2 Throughout the assessment below for the River Wye SAC, particular attention has been paid to the conservation objectives of the River Wye SAC, as described in Table 8-2.

River lamprey

9.8.3 thin the River Wye, river lamprey is a primary reason for site selection, with the Wye noted as providing exceptionally good quality habitat for the species and supporting a healthy population[154].

Marine design element

Fish entrapment:

9.8.4 As presented within Section 9.4.3 et seq. (on the Severn Estuary SAC river lamprey qualifying feature) only nine river lamprey were recorded in the RIMP, two river lamprey were recorded within the CIMP1 dataset, and none in the CIMP2 dataset from HPB. As a result, accurately predicting impingement levels at HPC is difficult.

9.8.5 In the EA 2020 AA the population estimate for each of the catchments draining into the Severn Estuary SAC was based on the combined population for the Rivers Wye and Usk that was modelled by APEM (APEM Ltd., 2010) as part of the Severn Tidal Power Feasibility Study and Strategic Environmental Assessment (SEA). The population comparator was deemed

154 JNCC Site Description: River Wye SAC (undated) Available online at: https://sac.jncc.gov.uk/site/UK0012642. (Accessed 18 October 2023).

appropriate because river lamprey do not home to natal rivers and are considered panmictic. The combined Usk and Wye adult numbers provides a conservative Severn Estuary estimate of fish that could ascend the rivers to spawn. Impingement rates of river lamprey have been contextualised relative to a population estimate of 116,109 fish, to determine potential levels of significance. As such the results are consistent with those for the Severn Estuary SAC presented in Table 9-1. As outlined above, there were limited records of river lamprey within the CIMP datasets. However, it was still possible to estimate impingement levels for the species, with these values presented below, with mean annual losses of 14 equivalent adults equating to an annual effect of HPC (without an AFD) of 0.01 % of the population.

9.8.6 Again, as previously described, there are uncertainties in the predicted entrapment effects. This is because an unknown proportion of transformer river lamprey may be too small to be impinged and may be subject to entrainment at HPB. The application of a 5 mm mesh at HPC will increase the proportion of entrapped transformers being impinged and directed through the FRR system thereby incurring lower mortality rates than entrained fish. However, an unestablished proportion of transformers will still be entrained.

9.8.7 On the above basis of the low impingement rates, and precautionary approach of assuming all impinged fish were adults (EAV = 1), whilst noting the uncertainty, it can be concluded that total entrapment of river lamprey from the Project alone during HPC operation will have no adverse effect on the integrity of the River Wye SAC. This was also the conclusion of the EA's 2020 AA, which noted that river lamprey was not a species of concern for the River Wye.

9.8.8 Any effect during HPC defueling (decommissioning phase) will be even less due to reduced sea water abstraction during the approximately 4 years of abstraction during defueling. There is no effect on river lamprey from HPC construction via this pathway.

Indirect: Effects on fish populations through changes to water quality (contaminants / nutrients):

9.8.9 Detailed consideration of potential changes to water quality through release of contaminants, altered nutrient levels, and changes to dissolved oxygen levels in the water column, primarily in the vicinity of the FRR outfall, is presented in the assessment of impacts on the river lamprey qualifying species of the Severn Estuary SAC at Section 9.4.13 et seq. above.

9.8.10 Analysis of these potential changes concluded that there will be no adverse effect from the Project alone during HPC operation on the integrity of the Severn Estuary SAC due to river lamprey and the same conclusion applies to the integrity of the River Wye SAC due to river lamprey, through this impact pathway.

9.8.11 Any effect via this pathway will be much less for HPC defueling (decommissioning phase) due to the reduced abstraction of sea water during approximately 4 years during that phase. There will also be no effect via this pathway during HPC construction.

Compensation measures within the DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.8.12 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.19 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.8.13 See the assessment of mortality / injury through construction presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.23 et seq.) the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.8.14 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.26 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.8.15 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.28 et seq.), the conclusions of which apply equally here.

Lugg Weirs (River Wye tributary): disruption of migratory routes

9.8.16 See the assessment of disruption of migratory routes presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.18 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weir (River Wye tributary): Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.8.17 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.20 et seq), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weirs (River Wye tributary): Mortality / injury through construction during habitat works

9.8.18 See the assessment of mortality / injury through construction during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.23), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg weirs (River Wye tributary): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.8.19 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.24 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.8.20 See the assessment of changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.34 et seq.), the conclusions of which apply equally here.

Sea lamprey

9.8.21 As with river lamprey, the site provides exceptionally good quality habitat for sea lamprey, supporting a healthy population of the species.

Marine design element

Fish entrapment:

9.8.22 As described within Section 9.4.40 et seq. (on the Severn Estuary SAC sea lamprey qualifying feature),EA's 2020 HRA drew on a population estimate of sea lamprey using the combined population of the Rivers Wye and Usk, as modelled for the Severn Tidal Power Feasibility Study and Strategic Environmental Assessment (SEA). Impingement rates have been contextualised relative to a population estimate of 15,269 fish to determine potential levels of significance. As such the results are consistent with those for the Severn Estuary SAC presented in Table 9-2, with a mean annual entrapment effect of HPC (without an AFD) of 0.43 % of the population.

9.8.23 Estimates of impingement of sea lamprey at HPC, based on the CIMP datasets, are presented within Table 9-2.

9.8.24 Estimated annual impingement losses of 71 sea lamprey results in mean entrapment effects which are predicted to be 0.43 % of the conservative population estimate. Furthermore, an EAV of 1, the maximum value for a semelparous fish, has been applied to all lamprey impinged adding precaution to the assessment as impingement would affect a mixture of transformers, sub-adults and adult fish, not all of which would survive. However, as with river lamprey an unquantified proportion of transformers will be subject to entrainment.

9.8.25 On the above basis, of the identified uncertainties and inbuilt precaution in the assessment, entrapment effects on sea lamprey from the Project alone during HPC operation through this pathway will have no adverse effect on the integrity of the River Wye SAC. This was also the conclusion of the EA's 2020 HRA, which noted that sea lamprey was not a species of concern for the River Wye SAC. Any effect during HPC defueling (decommissioning phase) will be less than HPC operation due to the reduced sea water abstraction during approximately 4 years during defueling. There is also no effect on sea lamprey of the River Wye SAC during HPC construction via this pathway.

Indirect: effects on fish populations through changes to water quality (contaminants / nutrients):

9.8.26 See the assessment of indirect effects on fish populations through changes to water quality (contaminants / nutrients) presented under the river lamprey qualifying species of the River Wye SAC (Section 9.4.13 et seq.), the conclusions of which apply equally here.

Compensation measures within the DCO Material Change Outer Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.8.27 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.19 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.8.28 See the assessment of mortality / injury through construction presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.23), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.8.29 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.26 et seq.) the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.8.30 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under for river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.28 et seq.) the conclusions of which apply equally here.

Lugg Weirs (River Wye tributary): disruption of migratory routes:

9.8.31 See the assessment of disruption of migratory routes presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.18 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weir (River Wye tributary): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.8.32 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.20 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weirs (River Wye tributary): Mortality / injury through construction during habitat works:

9.8.33 See the assessment of mortality / injury through construction during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.23 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg weirs (River Wye tributary): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.8.34 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.24 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.8.35 See the assessment of indirect effects from changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.4.34 et seq.), the conclusions of which apply equally here.

Twaite shad

9.8.36 Historically, twaite shad have been abundant in the River Wye, migrating over 100 km upstream to spawn; the highest recorded site being at Builth Wells. EA data indicate that the River Wye supports the largest spawning areas for the species of the three rivers studied in the area. Of the habitats present in the river, twaite shad frequently use the deep pools present to congregate before spawning. Baseline populations for twaite shad are presented in Table 9-3.

Marine design element

Fish entrapment:

9.8.37 Predicted entrapment effects for twaite shad are presented in Table 9-14 noting that, based on updated calculations, there was the potential for annual losses of 48 adult fish based on CIMP1, and up to 104 adult fish based on the CIMP2 dataset.

9.8.38 It is not possible to determine from which spawning population the predominantly juvenile (0+ group) impinged twaite shad originate, however, the likelihood is that these impinged small fish at HPB are emigrants from the Rivers Severn, Usk and Wye that drain into the Severn Estuary upstream of HPB. Accordingly, the precautionary approach adopted in the HRA is to apportion total losses relative to each SAC individually. The Planning Inspector concluded in his report, that this was a "*reasonable worst case scenario*".

Table 9-14: Predictions of impingement and entrapment for the effects of HPC (without AFD) on twaite shad populations of the River Wye SAC, compared to the EA predictions presented at the WDA Permit inquiry. The results of the upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	EA-WDA Permit inquiry predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment U95 % CI population effect
CIMP1	43,348	0.2 %	0.11 %	0.16 %	0.67 %
CIMP2	N/A				

9.8.39 Based on predicted entrapment effects (Table 9-14), and emerging telemetry survey data within the Severn Estuary, as described in the Severn Estuary SAC section on twaite shad (Section 9.4.64 et seq.), it cannot be concluded that there will be no significant effect on the twaite shad population of the River Wye.

9.8.40 As such it is concluded that there is a risk to the integrity of the River Wye SAC, which cannot be excluded beyond reasonable doubt, from the marine design element of Project alone during HPC operation through entrapment of the River Wye SAC twaite shad qualifying species.

9.8.41 This conclusion is consistent with the findings of the Planning Inspector in 2021 and the Secretary of State in 2022. Any risk of effect during defueling (decommissioning phase) will be much less due to the reduced abstraction of sea water during approximately 4 years during the defueling phase. The HRA derogation tests must accordingly be met.

9.8.42 There is no risk of an effect on twaite shad during HPC construction via this pathway.

Indirect: Effects on fish populations through changes to water quality (contaminants / nutrients):

9.8.43 See the assessment of indirect effects on fish populations through changes to water quality (contaminants / nutrients) presented under the river lamprey qualifying species of the River Wye SAC (Section 9.8.9 et seq.), the conclusions of which apply equally here.

Compensation measures within the DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.8.44 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under twaite shad as qualifying features of the Severn Estuary SAC (Section 9.4.75 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.8.45 See the assessment of mortality / injury through construction presented under twaite shad as qualifying features of the Severn Estuary SAC (Section 9.4.78 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.8.46 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under twaite shad as qualifying features of the Severn Estuary SAC (Section 9.4.81 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.8.47 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under twaite shad as qualifying features of the Severn Estuary SAC (Section 9.4.83 et seq.), the conclusions of which apply equally here.

Lugg Weirs (River Wye tributary): disruption of migratory routes:

9.8.48 See the assessment of disruption of migratory routes presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.18 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary. However, it should be noted that any potential effects could be reduced due to this stretch of river being far upstream, outside of twaite shad usual spawning habitats.

Lugg Weir (River Wye tributary): Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.8.49 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.20 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary. However, it should be noted that any potential effects could be reduced due to this stretch of river being far upstream, outside of twaite shad usual spawning habitats.

Lugg Weirs (River Wye tributary): Mortality / injury through construction during habitat works:

9.8.50 See the assessment of mortality / injury through construction during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.23 et seq), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary. However, it should be noted that any potential effects could be reduced due to this stretch of river being far upstream, outside of twaite shad usual spawning habitats.

Lugg weirs (River Wye tributary): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.8.51 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.24 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary. However, it should be noted that any potential effects could be reduced due to this stretch of river being far upstream, outside of twaite shad usual spawning habitats.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.8.52 See the assessments of indirect changes to hydrodynamics and sediment transport presented under river lamprey as qualifying features of the Severn Estuary SAC (Sections 9.4.34 et seq.), the conclusions of which apply equally here.

Allis shad

9.8.53 Baseline populations for Allis shad are presented in Table 9-8.

Marine design element

Fish entrapment:

9.8.54 Two Allis shad were recorded in the CIMP1 dataset, with none positively recorded during CIMP2 surveys or in the RIMP. The presence of Allis shad in the Severn Estuary is not disputed, and some Allis shad may stray to spawn in the river catchments. However, the presence of self-sustaining Allis shad populations in the rivers of the Severn Estuary catchment is not certain, as gill raker counts and genetic analyses of juvenile shad impinged in CIMP2 showing individuals were either twaite shad or hybrids. The EA in 2020 reviewed the use of this stock area and concluded that because of the historical evidence of large, local populations of Allis shad which have since declined to very low levels, that a precautionary approach should be taken in the assessment of the species and that individuals impinged at HPB should be treated as being from a small local population. The EA further concluded that while it was feasible that an occasional fish from more distant populations could be present within the Severn Estuary, this was increasingly unlikely further up the estuary.

9.8.55 As Allis shad show a very high level of homing to a particular river, the EA concluded in 2020 that the fish impinged originated from the rivers Severn and the Wye closer to HPC. The evidence used to support this conclusion was based on a genetic analysis study (Jolly *et al.*, 2012), and anecdotal evidence from netsmen, cameras and eDNA.

9.8.56 The EA AA of 2020 used the modelled population estimate for twaite shad, with the assumption that 3 % of the modelled population in the Severn Estuary SAC would be of Allis shad and that 1 % could be attributed to the River Wye SAC.

9.8.57 Table 9-15 presents estimated impingement rates for Allis shad within the River Wye SAC.

Table 9-15: Predictions of impingement and entrapment for the effects of HPC (without AFD) on Allis shad populations of the River Wye SAC, compared to the EA predictions presented at the WDA Permit inquiry. The results of the upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	EA-WDA Permit inquiry predicted population effects	Current assessment predicted impingement population effects	Current assessment entrapment mean population effect	Current assessment entrapment U95 % CI population effect
CIMP1	433	1.6 %	2.47 %	3.70 %	15.68 %
CIMP2	N/A				

9.8.58 Historically Allis shad have been much more abundant in the Severn Estuary catchments than they are now, and the EA interpretation of genetic studies is that a remnant local population exists. The EA conclude that estimated losses at HPC are likely to put further pressure on a declining population, while also preventing population recovery.

9.8.59 The Planning Inspector considered the declining Allis shad population, the uncertainty in the assessment of impacts, and concluded that adverse effects on the integrity of the River Wye SAC for which Allis shad is a qualifying species could not be excluded beyond reasonable scientific doubt.

9.8.60 Despite no Allis shad being observed in CIMP2, the updated CIMP1 assessment increased the EA's estimate of six equivalent adult fish lost due to impingement per annum to an estimated 11 fish. Therefore, on a precautionary basis, it is concluded that it is not possible to exclude a risk to the integrity of the River Wye SAC from the marine design element of Project alone during HPC operation through entrapment of the River Wye SAC Allis shad qualifying species. Any risk of effect during defueling (decommissioning phase) will be much less due to the reduced abstraction of sea water during approximately 4 years during the defueling phase. The HRA derogation tests must accordingly be met.

9.8.61 There is no risk of an effect on Allis shad during HPC construction via this pathway.

Indirect: Effects on fish populations from changes to water quality (nutrients / contaminants):

9.8.62 See the assessment of effects on fish populations from changes to water quality (nutrients / contaminants) presented under the Allis shad qualifying species of the River Usk SAC (Section 9.7.65 et seq.), the conclusions of which apply equally here.

Compensation measures within the DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities

9.8.63 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the Allis shad qualifying species of the River Usk SAC (Section 9.7.69 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction during habitat works:

9.8.64 See the assessment of mortality / injury through construction during habitat works presented under the Allis shad qualifying species of the River Usk SAC (Section 9.7.73 et seq.) the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.8.65 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under the Allis shad qualifying species of the River Usk SAC (Section 9.7.76 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.8.66 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under the Allis shad qualifying species of the River Usk SAC (Section 9.7.78 et seq.), the conclusions of which apply equally here.

Lugg Weirs (River Wye tributary): disruption of migratory routes:

9.8.67 See the assessment of disruption of migratory routes presented for the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.85 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weir (River Wye tributary): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.8.68 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.87 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weirs (River Wye tributary): Mortality / injury through construction during habitat works:

9.8.69 See the assessment of mortality / injury though construction during habitat works presented under the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.90), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg weirs (River Wye tributary): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.8.70 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.91 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.8.71 See the assessment of indirect effects of changes to hydrodynamics and sediment transport presented under the Allis shad qualifying feature of the River Usk SAC (Section 9.7.81 et seq.), the conclusions of which apply equally here.

Atlantic salmon

9.8.72 The River Wye has, historically, been the most productive river in Wales for Atlantic salmon, with high-quality spawning grounds and juvenile habitat in both its main channel and associated tributaries. With generally good water quality, plus a diverse range of geological conditions creating a range of habitats, this has remained favourable for the species.

The River Wye Atlantic salmon population is particularly notable for the very high proportion (around 75 %) of multi sea winter (MSW) fish, that is fish that spend more than one year at sea before returning to fresh water to spawn. These fish are generally larger and the females more fecund than fish that only spend one year at sea prior to spawning (grilse). This important stock component has declined sharply in recent years throughout the UK, including in the River, with a consequent marked decline in the population since the 1980s. However, the River Wye salmon population is still of considerable importance in UK terms. Baseline populations for Atlantic salmon are presented in Table 9-16.

Marine design element

Fish entrapment:

9.8.73 Ten Atlantic salmon were caught in the 39-year RIMP. No Atlantic salmon were impinged during the CIMP1 study period, although two individuals were caught in additional samples outside the core assessment period. No salmon were observed during CIMP2.

9.8.74 Within their 2020 AA, the EA estimated that 12 equivalent adult salmon would be lost each year, based on RIMP data from 1997-2017. Using RIMP data from 1997-2019 and all available CIMP data and applying the EA calculation method, a revised estimate of 22 equivalent adult Atlantic salmon would be lost each year.

9.8.75 Predicted losses from the marine design element of the Project, based on the method described in Section 6, for the River Wye, are summarised below.

Table 9-16: Predictions of entrapment for the effects of HPC on Atlantic salmon populations of the River Wye SAC, compared to the EA predictions presented at the WDA Permit inquiry. The results of the upper 95 % CIs from uncertainty analyses are provided.

Dataset	Population estimate (adult numbers)	WDA Permit inquiry EA value	Current assessment impingement prediction	Current assessment entrapment mean	Current assessment entrapment U95 % CI population effect
RIMP	5,890	0.2 %			
CIMP & RIMP	N/A		0.23 %	0.18 %	1.01 %

9.8.76 On the basis of predicted entrapment rates, the EA noted within their 2020 AA that it was not possible to conclude no adverse effects on site integrity of the River Wye SAC due to entrapment effects on Atlantic salmon populations. The updated impingement data provides no additional evidence to alter the conclusions of the EA 2020 HRA.

9.8.77 It is therefore concluded that there is a risk to the integrity of the River Wye SAC (which cannot be excluded beyond reasonable doubt) from the marine design element of Project alone during HPC operation through entrapment of the River Wye SAC Atlantic salmon qualifying species. Any risk of effect during defueling (decommissioning phase) will be much less due to the reduced abstraction of sea water during approximately 4 years during the defueling phase. The HRA derogation tests must accordingly be met.

9.8.78 There is no risk of an effect on Atlantic salmon during HPC construction via this pathway.

Indirect: Effect on fish populations from changes to water quality (nutrients / contamination):

9.8.79 See the assessment of effects on fish populations from changes to water quality (nutrients / contamination) presented for under Atlantic salmon qualifying species of the River Usk SAC (Section 9.7.102 et seq), the conclusions of which apply equally here.

Compensation measures within the DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.8.80 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the Atlantic salmon qualifying species of the River Usk SAC (Section 9.7.108 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.8.81 See the assessment of mortality / injury through construction presented under the Atlantic salmon qualifying species of the River Usk SAC (Section 9.7.112 et seq.) the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.8.82 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented for the Atlantic salmon qualifying species of the River Usk SAC (Section 9.7.115 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.8.83 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under the Atlantic salmon qualifying species of the River Usk SAC (Section 9.7.117 et seq.), the conclusions of which apply equally here.

Lugg Weirs (River Wye tributary): disruption of migratory routes:

9.8.84 See the assessment of disruption of migratory routes presented under the Atlantic salmon qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.124 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weir (River Wye tributary): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.8.85 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the Atlantic salmon qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.126 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg Weirs (River Wye tributary): Mortality / injury through construction during habitat works:

9.8.86 See the assessment of mortality / injury through construction during habitat works presented under the Atlantic salmon qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.129), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Lugg weirs (River Wye tributary): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.8.87 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the Atlantic salmon qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.130 et seq.), the conclusions of which apply equally here in respect of the Lugg Weirs on the River Wye tributary.

Compensation measures outside the DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.8.88 See the assessment of indirect changes to hydrodynamics and sediment transport presented under the Atlantic salmon qualifying species of the River Usk SAC (Section 9.7.120 et seq.), the conclusions of which apply equally here.

Otter

Marine design element

Indirect effect on otter through changes in prey resources

9.8.89 See the assessment of indirect effect on otter through changes in prey resources under otter as a qualifying species of the River Usk SAC (Section 9.7.143 et seq.), the conclusions of which apply equally here to the otter of the River Wye SAC.

Compensation measures within the Material Change DCO Order Limits

Mousenatch / Eyton / Coxall weirs (River Lugg): Disturbance and displacement:

9.8.90 Otter are found along the entire length of the River Wye and its main tributaries[155] which includes the River Lugg. As part of its compensatory measures, NNB is investigating the possibility of weir removal / easement at three possible locations on the River Lugg. These are Mousenatch, Eyton and Coxall. Although the Lugg weirs are not located within the River Wye SAC itself, as a mobile species with female territories of approximately 20 km, there are feasible impact pathways.

9.8.91 See the assessment of disturbance and displacement under otter as a qualifying species of the River Usk SAC (Section 9.7.145 et seq.), the conclusions of which apply equally here to the otter of the River Wye SAC.

155 Natural Resources Wales (2022) Core management plan including conservation objectives for Afon Gwy / River Wye

Mousenatch / Eyton / Coxall weirs (River Lugg): Indirect effects through changes to water quality (contaminant / nutrient release) during construction:

9.8.92 See the assessment of indirect effects through changes to water quality (contaminant / nutrient release) during construction under otter as a qualifying species of the River Usk SAC (Section 9.7.149), the conclusions of which apply equally here to the otter of the River Wye SAC.

Mousenatch / Eyton / Coxall weirs (River Lugg): Disruption of commuting corridors:

9.8.93 See the assessment of disruption of commuting corridors under otter as a qualifying species of the River Usk SAC (Section 9.7.152 et seq.) the conclusions of which apply equally here to the otter of the River Wye SAC.

Mousenatch / Eyton / Coxall weirs (River Lugg): Habitat loss and fragmentation of foraging habitat physical damage:

9.8.94 See the assessment of habitat loss and fragmentation of foraging habitat physical damage under otter as a qualifying species of the River Usk SAC (Section 9.7.156 et seq.), the conclusions of which apply equally here to the otter of the River Wye SAC.

Mitigation measures

9.8.95 No further mitigation is anticipated for the migratory fish species or otter of the River Wye SAC other than those measures described above.

Conclusions on integrity from the Project alone

9.8.96 On the basis of the above assessments, and in view of the conservation objectives, it cannot be excluded beyond reasonable scientific doubt that the Project alone during HPC operation will risk an adverse effect on the integrity of the River Wye SAC due to the fish entrapment pathway of impact on Twaite shad, Allis shad and Atlantic salmon. Any effects during approximately 4 years of defueling (decommissioning phase) will be much less since there will be reduced sea water abstraction during that time.

9.8.97 The HRA derogation tests therefore apply.

9.8.98 There will be no effect on the River Wye SAC during HPC construction via this pathway.

9.8.99 There will be no risk of an adverse effect from the Project alone during construction, operation and the four defueling years (decommissioning phase) on the integrity of the River Wye SAC via other qualifying features in relation to any pathway; or via Twaite shad, Allis shad and Atlantic salmon via any other pathway.

Conclusions on integrity from the Project in combination with other plans and projects

9.8.100 See the text provided under this heading for the Severn Estuary SAC (Section 9.4.215 et seq).

Consideration of past, current and future baselines

9.8.101 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.8.102 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.9 River Towy / Afon Tywi SAC

9.9.1 The River Towy SAC is designated primarily for its large spawning population of twaite shad, and for being one of the best rivers in Wales for otter. The twaite shad population of the River Towy is considered to be self-sustaining, with spawning sites occurring throughout the lower reaches of the river. Both water quality and quantity are considered adequate to maintain the population, with the only potential obstruction to migratory routes along the river being the weir at Manorafan, which may form an obstacle during low flow conditions.

9.9.2 Throughout the assessment below for the River Towy SAC, particular attention has been paid to the conservation objectives of the River Towy SAC, as described in Table 8-2.

River lamprey

Marine design element

Fish entrapment:

9.9.3 As described previously in Section 9.4.3 et seq. (the section on the river lamprey qualifying feature of the Severn Estaury SAC), only nine river lamprey were recorded within the RIMP dataset, two in CIMP1, and none in CIMP2 at HPB, therefore, accurately predicting impingement levels at HPC is difficult. Further, no specific baseline population has been established for the River Towy, meaning that contextualisation of any impingement cannot be undertaken.

9.9.4 For river lamprey populations of the River Towy then, a qualitative assessment has been undertaken, drawing on the findings of effects on the more proximal Seven Estuary SAC and of the EA's 2020 AA, which concluded that there be no adverse effect on site integrity via this qualifying species for the River Towy SAC. The findings of the latest CIMP2 dataset have provided no evidence to alter these conclusions.

9.9.5 It can therefore be concluded that total entrapment of river lamprey from the Project alone during HPC operation will have no adverse effect on the integrity of the River Towy SAC. Any effect during HPC defueling (decommissioning phase) will be even less due to reduced sea water abstraction during the approximately 4 years of abstraction during defueling. There is no effect on river lamprey from HPC construction.

Indirect: Effects on fish populations through changes to water quality (contaminants / nutrients):

9.9.6 See the assessment of the effects on fish populations through changes to water quality (contaminants / nutrients) presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.13 et seq.), the conclusions of which apply equally here.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.7 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.19 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.9.8 See the assessment of mortality / injury through construction presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.23 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.9.9 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.26 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.9.10 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.28 et seq.), the conclusions of which apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.9.11 See the assessment of indirect effects of changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.34 et seq.), the conclusions of which apply equally here.

Manorafon Weir (River Towy): disruption of migratory routes:

9.9.12 See the assessment of disruption of migratory routes presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.18 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.13 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.20 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Mortality / injury through construction during habitat works:

9.9.14 See the assessment mortality / injury through construction during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.23 et seq.) the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.9.15 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.24 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Sea lamprey

Marine design element

Fish entrapment:

9.9.16 As with river lamprey for the River Towy SAC, no specific impingement rate prediction is available for sea lamprey. Therefore, a qualitative assessment can be completed. This again draws on the findings of effects on the more proximal Seven Estuary SAC and the EA's 2020 AA, which concluded that there would be no adverse effect on integrity via this qualifying species for the River Towy SAC. The findings of the latest CIMP2 dataset have provided no evidence to alter these conclusions.

9.9.17 It can therefore be concluded that total entrapment of sea lamprey from the Project alone during HPC operation will have no adverse effect on the integrity of the River Towy SAC. Any effect during HPC defueling (decommissioning phase) will be even less due to reduced sea water abstraction during the approximately 4 years of abstraction during defueling. There is no effect on sea lamprey from HPC construction via this pathway.

Indirect: Effects on fish populations through changes to water quality (contaminants / nutrients):

9.9.18 See the assessment of effects on fish populations through changes to water quality (contaminants / nutrients) presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.13 et seq.), the conclusions of which apply equally here.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.19 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.19 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.9.20 See the assessment of mortality / injury through construction presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.23 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.9.21 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.26 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.9.22 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.28 et seq.), the conclusions of which apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.9.23 See the assessment of changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying species of the Severn Estuary SAC (Section 9.4.34 et seq.), the conclusions of which apply equally here.

Manorafon Weir (River Towy): disruption of migratory routes:

9.9.24 See the assessment of disruption of migratory routes presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.18 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.25 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.20 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Mortality / injury through construction during habitat works

9.9.26 See the assessment of mortality / injury through construction during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.23 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.9.27 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.24 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Twaite shad

Marine design element

Fish entrapment:

9.9.28 As with both river and sea lamprey, targeted determination of impingement rates for twaite shad of the River Towy has not been undertaken. However, also as with the lamprey species, the EA concluded within their 2020 AA that there would be no adverse effect on site integrity via twaite shad as a qualifying species for the River Towy SAC.

9.9.29 However, whilst there has been no specific analysis completed which would contradict the EA's conclusions, emerging telemetry evidence on shad movements within the Severn Estuary and Bristol Channel (as described in the Severn Estuary SAC section on twaite shad, see Section 9.4.64 et seq.) must also be considered within this context. Preliminary data collected as part of a collaborative project between Swansea University and the Unlocking the Severn project shows the presence of twaite shad in the Severn Estuary including in Bridgwater Bay. Impingement predictions for HPC have been derived based on impingement monitoring at HPB. Therefore, to provide further information on the utilisation of Bridgwater Bay by post-spawning twaite shad and determine the relative risk between the HPC and HPB intake locations, acoustic receivers have been deployed on the HPC construction site marker buoys by the University of Swansea in May 2023.

9.9.30 Preliminary data from the HPC array and from other receivers in the Severn Estuary, Swansea Bay and Carmarthen Bay, show that mature adult twaite shad are present in the Severn Estuary / Bristol Channel, including in Bridgwater Bay, during the summer and autumn[156]. Twaite shad tagged in the Rivers Towy, Severn and Wye were recorded in the immediate area

156 Clarke, D., Rees, C., Franconi, N., Blow, G., Davies, P., Britton, R., Yeldham, M., Nunn, A., Dodd, J., Velterop, R., Crundwell, C., Neilsen, I. and J. Bolland. 2023. Twaite Shad Movements Near Hinkley Point C Abstraction. Report prepared for Environment Agency UK. Swansea University. 31pp.

of HPC between May and July 2023. A total of 37 individual fish were detected by the HPC array, and all receivers detected twaite shad, with more detections at the receivers furthest offshore. In addition, preliminary sensor data of the depth distribution of twaite shad from 12 individuals, suggests that twaite shad swim throughout the water column, with individuals recording depths at or below the height of the HPC intakes.

9.9.31 Acoustic receivers remain deployed in Bridgwater Bay. The data being gathered will provide additional context in relation to the relative risk of impingement of twaite shad at HPC relative to HPB.

9.9.32 Therefore, whilst the potential for connectivity between the SAC and the Project cannot be excluded, the evidence base is still developing as more information is collected, analysed and reported on. The additional data described above will be reviewed and applied, where appropriate, to support the DCO Material Change application to elucidate any potential increase in the risk of abstraction of adult fish.

9.9.33 At the time of writing, it is concluded that it remains the case (as per the EA's 2020 AA) that impingement of twaite shad from the Project alone during HPC operation will have no adverse effect on the integrity of the River Towy SAC. Any effect during HPC defueling (decommissioning phase) will be even less due to reduced sea water abstraction during the approximately 4 years of abstraction during defueling. There is no effect on Twaite shad from HPC construction via this pathway.

Indirect: Effects on fish populations through changes to water quality (contaminants / nutrients):

9.9.34 See the assessment of effects on fish populations through changes to water quality (contaminants / nutrients) presented under twaite shad as a qualifying species of the Severn Estuary SAC (Section 9.4.71 et seq.), the conclusions of which apply equally here.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.35 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under twaite shad as a qualifying species of the Severn Estuary SAC (Section 9.4.75 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.9.36 See the assessment of mortality / injury through construction presented under twaite shad as a qualifying species of the Severn Estuary SAC (Section 9.4.78 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.9.37 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under twaite shad as a qualifying species of the Severn Estuary SAC (Section 9.4.81 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.9.38 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under twaite shad as a qualifying species of the Severn Estuary SAC (Section 9.4.83 et seq.), the conclusions of which apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.9.39 See the assessment of indirect effects from changes to hydrodynamics and sediment transport presented under twaite shad as a qualifying species of the Severn Estuary SAC (Section 9.4.88), the conclusions of which apply equally here.

Manorafon Weir (River Towy): disruption of migratory routes:

9.9.40 See the assessment of disruption of migratory routes presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.18 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.41 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.20 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Mortality / injury through construction during habitat works:

9.9.42 See the assessment of mortality / injury through construction during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.23 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.9.43 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under the river lamprey qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.24 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Allis shad

Marine design element

Fish entrapment:

9.9.44 As outlined within Section 9.7.61 et seq (where Allis shad is discussed in the context of the River Usk SAC), two Allis shad were impinged during CIMP1, with none positively recorded during CIMP2 surveys. Detailed impingement predictions have not been undertaken in relation to the Allis shad population of the River Towy SAC; however, in their 2020 AA, the EA stated that there is currently no known breeding population of Allis shad within the River Towy, and that straying from other populations is unlikely. Therefore, it was possible for the EA within their 2020 AA to conclude that there would be no adverse effect on integrity of the River Towy SAC in relation to Allis shad. Analysis of data from CIMP2 found no evidence to alter this conclusion.

9.9.45 On this basis, it is concluded that there will be no adverse effect on the integrity of the River Towy SAC from the Project alone via HPC operation through the Allis shad entrapment pathway. Any effect will be even less during the 4 years of HPC defueling (decommissioning phase) due to the reduced abstraction of seawater during that period. There is no impact during HPC construction via this pathway.

Indirect: effects on fish populations through changes in water quality through release of contaminants / nutrients:

9.9.46 See the assessment of effects on fish populations through changes in water quality through release of contaminants / nutrients presented under Allis shad as a qualifying species of the River Usk SAC (Section 9.7.65 et seq.), the conclusions of which apply equally here.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.47 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under Allis shad as a qualifying species of the River Usk SAC (Section 9.7.69 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Mortality / injury through construction:

9.9.48 See the assessment of mortality / injury through construction presented under Allis shad as a qualifying species of the River Usk SAC (Section 9.7.73 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release)

9.9.49 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under Allis shad as a qualifying species of the River Usk SAC (Section 9.7.76 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on fish populations through changes to hydrodynamics and sediment transport:

9.9.50 See the assessment of indirect effects on fish populations through changes to hydrodynamics and sediment transport presented under Allis shad as a qualifying species of the River Usk SAC (Section 9.7.78 et seq.), the conclusions of which apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass: Indirect: Changes to hydrodynamics and sediment transport:

9.9.51 See the assessment of indirect changes to hydrodynamics and sediment transport presented under river lamprey as a qualifying feature of the Severn Estuary SAC (Section 9.7.34 et seq.) which apply equally here.

Manorafon Weir (River Towy): disruption of migratory routes:

9.9.52 See the assessment of disruption of migratory routes presented under the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.85 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.53 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.87 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Mortality / injury through construction during habitat works:

9.9.54 See the assessment of mortality / injury through construction during habitat works presented under the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.90 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Manorafon Weir (River Towy): Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.9.55 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under the Allis shad qualifying feature of the River Usk SAC (Trostrey Weir) (Section 9.7.91 et seq.), the conclusions of which apply equally here in respect of the Manorafon Weir on the River Towy.

Brook Lamprey

Compensation measures outside the Material Change DCO Order Limits

Manorafon weir, River Towy: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.56 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under brook lamprey as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.134 et seq.), the conclusions of which apply equally here to the brook lamprey of River Towy SAC.

Manorafon weir, River Towy: Mortality / injury through construction during habitat works:

9.9.57 See the assessment of mortality / injury through construction during habitat works presented under brook lamprey as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.133), the conclusions of which apply equally here to the brook lamprey of River Towy SAC.

Manorafon weir, River Towy: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works:

9.9.58 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) during habitat works presented under brook lamprey as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.137 et seq.), the conclusions of which apply equally here to the brook lamprey of River Towy SAC.

Bullhead

Compensation measures outside the Material Change DCO Order Limits

Manorafon weir, River Towy: Mortality / injury through construction activities:

9.9.59 See the assessment of mortality / injury through construction activities presented under river lamprey as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.23 et seq.), the conclusions of which apply equally here to the bullhead of the River Towy SAC.

Manorafon weir, River Towy: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.9.60 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under river lamprey as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.20 et seq.), the conclusions of which apply equally here to the bullhead of the River Towy SAC.

Manorafon weir, River Towy: Indirect effects on fish populations through changes to water quality (contaminant / nutrient release):

9.9.61 See the assessment of indirect effects on fish populations through changes to water quality (contaminant / nutrient release) presented under river lamprey as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.24 et seq.), the conclusions of which apply equally here to the bullhead of the River Towy SAC.

Otter

Marine design element

Indirect effect on otter through changes in prey resources

9.9.62 See the assessment of indirect effect on otter through changes in prey resources presented under otter as a qualifying species of the River Usk SAC (Section 9.7.143 et seq.), the conclusions of which apply equally here to the otter of River Towy SAC.

Compensation measures outside the Material Change DCO Order Limits

Manorafon weir: Disturbance and displacement:

9.9.63 See the assessment of disturbance and displacement presented under otter as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.145 et seq.), the conclusions of which apply equally here to the otter of River Towy SAC.

Manorafon weir: Indirect effects through changes to water quality during construction:

9.9.64 See the assessment of indirect effects through changes to water quality during construction presented under otter as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.149 et seq.), the conclusions of which apply equally here to the otter of River Towy SAC.

Manorafon weir: Disruption of commuting corridors:

9.9.65 See the assessment of disruption of commuting corridors presented under otter as a qualifying species of the River Usk SAC (Trostrey Weir) (Section 9.7.152), the conclusions of which apply equally here to the otter of River Towy SAC.

Manorafon weir: Habitat loss and fragmentation of foraging habitat:

9.9.66 See the assessment of habitat loss and fragmentation of foraging habitat presented under otter as a qualifying species of the River Usk SAC (Section 9.7.156 et seq.), the conclusions of which apply equally here to the otter of River Towy SAC.

Mitigation measures

9.9.67 No further mitigation is anticipated for the migratory fish species or otter of the River Towy SAC other than those measures described above.

Conclusions on integrity from the Project alone

9.9.68 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four defueling years of decommissioning will have no adverse effect on integrity on the River Towy SAC.

Conclusions on integrity from the Project in combination with other plans and projects

9.9.69 See the text provided for the Severn Estuary SAC (Section 9.4.215 et seq.).

Consideration of past, current and future baselines

9.9.70 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.9.71 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.10 Somerset Levels & Moors SPA

Introduction

9.10.1 The Somerset Levels & Moors contains the largest area of lowland wet grassland in England and the Somerset Levels & Moors SPA is comprised of 12 SSSIs falling within an area of floodplains. The SPA is designated for four overwintering qualifying bird species: teal; golden plover; lapwing and Bewick's swan; and for its overwintering waterbird assemblage. While lapwing and golden plover are UK residents, teal and Bewick's swans are UK winter migrants. Desk study data (WeBS survey[157] in winter 2021/22 and 2022/23 and surveys for the Bridgwater Tidal Barrier in winter 2016/17) would suggest limited, if any, presence of the qualifying bird species at Pawlett Hams and this is discussed further in the assessment below.

9.10.2 The Somerset Levels & Moors SPA is approximately 10 km from the nearest element of the Project (Pawlett Hams / The Island) and as such there will be no direct impact (such as loss of SPA land) upon this SPA from the Project.

157 Austin, G.E., Calbrade, N.A., Birtles, G.A., Peck, K., Shaw, J.M. Wotton, S.R., Balmer, D.E. and Frost, T.M. 2023. Waterbirds in the UK 2021/22: The Wetland Bird Survey and Goose & Swan Monitoring Programme. BTO/RSPB/JNCC/NatureScot. Thetford.

9.10.3 However, there is connectivity between the Severn Estuary and the Somerset Levels & Moors SPA, particularly via the Huntspill River which has its opening at The Island. Birds are mobile species and therefore the Severn Estuary could potentially provide supporting habitat for some of the birds of the Somerset Levels & Moors SPA bird qualifying features. For this reason, both construction and operation of the saltmarsh creation / enhancement at Pawlett Hams / The Island could potentially result in indirect effects on the Somerset Levels & Moors SPA if birds from the SPA use Pawlett Hams or The Island as an important resource.

9.10.4 There are no impact pathways from other compensatory measure elements of the Project to this SPA.

9.10.5 Throughout the assessment below for the Somerset Levels & Moors SPA, particular attention has been paid to the conservation objectives of the Somerset Levels & Moors SPA, as described in Table 8-1.

Teal

Marine design element

Indirect: Indirect effects on bird species through changes to water quality

9.10.6 See the assessment at Section 9.4.13 et seq. above for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) which describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. The description there applies equally here and as such, there is no risk to birds through any related bioaccumulation impact pathway.

9.10.7 There is also the potential, through FRR discharge during HPC operation, to generate smothering effects on habitats (as a result of increased organic carbon enrichment) with subsequent indirect effects on the bird species that use those habitats. This potential impact has been assessed with particular reference to smothering of intertidal soft sediment habitats (an important habitat for wading birds and wildfowl bird species). The assessment at Section 9.4.13 et seq. above for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. Results there showed that the area estimated to be in excess of the derived daily benchmark of 0.3 g organic carbon/m^2/day was 0.17 km^2 (using 2009-10 data) and 0.15 km^2 (using 2021-22 data). On the basis of this no effect is predicted.

9.10.8 This means that, in view of relevant conservation objectives of the Somerset Levels and Moors SPA, there will be no adverse effect from the Project alone through the FRR system during HPC operation on the Somerset Levels and Moors SPA via teal through this impact pathway. During defueling of HPC any effect will be even less due to the reduced abstraction of seawater during 4 years of defueling. This is also no impact during construction.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities

9.10.9 If construction works at Pawlett Hams or The Island were to be carried out during winter periods, it is possible that the birds of the Somerset Levels and Moors SPA, if they are using Pawlett Hams or The Island as an important resource, could be temporarily disturbed. However, any disturbance to the wintering birds that are the interest features of this SPA can be avoided by timing work to avoid the winter and thereby avoid any potential for disturbance.

9.10.10 There will accordingly be no adverse effect on the integrity of the Somerset Levels & Moors SPA from the Project alone through this impact pathway for teal.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release)

9.10.11 There is the potential for sediment to be disturbed during construction works at Pawlett Hams and The Island through, for example, breaking sea defences or lowering ground levels. Increased suspended sediment levels have the potential to alter water quality, for example through sediment loading or introduction of contaminants or nutrients into the aquatic system.

9.10.12 This potential impact can be reduced by timing the excavation works to avoid high tide or use of coffer dams, particularly at The Island. Further, through implementation of standard pollution-control best practice measures, the release of contaminants / other pollutants can be mitigated against, further reducing the potential for adverse changes in water quality.

9.10.13 In addition, the Severn Estuary estuarine system is a highly turbid and dynamic environment, with variable background levels. Changes as a result of works at Pawlett Hams / The Island will likely be subsumed into these background levels. Furthermore, no noticeable alteration in suspended sediment concentrations from Pawlett Hams / The Island would be expected approximately 9 km inland at the aquatic environments of the Somerset Levels & Moors SPA.

9.10.14 There will accordingly be no adverse effect on the integrity of the Somerset Levels & Moors SPA from the Project alone through this impact pathway for teal.

Pawlett Hams / The Island: Permanent modification of bird habitat and permanent displacement of species

9.10.15 Desk study data suggests that teal are not using Pawlett Hams as an important resource. For example, teal have not been recorded in the WeBS surveys undertaken at Pawlett Hams in winter 2020/21 or 2021/22, although surveys in winter 2016/17 for the Bridgwater Tidal Barrier regularly recorded teal along the River Parrett on the west and southern boundary of Pawlett Hams.

9.10.16 The proposed compensatory measures at Pawlett Hams will result in a change in the habitats present within Pawlett Hams from predominantly permanent pasture and arable land to saltmarsh, intertidal mudflat and saltwater lagoons flooded at all stages of the tide. However, some grassland would be retained. As a bird of marine, intertidal and wetland environments, these new habitats will favour teal, and this species is more likely to use the new / enhanced intertidal saltmarsh habitats and will benefit from the increased carrying capacity of these new habitats.

9.10.17 No permanent change in habitat type would occur at The Island and so no impact pathway to teal is anticipated from The Island compensatory measures.

9.10.18 There will accordingly be no adverse effect on the integrity of the Somerset Levels & Moors SPA from the Project alone through this impact pathway on the teal qualifying species for teal.

Golden plover

Marine design element

Indirect: Indirect effects on bird species through changes to water quality

9.10.19 See the assessment of indirect effects on bird species through changes to water quality presented under the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.6 et seq.), the conclusions of which apply equally here for golden plover qualifying species of the Somerset Levels & Moors SPA.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities

9.10.20 Although golden plover are UK residents in northern England, the population associated with the Somerset Levels & Moors SPA are winter migrants. Therefore, see the assessment of disturbance and displacement during construction activities above (Section 9.10.9 et seq.) under the teal qualifying species of the Somerset Levels & Moors SPA, the conclusions of which apply equally for the golden plover qualifying species of the Somerset Levels & Moors SPA.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release):

9.10.21 See the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented under the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.11 et seq.) the conclusions of which apply equally here for golden plover qualifying species of the Somerset Levels & Moors SPA.

Pawlett Hams: Permanent modification of bird habitat and permanent displacement of species

9.10.22 The proposed compensatory measures at Pawlett Hams will result in a change in the habitats present within Pawlett Hams from predominantly permanent pasture and arable land to saltmarsh, intertidal mudflat and saltwater lagoons flooded at all stages of the tide. In general, golden plover tend to be birds of arable and pasture with associated ditch networks, and so there would be a potential pathway of effect between the works at Pawlett Hams and golden plover from the Somerset Levels & Moors SPA population if they were to rely on Pawlett Hams as important supporting habitat.

9.10.23 However, desk study survey data would suggest that golden plover are not using Pawlett Hams as an important resource. For example, golden plover have not been recorded in the WeBS[158] surveys undertaken at Pawlett Hams in winter 2020/21 or 2021/22 nor were any records returned by SERC. The surveys in winter 2016/17 and spring 2017/8 for the Bridgwater Tidal Barrier recorded golden plover in low numbers to the east of Pawlett Hams (within similar habitat as at Pawlett Hams) in the next bend of the river, at low tide. In addition, golden plover use marine and inter tidal habitats (as well as arable land) and so the change in habitats at Pawlett Hams is unlikely to cause permanent displacement of individuals which would also likely be moving up and down the River Parrett and Huntspill River as tides change. The loss of agricultural land at Pawlett Hams would therefore likely be offset by new saltmarsh for feeding and roosting by golden plover; indeed the carrying capacity for golden plover would be increased as while some grassland i.e. nesting habitat, would be retained the creation of saltmarsh would boost the available feeding resource.

9.10.24 Accordingly, there will be no adverse effect on the integrity of the Somerset Levels & Moors SPA from the Project alone through this impact pathway for the golden plover qualifying species.

Lapwing

Marine design element

Indirect: Indirect effects on bird species through changes to water quality:

9.10.25 See the assessment of indirect effects on bird species through changes to water quality presented under the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.6 et seq.), the conclusions of which apply equally here for the lapwing qualifying species of the Somerset Levels & Moors SPA.

---

158 Austin, G.E., Calbrade, N.A., Birtles, G.A., Peck, K., Shaw, J.M. Wotton, S.R., Balmer, D.E. and Frost, T.M. 2023. Waterbirds in the UK 2021/22: The Wetland Bird Survey and Goose & Swan Monitoring Programme. BTO/RSPB/JNCC/NatureScot. Thetford.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities:

9.10.26 Although lapwing are UK residents in most of England and eastern Wales, the population associated with the Somerset Levels & Moors SPA are winter migrants[159]. Therefore, see the assessment of disturbance and displacement during construction activities presented above under the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.9 et seq.), the conclusions of which apply equally for the lapwing qualifying species of the Somerset Levels & Moors SPA

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release):

9.10.27 See the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented under the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.11 et seq.), the conclusions of which apply equally for the lapwing qualifying species of the Somerset Levels & Moors SPA.

Pawlett Hams: Permanent modification of bird habitat and permanent displacement of species:

9.10.28 The WeBS count from 2022/23 has a maximum count of two individual lapwing at Pawlett Hams. The Bridgwater Tidal Barrier in winter 2016/17 identified a peak of 90 individual lapwing at Pawlett Hams. The latter is approximately 0.2 % of the mean peak count of 36,565 individuals between 1989/90 to 1993/94 (at designation). The new saltmarsh habitats at Pawlett Hams will be suitable for lapwing for foraging and roosting and retained grassland habitats would continue to provide nesting opportunities.

9.10.29 As with golden plover, the carrying capacity of the site for lapwing would be increased as although the potential nesting habitat would be reduced in area, this would be offset by the creation of additional feeding resource, resulting in an overall benefit. Plentiful grassland habitat is also available in the wider landscape. Of note, BTO surveys have shown that

159 RSPB Lapwing https://www.rspb.org.uk/birds-and-wildlife/lapwing (Accessed: 11 December 2023).

numbers of lapwing have increased in coastal wetlands in recent years as birds appear to feed more on mudflats at low tide[160].

9.10.30 There will accordingly be no adverse effect on the integrity of the Somerset Levels & Moors SPA from the Project alone through this impact pathway on the lapwing qualifying species.

Bewick's swan

Marine design element

Indirect: Indirect effects on bird species through changes to water quality:

9.10.31 See the assessment of indirect effects on bird species through changes to water quality presented under the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.6 et seq.), the conclusions of which apply equally here for the Bewick's swan qualifying species of the Somerset Levels & Moors SPA.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities:

9.10.32 See the assessment of disturbance and displacement during construction activities presented above under the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.9 et seq.), the conclusions of which apply equally for the Bewick's swan qualifying species of the Somerset Levels & Moors SPA.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release):

9.10.33 See the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented above for the teal qualifying species of the Somerset Levels & Moors SPA (Section 9.10.11 et seq.), the conclusions of which apply equally for the Bewick's swan qualifying species of the Somerset Levels & Moors SPA.

---

160 BTO (2023) Lapwing https://www.bto.org/understanding-birds/birdfacts/lapwing (Accessed: 11 December 2023).

Pawlett Hams: Permanent modification of bird habitat and permanent displacement of species

9.10.34 Bewick's swans are herbivorous, grazing at inland agricultural sites in winter months. However, WeBS survey data from winters 2021/22 and winter 2022/23 suggest that Bewick's swan are not regularly recorded at Pawlett Hams nor at the Somerset Levels & Moors SPA closest to Pawlett Hams. As such neither site provides important supporting resources for this bird species.

9.10.35 There will accordingly be no adverse effect on the integrity of the Somerset Levels & Moors SPA from the Project alone through this impact pathway on the Bewick's swan qualifying species.

Waterbird assemblage

Marine design element

Indirect: Indirect effects on bird species through changes to water quality

9.10.36 Whilst it is acknowledged that the waterbird assemblage of the Somerset Levels & Moors SPA comprises different species to that of the waterbird assemblage of the Severn Estuary SPA the general type of birds, i.e. waders and wildfowl, are the same. As such, see the assessment of indirect effects on bird species through changes to water quality presented under the waterbird assemblage qualifying species of the Severn Estuary SPA (Section 9.5.42 and 9.5.11 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors SPA.

Indirect: effects on piscivorous (fish eating) birds through changes to prey resources

9.10.37 The waterbird assemblage of the Somerset Levels & Moors SPA is mainly made up of wildfowl and waders which are not piscivorous. However, the assemblage may include a small number of birds that are piscivorous, such as sawbills (goosander, red breasted merganser and smew). Given the small proportion of the assemblage that is piscivorous and the low level of impact on fish populations from fish entrapment during HPC operation, there will be no adverse effect from the Project alone upon the integrity of the Somerset Levels and Moors SPA via the assemblage and the prey resource impact pathway. This is even less of a concern during the 4-year defueling of the decommissioning phase. There will be no effect through this pathway during HPC construction.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities

9.10.38 Whilst it is acknowledged that the waterbird assemblage of the Somerset Levels & Moors SPA comprises different species to that of the water bird assemblage of the Severn Estuary SPA the general type of birds i.e. waders and wildfowl, are the same. As such, see the assessment of disturbance and displacement during construction activities presented under the waterbird assemblage qualifying species of the Severn Estuary SPA (Section 9.5.42 and 9.5.15 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors SPA.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release)

9.10.39 Whilst it is acknowledged that the waterbird assemblage of the Somerset Levels & Moors SPA comprises different species to that of the water bird assemblage of the Severn Estuary SPA the general type of birds i.e. waders and wildfowl, are the same. As such, see the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented for the waterbird assemblage qualifying species of the Severn Estuary SPA (Section 9.5.42 and 9.5.18 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors SPA.

Pawlett Hams: Permanent modification of bird habitat and permanent displacement of species

9.10.40 Whilst it is acknowledged that the waterbird assemblage of the Somerset Levels & Moors SPA comprises different species to that of the water bird assemblage of the Severn Estuary SPA the general type of birds i.e. waders and wildfowl, are the same. As such, see the assessment of permanent modification of bird habitat and permanent displacement of species presented for the waterbird assemblage qualifying species of the Severn Estuary SPA (Section 9.5.42 and 9.5.21 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors SPA.

Mitigation measures

9.10.41 No additional mitigation measures to those detailed above are deemed necessary to avoid an adverse effect on integrity of the Somerset Levels & Moors SPA from the Project alone.

Conclusions on integrity from the Project alone

9.10.42 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four defueling years of decommissioning will have no adverse effect on integrity on the Somerset Levels & Moors SPA.

Conclusions on integrity from the Project in combination with other plans and projects

9.10.43 See text provided for the "*in combination with other plans and projects*" section of the Severn Estuary SAC above (Section 9.4.215 et seq.).

Consideration of past, current and future baselines

9.10.44 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.10.45 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.11 Somerset Levels & Moors Ramsar

9.11.1 The Somerset Levels & Moors Ramsar is a complex of sites with its closest component located approximately 10 km to the east of Pawlett Hams. The Ramsar designation is for three criteria: presence of vascular plant and invertebrate Red Data Book species; bird assemblage of international importance with a peak count in winter of 97,155; and species occurring at levels of international importance with peak counts in winter – teal and lapwing. Of note, the Ramsar citation includes 'breeding' for lapwing.

9.11.2 Due to the intervening distance, no direct impact (such as loss of land) would occur upon the Ramsar site from the Project. However, there is connectivity between the Severn Estuary and the Somerset Levels & Moors Ramsar via the Huntspill River which has its mouth at The Island. Birds are mobile species and therefore the Pawlett Hams and The Island within the Severn

Estuary could potentially provide some of the birds of the Somerset Levels and Moors Ramsar with supporting foraging and roosting habitat. For this reason both construction and operation of the saltmarsh creation / enhancement at Pawlett Hams and The Island could potentially result in indirect effects on the Somerset Levels and Moors Ramsar if the birds from the Ramsar site use Pawlett Hams or The Island as an important resource.

9.11.3 There are no impact pathways from other compensatory measure elements of the Project to this Ramsar site.

9.11.4 Throughout the assessment below for the Somerset Levels & Moors Ramsar, particular attention has been paid to the conservation objectives of the Somerset Levels & Moors Ramsar, as described in Table 8-2.

Criterion 5: Assemblage of international importance: winter assemblage of waterfowl

Marine design element

Indirect: Indirect effects on bird species through changes to water quality

9.11.5 Whilst it is acknowledged that the waterbird assemblage of the Severn Estuary SPA (according to the Regulation 33 advice dated June 2009) comprises of a list of 16 bird species, those species are waders and wildfowl, and it is waders and wildfowl which make up the waterbird assemblage of the Somerset Levels & Moors Ramsar site. As such, see the assessment of indirect effects on bird species through changes to water quality presented under the waterbird assemblage qualifying species of the Severn Estuary SPA (Section 9.5.42 and 9.5.11 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors Ramsar.

Indirect: effects on piscivorous (fish eating) birds through changes to prey resources

9.11.6 The waterfowl assemblage of the Somerset Levels & Moors Ramsar is mainly made up of wildfowl and waders which are not piscivorous. However, the assemblage may include a small number of birds that are piscivorous, such as sawbills (goosander, red breasted merganser and smew). Given the small proportion of the assemblage that is piscivorous and the low level of impact on fish populations from fish entrapment during HPC operation, there will be no adverse effect from the Project alone upon the integrity of the Somerset Levels and Moors Ramsar via the assemblage and the prey resource impact pathway. This is even less of a concern during the 4-year defueling of the decommissioning phase. There will be no effect through this pathway during HPC construction.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities:

9.11.7 Whilst it is acknowledged that the waterbird assemblage of the Severn Estuary SPA (according to the Regulation 33 advice dated June 2009) comprises of a list of 16 bird species, those species are waders and wildfowl, and it is waders and wildfowl which make up the waterbird assemblage of the Somerset Levels & Moors Ramsar site. As such, see the assessment of disturbance and displacement during construction activities presented under the waterbird assemblage qualifying species of the Severn Estuary SPA (Section 9.5.42 and 9.5.15 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors Ramsar.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release):

9.11.8 Whilst it is acknowledged that the waterbird assemblage of the Severn Estuary SPA (according to the Regulation 33 advice dated June 2009) comprises of a list of 16 bird species, those species are waders and wildfowl, and it is waders and wildfowl which make up the waterbird assemblage of the Somerset Levels & Moors Ramsar site. As such, see the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented under the waterbird assemblage qualifying species of the Severn Estuary SPA (9.5.42 and 9.5.18 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors Ramsar.

Pawlett Hams: Permanent modification of bird habitat and permanent displacement of species:

9.11.9 Whilst it is acknowledged that the waterbird assemblage of the Severn Estuary SPA (according to the Regulation 33 advice dated June 2009) comprises of a list of 16 bird species, those species are waders and wildfowl, and it is waders and wildfowl which make up the waterbird assemblage of the Somerset Levels & Moors Ramsar site. As such, see the assessment of permanent modification of bird habitat and permanent displacement of species presented for the waterbird assemblage qualifying species of the Severn Estuary SPA

(Section 9.5.42 and 9.5.18 et seq.), the conclusions of which apply equally for the waterbird assemblage feature of the Somerset Levels & Moors Ramsar.

Criterion 6: Species occurring at levels of international importance: teal

Marine design element

Indirect: Indirect effects on bird species through changes to water quality:

9.11.10 See the assessment of indirect effects on bird species through changes to water quality presented under the teal qualifying feature of the Somerset Levels & Moors SPA (Section 9.10.6 et seq.), the conclusions of which apply equally here to the teal of the Somerset Levels & Moors Ramsar site.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities:

9.11.11 See the assessment of disturbance and displacement during construction activities presented under the teal qualifying feature of the Somerset Levels & Moors SPA (Section 9.10.9 et seq.), the conclusions of which apply equally here to the teal the Somerset Levels & Moors Ramsar site.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release):

9.11.12 See the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented under the teal qualifying feature of the Somerset Levels & Moors SPA (Section 9.10.11 et seq.), the conclusions of which apply equally here to the teal the Somerset Levels & Moors Ramsar site.

Pawlett Hams: Permanent modification of bird habitat and permanent displacement of species:

9.11.13 See the assessment of permanent modification of bird habitat and permanent displacement of species presented under the teal qualifying feature of the Somerset Levels & Moors SPA (Section 9.10.15 et seq.), the conclusions of which apply equally here to the teal the Somerset Levels & Moors Ramsar site.

Criterion 6: Species occurring at levels of international importance: lapwing

Marine design element

Indirect: Indirect effects on bird species through changes to water quality:

9.11.14 See the assessment of indirect effects on bird species through changes to water quality presented under the teal qualifying feature of the Somerset Levels & Moors SPA (Section 9.10.6 et seq.), the conclusions of which apply equally here to the lapwing of the Somerset Levels & Moors Ramsar site.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement during construction activities:

9.11.15 The lapwing designation for the Ramsar site appears to cover both breeding and overwintering populations.

9.11.16 See the assessment of disturbance and displacement during construction activities under the overwintering lapwing feature of the Somerset Levels & Moors SPA, the conclusions of which apply equally here to the overwintering lapwing of the Somerset Levels & Moors Ramsar site.

9.11.17 Lapwing are known to be breeding at Pawlett Hams with approximately 15 pairs in 2023. Construction activities within the lapwing breeding season would result in temporary disturbance and displacement. However, by definition, these lapwing are not breeding within the Somerset Levels & Moors Ramsar (since they are breeding at Pawlett Hams) and should there be an important habitat link, fifteen breeding pairs make up only approximately 0.08 % of the over 36,580[161] individuals estimated using the Somerset Levels & Moors Ramsar.

9.11.18 In light of this and the plentiful alternative habitats available to breeding lapwing in the area, it is not considered that possible disturbance of breeding lapwing due to construction activities at Pawlett Hams could lead to any adverse effect on the integrity of the Ramsar site through this impact pathway. Furthermore there is also the option, to avoid potential construction disturbance, of construction activities avoiding lapwing breeding times

[161] Please note that the peak value given for wintering lapwing of the concurrent Somerset Levels and Moors SPA site is slightly different at 36,565

(between late March and mid-June[44]), although this is considered to be unnecessary for the reasons given.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release)

9.11.19 See the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented for the teal qualifying feature of the Somerset Levels & Moors SPA (Section 9.10.11 et seq.), the conclusions of which apply equally here to the lapwing of the Somerset Levels & Moors Ramsar site.

Pawlett Hams: Permanent modification of bird habitat and permanent displacement of species

9.11.20 The new saltmarsh habitats at Pawlett Hams will be suitable for lapwing for foraging and roosting, and retained grassland habitats will continue to provide nesting opportunities in addition to those available in the wider landscape. The carrying capacity of the site for lapwing will be increased as although the potential nesting habitat will be reduced in area, this will be offset by the creation of additional feeding resource, resulting in an overall benefit. Of note, the British Trust for Ornithology ('BTO') surveys have shown that numbers of lapwing have increased in coastal wetlands in recent years as birds appear to feed more on mudflats at low tide[162].

9.11.21 There will accordingly be no adverse effect on the integrity of the Somerset Levels & Moors Ramsar from the Project alone through this impact pathway on the lapwing qualifying species.

Mitigation measures

9.11.22 No additional mitigation measures to those detailed above are deemed necessary to avoid an adverse effect on integrity of the Somerset Levels & Moors Ramsar from the Project alone.

Conclusions on integrity from the Project alone

9.11.23 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four

162 BTO (2023) Lapwing https://www.bto.org/understanding-birds/birdfacts/lapwing (Access: 11 December 2023)

defueling years of decommissioning will have no adverse effect on integrity on the Somerset Levels & Moors Ramsar site.

Conclusions on integrity from the Project in combination with other plans and projects

9.11.24 See text provided for the "*in combination with other plans and projects*" section of the Severn Estuary SAC above (Section 9.4.215 et seq.).

Consideration of past, current and future baselines

9.11.25 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.11.26 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.12 Other European sites screened-in for migratory fish species

Introduction

9.12.1 In addition to the impact pathways identified for the fish qualifying features of the Severn Estuary SAC, the Severn Estuary Ramsar site, the River Usk SAC, the River Wye SAC and the River Towy SAC, which have been assessed in the relevant site-specific sections above, there are twelve further screened-in sites within the screening Table 8-3 for migratory fish species which arose from NNB's selected ZOI. These twelve designated sites and their respective migratory fish qualifying features are as follows:

- River Teifi SAC:
  - Sea lamprey
  - River lamprey
  - Atlantic salmon
- Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC:

    - Twaite shad;
    - Sea lamprey;
    - River lamprey; and
    - Allis shad.
- River Axe SAC:
    - Sea lamprey.
- Cardigan Bay / Bae Ceredigion SAC:
    - Sea lamprey; and
    - River lamprey.
- Cleddau Rivers / Afonydd Cleddau SAC:
    - River lamprey; and
    - Sea lamprey.
- River Avon SAC:
    - Sea lamprey; and
    - Atlantic salmon.
- Pembrokeshire Marine / Sir Benfro Forol SAC:
    - Sea lamprey;
    - River lamprey;
    - Allis shad; and
    - Twaite shad.
- Plymouth Sound & Estuaries SAC:
    - Allis Shad.
- Dee Estuary SAC:
    - Sea lamprey; and
    - River lamprey
- River Itchen SAC:

    - Atlantic salmon.
- Afon Eden:
    - Atlantic salmon
- Dartmoor SAC:
    - Atlantic salmon.

9.12.2 Throughout the assessment below, particular attention has been paid to the conservation objectives of the relevant sites, as described in Table 8-2.

Marine design element

Fish entrapment:

9.12.3 Detailed assessments have been presented above for the risk of fish entrapment during HPC operation on Annex II or Criterion 4 migratory fish species at five sites: the Severn Estuary SAC, Severn Estuary Ramsar site, River Usk SAC, River Wye SAC and River Towy SAC.

9.12.4 In those five assessments, entrapment of river lamprey and sea lamprey during operation and the four years of defueling (during decommissioning) has been found not to be of concern for any of the five sites. For that reason, it can be concluded that there will also be no adverse effect from the Project alone via this pathway during HPC construction, operation and the four years of defueling during decommissioning on the integrity of the above listed SACs for which sea and / or river lamprey are qualifying species. This therefore means that, of the additional sites above, four SACs (the Cleddau Rivers SAC, Cardigan Bay SAC, Dee Estuary SAC and River Axe SAC) are not a concern at all from the Project marine design element alone since the only migratory fish which are qualifying species for these sites are river lamprey and sea lamprey.

9.12.5 The other SACs listed above have other qualifying species (Atlantic salmon, Twaite shad, Allis shad) for which entrapment from the Project alone has been found to be a potential concern in the detailed assessments presented above of the Severn Estuary SAC, Severn Estuary Ramsar site, River Usk SAC and River Wye SAC.

9.12.6 For the remaining SACs, which are more distant from the Project, a quantitative assessment has not been undertaken. However, it is predicted that due to their distances from the marine design element of the Project, and therefore limited (if any) connectivity between the

Project and the designated site, there will be no adverse effect on the integrity of the identified SACs through the fish entrapment pathway of impact.

9.12.7 This conclusion accords with the EA's conclusions in 2020. The EA in their AA of 2020, in relation to fish entrapment assessed the following four designated sites from the list above in respect of the migratory fish qualifying features: 1. Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC; 2. Afonydd Cleddau / Cleddau Rivers SAC; 3. Pembrokeshire Marine / Sir Benfro Forol SAC; and 4. Plymouth Sound & Estuaries SAC. In respect of each of these four designated sites, the EA in their AA of 2020 concluded no adverse effect on site integrity as a result of the relevant migratory fish qualifying features through the fish entrapment impact pathway. (The EA did not in 2020 (due to the differences in approach to the ZOI as described above) assess the remaining designated sites from the list of 12 above in respect of any of the migratory fish qualifying features: 1. Afon Teifi / River Teifi SAC; 2. Cardigan Bay / Bae Ceredigion SAC; 3. River Axe SAC; 4. River Avon SAC; 5. River Itchen SAC; 6. Dee Estuary SAC; 7. Afon Eden SAC; and 8. Dartmoor SAC).

9.12.8 Analysis of the latest impingement data from CIMP2 has not resulted in any findings which would alter this conclusion.

9.12.9 For twaite shad specifically, the EA in their AA of 2020 additionally assessed Blackwater River (Cork / Waterford) SAC, River Barrow and River Nore SAC and Slaney River Valley SAC. This was due to the Unlocking the Severn project identifying connectivity between the River Severn twaite shad population and the Blackwater River (Cork / Waterford) SAC, River Barrow and Nore SAC and Slaney River Valley SAC. All of these additional sites are in south-east Ireland and the EA combined these sites, stating that the assessment was the same for each site. The EA concluded no adverse effect on site integrity as a result of twaite shad qualifying feature of these sites through fish entrapment. Having regard to the available evidence including the conservation objectives, including the recent telemetry data for twaite shad referred to above, it is concluded that these EA conclusions remain valid now. However, it is noted that emerging telemetry data from the Severn Estuary will continue to be reviewed, and further consideration will be given to its findings within the DCO Material Change application.

9.12.10 It is therefore concluded that migratory fish entrapment from the Project alone during HPC operation will, in view of the relevant conservation objectives of the above twelve SACs and the three additional sites included by the EA in their 2020 AA, have no adverse effect on the integrity of those SACs. Any effect during HPC defueling (decommissioning phase) will be even less due to reduced sea water abstraction during the approximately 4 years of abstraction during defueling. There is no effect via this pathway from HPC construction.

Indirect: Effects on fish populations through changes to water quality (contaminants / nutrients):

9.12.11 See the assessment of effects on fish populations through changes to water quality (contaminants / nutrients) presented under the river lamprey qualifying feature of the Severn Estuary SAC (Section 9.4.13 et seq.), the conclusions of which apply equally here.

Compensation measures within DCO Material Change Order Limits

Pawlett Hams / The Island:

9.12.12 See the assessment presented in respect of various pathways and Pawlett Hams / The Island for the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.19 to Section 9.4.33), the conclusions of which apply equally here.

Compensation measures outside DCO Material Change Order Limits

Native oyster reefs / kelp / seagrass:

9.12.13 See the assessment presented in respect of various pathways and native oyster reefs / kelp / seagrass for the river lamprey qualifying species of the Severn Estuary SAC (Section 9.4.34 to Section 9.4.39), the conclusions of which apply equally here.

Mitigation measures

9.12.14 Assessment of the impact pathway "*Fish entrapment*" has already taken into account the mitigation measures (being the capped head and the FRR), as described in detail within Section 6.2.

9.12.15 As regards the sections above on further impact pathways standard best practice mitigation measures will be applied to avoid and minimise any potential impacts.

Conclusions on integrity from the Project alone

9.12.16 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four defueling years of decommissioning will have no adverse effect on the integrity on the above sites (the 12 screened-in following NNB's chosen ZOI and the additional sites considered by the EA in their AA in 2020).

Conclusions on integrity from the Project in combination with other plans and projects

9.12.17 See text under this heading for the Severn Estuary SAC (Section 9.4.215 et seq.).

Consideration of past, current and future baselines

9.12.18 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.12.19 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.13 Other European / Ramsar sites screened-in for piscivorous bird qualifying features

Introduction

9.13.1 There are nineteen further screened-in sites within the screening Table 8-3 above (based on NNB's chosen ZOI) for piscivorous bird qualifying features. These designated sites and their respective piscivorous bird qualifying features are as follows:

- Skomer, Skokholm and the Seas off Pembrokeshire SPA:
  - Storm petrel
  - Manx shearwater
  - Atlantic puffin
  - Lesser black-backed gull
  - Seabird assemblage

- Aberdaron Coast and Bardsey Island / Glannau Aberdaron ac Ynys Enlli SPA:
  - Manx shearwater
- Grassholm SPA:
  - Northern Gannet
- Northern Cardigan Bay SPA:
  - Red-throated diver
- Chesil Beach and the Fleet SPA:
  - Little tern
- Solent and Dorset Coast SPA:
  - Sandwich tern
  - Little tern
  - Common tern
- Dee Estuary SPA:
  - Sandwich tern
  - Little tern
  - Common tern
  - Waterbird assemblage
- Dee Estuary Ramsar:
  - Bird assemblages of international importance
- Solent and Southampton Water SPA:
  - Sandwich tern
  - Roseate tern
  - Little tern
  - Common tern
  - Mediterranean gull
  - Waterbird assemblage

- Solent and Southampton Water Ramsar:
  - Waterfowl assemblages of international importance
- Poole Harbour Ramsar:
  - Common tern (as part of Criterion 3)
  - Mediterranean tern (as part of Criterion 3)
  - Waterfowl assemblages of international importance
- Poole Harbour SPA:
  - Mediterranean gull
  - Sandwich tern
  - Common tern
  - Waterbird assemblage
- Burry Inlet Ramsar:
  - Waterfowl assemblages of international importance
- Exe Estuary Ramsar:
  - Waterfowl assemblages of international importance
- Exe Estuary SPA:
  - Waterbird assemblage
- Upper Nene Valley Gravel Pits SPA:
  - Waterbird assemblage
- Upper Nene Valley Gravel Pits:
  - Waterbird assemblage
- Mersey Estuary SPA:
  - Waterbird assemblage
- Mersey Estuary Ramsar:
  - Waterfowl assemblages of international importance

9.13.2 Throughout the assessment below, particular attention has been paid to the conservation objectives of the relevant sites, as described in Table 8-2.

Marine design element

Indirect: Effects on piscivorous (fish eating) birds through changes to prey resources

9.13.3 The primary pathway of effect from the marine design element (AFD requirement removal) of the Project on piscivorous birds is as an indirect effect from changes to prey resources (fish species) and associated changes to foraging success, with the focus of this assessment being the qualifying piscivorous bird features and waterfowl assemblages of the screened-in sites listed above.

9.13.4 The assessments of the Project on the lesser black backed gull of the Severn Estuary Ramsar site Criterion 5 bird species (see Section 9.6.39 et seq.) concluded that there was no adverse effect of the marine design element from Project alone via HPC construction, operation or the four years of defueling during decommissioning on the integrity of the Severn Estuary Ramsar from this impact pathway. This was in part because the lesser black backed gull is not exclusively piscivorous, and due to the Severn Estuary representing only a proportion of the species' foraging area.

9.13.5 It can also be concluded, in view of the relevant conservation objectives, that there will be no adverse effect from the marine design element of the Project alone during HPC operation or the four years of defueling during decommissioning on the integrity of any of the 19 designated sites listed above in respect of all qualifying species listed above via this impact pathway.

9.13.6 This is because, although it cannot be ruled out that birds that are the qualifying features of these sites may visit the Severn Estuary, it is highly unlikely that the birds of these more distant European / Ramsar sites (from the marine design element) would be regularly traveling to this part of the estuary where fish will be entrapped by the HPC water intake. There are other feeding areas available for these birds and the birds would have to expend commuting energy from these more distant sites to reach the Severn Estuary, therefore they are unlikely to be relying on the area as a key foraging ground.

9.13.7 There is no effect on these sites via this pathway during HPC construction.

9.13.8 This conclusion is consistent with the EA's conclusion in their AA of 2020 for the WDA Permit inquiry in relation to the impact on piscivorous bird species from not fitting an AFD.

9.13.9 The EA considered the effects of removal of the AFD requirement on five piscivorous bird species. These species (gannet, Manx shearwater, fulmar, storm petrel and lesser black-backed gull) had been identified by the EA through reliance on mean maximum foraging ranges as outlined by Thaxter et al 2012. Through the assessment of these five species the EA considered 21 SPAs (18 of which were taken to AA) and concluded that there would be no adverse effect on the integrity of those sites through this pathway of impact.

9.13.10 As has been explained above, the method for identification of European / Ramsar sites for consideration in this HRA Report has been different to that adopted by the EA in 2020. The HRA Report considers sites based on chosen ZOI whereas the EA considered sites based on mean maximum foraging ranges. This explains the differences in the sites assessed.

9.13.11 Based on the five piscivorous bird species of interest to the EA, the EA assessed, in relation to loss of piscivorous bird prey species, three of the nineteen piscivorous bird sites listed in this section of the HRA Report above: 1. Aberdaron Coast and Bardsey Island SPA; 2. Grassholm SPA; and 3. Skomer, Skokholm, and the Seas of Pembrokeshire SPA. The EA was able to conclude that there would be no adverse effect on site integrity for these sites in relation to loss of prey species for the qualifying piscivorous bird species.

9.13.12 The EA in their AA of 2020 also reached the same conclusion in relation to loss of piscivorous bird prey species in relation to the following additional sites: 1. Saltee Islands SPA; 2. Lambay Island SPA; 3. Beara Peninsula SPA; 4. Cliffs of Moher SPA; 5. Kerry Head SPA; 6. Deenish Island and Scariff Island SPA; 7. Puffin Island SPA; 8. Iveragh Peninsula SPA; 9. Skelligs SPA; 10. Dingle Peninsula SPA; 11. West Donegal Coast SPA; 12. Copeland Islands SPA; 13. Blasket Islands SPA; 14. Horn Head to Fanad Head SPA; and 15. Clare Island SPA. Based on the findings presented within this HRA Report, and the relevant conservation objectives, the conclusions reached by the EA in 2020 are considered to remain valid now.

Indirect: Effects on piscivorous birds through changes to water quality through release of contamination / nutrients:

9.13.13 See the assessment of indirect effects on birds through changes to water quality through release of contamination / nutrients presented under the gadwall qualifying feature of the Severn Estuary SPA (Section 9.5.11 et seq.), the conclusions of which apply equally here.

Compensation measures within the DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance (noise, vibration, light) and temporary displacement through construction activities:

9.13.14 See the assessment of disturbance (noise, vibration, light) and temporary displacement through construction activities presented under the gadwall qualifying feature of the Severn Estuary SPA (Section 9.5.15 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Indirect effects on bird species through changes to water quality (contaminant / nutrient release):

9.13.15 See the assessment of indirect effects on bird species through changes to water quality (contaminant / nutrient release) presented under the gadwall qualifying feature of the Severn Estuary SPA (Section 9.5.18 et seq.), the conclusions of which apply equally here.

Pawlett Hams / The Island: Temporary loss of habitat during construction activities:

9.13.16 See the assessment of temporary loss of habitat during construction activities presented under the gadwall qualifying feature of the Severn Estuary SPA (Section 9.5.20), the conclusions of which apply equally here.

Pawlett Hams / The Island: Permanent modification of bird habitat and permanent displacement of species

9.13.17 Pawlett Hams / The Island does not provide habitat that would support certain of the qualifying piscivorous bird species relevant to the designated sites above, namely gannet, Manx shearwater, fulmar and storm petrel, as these are piscivorous birds that nest on cliffs or in the case of Manx shearwater in burrows on typically on cliff tops.

9.13.18 In relation to the remaining piscivorous bird species qualifying features of the sites above, the change of land use at Pawlett Hams and The Island will not give rise to impacts on them. While the area may be used for loafing by some piscivorous species in particular lesser black-blacked gull, the wider locality provides extensive areas of similar agricultural land that would provide such birds with alternative loafing areas should they be disturbed during the construction phase.

9.13.19 In the long term, once the managed retreat is completed, the intertidal saltmarsh habitat at Pawlett Hams and The Island is expected to provide new / enhanced habitat for any piscivorous bird species of the sites listed above using it for feeding or loafing.

9.13.20 It is therefore concluded that no effect will arise on piscivorous seabirds as a result of these two impact pathways from these compensation measures elements of the Project.

9.13.21 Therefore, it can be concluded, in view of the relevant conservation objectives, that there will be no adverse effect from the Project alone on the integrity of any of the designated sites listed above in respect of this impact pathway.

Pawlett Hams / The Island: Indirect effects on bird species through changes in hydrodynamics and sediment transport

9.13.22 See the assessment of indirect effects on bird species through changes in hydrodynamics and sediment transport presented under the gadwall qualifying feature of the Severn Estuary SPA (Section 9.5.27), the conclusions of which apply equally here.

Weir removal / easement: Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye):

9.13.23 With regard to the removal of weirs the habitat present is unlikely to support any of the piscivorous qualifying bird species of the designated sites listed in this section above. The habitat present will not be suitable at all for the seabirds gannet, Manx shearwater, fulmar and storm petrel.

9.13.24 Therefore, in view of the relevant conservation objectives, there will be no adverse effect from the Project alone on the integrity of any of the designated sites listed above in respect of all qualifying species listed above via this impact pathway.

Compensation measures outside the DCO Material Change Order Limits

Weir removal / easement: Trostrey Weir, River Usk and Manorafan Weir, River Towy:

9.13.25 With regard to the removal of weirs the habitat present is unlikely to support any of the piscivorous qualifying bird species of the designated sites listed in this section above. The habitat present will not be suitable at all for the seabirds gannet, Manx shearwater, fulmar and storm petrel.

9.13.26 Therefore, in view of the conservation objectives, there will be no adverse effect from the Project alone on the integrity of any of the designated sites listed above in respect of all qualifying species listed above via this impact pathway.

Native oyster reef, kelp and seagrass creation

9.13.27 These are considered together because the creation / enhancement of these habitats requires similar procedures to establish these new habitats e.g. the seeding of species from boats. Even though the proposed locations of seagrass beds, kelp forests and native oyster reefs are not at present known, it is possible to provide a high-level assessment.

9.13.28 The precise locations of these new habitats are yet to be finalised. If the habitat creation / enhancement works are within or close to any of the above designated sites then they could have the potential to cause disturbance and / or displacement of bird species temporarily. However, should birds be temporarily displaced from areas, there will be sufficient habitat in elsewhere for them to use during the works.

9.13.29 During the creation / enhancement of these habitats, it is possible that some piscivorous birds may be disturbed by for example, the passage of boats. However, such disturbance would not give rise to any effect upon the species as any disturbance would be short lived. It is expected that mitigation measures can and will be designed to further minimise any SPA impacts. Further detailed assessments will be undertaken when more details of the proposed locations of these compensatory measures are known.

9.13.30 Habitat creation / enhancement has the potential to result in positive indirect effects on piscivorous seabirds, through general improvements to fish populations within the area. Further, seagrass beds, kelp forests and native oyster reefs all have the capacity to increase the abundance and diversity of marine communities in their immediate vicinity, and to an extent within the wider area. This may further enhance the prey resource for seabirds and waterfowl in the Severn Estuary.

9.13.31 On the above basis (a high-level, qualitative assessment), but subject to further detailed assessment when further details are known (including when formal applications are made to the relevant competent authorities for the relevant regulatory consents), there will be no adverse effect from the Project alone on the above sites via the creation / enhancement of the native oyster reef, kelp or seagrass habitats through this impact pathway.

Mitigation measures

9.13.32 Assessment of the impact pathway "*Fish entrapment*" has already taken into account the mitigation measures (being the capped head and the FRR), as described in detail within Section 6.2.

9.13.33 As regards the sections above on further impact pathways standard best practice mitigation measures will be applied to avoid and minimise any potential impacts.

Conclusions on integrity from the Project alone

9.13.34 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four defueling years of decommissioning will have no adverse effect on the integrity of the above sites (the 19 screened-in via NNB's chosen ZOI and the additional sites considered by the EA in its 2020 AA).

Conclusions on integrity from the Project in combination with other plans and projects

9.13.35 See text under this heading for the Severn Estuary SAC (Section 9.4.215).

Consideration of past, current and future baselines

9.13.36 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.13.37 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.14 Other European sites screened-in for marine mammal interest features

Introduction

9.14.1 The primary pathway of effect from the Project on marine mammals is as a secondary or indirect effect from entrapment effects on prey resources, i.e. fish. However, additional pathway effects have also been considered as required. The following assessment focusses on potential effects on the following species, identified due to their listing as Annex II qualifying features of screened-in designated European sites based on NNB's selected ZOI:

- Harbour porpoise;
- Bottlenose dolphin; and
- Grey seal.

9.14.2 The screened-in designated sites based on NNB's chosen ZOI referred to above are as follows:

- Bristol Channel Approaches SAC / Dynesfeydd Môr Hafren SAC:
  - Harbour porpoise
- Pembrokeshire Marine/ Sir Benfro Forol SAC:
  - Grey seal
- Cardigan Bay/ Bae Ceredigion SAC:
  - Grey seal
  - Bottlenose dolphin
- West Wales Marine / Gorllewin Cymru Forol SAC:
  - Harbour porpoise
- Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau SAC:
  - Bottlenose dolphin
  - Grey seal
- Lundy SAC
  - Grey seal

9.14.3 Throughout the assessment below, particular attention has been paid to the conservation objectives of the relevant sites, as described in Table 8-2.

Marine design element

Indirect effects on marine mammals through changes to prey resources:

9.14.4 The potential change to the prey species of marine mammal qualifying features of the six screened-in designated sites above is the main potential pathway of effect from the marine design element identified for this assessment.

9.14.5 Whilst there may be potential effects from impingement on individual fish, none of the three marine mammal species identified above exhibit reliance upon any individual fish species. The Severn Estuary also represents only a small area of their wider foraging range. Further, there is seasonal and geographical variation in marine mammal diets reflecting changing and local availability of prey species. This provides further resilience with regards to the impingement of individual species.

9.14.6 It can be concluded, in view of the relevant conservation objectives, that there will be no adverse effect from the Project alone during HPC operation or the 4 years of defueling during decommissioning on the integrity of any of the designated sites listed above in respect of this impact pathway. There is also no impact during HPC construction via this pathway.

9.14.7 This conclusion is consistent with the EA's conclusions in their AA of 2020 in relation to loss of marine mammal prey species. With the single exception of the Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau SAC, in respect of the grey seal qualifying feature, the EA assessed each of the six designated sites above with respect to their respective marine mammal qualifying features and concluded no adverse effect on site integrity in relation to the relevant marine mammal qualifying features through the loss of prey species impact pathway associated with removing the AFD requirement.

9.14.8 For harbour porpoise specifically, the EA in their AA of 2020 additionally assessed the following five designated sites with the harbour porpoise qualifying feature: 1. North Anglesey Marine / Gogledd Mon Forol MPA and SAC; 2. North Channel SAC; 3. Rockabill to Dalkey Island SAC; 4. Roaringwater Bay and Islands SAC; and 5. Blasket Islands SAC. The reason for the difference between sites assessed in this HRA Report and those assessed in the EA's 2020 assessment lies in the different approach to identifying ZOIs. The EA concluded no adverse effect on site integrity through loss of harbour porpoise prey species in relation to these 5 additional designated sites. It is concluded that the EA conclusions in 2020 remain valid now.

9.14.9 For the grey seal specifically, the EA in their AA of 2020 additionally assessed the following three designated sites with the grey seal qualifying feature: 1. Roaringwater Bay and Islands SAC; 2. Blasket Islands SAC; and 3. Isles of Scilly Complex SAC. The EA concluded no adverse effect on site integrity as a result of the grey seal qualifying feature of these sites through loss of prey species. It is concluded that the EA conclusions in 2020 remain valid now.

Indirect effects on marine mammals through effects on the prey species as a result of changes to water quality (nutrients / contaminants release):

9.14.10 See the assessment at Section 9.4.13 et seq. above for the river lamprey qualifying feature of the Severn Estuary SAC (marine design element: indirect effects on fish populations through changes to water quality (contaminants / nutrients)) which describes the assessment of impact on water quality from removal of the AFD and anticipated changes to the level of dead / decaying fish matter released through the FRR system. The description there applies equally here and as such, there is no risk to marine mammals through any related bioaccumulation impact pathway.

9.14.11 This is in line with the EA's AA of 2020. The EA concluded that there was no adverse effect on site integrity of the Bristol Channel Approaches SAC in respect of the harbour porpoise qualifying species listed for that site as a result of changes to prey resources. The EA subsequently inferred the same conclusion for the remaining designated sites supporting harbour porpoise considered by them.

9.14.12 This means that, in view of relevant conservation objectives of the SPA, there will be no adverse effect from the Project alone through the FRR system during HPC operation on the above marine mammal sites through this impact pathway. During defueling (decommissioning phase) of HPC any effect will be even less due to the reduced abstraction of seawater during 4 years of defueling. This is also no impact during construction via this pathway.

Compensation measures within the DCO Material Change Order Limits

Pawlett Hams / The Island: Disturbance and displacement

9.14.13 Any development in the marine environment has the potential to disturb marine communities or cause potential displacement as animals are forced to temporarily move into other areas. Whilst marine mammals are present within the Severn Estuary / wider Inner Bristol Channel, it is not considered a key habitat for any of the three Annex II marine mammal species addressed within this HRA Report.

9.14.14 For bottlenose dolphin especially, the EA, in their 2020 AA, stated that the Severn Estuary / Inner Bristol Channel area does not comprise a functionally linked habitat for the species.

9.14.15 There will accordingly be no adverse effect on the integrity of any of the above designated sites from the Project alone through this impact pathway.

Pawlett Hams / The Island: Indirect: Effects on marine mammals through changes to prey resources:

9.14.16 There is the potential for prey resources of marine mammals to be affected through development of the compensation measures. However, as described above, each of the species considered is generalist in nature, and able to take advantage of large foraging ranges, of which the Severn Estuary and the Parrett Estuary, represent a tiny proportion.

9.14.17 Further, the development of compensatory saltmarsh habitat within the Severn Estuary is predicted to benefit the fish populations of the wider estuarine area, thereby having the potential to indirectly benefit the species which prey upon them, including marine mammals.

9.14.18 There will accordingly be no adverse effect on the integrity of any of the above designated sites from the Project alone through this impact pathway.

Weir removal / easement - Maisemore Weir and Upper Lode Weir, River Severn and Lugg Weirs (River Lugg, tributary of River Wye):

9.14.19 See the assessment and conclusions for the effects of the potential River Severn and River Lugg weir works on qualifying fish species of the Severn Estuary SAC (Section 9.4.31 et seq) and the River Wye SAC (Section 9.8.16 to 9.8.19) which are equally applicable here.

9.14.20 Based on those assessments it is concluded that works on weirs on the Rivers Severn and Lugg will not indirectly affect marine mammal qualifying features of the above European sites through effects on fish populations of the Severn Estuary SAC or the River Wye SAC.

9.14.21 There will accordingly be no adverse effect on the integrity of any of the above designated sites from the Project alone through this impact pathway.

Compensation measures outside the DCO Material Change Outer Limits

Native oyster reefs / kelp / seagrass: Disturbance and displacement

9.14.22 Even though the proposed location of seagrass beds, kelp forests and native oyster reefs is not at present known, it is possible to provide a high-level assessment.

9.14.23 Any works in the marine environment have the potential to cause disturbance and displacement of marine mammal species, if present in the vicinity. However, there are wide areas of marine habitat available within the Severn Estuary and beyond for marine mammals. Therefore, it is considered that marine mammals would be able to utilise habitats away from the works, with no detrimental effects at either an individual or population level.

9.14.24 Based on a high-level assessment, and subject to further assessment including when the relevant regulatory consents are sought, there will accordingly be no adverse effect on the integrity of any of the above designated sites from the Project alone through this impact pathway.

Weir removal / easement - Trostrey Weir, River Usk and Manorafan Weir, River Towy:

9.14.25 See the assessment and conclusions for effects of the potential River Usk and River Towy weir works on fish species for the River Usk SAC (Section 9.7.18 to 9.7.26) and the River Towy SAC (Section 9.9.63 to 9.9.66), which are equally applicable here.

9.14.26 Based on those assessments it is concluded that works on weirs on the Rivers Usk and Towy will not indirectly affect marine mammal qualifying features of the above European sites through effects on fish populations of the Severn Estuary SAC or the River Wye SAC.

9.14.27 There will accordingly be no adverse effect on the integrity of any of the above designated sites from the Project alone through this impact pathway.

Mitigation measures

9.14.28 Assessment of the impact pathway "*Fish entrapment*" has already taken into account the mitigation measures (being the capped head and the FRR), as described in detail within Section 6.2.

9.14.29 As regards the sections above on further impact pathways standard best practice mitigation measures will be applied to avoid and minimise any potential impacts.

Conclusions on integrity from the Project alone

9.14.30 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four defueling years of decommissioning will have no adverse effect on the integrity of the above sites (the 6 included above due to NNB's chosen ZOI and the additional sites considered by the EA in its 2020 AA).

Conclusions on integrity from the Project in combination with other plans and projects

9.14.31 See the text provided under this heading in the Severn Estuary SAC section of this shadow AA (Section 9.4.215).

Consideration of past, current and future baselines

9.14.32 As described within Section 9.3, the assessment presented above is focused on the current baseline, with consideration of the past baseline where appropriate. Given the temporal proximity between the current baseline and the appropriate future baseline data of 2027 (when the Project is anticipated to be fully operational), it is not considered there will be any substantial changes between the current and future baselines.

9.14.33 On this basis, the conclusions presented above with respect to the Project alone and in combination are considered applicable from both a current and future baseline perspective.

9.15 Other European sites screened-in for otter interest features

Introduction

9.15.1 In addition to the impact pathways identified for the otter qualifying features of the River Usk SAC, the River Wye SAC and the River Towy SAC, which have been assessed above, there are five further sites with otter as a qualifying species. These are as follows:

- Exmoor and Quantock Oakwoods SAC
- Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC
- Pembrokeshire Marine/ Sir Benfro Forol SAC
- Cleaddau Rivers / Afonydd Cleddau SAC
- River Teifi / Afon Teifi SAC

9.15.2 Throughout the assessment below, particular attention has been paid to the conservation objectives of the relevant sites, as described in Table 8-2.

Marine design element

Indirect effect on otter through changes in prey resources

9.15.3 The impact pathway from the marine design element (AFD requirement removal) of the Project on otter is as a secondary or indirect effect from changes to prey resources (fish species) and associated changes to foraging success. The assessment for the potential impacts on the River Usk SAC, River Wye SAC and River Towy SAC all concluded that otter are not dependent upon fish species that may be entrapped by the Project, as a significant part of their diet. The same conclusion can be drawn for these additional sites as they are at additional distance from the marine design element where the entrapment will take place.

9.15.4 As such, it is concluded that the indirect effect on otter due to changes in prey resources, from the Project alone, during HPC operation will, in view of the relevant conservation objectives, have no adverse effect on the integrity of the above five listed sites. Any effect during HPC defueling (decommissioning stage) will be even less due to reduced sea water abstraction. There is no effect via this pathway from HPC construction.

9.15.5 This conclusion accords with the EA's conclusions in their AA of 2020 for the WDA Permit inquiry on not fitting an AFD. The EA considered the effects of the removal of the AFD on seven sites where otter are qualifying feature species, all of which are also included in this assessment.

Mitigation measures

9.15.6 No additional mitigation measures are required to those already detailed in the single site assessments above.

Conclusions on integrity from the Project alone

9.15.7 On the basis of the above assessments, and in view of the relevant conservation objectives, it can be concluded that the Project alone during HPC construction, operation and the four defueling years of decommissioning will have no adverse effect on the integrity of the above otter sites.

Conclusions on integrity from the Project in combination with other plan and projects

9.15.8 See the text provided under this heading in the Severn Estuary SAC section of this shadow AA (Section 9.4.215).

9.16 Overall Conclusions of this shadow AA

9.16.1 Taking into account the application of mitigation measures where relevant, it has, in view of the relevant conservation objectives, not been possible to exclude beyond reasonable scientific doubt a risk of an adverse effect on integrity of the following European / Ramsar sites due to potential impacts of the Project alone during HPC operation via the fish entrapment pathway of impact (linked to the marine design (removal of the AFD element requirement) of the Project) on the following listed qualifying features:

- Severn Estuary SAC:
  - Estuaries (H1130) qualifying habitat feature
  - Twaite shad qualifying species
- Severn Estuary Ramsar site:
  - Criterion 4 assemblage of migratory fish species
- River Wye SAC:

  - Atlantic salmon
  - Twaite shad
  - Allis shad
- River Usk SAC:
  - Atlantic salmon
  - Twaite shad

9.16.2 The effects during approximately 4 years of defueling (decommissioning phase) will be much less due to the reduced sea water abstraction during that period of defueling. There will be no effect on the above sites via the fish entrapment pathway during HPC construction.

9.16.3 The HRA derogation tests therefore apply.

9.16.4 There will be no risk of an adverse effect from the Project alone (or based on a high-level assessment in this HRA Report (with further consideration to be given to this issue when the DCO Material Change application is made) in combination with other plans or projects) during construction, operation and the four defueling years (decommissioning phase) on the integrity of the above 4 European / Ramsar sites via other qualifying features in relation to any pathway; or via the listed qualifying features via any other pathway.

9.16.5 For all other screened-in European / Ramsar sites there will be no adverse effect on the integrity of those sites from the Project alone during construction, operation or four years of defueling during the decommissioning phase (or based on a high-level assessment in this HRA Report (with further consideration to be given to this issue when the DCO Material Change application is made) in combination with other plans or projects).

10 HRA STAGE 3: NO ALTERNATIVE SOLUTIONS

10.1 Part 1: Introduction

Purpose and scope of assessment

10.1.1 This section of the HRA Report presents NNB's 'assessment of alternative solutions' for the Project. This identifies whether there are any 'alternative solutions' to the Project in the context of the Habitats Regulations.

10.1.2 This section of the HRA Report focusses on those activities associated with the Project for which appropriate assessment under the Habitats Regulations, as set out in the Stage 2 AA of this HRA Report has concluded an adverse effect on site integrity cannot be ruled out.

10.1.3 The shadow AA has concluded (see Section 9.16) that there is a risk to site integrity (through HPC fish entrapment) that cannot be excluded beyond reasonable scientific doubt from the Project, with respect to four European / Ramsar sites through the following qualifying features:

- Severn Estuary SAC: the Estuaries qualifying habitat feature through the risk of an effect on the typical fish species assemblage; and Twaite shad qualifying species;
- Severn Estuary Ramsar site: the Criterion 4 migratory fish assemblage;
- River Usk SAC: the Atlantic salmon and Twaite shad qualifying species; and
- River Wye SAC: the Atlantic salmon, Twaite shad and Allis shad qualifying species.

NAS Assessment Structure

10.1.4 This section of the HRA Report is set out as follows:

- Part 1 – introduces the purpose and scope of the report, linking back to description of the Project.
- Part 2 – sets out the methodology adopted by NNB for the assessment of alternative solutions.
- Part 3 – provides details of the Project need and defines its 'critical objectives'.

- Part 4 – summarises particular aspects of the Project that relate to the envisaged potential for harm and discussion of proposed mitigation for the potential harm.
- Part 5 – produces a long list of potential alternative solutions to address the potential harm. The long list is screened to define a short list of options that would fulfil the Project need and objectives.
- Part 6 – considers whether any short-listed potential alternative solutions are 'feasible'.
- Part 7 – indicates whether any feasible alternative solutions would have a lesser effect on the integrity of the protected sites.
- Part 8 – sets out the conclusions of the assessment of alternative solutions.

10.2 Part 2: Methodology adopted by NNB for the assessment of alternative solutions

Legal Framework

10.2.1 The legal tests to justify a derogation to the provision in Article 6(3) of the Habitats Directive and regulation 63(5) of the Habitats Regulations are found in both the subsequent provisions of the respective legislation.

10.2.2 The legal test relating to NAS is set out under Article 6(4) of the Habitats Directive as follows (emphasis added through underlining):

"If, in spite of a negative assessment of the implications for the site <u>and in the absence of alternative solutions</u>, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted."

10.2.3 Article 6(4) of the Habitats Directive, and the legal test therein, has been transposed into domestic legislation by regulation 64(1) of the Habitats Regulations, which provides (emphasis added through underlining):

"(1) If the competent authority is satisfied that, <u>there being no alternative solutions</u>, the plan or project must be carried out for imperative reasons of overriding public interest (which,

subject to paragraph (2), may be of a social or economic nature), it may agree to the plan or project notwithstanding a negative assessment of the implications for the European site or the European offshore marine site (as the case may be)."

10.2.4 The above test has been considered and interpreted by domestic and CJEU retained case law and its application addressed in guidance documents.

Methodology

10.2.5 The methodology adopted to assess alternative solutions has been developed based on guidance from a range of sources, including:

- Defra, Natural England, Welsh Government and Natural Resources Wales, Habitats regulations assessments: protecting a European site ('Joint Government Guidance')[163]
- Defra, Habitats and Wild Birds Directives: guidance on the application of article 6(4), December 2012 ('Withdrawn 2012 Defra Guidance')[164]
- PINS Advice Note 10: Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects ('PINS Advice Note 10')
- Tyldesley, D and Chapman C, The Habitats Regulations Assessment Handbook ('DTA Handbook')
- European Commission, Commission Notice, Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, November 2018 ('Managing Natura 2000')
- European Commission, Assessment of plans and projects in relation to Natura 2000 sites – Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC, 28 September 2021 ('Methodological Guidance')
- Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC, January 2007 ('2007 Commission Guidance')

The No Alternative Solutions Test is part of a stepwise approach

10.2.6 Article 6(4) of the Habitats Directive / regulation 64(1) of the Habitats Regulations is part of a stepwise process, applied in accordance with and following the identification of the impacts

163 Habitats regulations assessments: protecting a European site - GOV.UK (www.gov.uk), accessed on 19 December 2023.

164 Whilst the July 2012 Guidance is withdrawn, it still offers helpful further detailed information which can be drawn on. We therefore draw attention to relevant points arising from this Guidance in the analysis below, to the extent this is helpful.

on the conservation objectives of the European site under the Article 6(3) appropriate assessment.[165]

- A sequential approach to the appropriate assessment, and derogation tests, where applicable, must be applied in practice as prescribed by the Habitats Directive and as confirmed in the case law of the CJEU.[166]
- Article 6(4) can only be applied after the implications of the plan or project have been appropriately assessed following the requirements of Article 6(3).[167] Knowledge of the implications on the conservation objectives of the European site in question are a prerequisite to the application of the derogation tests.[168]

10.2.7 Accordingly, Stage 3 of this HRA Report follows the Stage 1 screening and Stage 2 AA undertaken as part of the HRA.

10.2.8 The process of applying Article 6(4) itself is also a stepwise process with three elements:

- Assessment of the existence of alternative solutions;
- Assessment of the existence of imperative reasons of overriding public interest, which may include 'those of a social or economic nature'; and
- The securing of compensatory measures to ensure the protection of the overall coherence of the Natura 2000 network (now the National Site Network).[169]

10.2.9 The absence of alternative solutions must be demonstrated.[170]

10.2.10 NAS and IROPI are separate tests, to be applied in sequence. The examination of alternative solutions must be concluded before moving on to the assessment of whether the Project is

165 Case C-399 Grune Liga, paragraph 57; Case C-182/10 Solvay et al v Region Wallonne, paragraph 74.

166 Case C-209/02 European Communities v Republic of Austria, C-239/04 Commission v Portugal, Case C-304/05 Commission of the European Communities v Italian Republic, Case C-560/08 European Commission v Kingdom of Spain, C-404/09 European Commission v Kingdom of Spain.

167 DTA Handbook, Part C13.1, Principle 1.

168 Case C-304/05, Commission of the European Communities v Italian Republic, paragraph 83.

169 The Habitats Regulations retain reference to Natura 2000, but clarify in Regulation 3(10) that "for the purposes of the Habitats Regulations, and any guidance issued before exit day (being 31 December 2020) by the appropriate authority or the appropriate nature conservation body, relating to the application of the Habitats Regulations, on or after exit day, references to 'Natura 2000' are to be construed as references to the national site network". 'National Site Network' is defined as "the network of sites in the United Kingdom's territory consisting of such sites as (a) immediately before exit day formed part of Natura 2000; or (b) at any time on or after exit day are European sites, European marine sites and European offshore marine sites for the purposes of any of the retained transposing regulation".

170 C-239/04 European Commission v Portugal (the Castro Verde case), paras 35-39 of the judgment. See also Withdrawn 2012 Defra Guidance, para 10, page 2.

necessary for IROPI.[171] The two tests may be linked in that undertaking the alternative solutions test is predicated on there being some credible reasons to consider the plan or project in terms of IROPI; there is no logic in undertaking the examination of alternative solutions if there is no conceivable IROPI.[172]

10.2.11 The NAS and IROPI tests are separate from the assessment of compensation, which is the third stage in the sequential approach following the fulfilment of the IROPI test. Accordingly, Stage 3 of the HRA Report assesses the existence of any alternative solutions, the existence of imperative reasons of overriding public interest and sets out NNB's currently proposed compensatory measures package to be delivered both within and beyond the DCO Material Change Order Limits.

10.2.12 If the competent authority decides, with a reasonable framework of potential options, there are feasible alternative solutions to the plan or project, which would have a lesser effect on the European site(s) affected it cannot authorise the plan or project.[173]

10.2.13 The opinion of Advocate General Kokott in Case C-239/04 *Commission v Portugal* included the following (at paragraphs 43 and 44):

"The absence of alternatives cannot be ascertained when only a few alternatives have been examined, but only after <u>all the alternatives</u> have been ruled out. The requirements applicable to the exclusion of alternatives increase the more suitable those alternatives are for achieving the aims of the project without giving rise – beyond reasonable doubt – to manifest and disproportionate adverse effects.

...

Among the alternatives short-listed in that way, the choice does not inevitably have to be determined by which alternative least adversely affects the site concerned. Instead, the choice requires a balance to be struck between the adverse effect on the integrity of the SPA and the relevant reasons of overriding public interest."

171 Case C-239/04 (Castro Verde) paragraphs 36-39; DTA Handbook, Part C13.1, Principle 2; Joint Government Guidance, '3. Derogations: allow exceptions'.
172 DTA Handbook, Part C13.1, Principle 2.
173 DTA Handbook, Part C13.1, Principle 11.

10.2.14 The methodology adopted in this assessment is consistent with that approach. It consists of five steps, set out below, to establish the presence or absence of alternative solutions:

- Step 1 - Identify the need for the Project and define its objectives.
- Step 2 - Identify the potential harm the Project is predicted to cause to the integrity of European designated site(s).
- Step 3 - Produce a long list of potential alternative solutions and screen these to produce a shorter list.
- Step 4 - Consider whether any short-listed potential alternative solutions are 'feasible' alternative solutions.
- Step 5 - Consider whether any feasible alternative solutions would have a lesser effect on the integrity of any European designated site.

10.2.15 Each step is explained below.

Step 1 - Identify the need for the Project and define its objectives

10.2.16 In order to make an assessment of whether there are or are not any alternative solutions to the Project, there must first be provided a definition of the need elements of the Project.

10.2.17 The NAS test is that there are no 'alternative solutions', not merely that there are no 'alternatives'. Therefore, alternative solutions are led by the circumstances of the plan / project itself, including the 'genuine or critical' objectives of the plan / project.[174] If an alternative plan or project could not meet the central, genuine and critical objectives to be met by the proposal, it may be rejected as not constituting an "alternative solution", even if that alternative would have less effect on the environment or a European site.[175]

10.2.18 Part 3 of the Stage 3 NAS assessment of this HRA Report sets out the 'genuine or critical' objectives of the Project and explains how these objectives reflect and are supported by relevant national and local policies. For the reasons discussed below, these are central, genuine and critical objectives derived from national planning policy and engineering constraints.

174 DTA Handbook, Part C13.1, Principles 10, 13 and 14; R (oao Plan B Earth and others) v Secretary of State for Transport [2020] EWCA Civ 214, para 96.
175 DTA Handbook, Part C13.1, Principle 14.

10.2.19 Under section 104(2) of the Planning Act 2008, when determining an application for development consent for NSIPs, the Secretary of State must have regard to any National Policy Statement ('NPS') which "has effect" in relation to development of the description to which that application relates, and under section 104(3), the Secretary of State must determine the application in accordance with that relevant NPS, save to the extent that one or more of the exceptions in sections 104(4) to (8) applies. Section 105 applies in relation to an application for an order granting development consent if no NPS "has effect" in respect of the application and therefore section 104 does not apply. Section 105(2) provides that in deciding the application the Secretary of State must have regard to *inter alia* any matters which he considers are both important and relevant to his decision. That can include relevant NPS and draft NPS, even where no NPS "has effect" in relation to the application. Section 106 enables the Secretary of State to disregard any representation (including evidence) which he considers *inter alia* relates to the merits of policy set out in an NPS. Section 106 applies whether an application is determined pursuant to section 104 or section 105.[176]

10.2.20 NPS therefore play an important role in decision-making when determining development consent for major infrastructure. Their function is to provide clarity on current government policy so that issues which are established as a matter of policy do not need to be debated as part of the planning process for individual projects.

10.2.21 Part 3 of the Stage 3 NAS assessment refers to the NPS's which are relevant in identifying the 'genuine or critical' objectives of the Project. The relevant NPS's are:

- The Overarching National Policy Statement for Energy ('NPS EN-1'). It is assumed that The Overarching NPS for Energy (EN-1) published on 22 November 2023 will have been designated by Parliament by the time the application is submitted but, if not, then the assessment will also have regard to The Overarching NPS for Energy (EN-1) designated in July 2011; and
- The National Policy Statement for Nuclear Power Generation ('NPS EN-6').

10.2.22 Defining the 'genuine and critical' objectives of the Project enables a list of relevant potential alternative solutions to be identified at Step 3.

176 See R (on the application of Together Against Sizewell C) v Secretary of State for Energy Security and Net Zero [2023] EWHC 1526 (Admin), at paragraphs 129-130.

Step 2 - Identify the potential harm the Project is predicted to cause to the integrity of the protected sites

10.2.23 As explained above, the shadow AA has concluded (see Section 9.16) that there is a risk to site integrity (through HPC fish entrapment) that cannot be excluded beyond reasonable scientific doubt from the Project, with respect to four European / Ramsar sites through the following qualifying features:

- Severn Estuary SAC: the Estuaries qualifying habitat feature through the risk of an effect on the typical fish species assemblage; and Twaite shad qualifying species;
- Severn Estuary Ramsar site: the Criterion 4 migratory fish assemblage;
- River Usk SAC: the Atlantic salmon and Twaite shad qualifying species; and
- River Wye SAC: the Atlantic salmon, Twaite shad and Allis shad qualifying species.

10.2.24 Part 4 of the Stage 3 NAS assessment provides further details about the risk to site integrity (through fish entrapment) that has been identified.

Step 3 - Produce a long list of potential alternative solutions to address potential harm and screen these to produce a short list

10.2.25 The first part of this step - covered in Part 5 of this Stage 3 NAS assessment - involves identifying a list of potential alternative solutions, which must be carried out objectively and broadly.[177] A broad and objective consideration of alternative solutions may include changing the proposed: location, scale, size, design, methodology, processes or means of achieving the objective, timing, operator / undertaker of the activity, development or facility.

10.2.26 Accordingly, the formulation of the long list of potential alternative solutions has not been constrained by economic considerations.

10.2.27 The second part of this step screens the long list of potential alternative solutions against the Project's need and the objectives (as defined in Part 3 of this Stage 3 NAS assessment); only alternatives that meet or deliver the need and its objectives are considered in Part 6 of this Stage 3 NAS assessment.

177 Withdrawn 2012 Defra Guidance, para 16, page 3.

Step 4 - Consider whether any short listed potential alternative solutions are ‘feasible’ alternative solutions

10.2.28 The Defra Guidance paragraph 18 (Ref. 2.5) states that (emphasis added):

“The consideration of alternatives should be limited to options which are financially, legally and technically feasible. An alternative should not be ruled out simply because it would cause greater inconvenience or cost to the applicant. However, there would come a point where an alternative is so very expensive or technically or legally difficult that it would be unreasonable to consider it a feasible alternative … If the authority considers an option is not feasible, it would not be necessary to continue to assess its environmental impacts.”

10.2.29 The consideration of alternatives should therefore be limited to options which are financially, legally and technically feasible. Those components of feasibility are defined as follows:

- Legal feasibility: An alternative solution is considered to be not legally feasible where there is a legal impediment or where, from a legal or consenting perspective, it would be unreasonably difficult to deliver an alternative because it would have ‘unacceptable’ impacts.
- Technical feasibility: A potential alternative would not be technically feasible where it is impractical, incapable of being implemented, technically unsound and/or would not meet nuclear safety and regulatory requirements (including health and safety).
- Financial feasibility: A potential alternative would not be financially feasible where its cost is disproportionately high in the context of the scale of the reduction in the environmental effect that the alternative would achieve. There are direct and indirect costs associated with potential alternative solutions, as follows:
  - Direct costs include the cost of using more expensive equipment or the additional costs of construction the alternative solution.
  - Indirect costs would arise from the consequences of (for example) extending the HPC construction schedule due to the adoption of an alternative methodology.

10.2.30 While economic costs cannot be the sole determining factor when deciding the choice of alternative solutions, a threshold may eventually be exceeded because it is prohibitively expensive or technically or legally difficult meaning it would be unreasonable to consider it a feasible alternative solution.[178]

10.2.31 Ordinarily, the consideration of whether any short listed potential alternative solutions are 'feasible' alternative solutions would be presented in Part 6 of this Stage 3 NAS assessment. For the reasons discussed below, none of the long list of potential alternative solutions listed under Step 3 make the short list. There are therefore no alternative solutions to assess at this stage.

Step 5 - Consider whether any feasible alternative solutions would have a lesser effect on the integrity of the affected protected sites

10.2.32 The assessment of alternative solutions must link back to the Article 6(3) Habitats Directive assessment. A 'zero option' or 'do nothing approach' should be used as a baseline for comparing potential alternative solutions in respect of the effect on integrity.[179] The consideration of alternative solutions must focus on the method of achieving the clearly defined need / objective of the proposed plan or project which has a lesser impact on the European site.[180]

10.2.33 As stated above, none of the long list of potential alternative solutions listed under Step 3 make the short list. There are therefore no alternative solutions to assess at Step 4 nor at this Step 5 to consider whether they would have a lesser effect on the integrity of the affected protected sites.

10.3 Part 3: The Project Need and Objectives

Introduction

10.3.1 This Part sets out the need for the Project and identifies the Project's 'genuine and critical' objectives, supported by relevant national and local policies.

---

178 Case-399/14 Grune Liga, paragraph 77; see also Joint Government Guidance, '3. Derogations: allow exceptions', 'Test 1'.

179 DTA Handbook, Part C13.1, Principle 8: see also Withdrawn Defra Guidance, para 17, Page 4.

180 Section 3, Joint Government Guidance.

10.3.2 Only alternatives that meet or deliver the Project's need and objectives move on to be considered at Step 4, which determines whether any short-listed potential alternative solutions are "feasible" alternative solutions.[181]

The need for the Project

10.3.3 The "Project" being assessed is the construction (already ongoing); operation; and (to the extent assessment is possible) decommissioning of the nuclear build project at HPC "as changed" by the DCO Material Change application to be made (comprising six changes to the design of HPC and the delivery of associated compensatory habitat measures).

10.3.4 NNB is applying to remove the requirement to fit an AFD system from the 2013 DCO because, after lengthy and careful analysis, NNB has concluded that there are significant technical feasibility problems associated with the design, installation, maintenance and repair of an AFD system in the hydrologically dynamic tidal conditions of the Severn Estuary. This presents two key risks with the development as currently authorised.

10.3.5 First, there would be indefinite delays whilst an AFD system was developed and installed. This is because there was (and remains) no engineering precedent anywhere in the world for fitting an AFD system to open water intake heads, such as those at HPC, in waters with a comparable tidal range and currents. Despite extensive work by NNB and its specialist advisors, the engineering difficulties proved so challenging that NNB made the decision in November 2017 not to proceed with the AFD system. If the Project is not approved and an AFD system is required, HPC would not be able to commence operations in mid-2027, as planned. It would instead be necessary to delay the commencement of operations, potentially indefinitely, until an appropriate system had been designed, developed and tested. Approval of the Project allows that delay to be avoided and will ensure that HPC is able to contribute to meeting the urgent national need for a reliable and secure supply of new nuclear power. This will make a very substantial contribution to meeting the UK's predicted increase in demand for electricity, the predicted shortfall in energy generation capacity of 95 GW by 2035, and the UK's policy to decarbonise. The urgent need for secure and reliable low carbon energy from new nuclear power at Hinkley Point is clearly established by Government policy, including NPS EN-1 and EN-6, and is discussed below in Objectives 1 and 2.

---

181 Those alternative solutions must also be less damaging to the European site and not have an adverse effect on the integrity on European sites. That assessment takes place at Step 5.

10.3.6 Second, an important element of the technical feasibility problems associated with an AFD system (or any other fish deterrent system) is that the works in connection with it would need to rely heavily on ROVs. The independent expert advice that NNB has received is that existing ROVs fall significantly short of being able to undertake the work associated with the installation, maintenance and repair of an AFD system. This means it is highly unlikely that ROV's would ever, on their own, be an effective solution for the complex tasks which the installation, maintenance or repair activities an AFD system would require. The reasons why ROV technology alone cannot be used are discussed in Objective 3 below.

10.3.7 In the absence of suitable ROV technology to undertake the necessary tasks at the level of accuracy and reliability required for the installation, maintenance and repair of an AFD system, NNB would need to rely heavily on the use of human divers to undertake these activities. Doing this would expose divers for significant periods on a regular basis to intolerable health and safety risks which could lead to their deaths. NNB is firmly of the view that compliance with health and safety legislation, principles and guidance could not be achieved if divers were required to undertake work at the level of frequency and exposure to the high risks that such complex work would entail. These intolerable health and safety risks are discussed in Objective 4 below.

10.3.8 For these reasons it is critical that the Project is approved and the construction and commissioning of HPC can continue without an indefinite delay or in a way which introduces intolerable health and safety risks.

Genuine and critical objectives

10.3.9 The following genuine and critical objectives of the Project have been identified, each of which is discussed in detail below:

- Objective 1 – the need for low carbon energy from new nuclear power at Hinkley Point to provide a secure and reliable energy supply for the UK;
- Objective 2 – the urgent need for low carbon energy production;
- Objective 3 – the need for the Project to be technically feasible;
- Objective 4 – the need for the Project to be carried out in compliance with health and safety legislation;
- Objective 5 – the need to minimise fish entrapment; and
- Objective 6 – the need for design feasibility.

Project Critical Objectives

Objective 1 – the need for low carbon energy from new nuclear power at Hinkley Point to provide a secure and reliable energy supply for the UK ("Energy Production at HPC Objective")

10.3.10 The first 'genuine and critical' objective is to continue construction of, and to and operate HPC as, a new nuclear power station comprising two reactor units ('the Units') that will operate for 60 years, with the combined capacity to produce 3.2GW.

The need for HPC

10.3.11 HPC is identified in the NPS EN-6 as one of eight sites in the UK considered suitable for a new nuclear power station. The Government recognises in EN-6 the potential for HPC to have adverse effects on the integrity of European sites, and therefore sets out an IROPI case for the adoption of EN-6, including the development of a new nuclear power station at Hinkley Point, notwithstanding this. While EN-6 identifies a number of sites as potentially suitable for the siting of new nuclear generating stations, it makes clear that all of the listed sites should be considered to be needed and these sites should not be seen as alternatives to one another.

10.3.12 The 2013 DCO application was submitted by NNB on 31 October 2011 and the 2013 DCO was granted on 18 March 2013. The Secretary of State's decision to approve the DCO confirmed the need for new nuclear power station and the suitability of the site at Hinkley Point for such development.

10.3.13 The significance of HPC is also reflected in the Secretary of State's HPC Decision Letter dated 19 March 2013 at paragraph 6.4, which stated:

"It is critical that the UK continues to have secure and reliable supplies of electricity. An increasing proportion of those supplies needs to come from low carbon sources. It is Government policy that new nuclear power should be able to contribute as much as possible to the UK's need for new electricity generating capacity."

10.3.14 HPC will be the first nuclear power plant to be built in the UK for more than 20 years. Once operational it will generate approximately 7% of the UK's national energy needs and will provide a safe and secure low carbon electricity supply. The electricity generated by HPC's two Units will power 6 million homes and offset nine million tonnes of carbon dioxide emissions a year, equivalent to taking nearly four million cars off the road annually. Nuclear power plants can also operate continuously at high output levels, providing reliable baseload power that can balance the fluctuations inherent in renewable energy sources. Baseload is the minimum amount of electricity that is needed to meet the electricity demand at any given time.

10.3.15 The urgent need for new nuclear power has more recently been reaffirmed by Government in deciding to grant development consent for the Sizewell C nuclear power station in Suffolk, and in the new EN-1. The Government has also clearly assumed that HPC will become implemented and operational within NPS EN1 at paragraph 3.3.52 which states "… *our analysis suggests additional nuclear beyond Hinkley Point C will be needed to meet our energy objectives*".[182]

Construction and the timeline for the operation of HPC

10.3.16 The construction of the Units at HPC in accordance with the 2013 DCO is well advanced. HPC is now around 60% constructed, putting it on a pathway for the commissioning of HPC to commence in 2024 following the installation of individual items of equipment. Commissioning is the process by which systems and components of nuclear power plants, after they have been constructed, are made operational and verified so they are in line with the original design and meet the required safety and performance criteria. Commissioning is one of the key steps towards putting into service a new nuclear facility. The commissioning process will continue as more equipment and systems are installed and will take place alongside ongoing construction and installation activities. This will continue until the first Unit becomes operational in mid-2027 and the second Unit becomes operational 12 months later in mid-2028.

10.3.17 The construction already undertaken includes the installation of the water intake heads on the seabed of the Severn Estuary.[183]

10.3.18 The commissioning and operation of HPC has already been delayed by a year. In May 2023, NNB made the difficult decision to delay the start date for the first Unit as a result of the disruption caused by the Covid-19 pandemic, which reduced the number of workers on site

182 NPS EN-1 published on 22 November 2023

183 This decision was made in order that the commissioning of HPC could remain on schedule so that the operational phase could commence in mid-2027.

and disrupted the supply chain. Given the urgent need for low carbon energy, it is imperative that the timeline for the commissioning and operation of HPC is not further delayed.

Conclusions

10.3.19 The need for low carbon energy from new nuclear power at Hinkley Point to provide a secure and reliable energy supply for the UK is established by NPS EN-1 and NPS EN-6. The 2013 DCO granted consent for the construction and operation of the Units at HPC, confirming the need for the development and the suitability of the site. Construction has subsequently commenced and HPC is 60% built and currently on course to have both its Units operational by mid-2027 and mid-2028 respectively.

Objective 2 - The urgent need for low carbon energy production

Introduction

10.3.20 Government policy establishes that there is an urgent need for low carbon energy to be produced in the UK.

10.3.21 This urgent need for new nuclear energy generating infrastructure is driven by the following factors:[184]

- The continuing growth in the demand for electricity;
- The retirement of existing nuclear generation capacity leading to a reduction in capacity from 8.9GW now to 1GW of capacity by 2035 from power stations that are currently operational;
- The shortfall in generation of 95GW by 2035 predicted by the National Audit Office;
- The scale of the need for nuclear new build;
- The UK's commitment to the net zero target for 2050;
- The continuity and reliability of supply delivered by nuclear energy as part of a diverse energy mix and the urgent need for new nuclear power stations.

184 Summarised by Mr Justice Holgate in paragraph 9 of Together Against Sizewell C Ltd, R (On the Application Of) v Secretary of State for Energy Security and Net Zero [2023] EWHC 1526 (Admin).

10.3.22 Taken together, these factors require HPC to become operational as soon as possible. Indeed, the urgent need for HPC to start producing low carbon energy from nuclear power has grown since the granting of the 2013 DCO.

10.3.23 In terms of the legal and policy context, this growing urgency has been driven by the declaration of a climate emergency by the UK Government on 1 May 2019[185] and the amendment to the Climate Change Act 2008 to commit the UK to achieving net zero by 2050 (compared to the previous target of an 80% reduction in emissions by 2050). Greater policy emphasis has also been placed on the urgent need for energy security for the UK.[186]

10.3.24 The urgent need for low carbon energy from new nuclear power is established in clear terms in the following key legislative and policy developments:

- NPS EN-6 (2011)
- Climate Change Act 2008 (2050 Target Amendment) Order 2019 (SI 2019/1056)
- NPS EN-1[187] (November 2023)
- Energy Security Plan (2023)
- Net Zero Growth Plan (2023)
- British Energy Security Strategy (2022)
- Net Zero Strategy (2021)
- Energy White Paper (2020)[188]
- Ten Point Plan for a Green Industrial Revolution (2020)

10.3.25 The following sections consider these key legislative and policy developments in more detail in the context of the driving factors for new nuclear energy generating infrastructure referenced above.

185 https://hansard.parliament.uk/Commons/2019-05-01/debates/85FE0864-18D1-42BA-9D3C-CB2D0958D067/EnvironmentAndClimateChange#contribution-4676855B-3A15-4CCB-817E-06814F3AB2C2

186 Energy Security Plan (March 2023) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1148252/powering-up-britain-energy-security-plan.pdf

187 NPS EN-1 published on 22 November 2023

188 Energy White Paper (2020) Energy White Paper (publishing.service.gov.uk) (Accessed 18 December 2023)

The increasing demand for electricity

10.3.26 The need for low carbon energy production is now urgent because of the increasing demand for electricity in the UK. This is for the following reasons.

10.3.27 The Government's policy of decarbonisation (discussed further below) will increase demand for electricity. NPS EN-1 makes clear the government is committed to:

"… putting the UK on the path to meeting its net zero emissions target by 2050 by taking steps to decarbonise the UK's power networks and take steps to adapt to the risks posed by climate change". [189]

10.3.28 Decarbonisation means that the UK is likely to become more dependent on electricity generation. This is because electrification to reduce emissions in large parts of the transport, heating and industrial sectors could lead to more than half of final energy demand being met by electricity in 2050. This represents a "*doubling in demand for electricity*", up from the 17% of final energy demand being met by electricity in 2019 (see NPS EN-1[190] paragraphs 2.1.3 and 2.3.7).

10.3.29 If demand for electricity doubles by 2050, NPS EN-1[191] states that the UK will need a fourfold increase in low carbon generation and significant expansion of the networks that transport power to where it is needed. NPS EN-1[192] recognises that whilst reducing total demand for energy is a key element of the government's strategy for meeting its energy objectives, even with a reduction in final energy demand the share of electricity in the system is likely more than double (see NPS EN-1[193] paragraph 3.3.9).

10.3.30 NPS EN-1[194] leaves no doubt about the urgent need for new electricity capacity and, in particular, low carbon capacity. The demand for electrical energy continues to grow, and the modelling undertaken by the Department for Energy Security and Net Zero suggests that this

189 NPS EN-1 (2023) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147380/NPS_EN-1.pdf (Accessed 18 December 2023)

190 NPS EN-1 published on 22 November 2023

191 NPS EN-1 published on 22 November 2023

192 NPS EN-1 published on 22 November 2023

193 NPS EN-1 published on 22 November 2023

194 NPS EN-1 published on 22 November 2023

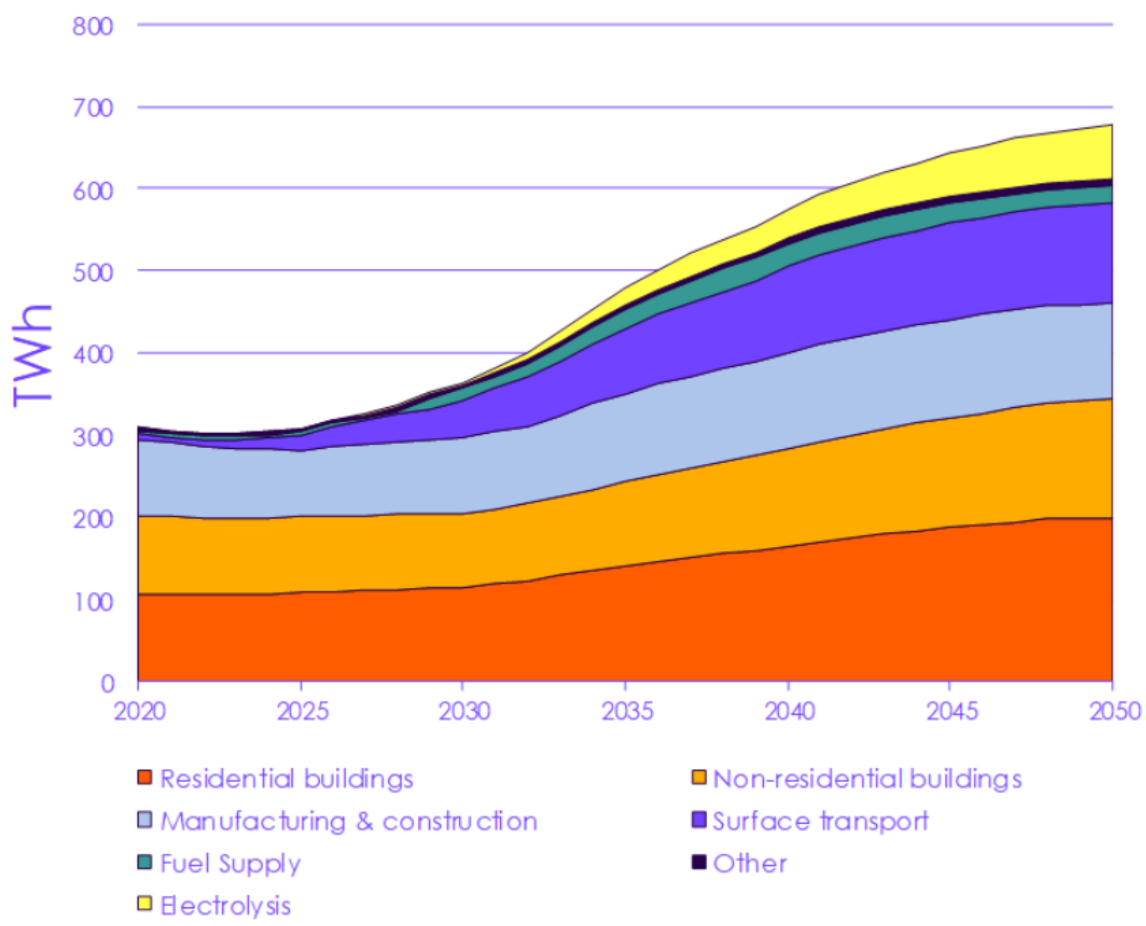
trend will continue despite efforts to promote better energy conservation and improvements in energy efficiency. Consequently, the NPS makes clear:

"Given the urgent need for new electricity infrastructure and the time it takes for electricity NSIPs to move from design conception to operation, there is an urgent need for new (and particularly low carbon) electricity NSIPs to be brought forward as soon as possible, given the crucial role of electricity as the UK decarbonises its economy." (see NPS EN-1 paragraph 3.3.83).

10.3.31 The Sixth Carbon Budget,[195] published by the Climate Change Committee in December 2020, graphically shows the predicted increase in electricity demand up to 2050, as shown in Figure 10-1 below.

195 https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Electricity-generation.pdf (Accessed 18 December 2023)

Figure 10-1: Electricity demand by sector 2020-2050



The decreasing supply of electricity

10.3.32 The need for low carbon energy generation to meet increasing demand is made more urgent in the context of a significant amount of electricity capacity being set to be retired by 2035. The National Audit Office identifies in its Report "*Nuclear power in the UK*"[196] that c. 64GW

196 National Audit Office, Nuclear Power In the UK, July 2016, https://www.nao.org.uk/reports/nuclear-power-in-the-uk/

of the UK's electricity capacity – i.e. over 60% of current UK generating capacity – is expected to be lost due to plant retirements by 2035. This comprises coal-fired power stations closing due to the need to reduce carbon emissions as well as nuclear power stations reaching the end of their operational life. Indeed, the UK currently has eight operational nuclear plants with a combined capacity of 8.9GW, and all but one of these is scheduled to close by 2030, with the other, Sizewell B, planned for decommissioning in 2035.

10.3.33 The decline in nuclear power was also highlighted by a report "*Nuclear Electricity in the UK*"[197] published by Department for Business, Energy and Industrial Strategy ('BEIS'). In 2023 BEIS was split to form the Department for Energy Security and Net Zero ('DESNZ') and the Department for Business and Trade. The report states that the UK's nuclear capacity peaked between in 1995 with the opening of Sizewell B, and that since then, no new plants have opened and eight have closed.

10.3.34 The decline in nuclear power is set in the context of a significant increase in demand for electricity as set out in the previous section. The Science, Innovation and Technology Select Committee issued its report "*Delivering Nuclear Power*" to the House of Commons in July 2023[198], which states:

"The Government's response, in its Energy Security Strategy, published in April 2022, is to aim to achieve 24 GW of nuclear capacity by 2050. This is an ambitious aim: it equates to three times current nuclear capacity, even before plant retirements, and it is almost double the highest nuclear installed capacity the UK has ever achieved. The Government estimated that nuclear power will then contribute around 25% of the UK's electricity supply" (page 4 paragraph 6)

...

"We believe that the Government is right to identify nuclear power as an important contributor to meeting our future electricity needs. Given the otherwise declining contribution of nuclear power, this ambition requires a substantial programme of nuclear new build" (page 5 paragraph 9)

---

197 BEIS (2019) Nuclear electricity in the UK - Nuclear_electricity_in_the_UK.pdf (publishing.service.gov.uk) (Accessed 18 December 2023)

198 https://committees.parliament.uk/publications/41092/documents/200324/default/ (Accessed 18 December 2023)

10.3.35 The national interest requires that HPC becomes operational as soon as possible, as it alone will provide 3.2GW of new energy generation capacity.

10.3.36 The crucial role HPC will play in generating electricity to help meet growing demands is directly reflected in NPS EN-1[199] at paragraph 3.3.52. This paragraph acknowledges the fundamental importance of HPC as well as additional new nuclear power stations. It says:

“Our analysis suggests additional nuclear beyond Hinkley Point C will be needed to meet our energy objectives.”

The need for new electricity and new nuclear power

10.3.37 Domestic and economic life in the UK relies on a secure supply of electricity. NPS EN-1[200] says:

“Energy underpins almost every aspect of our way of life. It enables us to heat and light our homes; *to manufacture goods; to produce and transport food; and to travel to work and for leisure. Our businesses and jobs rely on the use of energy. Energy is essential for the critical services we rely on – from hospitals to traffic lights and mobile devices. It is difficult to overestimate the extent to which our quality of life is dependent on adequate energy supplies.”* (Paragraph 2.3.1)

10.3.38 To reduce the environmental impacts associated with the essential use of energy, and to meet legal/international commitments to reduce greenhouse gas emissions, it is increasingly necessary that this energy supply comes from low carbon sources, such as nuclear.

10.3.39 Government policy has established that this is necessary notwithstanding the progress that can be (and has been) made with regards energy efficiency and demand management. This is because these gains must be set against the backdrop of decreasing energy supply.

10.3.40 In light of the doubling in demand for electricity by 2050 and the reduction in electricity capacity from existing nuclear power stations (as set out in the above two sections), NPS EN-

199 NPS EN-1 published on 22 November 2023

200 NPS EN-1 published on 22 November 2023

1[201] places an emphasis on the important role consented infrastructure projects, such as HPC, will have. Paragraph 3.2.4 states:

"A large number of consented projects can help deliver an affordable electricity system, by driving competition and reducing costs within and amongst different technology and infrastructure types. Consenting new projects also enables projects utilising more advanced technology and greater efficiency to come forward."

10.3.41 For this reason, the UK urgently needs HPC to be generating electricity as quickly as possible.

Policy to decarbonise

10.3.42 The Climate Change Act 2008 (2050 Target Amendment) Order 2019 (SI 2019/1056) came into force on 27 June 2019. This commits the UK government, by law, to reducing greenhouse gas emissions by 100% of 1990 levels (net zero) by 2050 (being an increase from 80% as set out originally).

10.3.43 NPS EN-1[202] states that to meet the target to cut greenhouse gas emissions to net zero by 2050 requires a step change in the decarbonisation of the UK energy system. This in turn necessitates a significant amount of energy infrastructure, both large and small-scale. NPS EN-1[203] recognises that significant levels of energy infrastructure development are vital to ensure the decarbonisation of the UK economy (paragraph 5.3.1)

10.3.44 This need for the UK to decarbonise is also reflected within the foreword to the Energy White Paper (December 2020).[204] This recognises that the Government has set a world-leading net zero target but that simply setting the target is not enough. Rather, failing "…*to act will result in natural catastrophes and changing weather patterns, as well as significant economic damage, supply chain disruption and displacement of populations*".[205] The Energy White Paper identifies that nuclear power continues to be an important source of reliable clean electricity, and that additional nuclear beyond HPC will be needed in a low-cost 2050 electricity system of very low emissions, and that we must be ready for this.

201 Draft NPS EN-1 published in March 2023
202 NPS EN-1 published on 22 November 2023
203 Draft NPS EN-1 published in March 2023
204 Energy white paper: Powering our net zero future - GOV.UK (www.gov.uk) (Accessed 18 December 2023)
205 See page 2 of the Energy White Paper (December 2020).

10.3.45 NPS EN-1[206] explains that there is a need to transform the energy system, tackle emissions, and continue to ensure a secure and reliable supply of energy. This means securely delivering energy at affordable prices for households and businesses. Doing this requires increasing the supply of clean energy from renewables, nuclear and hydrogen manufactured using low carbon processes (paragraph 2.3.6)

10.3.46 Nuclear power has the twin advantages of being low carbon and capable of delivering electricity at scale. In addition, nuclear power can also provide reliable baseload power that can balance the fluctuations inherent in renewable energy sources. It is for these reasons that nuclear power forms a key part of the Government's energy strategy for meeting electricity needs. For example, the importance of nuclear is reflected within the Government's Net Zero Growth Plan,[207] and also within paragraph 3.3.51 of NPS EN-1,[208] which states:

"Nuclear fission already provides the UK with continuous, reliable, safe low-carbon power. Nuclear plants produce no direct emissions during operation and have indirect life cycle GHG emissions comparable to offshore wind. Power stations with an estimated lifetime of 60 years provide large amounts of low carbon electrical power, using a relatively small amount of land. Nuclear, alongside other technologies could also offer broader system benefits, such as low carbon hydrogen production through electrolysis, or low carbon heat. In addition, nuclear generation provides security of supply benefits by utilising an alternative fuel source to other thermal plants, with a supply chain independent from gas supplies."

10.3.47 NPS EN-6 also advises that decision makers should give 'substantial weight' to the benefits (including the benefit of displacing carbon dioxide emissions) that would result from the delivery of a nuclear power station (paragraph 2.2.24).

10.3.48 The important role of nuclear was recently reaffirmed in the Secretary of State's decision letter for Sizewell C (dated 20 July 2022). The decision letter said:

---

206 NPS EN-1 published on 22 November 2023

207 The Net Zero Growth Plan (March 2023) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147457/powering-up-britain-net-zero-growth-plan.pdf (Accessed 18 December 2023)

208 NPS EN-1 published 22 November 2023

"The Secretary of State's decision is predicated by the principal and essential benefit of the Proposed Development as a significant contribution to limiting the extent of climate change in accordance with the objectives of the Paris Agreement."

10.3.49 The long-term decarbonisation of the UK energy system and economy, and a reduction in greenhouse gases, is critical to meeting Government legal commitments regarding Net Zero targets and in doing so try to secure ecosystem resilience.

10.3.50 The Examining Authority's Report for Sizewell C (dated 25 February 2022),[209] acknowledges that a delay in the deployment of nuclear could result in the UK being locked into a higher carbon energy mix for a longer period than is consistent with the Government's ambitions to decarbonise electricity supply (paragraph 5.19.133). Paragraph 5.19.138 of the Report stated:

"The ExA considers that relevant government publications and policy statements since the submission of the application reinforce the urgent need for significant increases in electrification in order to meet net zero by 2050, and make clear the crucial role that low-carbon technologies, including new nuclear, have to play in supporting intermittent renewables in achieving this at low cost. The ExA concludes that there is an urgent need for new nuclear energy infrastructure of the type comprised by the Proposed Development."

10.3.51 The Examining Authority re-iterated the important role nuclear has in decarbonisation at paragraph 5.19.265 of its Report:

"…the Government has clearly and consistently explained the role that nuclear power generation has to play in decarbonising the energy sector and the wider economy. Furthermore, it is the Government's position on need which is determinative. There is an urgent need for new nuclear energy generating infrastructure of the type comprised by the Proposed Development."

10.3.52 New nuclear power, including HPC, has an important role in the long-term decarbonisation of the UK energy system and economy, and a reduction in greenhouse gases. HPC is critical to meeting Government legal commitments regarding Net Zero targets. It is imperative that the operation of HPC is not delayed as this would increase the risk of the UK being locked into a

209 Sizewell C Examining Authorities Report (Volume 3 of 4) https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010012/EN010012-011162-SZC-Volume-3-Sections-5.14-5.23-FINAL.pdf (Accessed 18 December 2023)

higher carbon energy mix for a longer period than is consistent with the Government's ambitions to decarbonise electricity supply.

Energy Security

10.3.53 NPS EN-1[210] states that the security of energy supply is a top priority as the UK moves to decarbonise gas supply. It explains at paragraph 2.5.6 that the British Energy Security Strategy ('BESS') emphasises the importance of addressing the UK's underlying vulnerability to international energy prices by reducing our dependence on imported oil and gas, improving energy efficiency, remaining open minded about our onshore reserves including shale gas, and accelerating deployment of renewables, nuclear, hydrogen, carbon capture usage and storage, and related network infrastructure, so as to ensure a domestic supply of clean, affordable, and secure power as we transition to net zero.

10.3.54 Paragraph 3.3.53 of NPS EN-1[211] emphasises the importance of nuclear in relation to energy security. It says:

"As outlined in the British Energy Security Strategy, the government is increasing our plans for deployment of civil nuclear power by 2050s."

10.3.55 The BESS,[212] published in April 2022, is unequivocal about the role of nuclear power in this context. It says:

"We can only secure a big enough baseload of reliable power for our island by drawing on nuclear. Our aim is to lead the world once again in a technology we pioneered so that by 2050, up to a quarter of our power consumed in Great Britain is from nuclear."

10.3.56 The BESS states that the Government will increase plans for:

"… [the] deployment of civil nuclear to up to 24GW by 2050 – three times more than now and representing up to 25% of our projected electricity demand."

---

210 NPS EN-1 published 22 November 2023

211 NPS EN-1 published 22 November 2023

212 British Energy Security Strategy April 2022: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1069969/british-energy-security-strategy-web-accessible.pdf (Accessed 18 December 2023)

10.3.57 Following the BESS, the Government published the Energy Security Plan in March 2023, which sets out the steps the Government is taking to ensure the UK is more energy independent, secure and resilient. The Energy Security Plan builds on the Government's ambitions set out in the BESS and the Net Zero Strategy (2021).

10.3.58 The Energy Security Plan recognises the significance of Hinkley Point C. It says at page 28:

"Nuclear generation is a vital component of our future electricity system. We signed the contract for the first nuclear power station in a generation at Hinkley Point C, have made a ground-breaking investment of £700 million in Sizewell C in partnership with EDF, and have established Great British Nuclear to deliver a nuclear programme."

10.3.59 The Energy Security Plan emphasises the importance of nuclear power in meeting the projected UK 2050 electricity demand, stating at page 29:

"The Government is committed to ensuring that the UK is one of the best places in the world to invest in civil nuclear power and is taking the steps to revitalise the UK's nuclear industry. The British Energy Security Strategy set out our ambition for deploying up to 24 gigawatts by 2050, around 25% of our projected 2050 electricity demand."

10.3.60 As discussed above, whilst energy demand is increasing due to the electrification across industries and the drive to decarbonisation, supply is decreasing partly due to coal-fired power stations closing and existing nuclear power stations reaching the end of their operational life. This increase in demand and decrease in supply sits within the context of a shift to renewables such as wind and solar PV. These renewable sources can generate a large amount of energy, but their output is less predictable, and they are often located in locations away from the centre of demand. These are seen as key challenges in operating a decarbonised power system and are reflected in the "Decarbonisation of the Power Sector" report to the Business, Energy and Industrial Strategy Committee (dated 28 April 2023).213 Paragraph 15 of the report states:

"A decarbonised electricity system, with a high penetration of renewables, will come with challenges. Balancing supply and demand is expected to become harder. This is driven not only by the less predictable output of renewables, but also by new demands for electricity"

---

213 Decarbonisation of the Power Sector" report to the Business, Energy and Industrial Strategy Committee (dated 28 April 2023) https://committees.parliament.uk/publications/39325/documents/193081/default/ (Accessed 18 December 2023)

10.3.61 The report goes on to state:

"The expansion of renewables, especially offshore wind, will mean that more generation is located on the periphery of the network (for instance in Scotland or East Anglia or Cornwall), situated at greater distances from large centres of demand (such as South East England)"

10.3.62 HPC will be a secure and reliable source of 3.2GW of low carbon energy within an uncertain market. In doing this, HPC will operate continuously at high output levels, thereby providing reliable baseload power. It is therefore fundamental to the national interest that HPC becomes operational as soon as possible. The urgency for HPC is reiterated at paragraph 89 of the report. It says:

"The Nuclear Industry Association told us it has been "known for decades when these stations would retire and that the impact has been more gas burning". Dame Sue Ion, an internationally recognised expert on nuclear power policy, told us:

As the stable nuclear stations close down, currently the only firm power that we have that is available to us is coal and gas. In times where there is low wind and low solar, it will be the fossil fuels that make up that gap because that is what the alternative is.

The fall in nuclear output will be partly offset when Hinkley Point C, with a capacity of over 3 GW, comes online in the late 2020s. However, National Grid Electricity System Operator (ESO) does not expect nuclear capacity to return to current levels until 2035."

10.3.63 As nuclear power is a secure and reliable source of energy, it can also help reduce volatility in energy prices. This has been set out by EDF in previous written submissions to Parliament.[214] These submissions are reflected in paragraph 96 of the Decarbonisation of the Power Sector report, which states:

"…according to French utility EDF which is leading the Hinkley Point C project, building more nuclear plants could help reduce volatility in energy prices by reducing the UK's exposure to international gas prices and lowering the overall cost of the system, reducing the curtailment of intermittent renewables."

214 NNB Generation Company (SZC) Limited (DPS0053); EDF (DPS0059)

Future energy modelling

10.3.64 The urgent need for nuclear power is clearly established by national policy. It is also useful to consider the energy modelling prepared by BEIS in more detail to understand how this has informed the identification of that urgent need.

10.3.65 BEIS published the Annex O: Net Zero and the power sector scenarios[215] in December 2020. It shows two illustrative net zero electricity demand and generation scenarios. BEIS modelling identifies two illustrative power sector demand scenarios that would support reaching net zero (with 2050 power sector demands of between 575TWh and 672TWh). To put this into context, the total electricity supplied by UK generation sources and imports is currently around 300TWh. These scenarios are not government targets or policy (the BEIS analysis notes that there are many different possible pathways for the power sector) but they do illustrate the scale of new low carbon generation required for the power system to meet net zero.

10.3.66 Under either scenario nuclear generation would rise above 2020 levels by 2035 (taking into account existing plants closing and being replaced by new nuclear generation). This would involve around 8GW of new build nuclear capacity by 2035. The BEIS analysis projects that the new build nuclear requirement could be between 20GW and 40GW by 2050 (for the lower and higher scenario respectively).

10.3.67 HPC and Sizewell C together would deliver around 6.4GW of capacity. Therefore, new nuclear build capacity would be required in addition to HPC and Sizewell C by 2035 in order to achieve the 8GW capacity relied upon in the BEIS modelling.[216] Between three or four times more new nuclear energy would be required to deliver the potential scale of capacity identified in the BEIS 2050 projections of 20GW – 40GW (for the lower and higher scenario respectively).

215 Annex O: Net Zero and the power sector scenarios (December 2020) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1059067/annex-o-net_zero-and-the-power-sector-scenarios.pdf (Accessed 18 December 2023)

216 Initial consenting activities (Stage 1 consultation and EIA scoping) for the Development Consent Order has started in relation to Bradwell B in 2020. However, no further progress has been made since and, therefore, Bradwell B is not expected to become operational before 2035. This information comes from the Bradwell B project website, accessed on 7 December 2023 - About the Project - Bradwell B Project Site.

10.3.68 To put this into further context, in the preceding 30 years to 2020, the UK has delivered only 2GW of new build capacity.

National Grid Future Energy Scenarios and Net Zero Growth Plan

10.3.69 The urgent need for new nuclear energy has also been raised by the National Grid Electricity Systems Operator ('ESO'). National Grid ESO's Future Energy Scenarios published in July 2023217 confirms that the need for new nuclear generation is acute if the 2050 emissions targets are to be met. It stated that HPC is the only new nuclear capacity expected ahead of 2033; but this new capacity will be more than offset by closures of existing nuclear stations over this same period. Some delays in closures of existing nuclear plant have increased capacity expectations for nuclear generation in the 2020s. However, the existing nuclear fleet is ageing and, by 2030 the only reactors on the system are expected to be Sizewell B and the newly built HPC in all scenarios. This is expected to leave nuclear capacity at 4.4GW in 2030 (comprised of 3.2GW from HPC and 1.2GW from Sizewell B), not recovering to current levels before 2035.

10.3.70 In the Net Zero Growth Plan (March 2023)[218] the Government stressed the important role of nuclear in helping the UK become a net zero economy by 2050. Within the Plan the Government aims to deliver up to 24GW of nuclear capacity by 2050.

10.3.71 National Grid ESO explained that there are already potential challenges if the Government is to meet its ambition of delivering 24GW of nuclear generation capacity to be installed by 2050, even taking into account the contribution made by HPC and Sizewell C. It stated:

"Based on our stakeholder engagement, within our scenarios the earliest date we see SMRs [Small Modular Reactors] connected to the system is 2033, after which point Consumer Transformation sees 8 GW installed over the subsequent ten years, at a build rate of approximately two per year. Alongside an additional large-scale nuclear reactor delivered in the 2030s, this is a total of approximately 16 GW of capacity from the mid-2040s. To reach the 24 GW target would likely require the acceleration of SMR deployment and/or the delivery of additional large scale reactor(s)."

217 National Grid ESO Future Energy Scenarios July 2023 https://www.nationalgrideso.com/document/283101/download (Accessed 18 December 2023)

218 The Net Zero Growth Plan (March 2023) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147457/powering-up-britain-net-zero-growth-plan.pdf (Accessed 18 December 2023)

10.3.72 National Grid ESO is therefore highlighting a shortfall in nuclear power generation even when taking into account the contribution made by Hinkley Point C, Sizewell C and new small modular reactors.

Conclusion

10.3.73 The urgent need for nuclear power is clearly established by national policy. In this context, the need for HPC has only increased since the granting of the 2013 DCO. The construction of the Units at HPC in accordance with the 2013 DCO is well advanced. HPC is now around 60% constructed, putting it on a pathway for the first Unit to become operational in mid-2027. The second Unit is due to commence operations 12 months later, in mid-2028. Accordingly, HPC is due to become operational at least 7 years before Sizewell C, the next nuclear power station due to be constructed in the UK. Any potential alternative solution which would delay the operation of HPC would be incapable of meeting this urgent need objective.

10.3.74 Indeed, it is because of this urgent need for the production of low carbon energy in the UK that the decision was made by NNB to install the intake heads in the Severn Estuary in the summer of 2022. This decision was made in order that the commissioning of HPC could remain on schedule so that the operational phase could commence in mid-2027.

Objective 3 – the need for the Project to be technically feasible

Introduction

10.3.75 It is an essential objective of any plan or project that it is technically feasible. Only technically feasible alternative solutions can be put forward for consideration. In this case, NNB is applying to remove the requirement to fit an AFD system from the 2013 DCO because, after lengthy and careful analysis, NNB has concluded that it is not technically feasible to install (and therefore maintain and repair) an AFD system (or any other fish deterrent system) in the Severn Estuary off Hinkley Point.

10.3.76 The significant technical feasibility concerns around the design, installation, maintenance and repair of an AFD system in the hydrologically dynamic tidal conditions of the Severn Estuary are discussed below. An important element of the technical feasibility problems associated with an AFD system (or any other fish deterrent system) is that the works in connection with it would need to rely heavily on ROVs.

10.3.77 However, an independent expert[219] who has assessed the available technology, has confirmed that existing ROVs fall significantly short of being able to undertake the work associated with the installation, maintenance and repair of an AFD system.[220] This independent expert advice has also confirmed that it is highly unlikely that ROVs would ever on their own be an effective solution for the complex tasks which the installation, maintenance or repair activities an AFD system would require. The reasons why ROV technology alone cannot be used for the installation, maintenance and repair tasks for an AFD system at the HPC intake location are discussed below.

10.3.78 In the absence of suitable ROV technology to undertake the necessary tasks at the level of accuracy and reliability required for the installation, maintenance and repair of an AFD system, NNB would need to rely heavily on the use of human divers to undertake these activities. The intolerable health and safety risks associated with any significant reliance on divers for these purposes is discussed below in the Health and Safety Objective.

Summary of the proposed material change to the 2013 DCO

10.3.79 At HPC, just like its predecessor (Hinkley Point B), a cooling water system will be installed which takes seawater from the Bristol Channel and uses it to condense the steam being passed through the turbines. Water intake and outfall tunnels extending approximately 3.3km and 1.9km (respectively) into the Bristol Channel will abstract and return water used in the cooling process. A full description of the cooling water system is set out in Appendix 2 of the Consultation Overview Document. No fish protection measures were included in the design of Hinkley Point A or Hinkley Point B, which operated for 35 years and 46 years respectively, and ceased operations in 2000 and 2022 respectively.

10.3.80 However, three fish protection measures were incorporated into the design of the cooling water system for HPC, as consented by the 2013 DCO. These measures are described in Sections 6.2.22 to 6.2.28 (above). The AFD system was proposed as a measure to help deter some species of fish from entering the power station's cooling water system by projecting underwater sound that can cause those fish to swim away from the entrance to the cooling water tunnels.

219 Stephen J Garven MEWI MAE.

220 As the decommissioning phase for HPC is 60 years away, and the approach to it is very different to installation and maintenance, then it may be possible with further technological developments for ROVs to be used as part of the decommissioning process.

10.3.81 An AFD system was intended to be the first fish protection measure that fish would encounter in the cooling water system design. In addition to this, the capped head design of the LVSE intake heads have been designed to minimise the potential for entry to the intake tunnels by any fish not deterred by an AFD system. For those fish that do nevertheless enter the intake tunnels, the FRR system is designed to recover and return them to the Bristol Channel quickly and with as little harm as possible.

10.3.82 The Project will include the LVSE with capped head and the FRR, but NNB is proposing to remove the 2013 DCO requirement to install the AFD system.

The AFD system

10.3.83 The purpose of an AFD system is to deter those fish that are sensitive to sound from approaching the intake heads. The effectiveness of an AFD system is dependent upon the hearing ability of the fish species concerned. The hearing sensitivity of species varies significantly.

10.3.84 Although there are examples of AFD systems being used at power stations in the UK and around the world, there are no permanent examples of such systems being installed in an offshore environment, or in conditions as harsh as those encountered in this part of the Bristol Channel. AFD systems are typically installed near the shoreline within sheltered estuaries or inland waters (rivers and lakes). AFD systems are easier to construct and maintain in such locations, as fewer sound projectors are required and the proximity of the intake to the shore means that the system can be constructed and maintained with limited disruption being caused by weather, water clarity and tidal conditions.

10.3.85 At the time of the 2013 DCO, AFD systems were regarded as emerging best practice. However, a design had not at that time been worked up by NNB or any other operator around the world in a location similar to HPC. It was agreed that detailed design would be carried out by NNB following the granting of the 2013 DCO which would then be presented as part of a submission to discharge 2013 DCO requirement CW1. NNB therefore undertook an extensive two-year programme to develop a design for an AFD system that would work during the operation of the power station, taking into account the following key considerations:

- The hearing sensitivity of fish and marine organisms present in the area.

- The isolated offshore location. This is because the intake heads would be located in an exposed location which is subject to high wave heights and frequent winter storms. These reduce the windows of time available to construct and maintain an AFD system.
- The tidal conditions. This is because the Bristol Channel is characterised by a very large tidal range and short period of 'slack water', where there is no significant movement either way in the tidal stream water. The tidal range (more than 10m between high and low tide) and fast current velocities (up to 1.8 metres per second at the intake head locations) mean that the only time available to undertake maintenance safely is approximately 30 to 60 minutes per tide at slack water.
- The water in the Severn Estuary has zero or near zero visibility conditions because of the high levels of suspended sediment (turbidity). This presents significant risks and constraints for offshore installation, maintenance and repair activities, particularly for divers.
- The nuclear safety classification of the intake heads. The sound modelling undertaken by NNB confirmed that the sound projectors for an AFD system would need to be mounted on or close to the intake heads in order to provide effective fish deterrence. However, as the cooling water system provides a function that is safety critical for the operation of the reactors, the design of the AFD system would need to meet the high design standards that are applied to all of HPC's safety critical systems.

10.3.86 Reflecting the complexity of these considerations, the optimum design identified by NNB would require a total of 288 underwater sound projectors (72 projectors per intake head), located along the sides of each intake head.

10.3.87 The installation of permanent structures with rails and / or lifting frames to raise the sound projectors out of the water for maintenance was considered but was concluded not to be practical. The sound projectors would therefore need to be fixed to structures and installed / recovered (for maintenance) in clusters by divers.

10.3.88 Figure 3-2 (above) illustrates a potential design identified by HPC (AFD system infrastructure shown in yellow).

10.3.89 There was (and remains) no engineering precedent anywhere in the world for fitting an AFD system to open water intake heads, such as those at HPC, in waters with a comparable tidal range and currents. This was recognised by the Environment Agency, which stated in 2019 that:

"... very few studies discuss the cost of installing, operating and maintaining the systems. The safety of operating and maintaining the systems is rarely addressed, especially for nuclear power plants where continued cooling water supply is of vital importance for the safe running of the plant. Equally there are very few studies that discuss the feasibility of installing the behavioural deterrent technologies in a range of environments and for different sites...".[221]

10.3.90 This remains the position.

Functional requirements for an AFD system at HPC

10.3.91 At a high level, an AFD system is comprised of the following three elements:

- Sound projectors: The sound projectors are responsible for generating the sound waves which deter the fish. They need to be able to output sound across the required frequency range and the larger the sound pressure level emitted per sound projector, the fewer the number of sound projectors required to achieve the target sound levels. The reliability of the sound projectors is important and the Mean Time to Failure determines the number of additional (spare) sound projectors required to meet the requirements of maintenance operations to replace failed units, thereby ensuring maintenance of the correct sound field. The extensive studies during the NNB optioneering work confirmed that 288 sound projectors would be required for the AFD to meet the sound requirements (72 sound projectors per intake head).
- Sound projector mounting structures: The individual sound projectors must be mounted onto the intake heads which are already installed on the seabed. The size, shape and positioning of the mounting structures will therefore have to be designed based on the intake head structures in their current design and position on the seabed. This is important because how the sound projectors are deployed will have an impact on the sound field they produce. Key considerations for the sound projector mounting structures will include the impact of these structures on the operation of the intake heads, which are nuclear safety classified structures, and how these mounting structures will be retrieved during maintenance operations.
- Power supply and communications systems: The AFD system requires an electrical power supply, as well as the relevant communications and diagnostics links. Continuity of supply is

221 Environment Agency, Nuclear power station cooling waters: evidence on 3 aspects, ref: SC170021, page 25 - DEFRA file sharing service (sharefile.com) (Accessed 18 December 2023)

important and cannot be intermittent. Reliability of all the components making up the power supply system is essential to maintain continuous generation of a deterrent sound field and to minimise maintenance.

10.3.92 Ensuring that an AFD system comprising these three elements can be installed and maintained, such that it remains functioning over the 60 year life of HPC, is an extremely complex exercise, particularly in light of the harsh environmental conditions in the Severn Estuary.

NNB's AFD design process

10.3.93 A large-scale research, optioneering and design exercise was undertaken by NNB (from 2014 to 2017 with some detailed specialist work preceding this in 2011). The purpose of this exercise was to try to find the optimal solution for the AFD system at HPC. This has involved:

- examining Environment Agency requirements and best practice;
- literature review of academic papers and liaising with experts in the field;
- analysing sites with operational AFD systems;
- analysing the market for potential suppliers;
- producing a set of requirements for the AFD system at HPC, taking into account both the nature and scale of the project, as well as the environmental conditions encountered in the Severn Estuary;
- a pre-optioneering phase to determine the most viable concepts for each of the work packages making up the overall AFD system;
- an optioneering phase to select the finalised concept for each work package; and
- design development of the finalised overall concept.

10.3.94 From this extensive and exhaustive exercise, the following conclusions were reached:

- The sound projectors must be mounted along the intake screens at as low an offset distance as possible.
- The sound envelope must maintain a strong acoustic gradient with reducing sound pressure levels with distance from the intake screens.

- Sound pressure levels must be >160 db re 1µPa across the surface of the intake screens. Sound pressure levels needs to be maintained in all tidal states, demonstrated by appropriate acoustic modelling.
- The sound frequency should be in the range 30-600 Hz with the capability of operating up to 2,000 Hz.
- There is only one sound projector supplier on the market with commercial scale installations that have proven efficiency in deterring fish. As this supplier additionally has acoustic modelling capabilities and knowledge of sound signal patterns effective in deterring fish, pre-optioneering and optioneering analysis were performed on the basis of their existing low frequency sound projector technology.
- The low frequency sound projector technology, which is used at Doel and Pembroke, requires frequent cleaning and replacement in environmental conditions which are far more benign than those encountered at HPC. The maintenance of sound projects at these sites is a major undertaking, which are on a much smaller scale than HPC with a much greater ease of access. The sound projector technology will require significant design development and improvement both to render it suitable for the conditions at HPC and also to extend the service life to an interval which is compatible with the scale of the plant and the limited access. However, even if this is achieved, it would still mean exposing personnel to frequent maintenance operations in hazardous conditions.
- During the pre-optioneering and optioneering phases, different AFD structure types were analysed with both surface and subsea ROV or diver retrieval of sound projector clusters. However, none of the surface retrieval structural options were found to be feasible for implementation at HPC, from both a technical and acoustic field perspective. Although the retained concept (subsea discrete lightweight structures) presents a greater challenge in terms of maintenance due to the requirement for diver and ROV intervention, it was the only solution allowing the sound projectors to be mounted close enough to the intake heads to ensure effective fish deterrence and presenting an acceptable nuclear safety impact with regard to having large, heavy structures around the intake heads.
- The retained concept was then further developed to arrive at the finalised basic design, which was shown to generate a highly effective acoustic field with no adverse impact on intake flow hydraulics.

10.3.95 NNB engaged Fish Guidance Systems in order to help formulate the initial concept design for the AFD and engaged Turnpenny Horsfield Aquatic Limited in 2013 to advise on the initial technical specification for the sound array.

Challenges associated with AFD installation, maintenance and repair

10.3.96 The AFD sound field and system requirements form only one part of the technical requirements for an AFD at HPC. Other engineering and nuclear safety requirements also apply and must be carefully considered. NNB therefore worked with a number of other specialist advisors led by Costain including Jacobs, Bureau Veritas, and RovCo Subsea. Despite their efforts, the engineering difficulties associated with an AFD system proved so challenging that NNB made the decision in November 2017 not to proceed with the AFD system. NNB revisited its decision-making as part of its preparation for the 2021 public inquiry into the variation of the WDA Permit to remove conditions relating to the requirement for the installation of an AFD system. It also revisited its decision-making in 2023 in its preparation for its material change application to remove the requirement for an AFD system from the 2013 DCO.

10.3.97 The following paragraphs summarise the current position on the challenges associated with AFD installation, maintenance and repair.

Challenges as a result of the intake heads having already been installed

10.3.98 First, the technical challenges associated with the installation of an AFD system (or other fish deterrent system) at this location are made more difficult now that the water intake heads have been installed (installation took place in the summer of 2022). This means that technical solutions must be bespoke to the installed infrastructure, increasing the complexity of the work and limiting options. These complexities will mean that it will take longer to design and install such a bespoke system. Overcoming these challenges would lead to indefinite delays before HPC could become operational.

The AFD system technology is untested in environmental conditions such as those found in the Severn Estuary

10.3.99 Second, there are currently no AFD systems operating in conditions like those experienced at the HPC intake locations. This means that the maintenance and repair regimes which would be required to ensure that the AFD system operates as required throughout HPC's 60 year operational lifetime are completely untested. To be confident that the AFD system could operate optimally over HPC's operational lifetime, NNB would need to work with its suppliers to devise and test maintenance and repair systems and technology from first principles. This would include maintenance and repair regimes for:

- the sound projectors;

- the structural frames which will support the sound projectors clusters and, if required, the replacement of these frames;
- the offshore monopile central hub and equipment; and
- the underwater cabling,[222] either from the central hub to the sound projectors at the intake heads, or from the shore based power supply to the hub including, if required, their replacement.

10.3.100 This means that in addition to the time it would take to develop an AFD system, NNB would also need to spend a considerable amount of time working with its suppliers to carefully devise an accompanying maintenance and repair regime. Doing this would compound the delays associated with the requirement to install an AFD system, greatly extending the period of time it would take before HPC could commence its commissioning and operational phases.

High tidal range in the Severn Estuary

10.3.101 Third, technical challenges of installation, maintenance and repair are also made more difficult because of the high tidal range in the Severn Estuary. The extreme tidal range at the HPC intake head locations results in high water velocities, especially during spring tides, which will restrict the time that divers or ROVs will be able to operate. The high-water velocities also contribute to poor visibility due to the disturbance of seabed sediment. Key considerations, associated with water velocities attributable to states of tide include:

- the maximum velocity on an ebbing tide is approximately 1.5 m/s;
- the maximum velocity on the flood tide is approximately 1.25 m/s;
- velocities can occasionally (< 5% of the time) peak at around 1.8 m/s under certain circumstances; and
- maximum turbidity values occur at just after low water as the tide begins to flow.[223]

10.3.102 These water velocities mean that the tidal window for diving operations at the HPC intake location is approximately one hour per tidal cycle, due to the fast tidal flows making it too

222 This would include the 11kV electrical and associated communications cabling needed to power the AFD Sound Projectors.

223 The allowable working limits for divers performing light work, as stated in the International Marine Contractors Association (‘IMCA’) guidelines (1987) is 0.5 m/s (1.0 knot). In this case the diving operations are not covered by the IMCA guidelines but will be determined in accordance with a risk assessment carried out by the diving contractor in accordance with the L104 Commercial diving projects inland/inshore Diving at Work Regulations 1997 Approved Code of Practice and guidance (2014).

dangerous to undertake safe diving outside of slack water (the short period in a tidal cycle with no water movement in either direction).

10.3.103 This imposes considerable constraints on the time it would take to install, maintain and repair an AFD system. Whilst ROVs can operate for longer periods than divers in each tidal cycle, there are still limitations as to the windows in which ROVs can be effectively used depending on the stage of the tidal cycle and the current strength/turbidity of the water. Because these can be extreme in the Severn Estuary, NNB would be restricted in terms of the number and length of windows in which ROVs could be utilised, even for relatively basic tasks, such as carrying out inspection work. Use of ROVs at Hinkley Point therefore faces significant technical feasibility challenges including, for example, powerful currents causing tether drag, the high risk of tether entanglement when flying ROVs, and the ROV operational reliance on sonar in the turbid waters of the Severn Estuary.

Extending the time between planned maintenance campaigns

10.3.104 Fourth, in order to extend the time between planned maintenance campaigns for the AFD system it would be necessary to ensure that the sound projector units are better able to withstand the extreme environmental conditions of the Seven Estuary for longer periods of time. However, doing this would necessarily require considerable further development and testing of the market available sound projector technologies in order to produce more robust units. For example, the use of Active Pressure Compensation Units ('APCUs') could stretch out maintenance times from every 12 to 18 months to a longer, perhaps 36 month, maintenance period. However, even if APCU technology was feasible, it would still need to be developed and extensively tested before it could be installed. This will lead to indefinite delays.

10.3.105 Using APCUs would also not eliminate the need for a rolling programme of planned maintenance and unplanned repair work during the operational lifetime of HPC with all of the considerable technical feasibility challenges associated with that. This would include, for example, the need to detach sound projector clusters and raise them out of the water and onto service boats to be worked on. As discussed below, these are tasks which could not be carried out by ROVs on their own.

Time available to undertake works at the intake heads

10.3.106 Finally, the isolated offshore location at the intake heads further reduces the windows of time available to install, maintain and repair an AFD system. For example, high wave heights and frequent winter storms can cause operational delays, providing only narrow windows for the considerable works an AFD system would require. Disruption due to poor weather would be highly likely given the lengthy annual offshore maintenance campaign. This could lead to indefinite delays before the commissioning and operational phases for HPC could commence.

The reasons why ROV technology alone cannot be used for the installation, maintenance and repair works for an AFD system at the HPC intake location

10.3.107 Crucial to the issue of technical feasibility at HPC is that ROVs would be needed for all of the installation, maintenance and repair works an AFD system (or other fish deterrent system) would require. This section will consider the reasons why ROV technology alone cannot be used for these works at this location.

10.3.108 In recent years there have been developments in ROV speeds and capability, including the ability to operate in tidal currents up to 5 knots. ROV technological advancement has most recently been focussed on the depth at which ROVs can operate, as well as the associated technology in sonar to enable better visibility in turbid conditions. However, recent technological advancement has not made ROVs sufficiently dexterous to allow for the more complex works associated with installing and maintaining an AFD system. It is also highly unlikely that ROVs would ever on their own be an effective solution for the complex tasks which the installation, maintenance or repair activities an AFD system would require.

10.3.109 Independent expert[224] advice on the use of ROVs and the existing ROV products available has concluded that there still does not exist an ROV system which combines these aspects sufficiently in such a manner to be feasibly and safely operated in the challenging conditions experienced at Hinkley Point, and to successfully deliver the extensive and complex works required for the installation, maintenance and repair of an AFD system.

10.3.110 Because ROVs are unable to undertake the works associated with the installation, maintenance and repair of an AFD system, these works would need to rely on divers to be carried out. The significant health and safety risks associated with reliance on divers for these tasks at this location is discussed below in the Health and Safety Objective.

224 Stephen J Garven MEWI MAE

ROV tether entanglement risk

10.3.111 A key reason why ROV technology cannot be relied upon on its own in the challenging environment of the Severn Estuary is a lack of operational visibility due to the location's high turbidity. This renders the ROV's lights and cameras unusable, meaning that the reliance on sonar for navigation and task-specific operations is crucial. The lack of visibility for ROV pilots, compounded by strong currents in the Severn Estuary, significantly increases the risk of an ROV's tether to the accompanying service boat becoming entangled when flying in and around the AFD system and its associated framework.

10.3.112 In this scenario, it is highly unlikely that disentanglement could occur using sonar alone. While sonar can provide detailed imagery to help understand the nature of a tether entanglement, without visual clarity in the zero or near zero visibility conditions of the Severn Estuary the operation of becoming untangled would remain a significant challenge. Additionally, relying solely on sonar for ROV manipulations is imprecise and could end up making the entanglement worse or the manipulations could end up damaging the tether itself. Damage to the tether would risk losing power and communication with the ROV. The risk associated with such an entanglement, which could lead to a Work Class ROV around the size of a minivan moving in an uncontrollable manner around the water intake heads, should not be underestimated and is not a scenario which NNB could countenance.

Use of autonomous ROV's

10.3.113 Autonomous ROVs ('AROVs') which are not reliant on tethers would avoid the risk of tether entanglement. NNB have considered this option and concluded that it is not feasible to use AROVs at this location. This is because of the need to be able to receive communications through the water column from the pilot in the accompanying service vessel. AROVs also need to communicate back to the accompanying service vessel. Clear, consistent two-way communications without time lags would be essential for any AROV carrying out the complex manipulation and lifting tasks needed for the installation, maintenance and repair of an AFD system (or other fish deterrent system). However, this would not be technically feasible in the turbid waters and extreme environmental conditions of the Severn Estuary. This is because these conditions would prevent or seriously disrupt communications between an AROV and its pilot on an accompanying service vessel.

10.3.114 In any case, even if it was possible to overcome the problems associated with communications with AROVs, independent expert advice on ROVs has confirmed that existing ROV technology falls significantly short of being able to undertake the work associated with the installation, maintenance and repair of an AFD system (or other fish deterrent system). Independent expert advice has also confirmed that it is highly unlikely that ROVs would ever on their own be an effective solution for the complex tasks which the installation, maintenance or repair activities an AFD system (or other fish deterrent system) would require.

Lifting the tubular cluster base and frame to the surface

10.3.115 A further key reason why ROV technology cannot be relied upon on its own in the extreme environmental conditions of the Severn Estuary relates to the need to lift the AFD system's tubular cluster base and frame. Lifting is necessary because the AFD system structure would need to be lifted to the surface of the water so that planned maintenance works or unplanned repair works can be carried out. Doing this, however, presents two major technical challenges.

Assessing the integrity of the tubular cluster base and frame for water ingress

10.3.116 The first major technical challenge is that there is the potential need for ROVs to be equipped with a radiation source so that they can inspect the integrity of any tubular AFD structures before lifting those structures to the surface of the water so that planned maintenance works or unplanned repair works can be carried out.

10.3.117 This is necessary because the AFD system would need to be installed using base and cluster frames constructed out of tubular materials. Most offshore structures which resemble an AFD system are constructed using tubular sections rather than an I beam or H beam alternative. This is because tubular structures have a higher strength to weight ratio due to their hollow cylindrical design which allows for better resistance, or load bearing, against multidirectional forces such as those experienced in offshore environments where forces are caused by waves, wind and current. In summary, tubular structures are better able to deal with these forces than I beam or H beam structures for the following reasons:

- Tubular structures have higher torsional rigidity and specific strength than conventional steel sections. This means that they can resist twisting and bending better than I beam or H beam structures, which are more prone to buckling and deformation caused by underwater currents. In the Severn Estuary, these currents can be extremely powerful.
- Tubular structures have direction-independent stiffness and drag. This means they can better withstand water currents from any direction equally well, while I beam or H beam structures have different stiffness and drag coefficients depending on the direction of the

water relative to their cross-sections. I beam structures, for example, have their strength along their axis, making them more suitable for unidirectional loads.

- Tubular structures have a lower surface area to volume ratio compared to I beam or H beam structures. This means they have less friction and resistance from the water, which reduces the drag force and the energy loss. It also reduces the corrosion and fouling effects of the water on the surface of the structures.
- Tubular structures have better load transfer and distribution than I beam or H beam structures. This means they can transfer the load from the braces to the chords more efficiently and uniformly, while I beam or H beam structures have stress concentration and discontinuity at the joints, which can cause cracks and failures.

10.3.118 However, although tubular structures are more appropriate in this environment, if they are exposed over time to harsh environmental conditions such as high pressure, low temperature and corrosive seawater this can lead to those structures becoming flooded and losing their structural integrity. This can happen where, for example, welding defects on the structure lead to water ingress.

10.3.119 Therefore, it is essential to Non-Destructively Examine ('NDE') the condition of tubular structures subsea before they are lifted to the surface for maintenance or repair work. This NDE examination should include a thorough inspection of the structure to identify any signs of flooding, corrosion, or other damage that could compromise its structural integrity.

10.3.120 Tubular structures can be made subject to NDE in the two following ways:

- By using a gamma radiation source: In this scenario a gamma radiation source would be attached to the ROV which could assess for changes within the density of the tubular structure and therefore detect whether the tubular is flooded. This technique would not require the ROV to come into contact with the structure and can be used in turbid or otherwise difficult environmental conditions.
- Alternating Current Field Measurement ('ACFM'): This technique detects, measures, monitors and tracks cracks on the tubular structure. Unlike gamma radiation sources, ACFM cannot detect if a tubular is flooded and only indicates if there is a problem. It is also impaired by marine growth, which may need to be removed where there is a potential risk to the ongoing integrity of the paint coating.

10.3.121 It is highly unlikely that ACFM would be an effective solution in the extreme environmental conditions of the Severn Estuary due to the inability of ROV's to effectively utilise the ACFM probe. ACFM inspection via ROV requires precise manipulator handling to keep the probe in contact with a clean surface. Complex geometries of the AFD structure and the lack of visibility in addition to strong tidal currents in the Severn Estuary would be challenging and undermine the integrity of inspections. This means that gamma radiation sources would be the more effective and reliable solution for flooded member detection.

10.3.122 However, if an ROV equipped with a gamma radiation source could not be retrieved having become entangled, broken down, or detached from its tether, this would result in a scenario where an ROV containing radioactive material would become lost in the marine environment of the Severn Estuary. Given the zero or near zero visibility conditions in the water and the strong tidal currents of the Severn Estuary, the recovery of that radioactive material would most likely be impossible. The loss of radioactive substances at sea with no hope of recovery would be an unacceptable public health and safety risk.

10.3.123 It may be possible to design the AFD cluster base and frame to cover/protect areas which are vulnerable to water ingress, such as the weld points. However, even if this was to be done it would still not be possible to guarantee that for the 60 year operational lifetime of HPC that all parts of the tubular structures could be protected from water ingress. This means that it would be necessary, from time to time, to assess the integrity of the structure for water ingress.

Assessing the integrity of the tubular cluster base and frame lifting points

10.3.124 The second major technical challenge concerns the lifting points for the AFD structure.

10.3.125 If the lifting points for the AFD structure are not permanently fixed integral parts of the cluster frame (i.e. they can be easily removed) then they will need to be assessed in terms of their compliance with The Lifting Operations and Lifting Equipment Regulations 1998 ('LOLER'), which are enforced by the Health and Safety Executive. LOLER is a set of regulations that places duties on people and companies who own, operate, or have control over lifting equipment. LOLER requires that all lifting operations involving lifting equipment must be properly planned by a competent person, appropriately supervised, and carried out in a safe manner.[225]

225 LOLER, regulation 9(3)

10.3.126 LOLER also requires that all equipment used for lifting is fit for purpose, appropriate for the task, suitably marked, and, in many cases, subject to statutory periodic 'thorough examination'. This means that the lifting points on subsea structures must be assessed in accordance with LOLER before complex lifts can take place. Lifting accessories must also be thoroughly examined prior to use.[226] Furthermore, for complex lifting operations, a documented lift plan will be required each time the lift is carried out. This may be the case when complex loads are to be lifted, where two or more cranes are used to lift the load, or where the operation is carried out at a location with exceptional hazards. All of these factors are relevant for lifting operations in the Severn Estuary.

10.3.127 Lifting the AFD tubular cluster base and frame would constitute a complex lift. This means that before parts of the AFD structure could be lifted to the surface for planned maintenance work or unplanned repair work, the lifting points on those structures would need to be assessed in accordance with LOLER. This means that the lifting points would need to be subjected to NDE using an ROV equipped with a manipulator, water jet and probe/sensor to assess for cracks or other structural defects. Such probes/sensors would include, for example, the use ACFM to detect, measure, monitor and track cracks.

10.3.128 However, regular planned, or unplanned, intervention and cleaning of the marine growth in zero visibility conditions to facilitate the required NDE could lead to the ROV manipulator(s) contacting the frame and lifting point itself and damaging the integrity of the crucial protective layer of paint coating on the lifting point. Any damage to the paint coat of the lifting point is highly likely to leave the lifting point compromised and more susceptible to the corrosive effects of seawater.

10.3.129 If a defect was detected in the lifting points over the 60 year operational lifetime of HPC then it would not be possible to lift the structure out of the water. This means that it would no longer be possible to maintain or repair sections of the AFD system for the remaining period of HPC's operation. The only way to avoid this would be to devise alternative ways of lifting the AFD cluster base and frame, for example by creating a platform underneath the structure to lift it up on. However, this would require ROVs to carry out the complex task of putting in place such a platform. ROVs could not now carry out these complex operations in the zero to near zero visibility conditions of the Severn Estuary. It is highly unlikely that ROVs would ever on their own be an effective solution for this complex task.

226 LOLER, Schedule 1

10.3.130 Permanently attached integral lifting points are treated by LOLER as being part of the load and therefore do not have to be thoroughly examined in accordance with that regime. Instead, permanently attached integral lifting points must be assessed in compliance with the Provision and Use of Work Equipment Regulations 1998 ('PUWER'), which are enforced by the Health and Safety Executive. PUWER imposes duties requiring work equipment to be safe for use,[227] maintained in a safe condition and inspected to ensure it is correctly installed and does not subsequently deteriorate.[228] If permanently attached integral lifting points are used in the AFD design, then that structure will be considered as "work equipment" and therefore subject to the requirements PUWER.[229] This means that the structure will need to be regularly inspected, including before the lifting points are used to bring the cluster frame to the surface for planned maintenance work or unplanned repair work. This would need to be carried out using the same techniques described above.

10.3.131 If defects were discovered in the lifting points during these inspections over the 60 year operational lifetime of HPC then it would not be possible to use them and therefore lift the structure out of the water. This means in this scenario that it would no longer be possible to maintain or repair sections of the AFD system for the remaining period of HPC's operation.

Alternative fish deterrent systems

10.3.132 It is also likely that any alternative fish deterrent system (e.g. bubble curtains, electrical barriers, strobe lighting, wedge wire curtains etc) would also require tubular structures and lifting points and therefore would be vulnerable to these issues.

Installing the base footings

10.3.133 In order to install the base and cluster frames for the AFD sound projectors, it will be necessary for the base frame to be attached to the footings located on the intake head(s). As shown in Figure 10-, there are 7 steel footings per head face, each with 8 bolts per stub in the concrete structure. There are 56 bolts per intake head face, totalling 448 bolts across the two intake heads, as shown in Figure 10-2 and Table 10-1 below.

227 PUWER, Regulation 4
228 PUWER, Regulation 5
229 PUWER, Regulation 2

Figure 10-2: Technical drawing of the base frame footings on the water intake heads

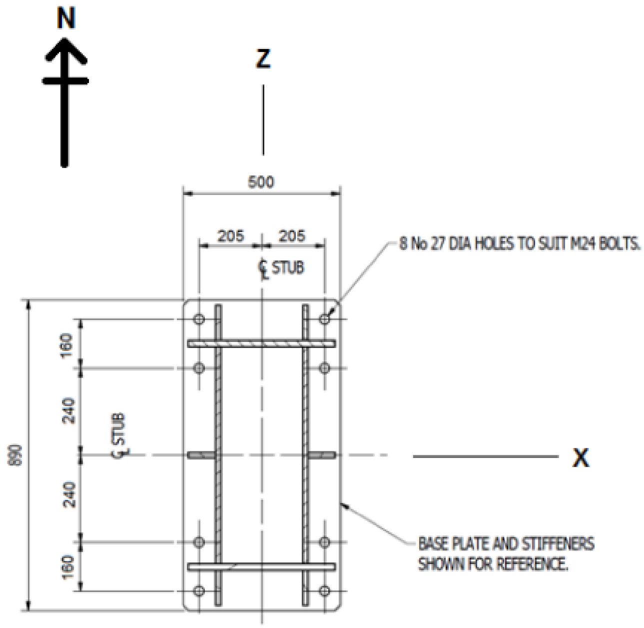


Table 10-1: Table of works for the installation of base/cluster frames and an indicative installation timescale

Out of Sequence Works - Installation of Base / Cluster Frames

	Per Side	Total per Head	Total Heads x4
Base Frames	3	6	24
Base Footings	7	14	56
Footing Stubs	56*	112	448
Cluster Frames	6	12	48

(*8 x stubs per Footing)

Indicative Installation Timescales - ROV with Sonar

	Total	Per12Hrs	Per 24hr Day	Total Days
Footing Stubs	448	4	8	56
Base Footings	56*	1	2	14
Base Frames	24	1	2	3
Cluster Frames	48	1	2	4

(*Footing Installation inc. Torquing of 8 x stubs)

10.3.134 In order for the base frame to be attached, each footing would need to be located and any sediment that has accumulated around them would need to be cleared. Once located, the base frame would need to be precisely vertically aligned and lowered into place. If this does not happen then it is highly likely that the stubs could be permanently damaged.

10.3.135 ROV's can use sonar to detect the footing stubs and can be used to remove any accumulated sediment. However, ROVs currently (and for the foreseeable future) lack the visual equipment needed to carry out in the zero or near zero visibility conditions of the Severn Estuary the task of vertically aligning the structure with the footings. This imposes serious technical feasibility constraints on this crucial element required for the installation of an AFD system (or any other fish deterrent system which would need to be installed in this way).

Augmented reality technology

10.3.136 An option which could assist in the use of ROVs would be to incorporate augmented reality software into their operation. This could be achieved by creating a precise and to scale replica model of the AFD system and intake head structure and mapping this with laser technology to create an accurate 3D model of those structures. ROV pilots would then be able to fly ROVs with the navigational assistance of this 3D model. This could be used to support the sonar capability of ROVs when operating underwater.

10.3.137 Aside from the considerable time and cost it would take to design, create and trial this augmented reality technology, ROVs using augmented reality would still be technically limited by the following two factors:

- ROVs would still need to be equipped with a radiation source: A radiation source would still be needed in order to inspect the structural integrity of tubular AFD structures before lifting those structures to the surface and recovering them to deck to carry out planned maintenance or unplanned repair works. For the reasons stated above, the risk of being unable to recover a radiation source on an ROV that had become entangled or broken down would pose an intolerable health and safety risk.
- Entanglement: The ROV would still need to be attached to a tether. ROV reliance on a tether makes it vulnerable to the tether becoming entangled when flying in and around the AFD system and its associated framework in the strong currents. As discussed above, if an ROV became entangled it would not be able to untangle itself. This means that divers would be needed in order to untangle the ROV.

The potential use of ROVs to monitor the water intake heads

10.3.138 Dr Manus O'Donnell said at paragraph 8.4.6 of his proof of evidence submitted to the 2021 public inquiry for the variation of the permit to remove conditions relating to the requirement for the installation of an AFD system that the intake heads would be "visually inspected every 18 months for scour/bathymetry at the seabed as well as a visual inspection of the apertures". That visual inspection would be carried out in a "passive manner so there is no equipment that can fail" using sonar.

10.3.139 Reference was made to visual inspections because it is good practice (on a precautionary basis) for marine civil structures to be subject to an inspection and maintenance strategy during their operational lifetime. A high-level summary of such an inspection and maintenance strategy is set out in Table 10-2 below.

Table 10-2: High-level inspection and maintenance strategy for Marine Works structures

Structure		Program	Means	Periodicity
Water intake	Between sea and forebay levels	Head loss monitoring	• Sensors for the forebay • Sea level measurements (harbour data, tidal gauge, etc) compared to water levels in HCA and HPF	Initially based on a monthly periodicity, and then set as a function of the hydraulic behaviour of the structures.
	Around water intake heads	Silt / scour monitoring	Multi-beam sonar system	To be performed at each offshore head location, with an initial frequency of 6 months (to match outage scheduling). The frequency during the station lifetime shall be adapted based on the observed inspection findings following the care and maintenance period.
	Intake screens	Visual inspection to check for damage/blockage	Water-filled ROV inspection by a ROV	To be performed at each offshore head location with an initial

Structure		Program	Means	Periodicity
				frequency of 6 months (to match outage scheduling). The frequency during the station lifetime shall be adapted based on the observed inspection findings following the care and maintenance period.
	Intake heads	Visual structural inspection to identify defects (e.g. cracks)	Water-filled inspection by a ROV	Every periodic outage preceding a ten yearly outage.
	Offshore intake shafts	Visual structural inspection to identify defects (e.g. cracks)	Water-filled inspection by a ROV	Every periodic outage preceding a ten yearly outage

10.3.140 In preparation for consultation, NNB has carefully considered the need for these inspections. NNB's conclusions are as follows:

- Importantly, because of the challenging conditions experienced at Hinkley Point, the Cooling Water System for HPC has been carefully constructed so as to design out the need for repair or maintenance during its operational lifetime. Inspection and maintenance during the operational lifetime of HPC is therefore not technically required due to this robust design. NNB will therefore consider whether good practice inspections (on a precautionary basis) should take place and in doing so whether it is technically feasible and safe to carry out any such inspections.
- The only planned inspections associated with the construction phase of HPC are bathymetry surveys of the seabed surface around the heads to check wave and tidal current scour patterns. This work will all be undertaken from a vessel. All such previous inspections of this kind have been undertaken from a vessel.
- With regards the first two items listed in the table (head loss monitoring between sea and forebay levels and silt/scour monitoring around water intake heads) these surveys can also

be undertaken from a vessel using standard seabed survey techniques. They would therefore not require any use of ROVs.

- With regards the third item listed in the table (visual inspection to check for damage/blockage to intake screens), there are no screens at the intake heads – only baffles and bars. It is therefore not necessary to implement an inspection and maintenance regime for intake screens.
- With regards the final two items listed in the table (visual structural inspection to identify defects in the intake heads and offshore intake shafts) it is, of course, not possible to carry out visual inspections in the zero or near zero visibility conditions in the Severn Estuary. Therefore, differing inspection techniques would be needed to detect for abnormalities in the surface of these structures. The good practice methodology suggests this would be carried out using an ROV, however, as discussed above, NNB will need to carefully consider whether these 10 yearly inspections are necessary and, if they are, what technology can safely be used given the technical limitations of ROVs operating in the Severn Estuary environment. If NNB did decide to carry out these inspections, the first inspection would not be required until the mid-2030s.

10.3.141 If it is determined by NNB that ROVs are required to carry out inspections for defects in the intake heads and offshore intake shafts, then the following points are relevant:

- The passive use of inspection class ROVs to detect for abnormalities in the surface of these structures is very different to the reliance on ROVs to carry out the complex installation, maintenance and repair works on an AFD system (or other fish deterrent system). This significantly reduces the risks discussed above of ROV tethers becoming entangled or snagged, particularly as inspections would likely be timed to be carried out during planned ten yearly outages reducing the risk of ROV or ROV tether entrainment in the intake heads.
- It may be possible that inspections to detect for abnormalities in the surface of these structures can be carried out using alternative forms of technology. If new inspection methods are developed that are more capable than ROVs and lower risk then it is likely that these will be deployed.
- It may be possible to dispense with inspections or extend the periodicity of inspections if the first inspection found no obvious weathering impacts. If the need for inspections is infrequent then this reduces the risks associated with the use of ROVs for inspections.
- Should any ROVs used for inspections become entangled or snagged, the use of divers to provide assistance would be at the very bottom of the health and safety hierarchy of control (discussed further in the Health and Safety Objective) and would only be relied upon

as a last resort after all other options had been considered and exhausted in accordance with health and safety legislation, principles and guidance. NNB would, of course, design any inspection regime in such a way that divers are not needed as a matter of routine and would ensure that any reliance on divers is kept to an absolute minimum in terms of the nature of the task and its duration.

Conclusions

10.3.142 Any potential alternative solution would need to be capable of overcoming the challenges regarding technical feasibility set out above.

10.3.143 Having carefully considered these challenges, NNB has concluded that the installation, maintenance and repair of an AFD system (or alternative fish deterrent system) presents significant and insurmountable technical feasibility challenges. This includes the fact that ROVs are not sufficiently developed to undertake the complex works required to install, maintain or repair an AFD system and it is highly unlikely that ROVs would ever on their own be an effective solution for the complex tasks. Moreover, the frequency with which ROVs would be required combined with the uniquely challenging tidal conditions in the Severn Estuary, increases the prospect of an ROV tether becoming entangled and uncontrollable. This would create further risks if ROVs are carrying radiation sources.

10.3.144 In the absence of suitable ROV technology to undertake at the level of accuracy and reliability required for the installation, maintenance and repair of an AFD system, NNB would need to place significant reliance on the use of human divers to undertake these activities. The health and safety risks associated with the reliance on divers is discussed below in the Health and Safety Objective.

Objective 4 – the need for the Project to be carried out in compliance with health and safety legislation

10.3.145 It is a critical objective of the Project that it is carried out in compliance with relevant health and safety legislation.

10.3.146 NNB is applying to remove the requirement to fit an AFD system from the 2013 DCO because it has significant and justified concerns that the use of human divers in the installation, maintenance and repair of the AFD system creates an intolerable safety risk which could lead to the deaths of divers.

10.3.147 Divers would be needed for this work because, as discussed above in the Technical Feasibility Objective, ROVs are not capable on their own of undertaking the complex processes required for the installation, maintenance and repair of an AFD system (or other fish deterrent system) and/or other tasks associated with the AFD works (such as the maintenance, recovery or repair of the offshore 11kV electrical and associated communications cabling needed to power the AFD Sound Projectors, or the recovery or disentanglement of 'snagged' ROVs at the intake heads).

10.3.148 NNB is firmly of the view that compliance with health and safety legislation, principles and guidance could not be achieved if divers were required to undertake work at the level of frequency and exposure to the high risks that such complex work would entail. All installation, maintenance and repair work at HPC must comply with the requirements of the Health and Safety at Work etc. Act 1974 ('the HSW Act'), the Management of Health and Safety at Work Regulations 1999 ('MHSWR'), the Construction (Design and Management) Regulations 2015 ('CDM Regulations'), the Diving at Work Regulations 1997, and the Control of Noise at Work Regulations 2005 ('CoNaWR'). These works would also need to comply with NNB's own health and safety policies, which go beyond the minimum standards prescribed by health and safety legislation, principles and guidance.

10.3.149 This view is also shared by Balfour Beatty, NNB's offshore works Principal Contractor. Whilst it is Balfour Beatty's view that aside from the health and safety risks involved in these works it would be technically possible for divers to carry out the installation, maintenance and repair works on an AFD system, the safety of personnel is paramount when selecting an appropriate methodology and that divers should only be called on as a last option after all other methods had been used to design out health and safety risks. For these reasons, the approach taken by NNB and Balfour Beatty at HPC has been to minimise health and safety risks and if diving is found to be necessary, to make sure that any such diving campaigns are as straightforward and safe as possible. This would not be possible, however, if NNB was required to install an AFD system. Rather, by installing an AFD system, NNB would be incorporating into the design of the cooling water intake heads structures which will significantly increase health and safety risks for divers with unacceptable reliance on ineffective controls at the bottom of the hierarchy of control known as 'the principles of prevention'.

10.3.150 To put the health and safety risks for divers into context, it is necessary first to understand the risks divers face when carrying out installation, maintenance and repair works. Second, those risks can then be considered in the context of the relevant regulatory framework in the UK which seeks to control the risks presented to workers.

10.3.151 It is not NNB's position that it would never send divers into the Severn Estuary under any circumstances. Diving works have already been undertaken by Balfour Beatty in the Severn Estuary to carry out survey works, primarily for Unexploded Ordinance ('UXO'), or for basic rigging for the recovery of items from the seabed. Divers will also be required in the future to dive down to the water outfall heads on two occasions to carry out minor works necessary for the installation of outfall cover slabs. However, these operations have been or will only be authorised following a rigorous assessment of health and safety risks and, in the case of the installation of outfall cover slabs, after minimising, by design the complexity of these tasks in accordance with health and safety legislation, principles and guidance. This is acceptable because the health and safety concern is necessarily related to the specific risks and difficulties associated with the tasks required in relation to the installation, maintenance and repair of the AFD. This is discussed further below.

Risks to divers carrying out installation, maintenance and repair works on an AFD system

10.3.152 As ROV technology cannot now (and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system, diving operations will be required. NNB have carefully assessed the feasibility of the diving operations at HPC, taking into account the lessons learned from UXO survey work performed at the intake locations. NNB has concluded that the installation, maintenance and repair works associated with an AFD system are particularly high risk for divers for the following reasons:

- Divers would need to be attached to the service boat via an umbilical which would provide air, an emergency supply of air, communication and (in some cases) hot water to the diver. Divers operating at the intake heads would need to work in zero or near zero visibility conditions sub-surface due to the heavy sediment load.[230] Doing this presents major difficulties.[231] Divers would therefore need to be equipped with sonar and guided by someone on board the support vessel. The images provided by acoustic cameras are fairly accurate, but they do not give any perspective and are difficult to interpret in terms of distance. This means that when the diver is in position, tasks can only be performed by touch. Doing this will necessarily require divers to carry out complex tasks in close proximity to the water intake heads in zero or near zero visibility conditions. These conditions create an increased risk that a diver's umbilical may become snagged or that divers become entangled underwater. Whilst divers would only be instructed to operate

230 The waters around HPC contain very high concentrations of suspended solids, resulting in zero or near zero visibility conditions for the vast majority of the time.

231 Verbal accounts given by the divers involved in UXO survey works described the water as "coffee water". The UXO dive team confirmed that were no significant variations in visibility over the four-month period of the 2017 UXO survey. Even in the best conditions, the best visibility was 30 cm, with no visibility at arm's length.

during slack waters, entanglement risks are increased because water velocity could be high at this location even when the waters are slack. Divers are particularly vulnerable to water flow, suction, or turbulence under water.

- The emergency standby diver (i.e. the rescue diver who would be called upon should the working diver become injured, entangled, or incapacitated) would not be able to see the diver should they be required to rescue them. Rather they would only be able to feel for the diver in the near in zero or near zero visibility waters. This increases the risks associated with rescue operations.
- These tasks would require lifting and lowering large items of equipment in zero or near zero visibility conditions. This increases the risk that divers could themselves become pinned underwater or trapped or, more likely, that their umbilical may become trapped or pinned, cutting off air supplies and communications to the diver, placing the diver at critical risk of harm.
- Divers and diver umbilicals would also be vulnerable to entrainment if they were carrying out planned maintenance, unplanned repairs or ROV recovery works in close proximity to the water intake heads whilst they are actively drawing in water. To minimise this risk, HPC would need to be put into emergency shutdown mode for the duration of diver works carried out in close proximity to the water intake heads. Indeed, doing this is required in accordance with the Diving at Work Regulations 1997 and the Health and Safety Executive Approved Code of Practice ('ACOP') for Commercial Diving Projects inland/inshore. Paragraph 48 of the ACOP says:

"Water flow, intakes and discharges

Divers are vulnerable to water flow, suction or turbulence, whether natural or caused by water intakes or discharges. Other differential pressure situations such as blanked pipelines and void spaces also pose a significant risk. Where any intakes or discharges are known or suspected, suitable measures (including where practical physical or mechanical isolation) should be taken to ensure that these cannot be operated while a diver is in the water. The measures to protect the diver should be part of a safe system of work, for example a permit-to-work system".

Aside from the disruption to power supply caused by multiple shutdowns or the erosion of nuclear safety margins this would cause, crucially, even in shutdown mode, there will still be a requirement for water to be drawn into the intake heads to cool the nuclear reactors. Whilst water velocity would be decreased when HPC is in shutdown mode, the draw of water would create hydrostatic pressure at/around the two intake heads. This differential pressure at/around the intake heads increases the vulnerability of divers, or diver umbilicals, to being dragged into the intake heads.

- Divers would also need to operate in the immediate vicinity adjacent to active sound projectors designed to produce sound pressure levels of >160 db re 1μPa across the surface of the intake screens and noise at the sound frequency range of 30-600 Hz, with the capability of operating up to 2,000 Hz. Whilst the specific speakers being worked on would be turned off, the adjacent bank of speakers would be operational creating a noise hazard for the divers. This continuous noise source would be considered as a noise level over and above the acceptable noises which have to be controlled in diving operations. To protect divers, the AFD system may have to be switched off for the duration of planned maintenance or unplanned repair work.

10.3.153 To give a sense of the scale of diving activity needed for an AFD system, NNB determined that a minimum of 72 days would be required each year of the 60 year operational lifetime of HPC to undertake planned maintenance work.

The UK health and safety legislative framework

HSW Act

10.3.154 The HSW Act is the primary piece of legislation covering occupational health and safety in Great Britain. The HSW Act sets out the general duties which:

- employers have towards employees and members of the public;
- employees have to themselves and to each other; and
- certain self-employed individuals have towards themselves and others.

10.3.155 Sections 2 and 3 of the HSW Act set out the general duty on employers to their employees and contractors as follows:

- Under section 2 HSW Act, it shall be the duty of every employer to "conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not thereby exposed to risks to their health and safety".
- Under section 3 HSW Act, it shall be the duty of every employer to "conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in his

employment who may be affected thereby are not thereby exposed to risks to their health or safety".

10.3.156 These duties under sections 2 and 3 HSW Act apply to non-NNB staff.

10.3.157 This means that NNB and the Principal Contractor for the offshore works, Balfour Beatty, have legal duties under the HSW Act which prevent them from designing an AFD system (or any alternative fish deterrent system) that could only be effectively installed and maintained by instructing the use of human divers to conduct the installation, maintenance and repair.

10.3.158 In addition, under section 6 HSW Act, it shall be the duty of any person who:

"... designs, manufactures, imports or supplies any article for use at work.... (a) to ensure, so far as is reasonably practicable, that the article is so designed and constructed that it will be safe and without risks to health at all times when it is being set, used, cleaned or maintained by a person at work".

10.3.159 In these circumstances, therefore, section 6 HSW Act imposes duties on any party involved in the design, manufacture, import or supply for any ROV or any part of the AFD system.

MHSWR

10.3.160 The MHSWR also apply in these circumstances. Regulation 3(1) MHSWR states that:

"Every employer shall make a suitable and sufficient assessment of -

(a) the risks to the health and safety of his employees to which they are exposed whilst they are at work; and

(b) the risks to the health and safety of persons not in his employment arising out of or in connection with the conduct by him or his undertaking, for the purpose of identifying measures he needs to take to comply with the requirements and prohibitions imposed upon him by or under the relevant statutory provisions...."

10.3.161 Schedule 1 of MHSWR, on the general principles of prevention, sets out a "hierarchy of controls" which employers must consider when assessing risks to their employees. These are:

- avoiding risks;
- evaluating the risks which cannot be avoided;

- combating the risks at source;
- adapting the work to the individual, especially as regards the design of workplaces, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health;
- adapting to technical progress;
- replacing the dangerous by the non-dangerous or less dangerous;
- developing a coherent overall prevention policy which covers technology, organisation of work, working conditions, social relationships and the influence of factors relating to the working environment;
- giving collective protective measures priority over individual protective measures; and
- giving appropriate instructions to employees.

10.3.162 Under the hierarchy, employers must assess risk controls from the top down (the top of the hierarchy of control being the elimination of risk or mitigation of risk where elimination is not possible, with the reliance on instructions being at the bottom of the mitigation controls).

CDM Regulations

10.3.163 The CDM Regulations also apply to the works at HPC as a notifiable project. The CDM Regulations aim to ensure health and safety issues are appropriately considered during the design and construction phases of projects as well as the end of life (i.e. decommissioning by way of demolition/dismantling). The overall goal of the regime is to reduce the risk of harm to those who must build, use and maintain structures.

10.3.164 The CDM Regulations set out roles for various prescribed duty holders which NNB and its designers and contractors would fulfil. For the offshore works at HPC, NNB act as 'Client',[232] 'Principal Designer'[233] and 'Designer'[234] and Balfour Beatty act as 'Principal Contractor'.[235]

10.3.165 Under the CDM Regulations, the Principal Designer and Principal Contractor have specific non-delegable and absolute duties under regulations 11 and 12 of the CDM Regulations with which it *must* comply. These duties require action to be taken which "*is not qualified by terms such as "so far as reasonably practicable""*.[236]

10.3.166 Importantly, these duties state, under regulation 11 CDM Regulations, that the Principal Designer must:

"… take into account the general principles of prevention and, where relevant, the content of any construction phase plan and any health and safety file".

10.3.167 This absolute duty requires the Principal Designer to follow the "*hierarchy of controls*" discussed above and which are referred to under the CDM Regulations as the "*general principles of prevention*". These general principles of prevention require employers to eliminate risk where possible.

10.3.168 As 'Client', NNB must also make suitable arrangements for managing their project, enabling those carrying it out to manage health and safety risks in a proportionate way (see regulations 4(1) and 4(2)).

232 In its role as 'client' under the CDM Regulations, being 'any person for whom a project is carried out', HPC is the duty holder that sets the tone (or culture) of the projects, who appoints the other duty holders, and who ensures that those duty holders are meeting their own duties.
233 The "Principal Designer" under the CDM Regulations has control of the pre-construction phase. The duties of a Principal Designer in relation to health and safety at the pre-construction phase are set out in regulation 11 of the CDM Regulations. The duties of a Principal Designer in relation to health and safety at the construction phase are set out in regulation 12 of the CDM Regulations
234 The 'designer' under the CDM Regulations is 'any person (including a client, contractor or other person referred to in [the CDM Regulations] who in the course or furtherance of a business - (a) prepares or modifies a design; or (b) arranges for, or instructs, any person under their control to do so, relating to a structure, or to a product or mechanical or electrical system intended for a particular structure, and a person is deemed to prepare a design where a design is prepared by a person under their control'. The duties of the designer are set out in regulation 9 of the CDM Regulations.
235 "Principal Contractors" are contractors appointed by the Client under regulation 5(1)(b) CDM Regulations to coordinate the construction phase of a project where it involves more than one contractor. The Principal Contractor has specified duties under regulations 11 and 12 CDM Regulations.
236 See Health and Safety Executive Publication L153, "Guidance on The Construction (Design and Management) Regulations 2015", page 88.

10.3.169 Under the CDM Regulations, the "Client" (in this case NNB), assisted by the 'Principal Designer' (also, in this case, NNB) will prepare information referred to in regulation 2 CDM Regulations as:

"Pre-construction information', meaning 'information in the client's possession or which is reasonably obtainable by or on behalf of the client, which is relevant to the construction work and is of an appropriate level of detail and proportionate to the risks involved, including - (a) information about - (I) the project; (ii) planning and management of the project; (iii) health and safety hazards, including design and construction hazards and how they will be addressed; and (b) information in any existing health and safety file".

10.3.170 The Health and Safety Executive Publication L153, "Guidance on The Construction (Design and Management) Regulations 2015", at paragraph 5, states that:

"... the principles duty holders should use in their approach to identifying the measures they should take to control the risks to health and safety in a particular project. The general principles of prevention are set out in full [which] ... in summary they are to: (a) avoid risks where possible; (b) evaluate those risks that cannot be avoided; and (c) put in place proportionate measures that control them at source".

Applicability of the health and safety legislative framework

10.3.171 NNB, as the 'Client' under the CDM Regulations, would not be acting in compliance with the CDM Regulations if it was to allow works to take place at its site which it knows to be inherently unsafe and which has no proportionate or easily definable benefit.

10.3.172 Furthermore, as the 'Principal Contractor' under the CDM Regulations, Balfour Beatty are required to plan, manage, monitor and co-ordinate matters relating to health and safety during this phase to ensure that, so far as is reasonably practicable, construction work is carried out without risks to health or safety (regulation 13(1) CDM Regulations). It is Balfour Beatty's view that the health and safety risks associated with the complex and difficult tasks required in order to install, maintain and repair an AFD system, as well as the amount of time required to carry out these tasks, would be disproportionate in the circumstances.

10.3.173 Schedule 3 of the CDM Regulations details particularised high level hazards that require specific detailed risk control strategies to be outlined due to the inherent high hazard nature of the risks. Schedule 3 lists ten specified high hazard activities, including the following which are relevant to the AFD (or other fish deterrent) system at HPC:

- Work with ionising radiation requiring the designation of controlled or supervised areas under regulation 16 of the Ionising Radiation Regulations 1999;
- Work near high voltage power lines;
- Work exposing workers to the risk of drowning;
- Work on wells… and tunnels;
- Work carried out by divers having a system of air supply; and
- Work involving the assembly or dismantling of heavy prefabricated components.

10.3.174 Five or six of the ten most hazardous activities envisaged by the CDM Regulations are therefore present in the diving operations for works associated with an AFD, indicating an extremely high level of risk.

10.3.175 The installation, maintenance and repair of the AFD system cannot be justified based on the level of risk to human life involved in such work. Setting to work divers to undertake these activities with these risks present would not be a proportionate or a reasonably practicable approach to risk.

Noise impacts on divers

10.3.176 In addition to the health and safety regimes described above, the CoNaWR impose a duty on employers to eliminate or mitigate noise hazards to their employees and others who from their undertaking can be harmed. The CoNaWR, as with much of the UK health and safety legislation, uses a hierarchy of control for employers to control the hazard of noise. Noise issues apply underwater and are a recognised hazard for divers. The Health and Safety Executive Research Report 735 ('RR735')[237] says:

"Divers are routinely exposed to a range of noise sources of sufficiently high intensity to cause auditory damage and audiometric studies indicate that diver hearing is impaired by exposure to factors associated with diving".

10.3.177 It adds in its executive summary that there "*…is evidence that divers are exposed to noise levels that exceed the requirements of CoNaWR*". RR735 executive summary discusses that

237 See https://www.hse.gov.uk/Research/rrpdf/rr735.pdf (Accessed 18 December 2023)

ambient noise and noises above and below water combine with the result that divers exceed the daily noise doses of the CoNaWR.

10.3.178 If divers were required to work on the AFD, the specific speakers being worked on would be turned off. However, the adjacent bank of speakers would remain on and thus create an unacceptable noise hazard for divers. This continuous noise source would be considered as a noise level over and above the typical noises which must be controlled in diving operations. RR735 demonstrates that divers without this continuous hazard are suffering from noise exposure above the daily doses outlined in CoNaWR. RR735 at the top of its hierarchy states: "*Eliminate or reduce noise at source, e.g. by redesigning the equipment generating noise*". This would clearly not be possible at the water intake heads as the very purpose of AFD system is to generate sound. The control and protection of fish at the expense of the risk to human divers would not be in compliance with CoNaWR.

NNB's health and safety policies

10.3.179 Beyond the regulatory requirements outlined above, NNB has a stringent approach to workplace safety. NNB policy and the approach taken is that safety needs to be a 'non-negotiable, enduring priority' and that everyone deserves to go home from work unharmed.

10.3.180 Application in practice of this approach to safety includes application of the following key principles:

- That every job will be done safely, no matter how important or urgent it is;
- That each individual has a personal responsibility for their own health, safety and wellbeing and for those around them;
- That putting people to work carries a specific responsibility and accountability for health, safety and wellbeing which will be visibly demonstrated;
- That every asset shall be operated safely, minimising the risk to as low as reasonably practicable by applying the principles of process safety;
- That each near miss is learned from in order to reduce the chance of harm next time, with special attention being paid to potential events with a risk of causing high harm;
- That each individual will spot, report and deal with hazards to help create a harm free workplace;
- A commitment to providing safe and healthy working conditions for the prevention of work-related injury and ill health; and

- Effective communication on health, safety and wellbeing matters with all relevant parties and internal and public communication on progress.

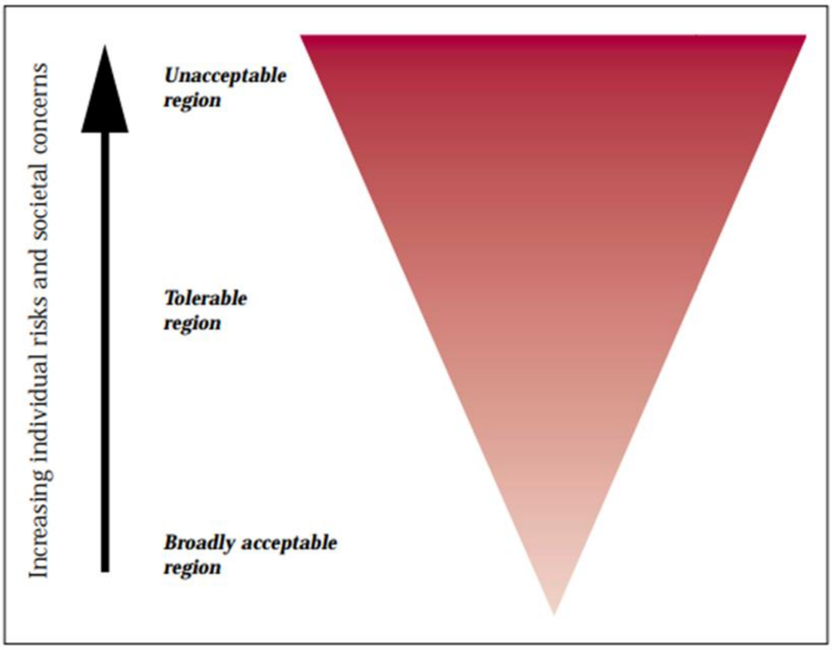
10.3.181 NNB also complies with the EDF Group Health and Safety Policy. This policy includes the following principles:

- Life is precious: no urgency justifies taking risks.
- Health and safety are integral aspects of all our activities every day. Exemplary behaviour by company officers and managers is crucial. They create the organisational conditions enabling a culture of prevention to take root and grow. Each of them, through their powers, resources and expertise, is responsible for their own health and safety, and for that of the men and women around them. Contributing to prevention is an element of professionalism for all employees.
- A personal commitment is expected from all parties involved: Group employees, temporary workers, contractors, managers and company officers.
- Each party is expected to strictly apply and comply with work procedures and safety rules, including the Group's 10 Life Saving Rules.
- Each party is expected to share ideas and work to improve NNB's performance.
- The medical teams and Health and Safety experts will provide constant, multi-disciplinary support so teams can develop and implement progress targets through joint responsibility programmes at the most local level.
- The ongoing dialogue with the staff representatives, especially in the staff representative bodies, will play a role in the continuous improvement of working conditions.
- Given the results, success comes from working together with contractors.
- NNB treat the employees of contractors and temporary workers working on the Group's sites with the same consideration as its own employees. Better health and safety performance is promoted in supply chain service contracts. Strong and close partnerships are established to achieve sustainable and measurable progress together.

Risk tolerability

10.3.182 The Health and Safety Executive's document 'Reducing Risk Protecting People'[238] sets out the Health and Safety Executive's framework for the tolerability of risk. This is set out in Figure 10- below.

Figure 10-3: Health and Safety Executive's framework for the tolerability of risk



122 The framework is illustrated in Figure 1. The triangle represents increasing level of 'risk' for a particular hazardous activity (measured by the individual risk and societal concerns it engenders) as we move from the bottom of the triangle towards the top. The dark zone at the top represents an unacceptable region. For practical purposes, a particular risk falling into that region is regarded as unacceptable whatever the level of benefits associated with the activity. Any activity or practice giving rise to risks falling in that region would, as a matter of principle, be ruled out unless the activity or practice can be modified to reduce the degree of risk so that it falls in one of the regions below, or there are exceptional reasons for the activity or practice to be retained.

238 See Reducing Risks: Protecting People - HSE's decision making process (Accessed 18 December 2023)

10.3.183 In accordance with this framework and having sought independent advice from an external health and safety consultant not otherwise engaged by NNB on the Project,[239] the designing of an AFD (or other fish deterrent) system which comprises high hazard construction and maintenance work, which has no benefit to nuclear safety, operational or personal safety, or for the provision of energy security, is unacceptable and cannot be justified. The use of divers to carry out the high hazard installation, maintenance and repair works on the AFD (or other fish deterrent) system, while technically possible, is extremely high risk due to the proximity of the intake heads to the AFD system (or any other alternative system), and due to the conditions in the offshore environment at the location of the proposed AFD (or other fish deterrent) system. Given the presence of so many CDM Regulations Schedule 3 risks, combined with the inhospitable conditions in the Severn Estuary as well as the close proximity of the works to the intake heads, the use of divers to undertake work associated with the AFD system is within the “unacceptable region” in the figure above.

10.3.184 According to the independent expert advice NNB has received,[240] an unacceptable region (one which cannot be justified in any sense) is reserved for a very limited number of activities or processes where there can be no defined acceptable risk.[241] This means that the risks associated with these activities or processes cannot be reduced to a level which is “as low as reasonably practicable” (‘ALARP’). ALARP is a principle used in the regulation and management of safety-critical and safety-involved systems. The concept of “reasonably practicable” involves weighing a risk against the trouble, time and cost needed to control it. The concept of what is “reasonably practicable” is at the heart of health and safety assessments.[242] If the cost of implementing safety measures significantly outweighs the benefits, it may be considered “grossly disproportionate”.

10.3.185 In certain circumstances, discrete diving operations may be proportionate (as discussed in the next section below). This would happen, for example, if they are carried out for a short period of time in slack water in order to achieve benefits associated with nuclear safety, operational

239 Dr Richard Brown PhD MSc PgCert FS Eng C. Build E CMABE CMIOSH EurOSHM SMAIChE MIET FEWI. Dr Brown is a chartered health and safety practitioner, chartered building engineer and fellow of the expert witness institute.

240 Dr Richard Brown, as above.

241 For example, the manufacture and use for any purpose of 2-naphthylamin which has extremely difficult to control exposure and produces severe negative health effects as a carcinogen.

242 In the leading case Edwards v National Coal Board [1949] 1 All ER 743 CA, the Court of Appeal held that the term “reasonably practicable” is narrower than the term “physically possible”. The Court of Appeal stated that a computation must be made in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in time, trouble, or money) is placed on the other. If it is shown that there is a gross disproportion between them, the risk being insignificant in relation to the sacrifice, the person upon whom the obligation is imposed discharges the onus which is upon him.

or personal safety, or for the provision of energy security and if they are carried out in ways which manage down the risks for divers in accordance with the ALARP principle.

10.3.186 The text accompanying Figure 10- above refers to the possibility of "*exceptional reasons for the activity or practice to be retained*". The term "exceptional reasons" in a health and safety context is not explicitly defined but is used to describe circumstances which are rare and require special consideration. Where "exceptional reasons" apply then additional or different safety measures may need to be implemented. When assessing whether "exceptional reasons" apply, two key considerations must be taken into account. The first is that where hazards create levels of individual risks which also give rise to societal concerns this will *"often play a far greater role in deciding whether a risk is unacceptable or not*".[243] This means that the potential impact of a risk on society, including socio-political responses, is a key factor, and often the most important one, when carrying out risk assessments. Second, when considering whether "exceptional reasons" apply, it is still necessary to apply a cost benefit analysis to assess whether the potential risks are grossly disproportionate to the potential benefits.

10.3.187 In this context there are no "exceptional reasons" which might justify the intolerable risks associated with the diving operations needed for the installation, maintenance and repair of an AFD system (or other fish deterrent system). This is because any "exceptional reasons" would need to be sufficiently compelling to overcome the wider societal concerns in connection with any attempt to carry out a cost benefit analysis into whether the potential risks to human life caused by high-risk diving operations could be balanced against the potential benefits associated with the installation of untested technology in extreme sea conditions to protect fish. It is NNB's view that there are no "exceptional reasons" which would overcome the societal concerns associated with a cost versus risk analysis which attempted to equate human life with the protection of fish.

Previous and planned diving operations in the Severn Estuary/at the water outfall heads

10.3.188 Diving works have already been undertaken by Balfour Beatty in the Severn Estuary to carry out survey works, primarily for UXO, or the basic rigging for the recovery of items from the seabed. Divers will also be required to dive down to the outfall heads to carry out minor works necessary for the installation of outfall cover slabs. Indeed, the fact that diving operations do take place in connection with the construction of HPC demonstrates that NNB

243 See paragraph 133 of The HSE discussion document "Reducing Risks, Protecting People – HSE's decision making process" (R2P2).

and Balfour Beatty do not take an unrealistic “zero risk” approach to the need for diving operations.[244]

10.3.189 These operations have been or will only be carried out by Balfour Beatty having carefully considered all options other than diving and following a rigorous assessment of health and safety risks and, in the case of the works needed to install outfall cover slabs, after minimising by design the complexity of these tasks in accordance with health and safety legislation, principles and guidance. Furthermore, only reputable, experienced and accredited diving companies have been instructed for these works.[245] In this way Balfour Beatty, working with NNB, have/will control or minimise risks where feasible so far as is reasonably practicable.

Diving operations which have already been carried out in the Severn Estuary

10.3.190 In the case of diving works which have already been undertaken in the Severn Estuary by Balfour Beatty, there have been 570 dives in connection with UXO investigations and 10 in connection with other survey works. These works were vital in order to enable the safe construction of HPC and were carried out prior to the intake heads being installed. UXO poses a severe risk to underwater infrastructure as well as service boats using jacks to settle on the seabed to carry out construction works or when dropping anchor and therefore had to be removed. The Accepted Balfour Beatty Construction Phase Plan for HPC stipulates that for all activities associated with diving operations a specific Hazard Identification Risk Assessment (‘HAZID’) must be completed focusing on the specific activities associated with the scope of work. Doing this ensures that risks are identified and controlled to levels which are as low as is reasonably practicable.

10.3.191 The risks associated with diving operations in connection with UXO investigations are also very different to the risks associated with the diving works for the installation, maintenance and repair of an AFD system at the water intake heads, as set out above at Section 10.3.152. For example, UXO diving campaigns can be timed to coincide with favourable weather conditions and crucially during dives divers do not need to operate in close proximity to operational underwater structures such as an AFD system or intake heads drawing in water with the tether entanglement and entrainment risks associated with this.

244 Although NNB does, rightly, take a “Zero Harm” approach in its health and safety policies to ensure that in the work place people are protected from physical harm.

245 Accredited in this context means diving operators who are IMCA and the Association of Diving Contractors (‘ADC).

Diving operations for the installation of outfall cover slabs on the outfall heads

10.3.192 In the case of the works which are contemplated for the installation of outfall cover slabs on the outfall heads, these works are vital for the safe operation of HPC. This is because in order to connect the outfall heads to the outfall tunnel in the seabed, shafts will need to be drilled through the heads and into the seabed. Once the shaft has been connected to the tunnel, the top of the shaft will need to be "capped" with concrete and made watertight to ensure that water does not dangerously discharge vertically through the shaft and out of the outfall head. In order for the outfall cover slabs to be put in place to cap the shaft, studs will need to be installed so that the cover slab can be laid in position. Nuts will then need to be applied to the studs after the placement of the cover slab. The scope of the works is to thread 16 studs into each head in one diving campaign and then, once the cover slabs are in place, apply nuts to the studs. These works will take place prior to the flooding of the forebay and the heads becoming operational.

10.3.193 It is Balfour Beatty's view that these works cannot be carried out by ROVs as they lack the manoeuvrability and dexterity required for this task. It is therefore anticipated that these works will need to be carried out by divers. The works will be carried out in two dive campaigns and there is no requirement for further follow up tasks or maintenance. Whilst these works are still at a design stage, health and safety considerations are being thoroughly considered to minimise the amount of work to be carried out by divers and to ensure that all potential risks have been identified and controlled to levels which are as low as is reasonably practicable. In addition to a HAZID, a comprehensive Hazard and Operability Study ('HAZOP') and Hazard Identification and Risk Assessment ('HIRA') will be carried out during the development of the detailed methodology with Balfour Beatty's experienced and accredited diving contractor. A HAZOP is a structured and systematic examination to identify the hazards to personnel, equipment, or the environment, as well as operability problems that could affect operations efficiency. A HIRA is a process that involves identifying hazards and assessing them properly to ensure the safety of workers and the environment.

Conclusion.

10.3.194 The introduction of high levels of human risk to install untested AFD technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon personnel who would be contracted to carry out the work. NNB is firmly of the view that compliance with health and safety legislation, principles and guidance could not be achieved if divers were required to undertake work at the level of frequency and exposure to the high risks that such complex work would entail. Independent advice from an external health and safety consultant not otherwise engaged by NNB on the Project agrees with this view.

10.3.195 Accordingly, the installation, maintenance and repair of the AFD system cannot be justifiable based on the risk to human life involved in such work. Doing this would not be a proportionate or reasonably practicable approach to risk.

10.3.196 Any potential alternative solution would need to be capable of overcoming these health and safety risks.

Objective 5 - the need to minimise fish entrapment

Introduction

10.3.197 The need to minimise fish entrapment is a critical objective of the Project. Entrapment includes both impingement and entrainment.

10.3.198 Impingement represents the primary impact pathway for most of the fish species and life-history stages present at HPC. Smaller life-history stages (such as eggs, larvae, juveniles, and for some small bodied species, adult fish) may be entrained. Collectively, these impacts are known as entrapment.

10.3.199 The marine design element of the Project considered in the HRA Report is the removal from the 2013 DCO of the requirement to fit an AFD system. Removal of the requirement to fit an AFD system has the potential to have a direct effect only on fish as a result of entrapment.

Aspect of the Project that relates to the potential for harm

10.3.200 The aspect of the Project that relates to the potential for harm is the marine design element of the Project i.e. the removal from the 2013 DCO of the requirement to fit an AFD system.

Proposed mitigation for the potential harm

10.3.201 The impacts associated with the operation of the water intake heads have been mitigated by the following embedded measures:

- LVSE intakes;
- Capped head mitigation; and

- FRR system

10.3.202 Detail on each of the above mitigation measures is provided in Sections 6.2.22 to 6.2.28 above.

10.3.203 Any proposed alternative solution would need to also minimise fish entrapment and not impact upon the embedded measures listed above.

Objective 6 – the need for design feasibility

Introduction

10.3.204 When installing infrastructure associated with a nuclear power plant, there are several key considerations regarding design feasibility which need to be carefully taken into account. The need to meet these design challenges is a critical objective of the Project.

10.3.205 These design considerations are:

- Operational function;
- Nuclear safety; and
- Site specific constraints.

Operational function

10.3.206 With regards operational function requirements of the Cooling Water System (over the 60 year operational life), any infrastructure such as an AFD system (or other fish deterrent system) including its installation, maintenance and repair must:

- not compromise the integrity of any structures associated with the operation of HPC; and
- not negatively affect the capacity of the water intake heads to draw in cooling water at 131.8 m3/s for both units at full operating power.

10.3.207 Any alternative solution would therefore have to ensure that operational function is not compromised.

Nuclear safety

10.3.208 With regards to nuclear safety requirements, these include:

- not to compromise the integrity of any structures associated with the operation of HPC; and
- provide capacity for safety critical cooling water intake flow at a consistent defined flow rate for the total intake system (estimated by NNB to be 9.8m3/s).

10.3.209 The heat removal system at HPC (of which the cooling water infrastructure forms part) is required to satisfy the highest category of nuclear safety. This places requirements on all parts of its design, including the intake heads, the tunnel, the forebay and pumping station. This also places a burden on all associated equipment and its maintenance, such that there is sufficient confidence that no hazard is introduced that impedes the nuclear safety requirements of the heat removal system or its individual critical components over the lifetime of the plant.

10.3.210 Because the HPC intake heads are nuclear safety classified structures, any AFD or other fish deterrent system installed must not adversely impact the ability of the intake heads to fulfil the Design Basis High Level Safety Function ('HLSF') of providing the safety critical cooling water to the power station. If AFD units (or other components of a fish deterrent system) are of a size/weight that could result in damage to the HLSF, they must either be seismically qualified, or installed at a sufficient distance from the intake heads that in the event of a collapse they could not harm the intake head.

10.3.211 It would also erode nuclear safety margins if HPC was required to be put into regular shutdowns. This is because regular shutdowns, in addition to the planned refuelling shutdowns, would also introduce greater "transients" into the system. The United States Nuclear Regulatory Commission define "transient" as:

"… a change in the reactor coolant system temperature, pressure, or both, attributed to a change in the reactor's power output. Transients can be caused by (1) adding or removing neutron poisons, (2) increasing or decreasing electrical load on the turbine generator, or (3) accident conditions".[246]

10.3.212 Regular shutdowns at HPC would increase or decrease the electrical load on the turbine generator.

246 See https://www.nrc.gov/reading-rm/basic-ref/glossary/transient.html (Accessed 18 December 2023)

10.3.213 Nuclear safety therefore introduces a uniquely challenging design parameter for an AFD system (or other fish deterrent system) that would need to be overcome. Any alternative solution would need to ensure that nuclear safety is not compromised.

Site specific constraints

10.3.214 Operational function and nuclear safety must also be considered in the context of the extremely challenging environment in which HPC is situated. The location of the intake heads approximately 3.3km offshore in the Severn Estuary means that operations must take place in an extremely harsh and challenging working environment with a very large tidal range;[247] in zero or near zero visibility conditions sub-surface due to the heavy sediment load;[248] and strong and fluctuating currents. Any installations are also vulnerable to biofouling caused by crabs, barnacles, limpets and other marine life. Furthermore, the design of the intake heads must minimise the impact on the local environment.

10.3.215 The isolated offshore location also further reduces the windows of time available to construct and maintain an AFD system, due to high wave heights and frequent winter storms. This would cause additional delays.

10.3.216 For these reasons, the Cooling Water System for HPC has been carefully constructed so as to design out so far as possible the need for repair or maintenance during its operational lifetime. Any alternative solution would also need to adequately address these site specific constraints.

10.4 Part 4: Assessed potential for harm

Introduction

10.4.1 This Part implements Step 2 of the methodology of the Stage 3 NAS assessment by:

- Describing the assessed potential for harm. That is, the activities which underly any Stage 2 AA conclusion that the risk of an adverse effect on integrity cannot be ruled out beyond reasonable scientific doubt.

247 The tidal range in the Severn Estuary, where the HPC intakes are located is very large. The tidal range between the Highest Astronomical Tide ('HAT') and Lowest Astronomical Tide ('LAT') is over 13 m.

248 The waters around HPC contain very high concentrations of suspended solids, resulting in zero or near zero visibility conditions for the vast majority of the time.

- Summarising particular aspects of the Project that relate to the potential for harm.
- Presenting the proposed mitigation for the potential harm.
- Identifying any residual potential for harm which requires assessment to determine if there are alternative solutions available.

Describing the assessed potential for harm

10.4.2 Impingement and entrainment (collectively entrapment) represent the impact pathway giving rise to the potential for harm from the Project in relation to fish species of the Severn Estuary.

Aspect of the Project that relates to the potential for harm

10.4.3 The aspect of the Project that relates to the potential for harm is the marine design element of the Project i.e. the removal from the 2013 DCO of the requirement to fit an AFD system.

Proposed mitigation for the potential harm

10.4.4 The impacts associated with the operation of the water intake heads have been mitigated by the following embedded measures:

- LVSE intakes;
- Capped head mitigation; and
- FRR system

10.4.5 Detail on each of the above mitigation measures is provided in paragraph 6.2.22 to 6.2.29 of this HRA Report.

Residual potential for harm which requires assessment to determine if there are alternative solutions available

Risk of adverse effect on integrity of the Severn Estuary SAC via the Estuaries qualifying feature

10.4.6 The Stage 2 AA (Section 9.4.210) has concluded that a risk to the integrity of the Severn Estuaries SAC Estuaries qualifying habitat feature from the entrapment of fish from the typical fish species assemblage could not be excluded beyond reasonable scientific doubt due to the potential for an effect on the structure of predator-prey relationships.

10.4.7 However, it is important to recognise that:

- No certainty of any adverse effect on the integrity of the Severn Estuary SAC has been identified via this ecological mechanism. There is instead merely a risk of an adverse effect on integrity that cannot be excluded beyond reasonable scientific doubt and furthermore this is on the basis of a precautionary assessment.
- As is explained in full at Section 9.4.141 and in Sections 12.7.4 to 12.7.9, the scale of entrapment losses and the associated risk to integrity via this mechanism must be seen in the appropriate context. That context is as follows:
  - Any change to the structure of the typical fish species assemblage through this ecological mechanism is likely to be minor relative to natural variability.
  - The estuarine food-web is diverse and adapted to variability in relative species abundance through dietary overlap and feeding plasticity.
  - The complexity of the food-web with multiple feeding interactions is expected to dampen effects to predator-prey pathways, so providing a degree of food-web resilience to any changes in the relative abundance of individual species resulting from HPC entrapment.
  - The Inspector in the WDA Permit inquiry found (see paragraphs IR11.36 and IR11.207 of his report dated 7 December 2021) that an activity leading to any level of harm to one typical fish species should not be considered as sufficient to result in compromised integrity of the Estuaries feature, albeit that a total loss of a single typical species would; and that (IR11.209) "… *'any' loss* [of a typical species] *cannot be considered sufficient to demonstrate impacts on integrity*".
  - The no adverse effect on integrity test must be considered as against the relevant qualifying feature and conservation objectives. In this case the qualifying feature is the Estuaries qualifying habitat and its relevant conservation objective is:

    "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 the Estuaries qualifying habitat".

    The focus of the assessment, therefore, is the risk of adverse effect in relation to the structure and function of the Estuaries qualifying habitat as a whole, of which the typical fish species assemblage is just one component amongst many other ecological components. It is against the structure and function of the Estuaries feature as a whole that the effect of entrapment of fish from the typical fish species assemblage must be judged;

- No priority habitats/species would or could be adversely affected by the Project.
- Any risk relates to effects which are not permanent (HPC's operational life is expected to be 60 years).

Risk of adverse effect on site integrity due to entrapment of fish from qualifying species of the Severn Estuary SAC, River Usk SAC and River Wye SAC and from the migratory fish species assemblage of the Severn Estuary Ramsar site

10.4.8 The Stage 2 AA (Section 9.16.1) has also concluded that a risk to the integrity of the Severn Estuaries SAC, River Usk SAC, River Wye SAC and the Severn Estuary Ramsar site could not be excluded beyond reasonable scientific doubt due to the entrapment of fish qualifying species / fish from the Ramsar migratory fish species assemblage.

10.4.9 However, it is important to recognise that:

- No certainty of any adverse effect on the integrity of the four European / Ramsar sites has been identified via this impact pathway. There is instead merely a risk of an adverse effect on integrity that cannot be excluded beyond reasonable scientific doubt and furthermore this is on the basis of a precautionary assessment.
- As explained in Section 12.7.4 to 12.7.9 the scale of entrapment losses and the associated risk to integrity via this impact pathway must be seen in the appropriate context. That context is as follows:
  - the predicted impacts of HPC on the three SAC sites in relation to their qualifying migratory fish species and on the Ramsar site for the Criterion 4 migratory species assemblage via this impact pathway are predicted to be low level; and
  - the risk of adverse effect on integrity arising from HPC is not permanent.

10.5 Part 5: Long List of Potential Alternative Solutions

10.5.1 This section implements Step 3 of the methodology of the Stage 3 NAS assessment by:

- Identifying a long list of potential alternative solutions.

- Screening the long list of potential alternative solutions against the Project need and objectives set out in Part 3 of the Stage 3 NAS assessment to produce a short list.

10.5.2 Table 10-3 presents a longlist of potential alternative solutions to the Project works. Table 10-3 starts by defining high level alternatives to the Project given the nature of the predicted effects of the Project.

Table 10-3: Long list of potential alternative solutions

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
1. Do nothing	Construct a power station at HPC without an AFD system	Construct a power station at HPC with an AFD system	Construct a power station at HPC with an AFD system in accordance with the requirements of the 2013 DCO consent	Removes the source of harm.
2. Alternative location for the intake water	Take cooling water from the Severn Estuary	Take cooling water from an alternative location	Abstract cooling water from a different source outside of the Severn Estuary or the marine environment.	Removes the source of harm. However, depending on the alternative location there may be impacts on other protected sites.
3. Alternative scales	Construct a nuclear power station with four cooling water intake heads (two	Construct a nuclear power station with two cooling water	Construct a power station with one rather than two water intake	Reduces, but does not remove the source of harm. Entrapment may increase if the

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
	intake heads per intake tunnel)	intake heads (one intake head operational)	heads to reduce the surface area for fish entrapment within the Severn Estuary.	water velocity increases as a result of reliance on one cooling water intake head.
		Construct a nuclear power station with more than four cooling water intake heads (more than two intake tunnels)	Construct a power station with more than four cooling water intake heads to try to reduce the water velocity passing through each intake head.	Doing this would increase the surface area of fish entrapment, which does not remove the source of harm.
4. Seasonal restrictions	Abstract cooling water continually from the Severn Estuary with no seasonal restrictions	Abstract water only at certain times of the year, on a seasonal basis	Abstract water when certain fish species are not present in the Severn Estuary to minimise entrapment of those species.	Reduces impacts on some seasonal/migratory fish, but does not remove the source of harm to species from the typical fish species assemblage in the Severn Estuary.

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
5. Phasing the construction works differently	Construct a power station without an AFD system for the duration of the Project	Retrofitting an AFD system to the intake heads when the AFD and ROV technology is available.	Moving ahead with construction and operation of HPC, but keeping AFD/ROV technology under review until it can be deployed safely by retrofitting it on to the intake heads without the need for divers for installation or maintenance or repair.	Reduces the total impact over the operational lifetime of the Project
6. Alternative construction methods/ locations for construction				
6.1 Bubble curtains	Construct a power station without bubble curtains to	Construct a power station with bubble curtains to deter fish.	Air bubble curtains are formed when a porous or perforated pipe with	Potentially reduces, but does not remove the source of harm.

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
	act as a deterrent to fish species.		nozzles is affixed to the seabed and fed with compressed air. The conceptual basis for this as a mitigation measure is that the rising curtain of bubbles formed may plausibly deflect organisms, as organisms drawn towards the bubble curtain may move with the vertical current generated by the bubble plume and be brought to the surface. Bubble curtains can therefore operate as deterrents in three ways:	

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
			• Acting as a physical, visible barrier to fish; • Creating an upward current, carrying smaller fish and non-mobile organisms away from the intake; and • Where combined with the presence of an AFD, it can further project the sound to cover a wider area.	
6.2 Strobe lighting	Construct a power station without strobe lighting to act as a deterrent to fish species.	Construct a power station with strobe lighting to deter fish.	The publication "Cooling Water Options for the New Generation of Nuclear Power Stations in the	Potentially reduces, but does not remove the source of harm.

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
			UK SC70015/SR3" (2010) notes that strobe lights have been used for many years to deter fish but have been limited by the high voltage requirements of the strobes and their bulb life. Strobe lighting can work well in clear water, or areas of low-medium turbidity within which sediment particles may act to reflect the light, transmitting the effects over a wider area.	

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
6.3 Electrical barriers	Construct a power station without electrical barriers to act as a deterrent to fish species.	Construct a power station with electrical barriers to act as a deterrent to fish species.	Electrical barriers have been successfully deployed in freshwater environments, pulsing electrical currents to deflect fish and mammals away from infrastructure.	Potentially reduces, but does not remove the source of harm.
6.4 Alternative methodology	Construct a power station without an AFD system for the duration of the development	Commission a new engineering system to provide an alternative fish deterrent system.	If no engineering system currently exists which can deliver an alternative fish deterrent, could NNB commission a new and different engineering system which would do this?	Remove the source of the harm.

Potential Alternative	Approach Included Within the Material Change Application to the 2013 DCO	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA and Ramsar Site
6.5 Installation of wedge-wire screens	Construct a power station without wedge-wire screens	Construct a power station with wedge-wire screens	Installing wedge wire screens with a fine mesh would screen the water of all objects (other than silt) before entering into the water intake head. It would also reduce the zone of influence around the intake heads.	Remove the source of the harm.

Screening the long list of potential alternative solutions

10.5.3 This section assesses whether the long list of potential alternative solutions set out in Table 10-3 could meet or deliver the Project 'genuine' and 'critical objectives' as defined in Part 3 of the Stage 3 NAS assessment.

10.5.4 Table 10-4 presents the findings of this detailed screening exercise.

Table 10-4: Screening the long list of potential alternative solutions

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
1. *Do nothing*	No	This potential alternative solution would require the fitting of an AFD system at the cooling water intake heads, in accordance with the 2013 DCO consent. The reason why this option has not been selected are discussed in Sections 10.3.4 to 10.3.8 above. In summary this potential alternative solution would not comply with the following Project objectives. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons. • Installing an AFD system now would require lengthy and indefinite delays whilst further work is undertaken to seek to design and develop an AFD system, if indeed this was possible. Designing and developing an AFD system, even if possible, would take a considerable amount of time as would the additional work required to develop the technology and systems needed to carry out planned maintenance and unplanned repair work to the	No

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		AFD system during the operational lifetime of HPC. In the case of the ROV technology required to carry out these tasks without any need for divers, independent expert advice on ROVs has confirmed that ROV technology cannot now (and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system on their own. This means that it may not be possible for NNB to develop the technology an AFD system would need to operate successfully. These delays, which could take many years, would occur because there was (and remains) no engineering precedent for fitting an AFD to an open-water intake system like that used at HPC in waters with comparable tidal range, currents and turbidity. This work would be made more challenging because the intake heads have now been installed underwater (installation took place in the summer of 2022). • If it was decided that ROVs, assisted by divers, would be used to install an AFD system, the process of installation would take a considerable amount of time due to the limited diving windows available to carry out the installation works.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• Considerable time would also be needed to secure an execution plan to underpin the marine works, the associated environmental and marine permitting and to secure the necessary construction equipment, infrastructure and contractual aspects to deliver the plan. • Efforts could be made reduce the need for maintenance by developing sound projector units which can better withstand the environmental conditions at the HPC water intake heads. For example, the use of APCUs could stretch out maintenance times from every 12 to 18 months to a longer period. However, it would take a considerable amount of time to develop and test this technology. • The isolated offshore location further reduces the windows of time available to install an AFD system, due to high wave heights and frequent winter storms. This would cause additional indefinite delays if contractors could not be deployed due to bad weather.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		These challenges would cause very substantial delays before the commissioning and operational phases for HPC could commence, and these delays could be indefinite. **Health and Safety Objective** To the extent that this alternative would require divers for the installation, maintenance and repair of the AFD system, it would not comply with the requirements of the HSW Act and supporting regulations. A failure to comply with the requirements of the HSW Act and supporting regulations would mean a failure to comply with the Health and Safety Objective. The introduction of high levels of human risk to install untested technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon future contractors. To do so would fail the legal test of the HSW Act and supporting regulations which impose a burden on an employer to eliminate risk where feasible. In this matter, NNB in pursuing the AFD system, would be introducing intolerable risk at the design stage which is indefensible and does not meet the legislative Health and Safety requirements to eliminate or design out risk where feasible. It would	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		also not comply with NNB's own health and safety policies, which go beyond the minimum standards prescribed by health and safety legislation, principles and guidance. **Technical Feasibility Objective** This potential alternative solution would not comply with the Technical Feasibility Objective. This is because even if the considerable technical feasibility issues associated with the development of a workable AFD system in this location could be overcome, crucially the installation, maintenance and repair of the AFD system would need to be reliant on ROV technology (rather than rely on divers). However, independent expert advice on ROVs has confirmed that ROV technology cannot now (and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system on its own. This is because factors such as tether drag, the high risk of tether entanglement when flying ROVs, ROV operational reliance on sonar, and the turbid environmental conditions of the Severn Estuary make the installation and ongoing subsea maintenance and repair of an AFD system problematic.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		Furthermore, if ROVs were used for planned maintenance and unplanned repair activities, they would likely need to be equipped with a gamma radiation source in order to inspect the integrity of the AFD system's tubular cluster base and frame before lifting those structures to the surface so that works could be carried out. In the challenging environment of the Severn Estuary, there is risk that ROVs may become snagged, entangled and/or fail underwater. ROVs carrying radioactive substances could pose a risk if they were snagged or entangled at the intake heads or became loose on the seabed or in the water column. This would cause an unacceptable risk to shipping or other human activities. **Design Feasibility Objective** This potential alternative solution would not comply with the Design Feasibility Objective. This is because installing an AFD system weakens the design feasibility of the Cooling Water System in terms of its operational functionality and compliance with nuclear safety requirements. This is due to the inherent vulnerability of an AFD system in such a challenging environment, with different components of the system requiring differing amounts of intervention during the lifetime of the power station. Design feasibility issues include the following:	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• In order to carry out installation, maintenance and repair activities, access would be by boat only, exposing personnel to the risks of working in the hazardous conditions of the Severn Estuary. It would also make inspection, maintenance and repair time extremely labour intensive. • Installing an AFD system which required regular maintenance and repair work would require the operation of maintenance vessels in the vicinity of the intake heads, increasing the risk of vessel mooring lines affecting the intake heads. • If divers were relied on to carry out works on the AFD system then this could cause nuclear safety risks. This is because if divers were involved then for health and safety reasons HPC would need to be put into shutdown mode to reduce the velocity of water being drawn into the water intake heads. Regular shutdowns for maintenance and repair works, in addition to the planned refuelling shutdowns, would introduce greater "transients" into the system. The increase in transients	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		caused by regular shutdowns would threaten HPC's nuclear safety margins. These design feasibility issues mean that the requirement to install an AFD system would not comply with the Design Feasibility Objective. **Energy Production at HPC Objective** This potential alternative solution would not comply with the Energy Production Objective. This is because ROV technology cannot now (and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system on its own requiring divers to be used. Aside from the intolerable health and safety risks associated with using divers for these tasks, if divers were used then HPC would need to be put into shutdown mode whilst divers carried out planned maintenance or unplanned repair works or are required to unsnag or untangle ROVs near to the water intake heads. This would be necessary in order to reduce the risk of divers or diver umbilicals becoming entrained in the water intake heads whilst they are actively drawing in water. Regularly putting HPC into shutdown mode would compromise its capacity to produce low carbon	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		energy. This is because HPC cannot generate energy when it is in shutdown mode.	
2. *Alternative location for the intake water*	No	This potential alternative solution would require the abstraction of cooling water from a different source outside of the Severn Estuary or the marine environment. This potential alternative solution would not comply with the following Project objectives. **Energy Production at HPC Objective** This potential alternative solution would not comply with the Energy Production at HPC Objective. This is because for design feasibility reasons, an offshore intake position was selected by NNB as the preferred option to enable energy production. Whilst nuclear safety redundancy has been built into the HPC design so that should one or both offshore cooling water intake heads fail, water could be taken from another location to cool down the reactors, in that scenario HPC will have been put into emergency shut down mode and would not be producing energy. Therefore, within the current design parameters of HPC, the option to take cooling water from another location is not a viable option in terms of HPC being able to produce energy. Doing this	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		would therefore not comply with the Energy Production at HPC Objective. If cooling water is to be taken from a completely different source then this would require a complete reconfiguration of HPC, the construction of which is well advanced and approximately 60% complete. The need to completely reconfigure HPC to incorporate a new cooling water system would jeopardise the viability of HPC as a nuclear power station. This would likely mean that HPC would not be constructed and therefore would not produce energy. Doing this would therefore not comply with the Energy Production at HPC Objective. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons. • The construction of HPC is already well advanced and approximately 60% complete, including the water intake heads and outfall tunnels which have already been installed. A fundamental redesign of the HPC Cooling Water System at	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		this stage to receive a consistent flow of cooling water from another source which is also compliant with nuclear safety requirements would require a fundamental redesign of HPC and considerable reengineering. This considerable reengineering would also present further problems which would take considerable time to carefully evaluate and consult on. For example, reliance instead on the alternative option of cooling towers would considerably add to the landscape and visual impacts associated with HPC. It is also noted that as a matter of national policy, paragraph 5.10.31 of NPS EN-1 (November 2023) states that the Secretary of State must expect information in the application justifying "…*the use of a cooling system that involves visible steam plumes or has a high visible structure, such as a natural draught cooling tower, and be satisfied that the application of modern hybrid cooling technology or other technologies is not reasonably practicable before giving consent to a development with natural draught cooling towers*". • The fundamental redesign of HPC to incorporate a new cooling water system would take a considerable amount of	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		time and would jeopardise its viability as a nuclear power station. This is because HPC is now so advanced that incorporating a new cooling water system design would require large parts of what has been constructed to be demolished. This would include the tunnels, the pumphouse and infrastructure located underneath the turbine halls. The cost and logistics of this makes it something that jeopardises the completion of HPC. The impact of an indefinite delay or the total loss of HPC as a source of low carbon energy could not be justified given the UK's urgent need for low carbon energy production. • This potential alternative solution would also require extensive material changes to the HPC's 2013 DCO consent. A material change application to the 2013 DCO of that scale would lead to significant delays in the commissioning and operational phases of HPC. **Design Feasibility Objective**	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		Taking cooling water from another source would also not comply with the Design Feasibility Objective. Taking into account all the requirements for the Cooling Water System at HPC, NNB carefully considered both the inshore and offshore environments for the placement of the water intake structures. NNB concluded that extensive coastal modifications would be required to secure a cross-shore intake that would provide sufficient depth of water at all times (so as to not draw in air during the extreme tidal changes). Due to the significant environmental impacts of such a structure, an inshore intake location was not considered further and an offshore intake position was selected as the preferred option. In order to find a suitable location for the intake heads, a number of offshore investigations were conducted over a large area of the Bristol Channel. These were split into two phases. The first was conducted in 2008 which studied factors such as the bathymetry, geology and sedimentology as well as looking for the presence of magnetic objects. The second stage of the offshore investigations was carried out in 2009/10 and was aimed at establishing the detailed geological and geotechnical models for the planned design.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		The results of these investigations led to a preliminary decision to site the intake heads roughly 5.3km from the coast. However, further review of the proposed intake location revealed that there were two major drawbacks with locating the heads so far from the coast. These were the costs associated with boring such long tunnels and the head loss (in broad terms, a loss of energy over the length of the tunnel due to friction with the internal surface) which would occur over such a distance. To overcome these drawbacks, locations closer to the coast were considered. The location 3.3km from the shore was selected as the most appropriate solution, taking into account the requirements to reduce the hazards associated with the low seawater level (with sufficient head of water - greater than 1m - maintained at all times) and head loss. The specific location was selected as a local minimum in sediment depths and one that avoids the tunnels crossing any major seismic faults. The final location was set in 2010 and approved in the 2013 DCO.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		It should be noted that the intake head locations were set prior to the publication of the Environment Agency publication "*Cooling Water Options for the New Generation of Nuclear Power Stations in the UK SC70015/SR3*" (2010). However, the requirements set out in that report had already been independently identified by NNB and captured through engineering and scientific due diligence as discussed above. Therefore, the primary considerations driving the location of the intake and outfall tunnels were related to nuclear and operational safety. However, environmental requirements were also thoroughly considered and taken into account (and so, for example, the tunnels were located so as to avoid loss of saltmarsh habitat and to minimise the impacts of the thermal plume from the outfall tunnels on the marine environment). For these reasons, the current locations of the intake heads have been carefully selected as they best comply with the Design Feasibility Objective. An alternative location for cooling water outside of the Severn Estuary and marine environment would therefore not comply with the Design Feasibility Objective.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
3. *Alternative scales*	No	The potential alternative solutions would require either: • the construction of a power station with one rather than two water intake heads to reduce the surface area for fish entrapment within the Severn Estuary; or • the construction of a power station with more than four cooling water intake heads to try to reduce the water velocity passing through each intake head. These potential alternative solutions would not comply with the following Project objectives. **Minimise Fish Entrapment Objective** These potential alternative solutions would have limited benefits/or negative impacts with regards the Minimise Fish Entrapment Objective. This is for the following reasons: • The construction of a power station with one rather than two water intake heads per unit to reduce the surface area for fish entrapment within the Severn Estuary would likely not lead to	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		a significant reduction in fish entrapment and may, in fact, increase fish entrapment. This is because a reduction in water intake heads from two to one would mean that the remaining water intake head would need to abstract water more quickly in order to ensure a consistent water supply of 131.8 m3/s required to cool the turbine condenser systems to allow for the generation of low carbon energy. The increased draw of water around the remaining operational water intake head could potentially increase fish entrapment because of the larger zone of influence within the Severn Estuary it would create. • Having carefully considered this option, NNB have concluded that the construction of a power station with more than four cooling water intake heads would not actually reduce the water velocity passing through each intake head. This is because the 0.3 m/s velocity at the water intake heads is determined by the design shape of the intake heads. Adding more intake heads would therefore not reduce water velocity. Rather it would just substantially increase the surface area within the Severn Estuary for fish entrapment.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		Energy Production at HPC Objective Neither of these potential alternative solutions would comply with the Energy Production at HPC Objective. This is for the following reasons: • The construction of a power station with one rather than two water intake heads per unit to reduce the surface area for fish entrapment within the Severn Estuary would erode the nuclear safety margins for HPC. Two intake heads were selected by NNB for nuclear safety reasons so that if one water intake head was not operational, cooling water could still be accessed via the second water intake head. Doing this ensures that there is a consistent water supply of 131.8 m3/s required to cool the turbine condenser systems to allow for the generation of low carbon energy. Reliance on one water intake head alone would mean that HPC would be vulnerable to an increased risk of emergency shutdown should that intake head be compromised and cannot provide a consistent water supply. HPC cannot create energy when it is in emergency shutdown mode.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• The construction of a power station with more than four cooling water intake heads would not be a realistic option as it would not reduce water velocity at the intake heads but rather just increase the surface area for fish entrapment. It would also require the abandonment of the existing water intake tunnels and the construction of new tunnels specially designed in order to service multiple water intake heads. Doing this would: (a) Require substantial amounts of additional concrete and steel, significantly increasing the carbon footprint associated with the construction of HPC. This would mean that it would take significantly longer for the carbon footprint for the construction of HPC to be off-set by the carbon savings made over time through the production of low carbon energy. (b) Require the cooling water system at HPC to be completely reconfigured, necessitating substantial amounts of reengineering at HPC. This would jeopardise the viability of HPC as nuclear power station. This would	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		likely mean that HPC would not be constructed and therefore would not produce energy. For these reasons these potential alternative solutions would not comply with the Energy Production at HPC Objective. **Design Feasibility Objective** Neither of these potential alternative solutions would comply with the Design Feasibility Objective. This is for the following reasons: • The construction of a power station with one rather than two water intake heads to reduce the surface area for fish entrapment within the Severn Estuary would erode the nuclear safety margins for HPC. Two intake heads were selected by NNB for nuclear safety reasons so that if one intake head was not operational, cooling water could still be accessed via the second intake head. Doing this ensures that there is a consistent water supply of 131.8 m3/s required to cool the turbine condenser systems to allow for the generation of low carbon energy. Reliance on one water intake head alone would mean that HPC would be vulnerable to an	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		increased risk of emergency shutdown should that intake head be compromised and cannot provide a consistent water supply. HPC cannot create energy when it is in emergency shutdown mode. This would be an unacceptable design weakness. • As discussed above in relation to the Urgent Need for Low Carbon Energy Production Objective, there would be significant design and engineering challenges associated with the construction of a nuclear power station with more than four cooling water intake heads and the additional tunnels required to service those intake heads. Significant survey work would be needed to ascertain where the additional intake heads and service tunnels could be located in the Severn Estuary. The design challenges associated with this option would require a substantial amount of time to be addressed and may be impossible to overcome. The difficulty in overcoming these serious design feasibility challenges would likely jeopardise the viability of HPC.	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		Urgent Need for Low Carbon Energy Production Objective The potential alternative solution to construct a power station with more than four cooling water intake heads would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons: • Substantial additional design and engineering on this scale would lead to catastrophic delays to the commissioning and operational phases of HPC. • The permanent structures at HPC have been constructed to a point where the location on land to give access to launch new tunnel boring machines has been obscured. Therefore, if this option was selected these locations would need to be cleared to allow access for the construction of the additional tunnels. Aside from the significant wasted costs / additional costs associated with these clearance works, rebuilding sections of the power plant which have already been built	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		would cause further significant delays in the commissioning and operational phases of HPC. • The construction site at Avonmouth operated by NNB contractors Balfour Beatty for the engineering works associated with the creation and installation of the water intake heads and tunnels is now being used by Balfour Beatty for other projects. It would take a significant amount of time to commission (and receive planning permission for) a new construction site with the necessary materials and equipment needed for the construction of additional water intake heads and tunnels. • The boring machinery to create the additional underground tunnels would need to be re-created. This is because the machinery used to construct the current two underground tunnels has either been decommissioned or is now entombed under the Severn Estuary. NNB would therefore need to go out to tender with suppliers for new bespoke boring machinery. This would take a significant amount of time and substantial additional costs.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• NNB would need to secure an enormous amount of materials, particularly concrete and steel, for the construction of additional tunnels and intake heads. It would take a significant amount of time for NNB to secure these materials from its suppliers. • NNB would need to find and secure a location for the storage and disposal of the new tunnel arisings. This would include securing the environmental permits necessary for the treatment of the tunnel arisings as waste. This would include an additional planning permission associated with the waste disposal site (if not already in place). Additionally, the tunnel arisings could be used in landscaping at HPC or another location. Such usage would require planning permission, which would take additional time to secure. • This potential alternative solution would require a further material change to the HPC (Nuclear Generating Station) Order 2013. A material change application of this scale to the	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		2013 DCO would lead to significant delays in the commissioning and operational phases for HPC. For these reasons, selecting this potential alternative solution would likely jeopardise the viability of HPC. The loss of supply of low carbon energy from HPC could not be justified given the UK's urgent need for low carbon energy production.	
4. *Seasonal restrictions*	No	This potential alternative solution would involve abstracting water at a lower velocity for seasonal periods to minimise the entrapment of certain fish species. This would not comply with the following Project objectives. **Energy Production at HPC Objective** This potential alternative solution would not comply with the Energy Production at HPC Objective. This is because seasonal restrictions on energy production would mean that HPC would need to regularly be put into shutdown mode for the duration of the seasonal restriction. This would severely compromise HPC's capacity to produce low	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		carbon energy because HPC cannot generate energy when it is in shutdown mode. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is because seasonal restrictions requiring HPC to be put into shutdown mode for the duration of the seasonal restriction would severely limit HPC's capacity to produce low carbon energy. This would prevent HPC meeting the UK's urgent need for low carbon energy production. **Design Feasibility Objective** This potential alternative solution would not comply with the Design Feasibility Objective. This is because HPC needs a consistent water supply of 131.8 m3/s required to cool the turbine condenser systems to allow for the generation of low carbon energy. HPC's reliance on a Cooling Water System that is subject to seasonal restrictions would therefore introduce a major design flaw into the consistent operation of HPC.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		Furthermore, regular seasonal shutdowns, in addition to the planned refuelling shutdowns, would also introduce greater "transients" into the system. The increase in transients caused by regular seasonal shutdowns would threaten HPC's nuclear safety margins. These design feasibility issues mean that the requirement for seasonal shutdowns would not comply with the Design Feasibility Objective. **Minimise Fish Entrapment Objective** This potential alternative solution would have limited benefit with regards the Minimise Fish Entrapment Objective. This is because even if HPC was placed into shutdown mode during the seasonal restriction period, water would still be abstracted (albeit at a lower velocity) from the Severn Estuary. This is because water must always be abstracted in order to cool HPC's nuclear reactors. Fish entrapment would therefore continue even in this scenario.	
5. *Phasing the construction works differently*	No	This potential alternative solution would require moving ahead with construction, commissioning and operation of HPC but keeping AFD/ROV technology under review until it can be deployed safely by retrofitting it on to the water intake heads without the need for divers	No

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		for installation or maintenance or repair. This potential alternative solution would not comply with the following Project objectives. **Design Feasibility Objective** This potential alternative solution would not comply with the Design Feasibility Objective. This is because installing an AFD system weakens the design feasibility of HPC's Cooling Water System. This is due to the inherent vulnerabilities of AFD systems in such a challenging environment, with different components of the system requiring differing amounts of intervention during the 60 year lifetime of the power station. Design feasibility issues include the following: • In order to carry out installation, maintenance and repair activities, access would be by boat only, exposing personnel to the risks of working in the hazardous conditions of the Severn Estuary. It would also make inspection, maintenance and repair time extremely labour intensive. • Installing an AFD system which required regular planned maintenance and unplanned repair work would require the operation of maintenance vessels in the vicinity of the intake	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		heads, increasing the risk of vessel mooring lines affecting the intake heads. These design feasibility issues mean that the requirement to install an AFD system would not comply with the Design Feasibility Objective. **Technical Feasibility Objective** If ROVs were used for maintenance activities rather than divers, they would likely need to be equipped with a gamma radiation source in order to inspect the integrity of the various tubular AFD structures before lifting those structures to the surface so that planned maintenance or unplanned repair works could be carried out. In the challenging environment of the Severn Estuary, there is risk that ROVs may become snagged and/or fail underwater. ROVs carrying radioactive substances could pose a risk if they were snagged or became entangled at the intake heads, causing damage to the intake heads or other parts of the AFD system. If the ROVs became loose on the seabed or in the water column, they could cause an unacceptable risk to shipping or other human activities. Therefore, installing an AFD system which required intervention from ROVs equipped with a gamma	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		radiation source for maintenance or repair works would introduce unacceptable risks. **Health and Safety Objective** Whilst this potential alternative solution would mean that an AFD system would only be retrofitted to the water intake heads once ROV technology was sufficiently advanced that it was capable of carrying out the installation, maintenance and repairs tasks without the need for divers, it would still not be possible to rule out the risk that ROV tethers could become snagged or entangled at the intake heads. If an ROV became entangled it would likely not be able to untangle itself. This means that divers would be needed in order to untangle the ROV. To the extent that this potential alternative solution would require divers for the installation, maintenance and repair of the AFD system, it would not comply with the requirements of the HSW Act and supporting regulations. A failure to comply with the requirements of the HSW Act and supporting regulations would mean a failure to comply with the Health and Safety Objective.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
6. *Alternative construction methods/locations for construction*			
6.1 Bubble curtains	No	This potential alternative solution would require the installation of bubble curtains to deter fish. This would not comply with the following Project objectives. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons. • Installing a bubble curtain system now would require a considerable delay whilst a suitable bubble curtain system was designed, tested and installed. There is no engineering precedent for fitting bubble curtains to an open-water intake system like that used at HPC in waters with comparable tidal range, currents and turbidity. Work would need to start from first principles on a bubble curtain system. This would include	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		tendering for a supplier of bubble curtain technology. This work would be made more challenging because the intake heads have now been installed underwater (installation took place in the summer of 2022). This means that engineering options would be constrained by having to fit around existing infrastructure. • In the case of the ROV technology required to carry out the installation, maintenance and repair of a bubble curtain system, to the extent that this infrastructure is similar to the infrastructure needed for an AFD system, independent expert advice on ROVs has confirmed that ROV technology cannot now (and is highly unlikely in the future to be able to) carry out these tasks on their own. This means that it may not be possible for NNB to develop the technology a bubble curtain system would need to operate successfully. • If it was decided that ROVs, assisted by divers, would be used to install a bubble curtain system, the process of installation would take a considerable amount of time due to the limited diving windows available to carry out the installation works.	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		• Considerable time would be needed to secure an execution plan to underpin the marine works, the associated environmental and marine permitting and to secure the necessary construction equipment, infrastructure and contractual aspects to deliver the plan. • This option would also require a further material change to HPC's 2013 DCO. A material change application to the 2013 DCO for a bubble curtain system would lead to significant delays in the commissioning and operational phases for HPC. • The isolated offshore location further reduces the windows of time available to install a bubble curtain system, due to high wave heights and frequent winter storms. This would cause additional delays if contractors could not be deployed due to bad weather. **Health and Safety Objective** To the extent that this potential alternative solution would require divers for the installation, maintenance and repair of the bubble curtain	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		system, it would not comply with the requirements of the HSW Act and supporting regulations. A failure to comply with the requirements of the HSW Act and supporting regulations would mean a failure to comply with the Health and Safety Objective. The introduction of high levels of human risk to install untested technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon future contractors. To do so would fail the legal test of the HSW Act and supporting regulations which impose a burden on an employer to eliminate risk where feasible. In this matter, NNB in pursuing the bubble curtain system would be introducing intolerable risk at the design stage which is indefensible and does not meet the legislative Health and Safety requirements to eliminate or design out risk where feasible. It is also likely that even if ROVs were to improve in the future so that they could carry out bubble curtain installation, maintenance and repair, divers would still be needed for other tasks associated with the system. This would mean that the diver health and safety risk associated with these activities would still be present. Any involvement of divers in these works would not comply with the requirements of the	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		HSW Act and supporting regulations (and, accordingly, the Health and Safety Objective). **Technical Feasibility Objective** This potential alternative solution would not comply with the Technical Feasibility Objective. This is because even if the considerable technical feasibility issues associated with the development of a workable bubble curtain system in this location could be overcome, crucially the installation, maintenance and repair of the bubble curtain system would need to be reliant on ROV technology (rather than rely on divers). However, ROV technology currently could not carry out all of the activities associated with the installation, maintenance and repair of a bubble curtain system at HPC on their own. Factors like the high risk of tether entanglement, their operational reliance on sonar, and the environmental conditions of the Severn Estuary make the installation and ongoing subsea maintenance requirements of a bubble curtain system problematic. Therefore, it is highly unlikely that ROVs would ever be an effective solution for installing a bubble curtain system or for the ongoing planned maintenance and unplanned repair activities it would require.	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		Design Feasibility Objective This potential alternative solution would not comply with the Design Feasibility Objective. This is because installing a bubble curtain system weakens the design feasibility of the Cooling Water System. This is due to the following inherent vulnerabilities of a bubble curtain system in such a challenging environment. • Bubble curtains can suffer from poor reliability due to blockage risk, exposure of structures on the seabed, and disruption from vessel activity in the area. The high levels of sediment at the intake locations would affect the bubble formation and render the system ineffective. • Bubble curtains are entirely inappropriate in the harsh environment of the Severn Estuary. This is because the high tidal flows in the Severn Estuary would mean that the bubbles would be distorted and dispersed soon upon release, reducing their efficiency at deterring fish entering the Cooling Water System. For these reasons, bubble curtains are not considered a feasible design alternative for the HPC Cooling Water System.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• In order to carry out necessary installation and maintenance activities, access would be by boat only, making maintenance and inspection both time and labour intensive but also, crucially, exposing personnel to the risks of working in the hazardous conditions of the Severn Estuary. Additional concerns include the operation of maintenance vessels in the vicinity of the intake heads, noting in particular the risk of vessel mooring lines affecting the intake heads. • If divers are used to carry out works on the bubble curtain system then this could cause nuclear safety risks. This is because if divers were used, for health and safety reasons HPC would need to be put into shutdown mode to reduce the velocity of water being drawn into the water intake heads. Regular shutdowns, in addition to the planned refuelling shutdowns, would introduce greater "transients" into the system. The increase in transients caused by regular shutdowns to allow for the maintenance of the bubble curtain system by divers would therefore threaten HPC's nuclear safety margins.	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		These design feasibility issues mean that the requirement to install a bubble curtain system would not comply with the Design Feasibility Objective. **Minimise Fish Entrapment Objective** This potential alternative solution would not comply with the Minimise Fish Entrapment Objective. This is because bubble curtains can suffer from poor reliability due to blockage risk, exposure of structures on the seabed, and disruption from vessel activity in the area. Further, in areas of high tidal flows such as the Severn Estuary, the bubbles will be distorted and dispersed soon upon release, reducing their efficiency at deterring fish entering the CWS. For these reasons, bubble curtains are not considered a feasible alternative because they would not provide an effective deterrent to prevent or minimise fish entrapment. **Energy Production at HPC Objective** This potential alternative solution would not comply with the Energy Production Objective. This is because ROV technology cannot now	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		(and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system on its own requiring divers to be used. Aside from the intolerable health and safety risks associated with using divers for these tasks, if divers were used then HPC would need to be put into shutdown mode whilst divers carried out planned maintenance or unplanned repair works or are required to untangled ROVs near to the water intake heads. This would be necessary in order to reduce the risk of divers or diver umbilicals becoming entrained in the water intake heads whilst they are actively drawing in water. Regularly putting HPC into shutdown mode would compromise its capacity to produce low carbon energy. This is because HPC cannot generate energy when it is in shutdown mode.	
6.2 Strobe lighting	No	This potential alternative solution would require the installation of strobe lighting to deter fish. This would not comply with the following Project objectives. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons.	No

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• Installing strobe lighting would require a considerable delay whilst a strobe lighting system was designed, tested and installed. There is no engineering precedent for fitting strobe lighting to an open-water intake system like that used at HPC in waters with comparable tidal range, currents and turbidity. Work would need to start from first principles on new system. This would include tendering for a supplier of strobe lighting technology. This work would be made more challenging because the intake heads have now been installed underwater (installation took place in the summer of 2022). This means that engineering options would be constrained by having to fit around existing infrastructure. • In the case of the ROV technology required to carry out the installation, maintenance and repair of strobe lighting, to the extent that this infrastructure is similar to the infrastructure needed for an AFD system, independent expert advice on ROVs has confirmed that ROV technology cannot now (and is highly unlikely in the future to be able to) carry out these tasks on their own. This means that it may not be possible for	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		NNB to develop the technology strobe lighting would need to operate successfully. • If it was decided that ROVs, assisted by divers, would be used to install strobe lighting, the process of installation would take a considerable amount of time due to the limited diving windows available to carry out the installation works. • Considerable time would be needed to secure an execution plan to underpin the marine works, the associated environmental and marine permitting and to secure the necessary construction equipment, infrastructure and contractual aspects to deliver the plan. • This option would also require a further material change to HPC's 2013 DCO. A material change application to the 2013 DCO for strobe lighting would lead to significant delays in the commissioning and operational phases for HPC. • The isolated offshore location further reduces the windows of time available to install strobe lighting, due to high wave	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		heights and frequent winter storms. This would cause additional delays if contractors could not be deployed due to bad weather. **Health and Safety Objective** To the extent that this potential alternative solution would require divers for the installation, maintenance and repair of the strobe lighting system, it would not comply with the requirements of the HSW Act and supporting regulations. A failure to comply with the requirements of the HSW Act and supporting regulations would mean a failure to comply with the Health and Safety Objective. The introduction of high levels of human risk to install untested technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon future contractors. To do so would fail the legal test of the HSW Act and supporting regulations which impose a burden on an employer to eliminate risk where feasible. In this matter, NNB in pursuing the strobe lighting system would be introducing intolerable risk at the design stage which is indefensible and does not meet the legislative Health and Safety requirements to eliminate or design out risk where feasible.	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		It is also likely that even if ROVs were to improve in the future so that they could carry out strobe lighting installation, maintenance and repair, divers would still be needed for other tasks associated with the strobe lighting. This would mean that the diver health and safety risk associated with these activities would still be present. Any involvement of divers in these works would not comply with the requirements of the HSW Act and supporting regulations (and, accordingly, the Health and Safety Objective). **Technical Feasibility Objective** This potential alternative solution would not comply with the Technical Feasibility Objective. This is because even if the considerable technical feasibility issues associated with the development of a workable strobe lighting system in this location could be overcome, crucially the installation, maintenance and repair of the strobe lighting system would need to be reliant on ROV technology (rather than rely on divers). However, ROV technology currently could not carry out all of the activities associated with the installation, maintenance and repair of a strobe lighting system at HPC on their own. Factors like the high risk of tether entanglement, their operational reliance on sonar, and the	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		environmental conditions of the Severn Estuary make the installation and ongoing subsea maintenance requirements of a strobe lighting system problematic. Therefore, it is highly unlikely that ROVs would ever be an effective solution for installing strobe lighting or for the ongoing planned maintenance and unplanned repair activities it would require. **Design Feasibility Objective** This potential alternative solution would not comply with the Design Feasibility Objective. This is because installing strobe lighting weakens the design feasibility of the Cooling Water System in the following ways: • Whilst strobe lighting can work well in clear water, or areas with low-medium turbidity, they do not operate well in high turbidity areas such as the Severn Estuary. In clear water or low-medium turbidity areas the sediment particles may act to reflect the light, transmitting the effects of the strobe lighting system over a wider area. In areas such as the Severn Estuary, however, with high levels of suspended sediment,	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		light is unlikely to propagate over wide areas. This greatly reduces the strobes' efficiency. • Due to the risk of biofouling on light lenses, strobe lights should only be deployed in locations where there is good access for regular cleaning. The harsh environment of the Severn Estuary would therefore be an inherently unsuitable location for the use of a strobe lighting system. In this environment, regular maintenance operations would need to be carried out by ROVs or divers. • In order to carry out necessary installation and maintenance activities, access would be by boat only, making maintenance and inspection both time and labour intensive but also, crucially, exposing personnel to the risks of working in the hazardous conditions of the Severn Estuary. Additional concerns include the operation of maintenance vessels in the vicinity of the intake heads, noting in particular the risk of vessel mooring lines affecting the intake heads.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• If divers are used to carry out works on the strobe lighting system then this could cause nuclear safety risks. This is because if divers were used, for health and safety reasons HPC would need to be put into shutdown mode to reduce the velocity of water being drawn into the water intake heads. Regular shutdowns, in addition to the planned refuelling shutdowns, would introduce greater "transients" into the system. The increase in transients caused by regular shutdowns to allow for the maintenance of the strobe lighting system by divers would therefore threaten HPC's nuclear safety margins. These design feasibility issues mean that the requirement to install strobe lighting would not comply with the Design Feasibility Objective. **Minimise Fish Entrapment Objective** This option would not comply with the Minimise Fish Entrapment Objective. This is because strobe lighting in a high-turbidity environment like the Severn Estuary would be ineffective. This is because in high levels of suspended sediment, light is unlikely to	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		propagate over wide areas. For this reason strobe lighting is not considered a feasible alternative because it would not provide an effective deterrent to prevent or minimise fish entrapment. **Energy Production at HPC Objective** This potential alternative solution would not comply with the Energy Production Objective. This is because ROV technology cannot now (and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system on its own requiring divers to be used. Aside from the intolerable health and safety risks associated with using divers for these tasks, if divers were used then HPC would need to be put into shutdown mode whilst divers carried out planned maintenance or unplanned repair works or are required to untangled ROVs near to the water intake heads. This would be necessary in order to reduce the risk of divers or diver umbilicals becoming entrained in the water intake heads whilst they are actively drawing in water. Regularly putting HPC into shutdown mode would compromise its capacity to produce low carbon energy. This is because HPC cannot generate energy when it is in shutdown mode.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
6.3 Electrical barriers		This potential alternative solution would require the installation of electrical barriers to deter fish. This would not comply with the following Project objectives. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons. • Installing electrical barriers would require a lengthy delay whilst a suitable electrical barrier system was designed, tested and installed. There is no engineering precedent for fitting electrical barriers to an open-water intake system like that used at HPC in waters with comparable tidal range, currents and turbidity. Work would need to start from first principles on new system. This would include tendering for a supplier of electrical barrier technology. This work would be made more challenging because the intake heads have now been installed underwater (installation took place in the summer of 2022). This means that engineering options would be constrained by having to fit around existing infrastructure.	No

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		This would be particularly challenging in the case of electrical barriers, which often need to be suspended in the water column. • In the case of the ROV technology required to carry out the installation, maintenance and repair of an electrical barrier system, to the extent that this infrastructure is similar to the infrastructure needed for an AFD system, independent expert advice on ROVs has confirmed that ROV technology cannot now (and is highly unlikely in the future to be able to) carry out these tasks on their own. This means that it may not be possible for NNB to develop the technology an electrical barrier system would need to operate successfully. • If it was decided that ROVs, assisted by divers, would be used to install an electrical barrier system, the process of installation would take a considerable amount of time due to the limited diving windows available to carry out the installation works.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• Considerable time would be needed to secure an execution plan to underpin the marine works, the associated environmental and marine permitting and to secure the necessary construction equipment, infrastructure and contractual aspects to deliver the plan. • This option would also require a further material change to HPC's 2013 DCO. A material change application to the 2013 DCO for an electrical barrier system would lead to significant delays in the commissioning and operational phases for HPC. • The isolated offshore location further reduces the windows of time available to install an electrical barrier system, due to high wave heights and frequent winter storms. This would cause additional delays if contractors could not be deployed due to bad weather. **Health and Safety Objective** To the extent that this potential alternative solution would require divers for the installation, maintenance and repair of an electrical barrier system, it would not comply with the requirements of the HSW Act and	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		supporting regulations. A failure to comply with the requirements of the HSW Act and supporting regulations would mean a failure to comply with the Health and Safety Objective. The introduction of high levels of human risk to install untested technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon future contractors. To do so would fail the legal test of the HSW Act and supporting regulations which impose a burden on an employer to eliminate risk where feasible. In this matter, NNB in pursuing an electrical barrier system would be introducing intolerable risk at the design stage which is indefensible and does not meet the legislative Health and Safety requirements to eliminate or design out risk where feasible. It is also likely that even if ROVs were to improve in the future so that they could carry out an electrical barrier system installation, maintenance and repair, divers would still be needed for other tasks associated with the system. This would mean that the diver health and safety risk associated with these activities would still be present. Any involvement of divers in these works would not comply with the	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		requirements of the HSW Act and supporting regulations (and, accordingly, the Health and Safety Objective). **Technical Feasibility Objective** This potential alternative solution would not comply with the Technical Feasibility Objective. Even if the considerable technical feasibility issues associated with the development of a workable electrical barrier installation in this location could be overcome, crucially the installation, maintenance and repair of the electrical barrier installation would need to be reliant on ROV technology (rather than rely on divers). However, ROV technology currently could not carry out all of the activities associated with the installation, maintenance and repair of an electrical barrier installation at HPC on their own. Factors like the high risk of tether entanglement, their operational reliance on sonar, and the environmental conditions of the Severn Estuary make the installation and ongoing subsea maintenance requirements of an electrical barrier installation problematic. Therefore, it is highly unlikely that ROVs would ever be an effective solution for installing an electrical barrier system or for the ongoing planned maintenance and unplanned repair activities it would require.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		Design Feasibility Objective This potential alternative solution would not comply with the Design Feasibility Objective. This is for the following reasons: • This method relies on different conductivities of the fish's body compared to the surrounding environment. However, this does not work well within seawater. Therefore, this fundamental design limitation means that the use of electrical barriers is not considered a feasible alternative in this environment. • In order to carry out necessary installation and maintenance activities, access would be by boat only, making maintenance and inspection both time and labour intensive but also, crucially, exposing personnel to the risks of working in the hazardous conditions of the Severn Estuary. Additional concerns include the operation of maintenance vessels in the vicinity of the intake heads, noting in particular the risk of vessel mooring lines affecting the intake heads.	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		• If divers are used to carry out works on the electrical barrier system then this could cause nuclear safety risks. This is because if divers were used, for health and safety reasons HPC would need to be put into shutdown mode to reduce the velocity of water being drawn into the water intake heads. Regular shutdowns, in addition to the planned refuelling shutdowns, would introduce greater "transients" into the system. The increase in transients caused by regular shutdowns to allow for the maintenance of the electrical barrier system by divers would threaten HPC's nuclear safety margins. These design feasibility issues mean that the requirement to install an electrical barrier system would not comply with the Design Feasibility Objective. **Minimise Fish Entrapment Objective** This option would not comply with the Minimise Fish Entrapment Objective. This is because there is the potential that fish stunned by the electrical current at the water intake heads may temporarily lose the ability to swim against currents, causing them to be drawn into the	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		intake heads. Furthermore, because the method relies on different conductivities of the fish's body compared to the surrounding environment, this does not work well within seawater. For this reason, electrical barriers are not considered a feasible alternative because it would not provide an effective deterrent to prevent or minimise fish entrapment. **Energy Production at HPC Objective** This potential alternative solution would not comply with the Energy Production Objective. This is because ROV technology cannot now (and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system on its own requiring divers to be used. Aside from the intolerable health and safety risks associated with using divers for these tasks, if divers were used then HPC would need to be put into shutdown mode whilst divers carried out planned maintenance or unplanned repair works or are required to untangled ROVs near to the water intake heads. This would be necessary in order to reduce the risk of divers or diver umbilicals becoming entrained in the water intake heads whilst they are actively drawing in water. Regularly putting HPC into shutdown mode	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		would compromise its capacity to produce low carbon energy. This is because HPC cannot generate energy when it is in shutdown mode.	
6.4 *Alternative methodology*	No	This potential alternative solution would require the installation of an entirely new and alternative fish deterrent specifically commissioned by NNB. This would not comply with the following Project objectives. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons. • Installing a new and as yet unknown fish deterrent system would require a lengthy delay whilst a suitable system was designed, tested and installed from first principles. This would include tendering for a supplier of the alternative fish deterrent technology. This work would be made more challenging because the intake heads have now been installed underwater (installation took place in the summer of 2022). This means that engineering options would be constrained by having to fit around existing infrastructure.	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		• In the case of the ROV technology required to carry out the installation, maintenance and repair of an alternative fish deterrent technology, to the extent that this infrastructure is similar to the infrastructure needed for an AFD system, independent expert advice on ROVs has confirmed that ROV technology cannot now (and is highly unlikely in the future to be able to) carry out these tasks on their own. This means that it may not be possible for NNB to develop the ROV technology an alternative fish deterrent technology would need to operate successfully. • If it was decided that ROVs, assisted by divers, would be used to install an alternative fish deterrent technology, the process of installation would take a considerable amount of time due to the limited diving windows available to carry out the installation works. • Considerable time would also likely be needed to secure an execution plan to underpin the marine works, the associated environmental and marine permitting and to secure the	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		necessary construction equipment, infrastructure and contractual aspects to deliver the plan. • This option would also require a further material change to HPC's 2013 DCO. A material change application to the 2013 DCO for the alternative fish deterrent technology would lead to significant delays in the commissioning and operational phases for HPC. • The isolated offshore location further reduces the windows of time available to install an alternative fish deterrent system, due to high wave heights and frequent winter storms. This would cause additional delays if contractors could not be deployed due to bad weather. **Health and Safety Objective** To the extent that this potential alternative solution would require divers for the installation, maintenance and repair of the alternative fish deterrent technology, it would not comply with the requirements of the HSW Act and supporting regulations. A failure to comply with the	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		requirements of the HSW Act and supporting regulations would mean a failure to comply with the Health and Safety Objective. The introduction of high levels of human risk to install untested technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon future contractors. To do so would fail the legal test of the HSW Act and supporting regulations which impose a burden on an employer to eliminate risk where feasible. In this matter, NNB in pursuing the alternative fish deterrent technology would be introducing intolerable risk at the design stage which is indefensible and does not meet the legislative Health and Safety requirements to eliminate or design out risk where feasible. It is also likely that even if ROVs were to improve in the future so that they could carry out the installation, maintenance and repair tasks an alternative fish deterrent system would require, divers would still be needed for other tasks associated with the system. This would mean that the diver health and safety risk associated with these activities would still be present. Any involvement of divers in these works would	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		not comply with the requirements of the HSW Act and supporting regulations (and, accordingly, the Health and Safety Objective).	
6.5 *Installation of wedge-wire screens*	No	This potential alternative solution would require the installation of wedge wire screens with a fine mesh. These would act to screen the water of all objects (other than silt) before entering into the water intake head. It would also reduce the zone of influence around the intake heads, reducing fish entrapment. This would not comply with the following Project objectives. **Urgent Need for Low Carbon Energy Production Objective** This potential alternative solution would not comply with the Urgent Need for Low Carbon Energy Production Objective. This is for the following reasons. • A wedge wire mesh could not be fitted to the water intake heads which have been installed and are in the process of being connected to the tunnels which will service them. Because the water intake heads could not be removed, alternative water intake heads would need to be designed, constructed and installed which are capable of being covered	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		by the wedge wire mesh. The existing tunnels would then need to be retrofitted to connect to these new water intake heads or new tunnels would need to be constructed. A fundamental redesign of HPC of this scale would take considerable additional time. It would also likely jeopardise the viability of HPC as a nuclear power station because of the additional construction costs involved. The impact of the loss of HPC as a source of low carbon energy could not be justified given the UK's urgent need for low carbon energy production. • Installing wedge wire screens would require a lengthy delay whilst a suitable wedge wire screen system was designed, tested and installed. There is no engineering precedent for fitting wedge wire screens to an open-water intake system like that used at HPC in waters with comparable tidal range, currents and turbidity. Work would need to start from first principles on new system. This would include tendering for a supplier of wedge wire screen technology. This work would be made more challenging because the intake heads have now been installed underwater (installation took place in the	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		summer of 2022). This means that engineering options would be constrained by having to fit around existing infrastructure. • In the case of the ROV technology required to carry out the installation, maintenance and repair of wedge wire screens, to the extent that this infrastructure is similar to the infrastructure needed for an AFD system, independent expert advice on ROVs has confirmed that ROV technology cannot now (and is highly unlikely in the future to be able to) carry out these tasks on their own. This means that it may not be possible for NNB to develop the technology wedge wire screens would need to operate successfully. • If it was decided that ROVs, assisted by divers, would be used to install wedge wire screens, the process of installation would take a considerable amount of time due to the limited diving windows available to carry out the installation works. • Considerable time would be needed to secure an execution plan to underpin the marine works, the associated environmental and marine permitting and to secure the	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		necessary construction equipment, infrastructure and contractual aspects to deliver the plan. • This option would also require a further material change to HPC's 2013 DCO. A material change application to the 2013 DCO for wedge wire screens would lead to significant delays in the commissioning and operational phases for HPC. • The isolated offshore location further reduces the windows of time available to install wedge wire screens, due to high wave heights and frequent winter storms. This would cause additional delays if contractors could not be deployed due to bad weather. **Health and Safety Objective** To the extent that this alternative would require divers for the installation, maintenance and repair of the wedge wire screen system, it would not comply with the requirements of the HSW Act and supporting regulations. A failure to comply with the requirements of the	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		HSW Act and supporting regulations would mean a failure to comply with the Health and Safety Objective. The introduction of high levels of human risk to install untested technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon future contractors. To do so would fail the legal test of the HSW Act and supporting regulations which impose a burden on an employer to eliminate risk where feasible. In this matter, NNB in pursuing the wedge wire screen system would be introducing intolerable risk at the design stage which is indefensible and does not meet the legislative Health and Safety requirements to eliminate or design out risk where feasible. It is also likely that even if ROVs were to improve in the future so that they could carry out wedge wire screen system installation, maintenance and repair, divers would still be needed for other tasks associated with the system. This would mean that the diver health and safety risk associated with these activities would still be present. Any involvement of divers in these works would not comply with the requirements of the HSW Act and supporting regulations (and, accordingly, the Health and Safety Objective).	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		Technical Feasibility Objective This potential alternative solution would not comply with the Technical Feasibility Objective. Even if the considerable technical feasibility issues associated with the development of a workable wedge wire screen system in this location could be overcome, crucially the installation, maintenance and repair of the wedge wire screen system would need to be reliant on ROV technology (rather than rely on divers). However, ROV technology currently could not carry out all of the activities associated with the installation, maintenance and repair of a wedge wire screen system at HPC on their own. Factors like the high risk of tether entanglement, their operational reliance on sonar, and the environmental conditions of the Severn Estuary make the installation and ongoing subsea maintenance requirements of a wedge wire screen system problematic. Therefore, it is highly unlikely that ROVs would ever be an effective solution for installing a wedge wire screen system or for the ongoing planned maintenance and unplanned repair activities it would require. **Design Feasibility Objective**	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		This potential alternative solution would not comply with the Design Feasibility Objective. This is for the following reasons: • A wedge wire mesh could not be fitted to the water intake heads which have been installed and are in the process of being connected to the tunnels which will service them. Because the water intake heads could not be removed, alternative water intake heads would need to be designed, constructed and installed which are capable of being covered by the wedge wire mesh. The existing tunnels would then need to be retrofitted to connect to these new water intake heads or new tunnels would need to be constructed. A fundamental redesign of HPC to allow for this would likely jeopardise the viability of HPC as a nuclear power station because of the additional construction costs involved. • Installing wedge wire screens would inherently weaken the design feasibility of the Cooling Water System. This is because the wedge wire screens would require regular maintenance (for example using an automated brushing system) so that water can pass through, particularly in the high turbidity conditions of	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		the Severn Estuary. If one or both water intake heads suffered a clogging event and lead to an emergency shutdown of the reactors. This would compromise HPC's capacity to produce low carbon energy. This is because HPC cannot generate energy when it is in emergency shutdown mode. • The maintenance schedule for the wedge wire screens would be continuous and would require ROV intervention. This is because components such as an automated brushing system would be vulnerable to breakdown in the challenging environment of the Severn Estuary. To the extent that divers would be needed for these works or if, for example, an ROV became entangled or malfunctioned, this would create an intolerable Health and Safety risk. • The entire wedge wire system would need to be replaced at least once during the lifecycle of HPC. This is due to the corrosion of the steel used to create the wedge wire mesh. • In order to carry out the necessary installation and maintenance activities, access would be by boat only, making	

Potential Alternative Solutions	Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'	Why and How?	Does this alternative pass this step?
		maintenance and inspection both time and labour intensive but also, crucially, exposing personnel to the risks of working in the hazardous conditions of the Severn Estuary. Additional concerns include the operation of maintenance vessels in the vicinity of the intake heads, noting in particular the risk of vessel mooring lines affecting the intake heads. • If divers are used to carry out works on the wedge wire system, then this could cause nuclear safety risks. This is because if divers were used, for health and safety reasons HPC would need to be put into shutdown mode to reduce the velocity of water being drawn into the water intake heads. Regular shutdowns, in addition to the planned refuelling shutdowns, would introduce greater "transients" into the system. The increase in transients caused by regular shutdowns to allow for the maintenance of the wedge wire screens by divers would therefore threaten HPC's nuclear safety margins. **Energy Production at HPC Objective** This potential alternative solution would not comply with the Energy Production Objective. This is because ROV technology cannot now	

Potential Alternative Solutions	**Does the Option Meet/Deliver the Project need and 'genuine' and 'critical objectives'**	**Why and How?**	**Does this alternative pass this step?**
		(and is highly unlikely in the future to be able to) carry out the installation, maintenance and repair tasks needed for an AFD system on its own requiring divers to be used. Aside from the intolerable health and safety risks associated with using divers for these tasks, if divers were used then HPC would need to be put into shutdown mode whilst divers carried out planned maintenance or unplanned repair works or are required to untangled ROVs near to the water intake heads. This would be necessary in order to reduce the risk of divers or diver umbilicals becoming entrained in the water intake heads whilst they are actively drawing in water. Regularly putting HPC into shutdown mode would compromise its capacity to produce low carbon energy. This is because HPC cannot generate energy when it is in shutdown mode.	

10.6 Part 6: Are there any feasible alternative solutions?

10.6.1 As set out in Table 10-4 above, no feasible alternative solutions which would meet the objectives of the Project have been identified in Step 3. Accordingly, Step 4 is not applicable.

10.7 Part 7: Are there any feasible alternative solutions that have a lesser effect on the integrity of any European designated site?

10.7.1 This section implements the final step of the Stage 3 NAS assessment, whereby alternative solutions determined to be feasible are assessed in accordance with Stage 2 of the HRA process.

10.7.2 However, as stated above, no feasible alternative solutions which would meet the objectives of the Project were identified in Step 3. Therefore, the potential effects on the integrity of designated sites remains as presented in Step 2.

10.8 Part 8: Conclusions of the assessment of alternative solutions

10.8.1 The assessment presented in this Stage 3 NAS assessment concludes that there is no feasible alternative to constructing and operating HPC without an AFD for the CWS which would meet the objectives of the Project.

11 HRA STAGE 3: IMPERATIVE REASONS OF OVERRIDING PUBLIC INTEREST

11.1 Introduction

11.1.1 This Stage 3 IROPI assessment presents NNB's IROPI case for the Project, in line with the requirements of the Habitats Regulations. The Stage 3 NAS assessment, set out in Section 10 of this HRA Report, has determined that there are no alternative solutions that would meet the Project's needs and objectives and have a lesser effect on European sites.

11.1.2 It is important to recognise that the Government has already established an IROPI case for the identification of HPC as a potentially suitable site for new nuclear power generation in NPS EN-6.[249] This IROPI assessment is of the Project rather than HPC, however, the IROPI case from NPS EN-6 in favour of HPC is of direct relevance in making the IROPI assessment for the Project.

11.1.3 In addition, in the recent decision to grant a DCO for the development of new nuclear power at Sizewell C, the Government was satisfied that there were IROPI for that development to proceed (subject to adequate compensatory measures being implemented). The IROPI case made in Sizewell C is very similar to the IROPI case set out below for the Project.

11.1.4 There is a compelling IROPI case for new nuclear power because of the vital role it plays in meeting the challenge of maintaining secure energy supplies for the UK. It can also help to tackle the global threat of climate change by contributing to cutting the UK's greenhouse gas emissions by 100% of 1990 levels (net zero) by 2050, as required under the Climate Change Act 2008 (2050 Target Amendment) Order 2019).

11.1.5 The Government's 2017 Ministerial Statement on Energy Infrastructure[250] confirmed its commitment to new nuclear power, stating that:

"... By 2035 overall demand for electricity is expected to have increased. Therefore, with a number of the existing coal and nuclear fleet due to close by 2030, new nuclear power

249 2009-nps-for-nuclear-volumeI.pdf (publishing.service.gov.uk) (Accessed 18 December 2023)

250 Written statements - Written questions, answers and statements - UK Parliament (Accessed 18 December 2023)

generation remains key to meeting our 2050 obligations… The need for the UK to continue to transition to a low-carbon electricity market is underlined by the 2015 United Nations Framework Convention on Climate Change ("UNFCCC") Paris Agreement. The Government believes that it is important that there is a strong pipeline of new nuclear power to contribute to the UK's future energy system."

11.1.6 NPS EN-1[251] reflects the urgent need for electricity infrastructure and the requirement to maintain security of energy supply, stating as follows:

"Given the urgent need for new electricity infrastructure and the time it takes for electricity NSIPs to move from design conception to operation, there is an urgent need for new (and particularly low carbon) electricity NSIPs to be brought forward as soon as possible, given the crucial role of electricity as the UK decarbonises its economy."

11.1.7 The NAO has updated the EN-1 predictions from July 2011 and now predicts an energy generation shortfall of 95GW by 2035 (as discussed in Section 10 of this HRA Report).

11.1.8 The need for the Project is both imperative and overriding because removing the requirement to fit an AFD system from the 2013 DCO will avoid the indefinite delays associated with the development and installation of an AFD system, thereby enabling the operational phase for HPC to commence in mid-2027 as planned. Avoiding further delay to HPC's schedule will ensure that HPC is able to contribute to meeting the urgent national need for a reliable and secure supply of new nuclear power, thereby helping address the UK's predicted shortfall in energy generation capacity of 95GW by 2035.

11.1.9 Approving the Project will also mean avoiding the intolerable health and safety risks associated with the installation, maintenance and repair of an AFD system which could lead to the deaths of divers. NNB is firmly of the view that compliance with health and safety legislation, principles and guidance could not be achieved if divers were required to undertake work at the level of frequency and exposure to the high risks that such complex work would entail. It is clearly in the public interest that major infrastructure projects like HPC do not design in intolerable health and safety risks.

251 Paragraph 3.3.83 NPS EN-1, published on 22 November 2023.

IROPI Assessment Structure

11.1.10 This Stage 3 IROPI assessment of the Project is set out as follows:

- Part 1 – Overview of the legislative and guidance framework for NNB's Stage 3 IROPI case
- Part 2 – The urgent need for the production of low carbon nuclear energy in the UK
- Part 3 – The public interest need for low carbon energy from HPC
- Part 4 – The social and economic benefits arising from approval the Project
- Part 5 – Minimising health and safety risks associated with the construction and operation of HPC
- Part 6 – The contribution of nuclear power to a reduction in greenhouse gas emissions
- Part 7 – Conclusion regarding the IROPI test

11.2 Part 1: Overview of the legislative and guidance framework for NNB's Stage 3 IROPI case

Legislation

The IROPI derogation test is part of a stepwise approach

11.2.1 The IROPI test is the second sequential test in the application of Article 6(4) of the Habitats Directive and regulation 64 of the Habitats Regulations.[252] The question of whether a plan or project must be carried out for imperative reasons of overriding public interest only arises after a negative assessment has been concluded under Article 6(3) Habitats Directive / regulation 63 Habitats Regulations (i.e. that the proposed plan or project would either result in an adverse effect on the integrity of the European site or such an effect cannot be ruled out) and after the competent authority is satisfied that there are no 'alternative solutions'.[253]

252 Joint Government Guidance, '3. Derogations: allow exceptions', 'Test 2'

253 Joint Government Guidance, '3. Derogations: allow exceptions'; DTA Handbook, Part C14.1, Principles 1 and 2; Case C-304/05 European Commission v Italy, paragraph 83; C-404/09 European Commission v Spain, paragraph 109

11.2.2 Accordingly, the tests under Article 6(4) must be considered in accordance with and following the identification of the impacts on the conservation objectives of the European site under the Article 6(3) appropriate assessment.[254]

The meaning of IROPI must be read within the context of the provision itself

11.2.3 The concept of IROPI is not defined in the Habitats Directive or the Habitats Regulations. However, reference to the second subparagraph of Article 6(4) Habitats Directive suggests that human health, public safety and beneficial consequences of primary importance for the environment, as well as those relating to a social or economic nature may be examples of such reasons (where priority habitats and / or species are not affected and there is a demonstrable public interest).

11.2.4 The test is that the interest must be identified as both 'public' and 'overriding'.[255] The test may be seen as comprising four elements for which the competent authority must be satisfied.[256] Those are that the reasons:

- Are imperative, i.e. the plan or project must be 'required', or 'indispensable',[257] or it must be 'essential' (whether urgent or otherwise) that the plan or project proceeds;
- Are 'overriding' in that whatever the benefits are, they must be evidenced to demonstrate that they outweigh the harm (or risk of harm) to the integrity of the site(s) identified in the appropriate assessment;
- Have a clear public interest, which must be delivered for more than solely a private interest. This can occur at a national, regional or local level and should be long term. Plans and projects which enact or are consistent with national policy statements are more likely to show a high level of public interest; and
- Have long-term benefits or interests.

254 Case C-399/14 Grune Liga, paragraph 57; Case C-182/10 Solvay et al v Region Wallonne, paragraph 74. See also DTA Handbook, Part C13.1, Principle 1.

255 Case C-182/10 Solvay et al v Region Wallonne, para 75; Case C-43/10 the Greek River Diversion Case, para 121.

256 DTA Handbook, Part C14.1, Principle 10; see also the three elements highlighted in Joint Government Guidance, '3. Derogations: allow exceptions', 'Test 2'.

257 See Managing Natura 2000 Sites, Chapter 5.3.2 'Examining imperative reasons of overriding public interest' p. 44; see also European Commission, Guidance document on Article 6(4) of the 2007 Commission Guidance, para 1.3.2, p. 8.

11.2.5 In this case, the Secretary of State must be satisfied that the Project needs to be carried out for imperative reasons of overriding public interest.[258] The test must be applied on a case-by-case basis.[259]

11.2.6 Defra guidance - which was based on the EC's guidance on Article 6(4) of the Habitats Directive - identifies that the consideration of the objective of the plan or project is central to the determination of IROPI.[260] The "critical" objectives of the Project were defined in the Stage 3 NAS assessment. These include:

- Objective 1 – the energy production at HPC objective;
- Objective 2 – the urgent need for low carbon energy production;
- Objective 3 – the technical feasibility objective;
- Objective 4 – the health and safety objective;
- Objective 5 – the minimise fish entrapment objective; and
- Objective 6 – the design feasibility objective.

The application of the IROPI test involves a balancing of factors

11.2.7 The harm to the European site must be outweighed, or overridden, by the reasons for agreeing to the plan or project. Ultimately, imperative reasons of overriding interest require a weighing up against the damage or, as in this case, the risk of damage caused to the site by the plan or project under consideration. Critically, the harm or risk of harm to the site must be overridden/outweighed by the benefits.

11.2.8 It is for the competent authority, in this case the Secretary of State, to weigh up IROPI against the objective of conserving natural habitats and wild fauna and flora. It is noted that in this case, no priority habitats/species would or could be adversely affected by the Project.

258 Case C-304/05 European Commission v Italy, paragraph 82; Case C-239/04 European Commission v Portugal (Castro Verde), paragraphs 35 and 36; DTA Handbook, Part C14.1, Principle 9

259 Withdrawn 2012 Defra Guidance, para 25, page6

260 See Withdrawn 2012 Defra Guidance, paras 20 and 25, pages5 - 6.

NPS EN-6

11.2.9 The existence of relevant national strategic plans or policy can be important and influential when considering whether the proposed development is likely to deliver public interest benefits.

11.2.10 Hinkley Point has been identified by the Government in NPS EN-6 as one of eight sites in the UK considered to be potentially suitable for the development of a new nuclear power station. In the development of NPS EN-6, the Government recognised that it could not rule out the potential for adverse effects on the integrity of European Sites adjacent to, or at a distance from, each of the sites listed in NPS EN-6. Accordingly, the Government presented a case for IROPI which sets out why the plan (the Government policy set out in NPS EN-1[261] and NPS EN-6) should proceed. This included policy support for the construction and operation of HPC.

11.2.11 That assessment is included as Annex A to NPS EN-6 and it establishes that the IROPI which justify the inclusion of HPC in NPS EN-6 relate to:

- the protection of human health;
- public safety; and
- overriding beneficial consequences of primary importance for the environment.

11.2.12 The principles in NPS EN-6, in conjunction with those in NPS EN-1[262] and subsequent Government energy policies, establish the urgent need in the public interest, and thus the IROPI case, for the production of low carbon energy at HPC. Approving the Project will enable this. This is because if the Project is not approved, there will be an indefinite delay in the commissioning and operational phases of HPC.

11.2.13 The IROPI assessment in NPS EN-6 provides important context and is directly relevant to this scheme-level assessment. In particular, the Government's assessment explained:

- why new generating capacity is needed;
- why there is a need for nuclear power as part of the generating mix;

261 Adopted NPS EN-1 published in July 2011
262 Adopted NPS EN-1 published in July 2011

- why it is necessary for the sites assessed as potentially suitable to be listed in the nuclear NPS and why not sites at different locations;
- why NPS EN-6 is needed; and
- why there are Imperative Reasons of Overriding Public Interest.

11.2.14 The fundamental importance of new nuclear power was reaffirmed in the Secretary of State's decision letter for Sizewell C (dated 20 July 2022) where the Government concluded that IROPI existed for the construction and operation of that new nuclear power station notwithstanding the negative assessment in that case. The IROPI case for Sizewell C, particularly in relation to the need for new nuclear power, is of direct relevance to the IROPI case for the Project.

11.2.15 The Secretary of State emphasised the essential benefit nuclear power has in limiting the extent of climate change within paragraph 5.34 and 5.3.5 of the decision letter:

"The Secretary of State has satisfied himself of the outstanding matters raised in relation to AEoI [Adverse Effect on Integrity] and is satisfied that there are IROPI for the Proposed Development to proceed subject to adequate compensatory measures being implemented. In arriving at his decision, the Secretary of State has reviewed how the Proposed Development provides a public benefit which is essential and urgent despite the harm from the Proposed Development alone to the integrity of the breeding marsh harrier feature of the Minsmere-Walberswick SPA and Ramsar."

"The Secretary of State's decision is predicated by the principal and essential benefit of the Proposed Development as a significant contribution to limiting the extent of climate change in accordance with the objectives of the Paris Agreement."

11.2.16 Paragraph 7.3 of the Secretary of State's decision letter for Sizewell C provides further detail on the IROPI case and again makes it clear that the Secretary of State gave the urgent need for new nuclear capacity substantial weight as part of that exercise. Very substantial weight is also given to the local economy and employment and skills benefits. The paragraph states:

"In the case of the Proposed Development, the ExA recognises [ER 7.5.4] the positive impacts of the proposal in terms of its contribution to the policy objectives of low-carbon energy production and notes that it would be in accordance with the aim of Government policy as set out in NPS EN-1 and EN-6 to achieve the delivery of major energy infrastructure including new nuclear electricity generation to meet the urgent need for new NSIPs. The ExA also

recognises there is clearly an urgent need for development of the type proposed [ER 7.5.4] and the Secretary of State attributes substantial weight to this need. The ExA notes the other potential benefits that would accrue very substantial weight are those relating to the local economy and business, and employment and skills, and attributes very substantial weight to the significant employment and skills benefits arising from the Proposed Development [ER 5.21.226]."

11.2.17 Paragraph 7.15 of the decision letter concludes that the needs case for new nuclear is of particular importance:

"Overall, the Secretary of State concludes that the benefits, in particular the need case as established in paragraph 7.3 above, outweigh the adverse impacts for the Proposed Development. The Secretary of State therefore concludes that consent should be granted for the Proposed Development."

11.2.18 The urgent need for new nuclear capacity, and its role in limiting the extent of climate change were of central importance to the IROPI case at Sizewell C and are of equal importance and relevance to the IROPI case for the Project. The urgent need for new nuclear has not diminished but in fact has increased since the 2013 DCO was made. This urgency is set out in further detail in Part 2 of this Stage 3 IROPI assessment.

Approach to IROPI

11.2.19 The IROPI case in respect of the Project relies on the following:

- The public interest need for low carbon energy from HPC in particular given that it is in the process of construction and is scheduled to become operational well in advance of the only other consented nuclear power station in the UK, Sizewell C. If the Project is not approved, the commissioning and operational phases of HPC will be delayed indefinitely.
- The social and economic benefits associated with approving the Project and not delaying the commissioning and operational phases of HPC.
- The public interest associated with approving the Project thereby minimising the health and safety risks in the construction and operation of HPC in accordance with NNB's legal duties. It is clearly in the public interest that all construction projects, but in particular major

infrastructure projects like HPC which help drive industry leading safety standards, do not design in intolerable health and safety risks.[263]

- That nuclear power constitutes a source of low carbon energy, which is of significant benefit to the environment generally by contributing to a reduction in greenhouse gas emissions. Those benefits will be delayed if the Project is not approved and there is an indefinite delay in the commissioning and operation of HPC.

11.2.20 The following sections establish that the Project has long-term benefits which are imperative and overriding, and that there is a public interest in its proceeding despite the shadow AA concluding (see Section 9.16) that there is a risk to site integrity (through HPC fish entrapment) that cannot be excluded beyond reasonable scientific doubt from the Project, with respect to four European / Ramsar sites through the following qualifying features:

- Severn Estuary SAC: the Estuaries qualifying habitat feature through the risk of an effect on the typical fish species assemblage; and Twaite shad qualifying species;
- Severn Estuary Ramsar site: the Criterion 4 migratory fish assemblage;
- River Usk SAC: the Atlantic salmon and Twaite shad qualifying species; and
- River Wye SAC: the Atlantic salmon, Twaite shad and Allis shad qualifying species.

11.3 Part 2: The urgent need for the production of low carbon nuclear energy in the UK

11.3.1 The adopted NPS EN-1 (July 2011), and the published NPS EN-1 (November 2023), make it clear that there is an urgent need for new nuclear power. The Government has reiterated this urgent need for new nuclear power within the Sizewell C decision (20 July 2022) and recent key legislative and policy developments. The urgent need for new nuclear power has been clearly established and does not need to be demonstrated again by NNB.

11.3.2 The urgent need set out in the NPS's, within key legislative and policy developments, and within the Sizewell C decision are discussed in detail in the Stage 3 NAS assessment. This

263 According to a research project carried out by Loughborough University, funded by the Institution of Occupational Safety and Health, major projects can significantly improve workers' understanding of health risks and champion universally high standards across the industry. In this way they set high safety standards and help in disseminating these standards across the industry, thereby raising the bar for occupational health management in construction. See: Major construction projects play a critical role in improving workers' understanding of occupational health risks, study suggests (August 2019) (Accessed 18 December 2023)

clearly confirms the urgent need for the Project to be approved so that HPC is not indefinitely delayed and can remain on schedule to deliver a secure and reliable supply of low carbon energy by mid-2027. The supply of energy from HPC is essential and indefinitely delaying the operation of HPC would be detrimental to the national interests of the UK.

11.4 Part 3: The public interest need for low carbon energy from HPC

11.4.1 The Government has already established an IROPI case for the identification of HPC as a potentially suitable site for new nuclear power generation in NPS EN-6.

NPS EN-6 site assessment

11.4.2 NPS EN-6 identifies HPC as one of eight potentially suitable sites for the deployment of new nuclear facilities (subject to the detailed consideration of the proposals for any site on which an application comes forward). These sites are required in order to meet the national need for low carbon energy production.

11.4.3 The site assessments included in Annex C of Volume II of EN-6 set out in detail why the selected sites, including HPC, have been found to be potentially suitable. These assessments set out the analysis and conclusions drawn against the Government's Strategic Siting Assessment ('SSA') criteria and reflect advice received from specialists and the regulators. They also reflect key points made during the opportunity for public comment in Spring 2009, consultation on the original draft Nuclear NPS from November 2009 to February 2010, and consultation on the revised draft Nuclear NPS from October 2010 to January 2011. The following Table 11-1 summarises the outcomes of the site assessment for HPC.

Table 11-1: HPC assessment of suitability against HPC criteria

SSA Criteria	Assessment outcome	Notes
Demographics	Pass	Relates to the proximity of the site boundary to an area which exceeds the semi-urban criterion.
Proximity to military activities	Pass	The Ministry of Defence has found that it is reasonable to conclude, at a strategic level, that any likely power station development within the site boundary can be protected against the risk of external hazards created by neighbouring military

SSA Criteria	Assessment outcome	Notes
		activities throughout its lifetime. The Office for Nuclear Regulation has agreed with this advice.
Flooding, storm surge and tsunami	Pass	This takes into account in particular that there is a low risk of flooding at this site (although parts of the site are in Flood Zone 3), and based on the advice of the Environment Agency and the findings of the Appraisal of Sustainability, it is reasonable to conclude that any new nuclear power station on the site could potentially be protected against flood risk throughout its lifetime, including the potential effects of climate change, storm surge and tsunami.
Coastal processes	Pass	The Government decided it was reasonable to conclude that a nuclear power station at the site could be protected against coastal erosion, including the effects of climate change, for the lifetime of the site. Mitigation of effects of coastal erosion may be possible through appropriate design and construction of defences.
Proximity to hazardous industrial facilities and operations	Pass	The Government decided it was reasonable to conclude that any likely power station development within the nominated site boundary can be protected against risk arising from proximity to hazardous facilities throughout its lifetime, taking into account possible countermeasures.
Proximity to civil aircraft movements	Pass	The Government decided it was reasonable to conclude that any likely power station development within the nominated site boundary can be protected against risks from civil aircraft movement, and that the effects on air traffic and aerodromes can be potentially mitigated.
Internationally designated sites of ecological importance	Pass	The Government noted the scope for avoidance and mitigation identified in the Habitats Regulations Assessment, and the need for more detailed studies. The Government's Habitats Regulations Assessment was not able to rule out adverse impacts on sites of European nature conservation

SSA Criteria	Assessment outcome	Notes
		importance. The Government therefore carefully considered whether it is appropriate to include Hinkley Point in this NPS. Annex A of NPS EN-6 says that the Government concluded that there is an IROPI that favours the inclusion of Hinkley Point in the Nuclear NPS despite the inability to rule out adverse effects on European Sites. This conclusion took into account the need for sites to be available for potential deployment by the end of 2025, the lack of alternatives, and the consideration given to compensatory measures.
Nationally designated sites of ecological importance	Pass	The Government noted that the Appraisal of Sustainability had identified potential impacts on nationally designated sites of ecological importance which it considers of strategic significance. The Government therefore concluded that there is a risk that there could be remaining effects on nationally designated sites. The Government also concluded, however that there is a need to ensure sufficient sites are available for development to meet the Government's energy policy objectives, as described in Part 2 of NPS EN-6. In view of this and in view of the limited number of potentially suitable sites, the Government concluded that the issues in relation to this criterion were not sufficient to justify excluding the site.
Areas of amenity, cultural heritage and landscape value	Pass	The Government noted that there may be some impacts, which can be fully assessed at a project level. In view of the limited number of potentially suitable sites, the Government did not think the issues in relation to this criterion were sufficient to justify not including the site in the NPS.

SSA Criteria	Assessment outcome	Notes
Size of site to accommodate operation	Pass	The Government concluded that based on the advice of the Office for Nuclear Regulation it was reasonable to conclude that there is enough land within the boundary nominated to safely and securely operate at least one new nuclear power station, including the safe and secure storage of all the spent fuel and intermediate level waste produced through operation, and from decommissioning, on the site of the station until it can be sent for disposal in a geological disposal facility.
Access to suitable sources of cooling	Pass	It was assumed that detailed modelling as part of the licensing process will give greater clarity about the acceptability of impacts in the light of the cooling technology that is proposed.

11.4.4 The conclusion of the UK Government's site assessment for Hinkley Point was that the site was potentially suitable for new nuclear development. This conclusion was based on the site meeting the SSA criteria, and the evidence from, inter alia, the public, regulators, Appraisal of Sustainability, and HRA site reports. The assessment identified a number of areas that would need further consideration by the applicant and/or the regulators should an application for development consent come forward. However, the Government concluded that none of these factors were sufficient to prevent the site from being considered as potentially suitable. The Secretary of State subsequently granted the 2013 DCO at HPC, thus confirming the suitability of the Hinkley Point site. Construction is now well underway on the new nuclear power station.

NPS EN-6 IROPI

11.4.5 Given that NPS EN-6 is a 'plan' for the purposes of the Habitats Directive, it was subjected to an HRA, including an appropriate assessment. The strategic level appropriate assessment undertaken for NPS EN-6 concluded that the potential for adverse effects on the integrity of European Sites, either from the plan alone, or in combination with other plans, could not be ruled out. Accordingly, the assessment went on to consider NAS and IROPI. Annex A outlines the IROPI that required that NPS EN-6 be designated.

11.4.6 The Government was satisfied that there were IROPI in making the eight sites considered as part of NPS EN-6 available as potential sites for development (subject to the planning inspector's detailed consideration of the proposals for any site on which an application comes forward) and listing them in NPS EN-6, even though potential adverse impacts on European Sites cannot be ruled out. This IROPI case was based on fulfilling the Government's energy policy objectives whilst contributing (at the time) to wider EU goals for sustainable low-carbon sources of energy as a means of reducing the damaging effects of climate change and ensuring security of energy supplies.[264]

Conclusion

11.4.7 In the context of the urgent need for new low carbon nuclear power, NPS EN-6 established HPC as a potentially suitable site, subsequent to further assessment. Following assessment of the application for development consent, the Secretary of State confirmed the suitability of the site and approved the construction and operation of a new nuclear power station at Hinkley Point. Construction of the two reactor Units at HPC is well advanced and is currently scheduled to start operations in mid-2027.

11.4.8 There are imperative public interest reasons of national importance for the Project to be approved so that the indefinite delay to the commissioning and operation of HPC associated with the need to develop and install an AFD system is avoided.

11.5 Part 4: The social and economic benefits arising from approval the Project

11.5.1 In addition to the urgent need for low carbon energy produced by new nuclear power and for that new nuclear power to be generated at HPC (as discussed above), there are also strong wider social and economic benefits of approving the Project. This is because if the Project is not approved, then the commissioning and operational phases of HPC will be indefinitely delayed by the need to seek to design, develop and install an AFD system. The problems associated with this would mean indefinitely delaying the achievement of the social and economic benefits arising from HPC's operation.

264 NPS EN-6, paragraph A.6.6.

The social and economic benefits arising from HPC's operational lifetime

11.5.2 HPC will provide around 900 jobs throughout its 60 year operational lifetime. The 2013 DCO Economic Strategy set out that during the operational phase of HPC, the following were expected to arise:

- GDP of £144m per year;
- associated wages of around £30m per year;
- avoiding the impacts of power outages, with an estimated cost of £25m per power outage; and
- indirect effects of £40m per year, supporting 360 jobs.

11.5.3 HPC is maximising opportunities for people and businesses in Somerset and across the UK. It is contributing significantly to the local and UK economy - every £1 spend by HPC generates an additional £2.50 in wider economic value for the local area. If the Project is not approved and an AFD system is required then the generation of electricity at HPC will be delayed indefinitely. Such a delay is likely to result in an indefinite demobilisation of the workforce with the consequential loss of construction related employment, business opportunities and wider effects including needing to cease the employment of the commissioning/operations staff who are already working at HPC. Such a pause could put at risk the substantial socio-economic benefits that the project is generating both during construction and the careful plans being executed to ensure a successful transition into the commissioning and operational phases of the project to enable the benefits set out above to be realised.

11.5.4 An indefinite pause in construction would also extend construction related impacts including landscape and visual effects arising from the construction site whilst an AFD system (or other fish deterrent system) is designed, tested and installed.

Conclusion

11.5.5 It is essential to the local, regional and national public interest that the Project is approved so that the socio-economic benefits associated with HPC can be fully realised.

11.6 Part 5: Minimising health and safety risks associated with the construction and operation of HPC

11.6.1 NNB is applying to remove the requirement to fit an AFD system from the 2013 DCO because it has significant and justified concerns that the use of human divers in the installation, maintenance and repair of the AFD system creates an intolerable safety risk which could lead to the deaths of divers.

11.6.2 NNB is firmly of the view that compliance with health and safety legislation, principles and guidance could not be achieved if divers were required to undertake work at the level of frequency and exposure to the high risks that such complex work would entail. These works would also need to comply with NNB's own health and safety policies, which go beyond the minimum standards prescribed by health and safety legislation, principles and guidance.

Reliance on divers

11.6.3 Divers would be needed for this work because, as discussed in NNB's Stage 3 NAS assessment, ROVs are not capable on their own of undertaking the complex processes required for the installation, maintenance and repair of an AFD system (or other fish deterrent system) and/or other tasks associated with the AFD works (such as the maintenance, recovery or repair of the offshore 11kV electrical and associated communications cabling needed to power the AFD Sound Projectors, or the recovery or disentanglement of 'snagged' ROVs at the intake heads).

Risks to divers

11.6.4 As discussed in NNB's Stage 3 NAS assessment, the installation, maintenance and repair works associated with an AFD system are particularly high risk to divers for the following reasons:

- Divers would need to be attached to the service boat via an umbilical whilst working in zero or near zero visibility conditions.[265] These conditions create an increased risk that a diver's umbilical may become snagged or that divers become entangled underwater. Whilst divers would only be instructed to operate during slack waters, entanglement risks are increased

265 The waters around HPC contain very high concentrations of suspended solids, resulting in zero or near zero visibility conditions for the vast majority of the time.

because water velocity could be high at this location even when the waters are slack. Divers are particularly vulnerable to water flow, suction, or turbulence under water.

- The emergency standby-diver would not be able to see the diver should they be required to rescue them. This increases the risks associated with rescue operations.
- These tasks would require lifting and lowering large items of equipment in zero or near zero visibility conditions. This increases the risk that divers could themselves become pinned underwater or trapped or, more likely, that their umbilical may become trapped or pinned, cutting off air supplies and communications to the diver, placing the diver at critical risk of harm.
- Divers and diver umbilicals would also be vulnerable to entrainment if they were carrying out planned maintenance, unplanned repairs or ROV recovery works in close proximity to the water intake heads whilst they are actively drawing in water.
- Even in shutdown mode, there will still be a requirement for water to be drawn into the intake heads to cool the nuclear reactors. Whilst water velocity would be decreased when HPC is in shutdown mode, the draw of water would create hydrostatic pressure at/around the two intake heads. This differential pressure at/around the intake heads increases the vulnerability of divers, or diver umbilicals, to being dragged into the intake heads.
- Divers would also need to operate in the immediate vicinity adjacent to active sound projectors designed to produce sound pressure levels of >160 db re 1μPa across the surface of the intake screens and noise at the sound frequency range of 30-600 Hz, with the capability of operating up to 2,000 Hz. To protect divers, the AFD system may have to be switched off for the duration of planned maintenance or unplanned repair work.

Conclusion

11.6.5 The introduction of high levels of human risk to install untested AFD technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon its supply chain. NNB is firmly of the view that compliance with health and safety legislation, principles and guidance could not be achieved if divers were required to undertake work at the level of frequency and exposure to the high risks that such complex work would entail. Independent advice from an external health and safety consultant not otherwise engaged by NNB on the Project agrees with this view.

11.6.6 Accordingly, the installation, maintenance and repair of the AFD system cannot be justifiable based on the risk to human life involved in such work. Doing this would not be a proportionate or reasonably practicable approach to risk.

11.6.7 It is clearly in the public interest that all construction projects, but in particular major infrastructure projects like HPC which help drive industry leading safety standards,[266] do not design in intolerable health and safety risks. For this reason, it is essential that the Project is approved.

11.7 Part 6: The contribution of nuclear power to a reduction in greenhouse gas emissions

11.7.1 The provision of low carbon energy is crucial for preventing or mitigating the impact of climate change on the environment and biodiversity. This is because unfettered climate change is predicted to have far-reaching effects, both on ecosystems as well as human health and public safety.

11.7.2 The significant benefit of low carbon energy, including nuclear power, is set out in Government policy and has been reinforced by recent Government decisions.

11.7.3 NPS EN-1 emphasises the urgent need for low carbon electricity including new nuclear power and its important role in helping cut greenhouse gas emissions to net zero by 2050. This is set out in further detail within Part 2 of this Stage 3 IROPI assessment.

11.7.4 The benefit of new nuclear power and its role in the reduction in greenhouse gas emissions is also recognised within Government decisions on individual applications for development consent, including the approval of the 2013 DCO, and the recent approval of Sizewell C. Within the Sizewell C decision (20 July 2022) the Secretary of State stated at paragraph 5.3.5:

"The Secretary of State's decision is predicated by the principal and essential benefit of the Proposed Development as a significant contribution to limiting the extent of climate change in accordance with the objectives of the Paris Agreement."

11.7.5 NPS EN-1[267] states a paragraph 4.10.2 that:

---

266 According to a research project carried out by Loughborough University, funded by the Institution of Occupational Safety and Health, major projects can significantly improve workers' understanding of health risks and champion universally high standards across the industry. In this way they set high safety standards and help in disseminating these standards across the industry, thereby raising the bar for occupational health management in construction. See: Major construction projects play a critical role in improving workers' understanding of occupational health risks, study suggests (August 2019). (Accessed 18 December 2023)

267 NPS published 22 November 2023

"Climate change is already altering the UK's weather patterns and this will continue to accelerate depending on global carbon emissions. This means it is likely there will be more extreme weather events. As well as climatic and seasonal changes such as hotter, drier summers and warmer, wetter winters, there is also a likelihood of increased flooding, drought, heatwaves, and intense rainfall events, as well as rising sea levels, increased storms and coastal change. Adaptation is therefore necessary to deal with the potential impacts of these changes that are already happening."

11.7.6 A reduction in greenhouse gases is critical to securing ecosystem resilience and, thereby, providing beneficial consequences of primary importance for the environment. New nuclear power can help bring about a reduction in greenhouse gases through clean, reliable and large-scale electricity generation.

11.7.7 The two 2 UKEPR™ Units under construction at HPC would each avoid 4.5m tonnes of carbon each year. Operation of the first Unit at HPC is due to commence in mid-2027, with the second Unit due to commence operations 12 months later. Therefore, the carbon avoidance each year from mid-2027 will be as follows:

Table 11-2: Carbon avoidance in millions of tonnes per year from mid-2027 to mid-2031[268]

Year	Carbon avoidance (millions of tonnes)
2027	4.5m
2028	13.5m
2029	22.5m
2030	31.5m
2031	40.5m

11.7.8 The construction of the two reactor Units at Hinkley Point C is well advanced and is currently scheduled to start operations in mid-2027. By approving the Project, the indefinite delay associated with the requirement to develop, and install and operate an AFD system can be avoided and the commissioning and operational phases of HPC can continue in accordance with current timeframes. This will ensure that crucial carbon avoidance can commence as quickly as possible. It is clearly in the public interest that steps are taken as quickly as possible

268 See NNB Publication, Life cycle carbon and environmental impact analysis of electricity from Hinkley Point C nuclear power plant development (dated 26 October 2021).

to avoid putting more carbon into the atmosphere to prevent or mitigate the severe impacts of climate change on the environment and biodiversity.

11.8 Part 7: Conclusion regarding the IROPI test

11.8.1 This Stage 3 IROPI assessment out the IROPI case for the Project in accordance with the requirements of the Habitats Regulations.

11.8.2 The assessment draws on the IROPI case established by the Government to demonstrate the imperative reasons of overriding public interest for the nuclear NPS, including the identification of HPC as a potentially suitable site for new nuclear generation. This assessment also draws on the more recent IROPI assessment set out within the Secretary of State's decision letter for Sizewell C (dated 20 July 2022) where the Government concluded that IROPI existed for the development of new nuclear power generation. As set out in Section 1 of this assessment, the Government concluded that the new nuclear power station, Sizewell C, would provide a public benefit which is essential and urgent.

11.8.3 The reasons to approve the Project are demonstrably:

- imperative;
- overriding; and
- in the public interest.

Imperative

11.8.4 The public interest in allowing plans or projects to proceed are imperative when they are "required", "indispensable" or "essential". In this case, it is both essential and urgent that the Project proceeds and the requirement to fit an AFD system is removed from the 2013 DCO. This report demonstrates that all the factors relied upon by the Government in its own assessment of IROPI for new nuclear generation remain relevant today but are reinforced by a number of factors, including the fact that the Government has since committed to more stringent carbon reduction targets. The imperative public interest importance and urgency of delivery of the Project is evidenced in this report by reference to established Government policy in the NPS and the following points are emphasised:

- The increasing demand for electricity: This is forecast to double by 2050 and that therefore the UK will need a fourfold increase in low carbon generation. This is likely despite efforts towards energy conservation and efficiency. It is therefore national policy that HPC is urgently needed so that it can generate the electricity the UK needs to meet growing demands.

- The decreasing supply of electricity: This is because over 60% of current UK generating capacity of electricity capacity is set to be retired by 2035. It is therefore national policy that HPC is urgently needed so that it can generate the electricity the UK needs to ensure a reliable and secure electricity supply.
- The need for new electricity and new nuclear power: To reduce the environmental impacts associated with the essential use of energy, and to meet legal/international commitments to reduce greenhouse gas emissions, it is increasingly necessary that the UK's energy supply comes from low carbon sources, such as nuclear. Furthermore, in light of the doubling in demand for electricity by 2050 and the reduction in electricity capacity from existing nuclear power stations, NPS EN-1[269] places an emphasis on the important role consented infrastructure projects, such as HPC, will have. Unless the Project is approved, there will be an indefinite delay before HPC can become operational.
- The UK Government's policy of decarbonisation: The Climate Change Act 2008 (2050 Target Amendment) Order 2050 (SI 2019/1056) commits the UK government, by law, to reducing greenhouse gas emissions by 100% of 1990 levels (net zero) by 2015 (being an increase from 80% as set out originally). Achieving this target will require a step change in the decarbonisation of the UK energy system. New nuclear, such as HPC, is confirmed in the Energy White Paper (December 2020) to have an important role to play in meeting the UK's energy requirements as well as in the context of the UK's policy of decarbonisation and energy security. NPS EN-1 explains that there is a need to transform the energy system, tackle emissions, and continue to ensure a secure and reliable supply of energy.[270] More recently, the Examining Authority's Report for Sizewell C (dated 25 February 2022), acknowledges that a delay in the deployment of nuclear could result in the UK being locked into a higher carbon energy mix for a longer period than is consistent with the Government's ambitions to decarbonise electricity supply. It is therefore essential that the Project is approved so that the operation of HPC is not indefinitely delayed.
- Energy security: HPC will be a secure and reliable source of 3.2GW of low carbon energy within an uncertain market. HPC will operate continuously at high output levels, thereby providing reliable baseload power. This is essential for the UK's energy security because whilst renewable sources can generate a large amount of energy, their output is less

269 NPS EN-1 published on 22 November 2023
270 NPS EN-1, published on 22 November 2023.

predictable and they are often located in locations away from the centre of demand. In contrast, the new nuclear power generated by HPC will be a secure and reliable source of energy. This can also help reduce volatility in energy prices. It is therefore of fundamental importance to the national interest that the Project is approved so that HPC can become operational as soon as possible.

11.8.5 All of the above points are nationally important with long term benefits for the public.

Overriding

11.8.6 In order for the imperative public interest benefits from the delivery of the Project to meet the 'overriding' legal test, the national, regional and/or local benefits associated with the Project must be evidenced to demonstrate that they outweigh the harm (or risk of harm) to the integrity of the site(s) identified in the Stage 2 AA.

11.8.7 Doing this requires consideration of where the balance lies between the specific risk of harm to protected European / Ramsar sites identified in the Stage 2 AA and the imperative public interest benefits associated with the delivery of the Project.

11.8.8 Having carried out this analysis in this case as set out below, NNB has concluded that Secretary of State can be satisfied that the statutory requirement of this Project being 'overriding' is decisively met in this case.

Risk of adverse effect on integrity of the Severn Estuary SAC via the Estuaries qualifying feature

11.8.9 The Stage 2 AA (Section 9.4.210) has concluded that a risk to the integrity of the Severn Estuaries SAC Estuaries qualifying habitat feature from the entrapment of fish from the typical fish species assemblage could not be excluded beyond reasonable scientific doubt due to the potential for an effect on the structure of predator-prey relationships.

11.8.10 However, as part of the balancing exercise described above, it is important to recognise those points listed in Part 4 of the Stage 3 NAS assessment (Section 10.4.7).

Risk of adverse effect on site integrity due to entrapment of fish from qualifying species of the Severn Estuary SAC, River Usk SAC and River Wye SAC and from the migratory fish species assemblage of the Severn Estuary Ramsar site

11.8.11 The Stage 2 AA (Section 9.16.1) has also concluded that a risk to the integrity of the Severn Estuaries SAC, River Usk SAC, River Wye SAC and the Severn Estuary Ramsar site could not be excluded beyond reasonable scientific doubt due to the entrapment of fish qualifying species / fish from the Ramsar migratory fish species assemblage.

11.8.12 However, as part of the weighing up exercise described above, it is important to recognise those points listed in Part 4 of the Stage 3 NAS assessment (Section 10.4.9).

The imperative public interest benefits associated with the delivery of the Project meet the statutory requirement of being 'overriding'

11.8.13 Weighed against the above risks, there are clear imperative public interest benefits in approving the Project and thereby avoiding an indefinite delay to the commissioning and operational phases of HPC. These imperative public interest benefits include the nationally important and far reaching social and economic benefits associated with removing delays to the operation of HPC together with the health and safety benefits of not designing into HPC intolerable health and safety risks for human divers.

11.8.14 In light of the nationally important and long term imperative public interest benefits associated with the Project set out above, it is clear that these benefits decisively outweigh and override the predicted risk of adverse effect on the integrity of European / Ramsar sites from HPC.

11.8.15 Given the imperative, nationally important and long term public interest benefits associated with the Project weighed against the risk (without any certainty of an adverse effect on integrity of certain European / Ramsar sites from the Project) and set in the appropriate context as explained in Section 10.4.7, the requirement that the Project has imperative reasons of *overriding* public interest is clearly met.

Public Interest

11.8.16 For the delivery of the Project to be 'in the public interest', there must be clear public (as opposed to private) interest associated with its delivery at a national, regional or local level which should also be long term. The delivery of the Project is plainly 'in the public interest' for the following reasons.

- If the Project is approved then the requirement to fit an AFD will not delay the commissioning and operational phases for HPC. It is of national public interest that HPC can start to generate low carbon energy as soon as possible given the urgent need for electricity. HPC will deliver up to 3.2GW of energy for the UK, enough to power around 6 million homes over its 60 year operational lifetime. The urgent need for new nuclear power was more recently re-affirmed by Government in its decision to grant the DCO for the Sizewell C nuclear power station.
- HPC would provide reliable baseload, low carbon energy, which would complement the development of renewable energy and play an important part in enabling the UK to meet its greenhouse gas emissions reduction commitments. It is clearly of national public interest that this should happen.
- The strategic IROPI case for a new nuclear power station at HPC has already been thoroughly assessed by the UK Government. HPC is identified in NPS EN-6 as one of eight sites in the UK considered suitable for a new nuclear power station. The Government recognises in NPS EN-6 the potential for adverse effects on the integrity of European sites and concluded that there were IROPI for the adoption of NPS EN-6, including the development of a new nuclear power station at Hinkley Point. NPS EN-6 states that all sites should be considered to be needed and sites should not be seen as alternatives to one another. The suitability of Hinkley Point as a site for new nuclear development was confirmed when the Secretary of State granted the 2013 DCO at HPC. Construction is now well underway.
- The wider social and economic benefits arise both during the construction and operation of HPC. If the Project is not approved and an AFD system is required, then the generation of electricity at HPC will need to be delayed indefinitely. Such a delay is likely to result in an indefinite demobilisation of the workforce with the consequential loss of construction related employment, business opportunities and wider effects including needing to cease the employment of the commissioning/operations staff who are already working at HPC. Such a pause could put at risk the substantial socio-economic benefits that the project is generating both during construction and the careful plans being executed to ensure a successful transition into the commissioning and operational phases of the project. Without this the social and economic benefits associated with the operation of HPC cannot be fully realised.

- The introduction of high levels of human risk to install untested technology in extreme sea conditions is not a tolerable risk that NNB can accept as part of its risk assessment or impose upon personnel who would be contracted to carry out the work. It is clearly in the public interest that all construction projects, but in particular major infrastructure projects like HPC which help drive industry leading safety standards, do not design in intolerable health and safety risks. For this reason, it is essential that the requirement to fit an AFD system is removed from the 2013 DCO.
- The provision of low carbon energy is crucial for preventing or mitigating the impact of climate change on the environment and biodiversity. By approving the Project, the requirement to fit an AFD system will not delay the crucial carbon avoidance which HPC can deliver. It is clearly in the public interest that steps are taken as quickly as possible to avoid putting more carbon into the atmosphere to prevent or mitigate the severe impacts of climate change on the environment and biodiversity.

Conclusion

11.8.17 This Stage 3 IROPI assessment demonstrates that the Secretary of State can be fully satisfied that there exist in this case imperative reasons of overriding public interest for the Project.

11.8.18 There are clear urgent (imperative) and significant public interest reasons for approving the Project and avoiding an indefinite delay to the commissioning and operational phases of HPC. These public interest benefits include the national social and economic benefits associated with removing delays to the operation of HPC together with the health and safety benefits of not designing into HPC intolerable health and safety risks for human divers. The operation of HPC will also support human health and public safety through the provision of baseload electricity for 60 years. The carbon avoidance associated with HPC will also prevent or mitigate the severe impacts of climate change on the environment and biodiversity.

11.8.19 Furthermore, it is clear that the nationally important, urgent and long term public interest benefits associated with the Project decisively override the predicted risk of adverse effect on site integrity from HPC. This is because:

- whilst HPC without an AFD gives rise to an acknowledged risk of an adverse effect on the integrity of four European / Ramsar sites which cannot be excluded beyond reasonable doubt, there is no certainty of any such adverse effect on integrity;
- the ecological context relating to the acknowledged risk, as explained above, shows that any impacts that occur are expected to be low level; and

- any impact will not be permanent.

11.8.20 For these reasons the Secretary of State can be satisfied that the Project meets the IROPI legal test.

12 HRA STAGE 3: NNB'S PROPOSED COMPENSATORY MEASURES PACKAGE

12.1 Introduction

12.1.1 This section of the HRA Report outlines NNB's currently proposed compensatory measures package to be delivered both within and beyond the DCO Material Change Order Limits. It provides:

- a summary of the legal requirement relating to compensatory measures;
- the feasibility process undertaken by NNB to date to arrive at its currently proposed package;
- an overview of NNB's currently proposed compensatory measures package;
- a summary of the AMMP envisaged to be established;
- the ecological benefits of the package in relation to the relevant qualifying features of the designated site(s) for which it has not been possible to conclude that the Project will have no adverse effect on integrity; and
- NNB's next steps to develop further its proposed compensatory measures package.

12.1.2 The document should be read in conjunction with the following two Technical Reports which are Appendices to this HRA Report:

- Cefas (2023) BEEMS Technical Report TR592: Benefits of the compensation package to the Estuaries qualifying feature of the Severn Estuary / Môr Hafren SAC: Typical fish species assemblage (Appendix 13.1); and
- Cefas (2023) BEEMS Technical Report TR595: The potential benefits of barrier easement and removal on populations of shad and Atlantic salmon and other diadromous species in the River Severn and selected Welsh rivers (Appendix 13.2).

12.1.3 Further key resources relied upon in this section of the HRA Report, in particular in relation to the creation and enhancement of marine compensatory habitats, include the following Restoration Handbooks:

- Saltmarsh Restoration Handbook[271];
- Restoring Estuarine and Coastal Habitats with Dredged Sediment: A Handbook[272];
- European Native Oyster Restoration Handbook[273]; and
- Seagrass Restoration Handbook[274].

12.2 The Compensatory Measures requirement

The Legal Context

12.2.1 The legal requirement for compensatory measures originally derived from Article 6(4) of the Habitats Directive (first paragraph):

"*If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.*"

12.2.2 Accordingly, under Article 6(4), compensatory measures are those which, following a negative AA, are necessary to ensure that the overall coherence of Natura 2000 is protected.

12.2.3 Regulation 68 of the Habitat Regulations implements the compensatory measures element of Article 6(4). Regulation 68 states:

---

271 Hudson, R., Kenworthy, J. and Best, M. (eds) (2021). Saltmarsh Restoration Handbook: UK and Ireland. Environment Agency, Bristol, UK. Available online at: https://catchmentbasedapproach.org/wp-content/uploads/2021/10/Saltmarsh-Restoration-Handbook_UPDATED_0522.pdf. Accessed 01 November 2023.

272 Manning, W.D., Scott, C.R and Leegwater. E. (eds) (2021). Restoring Estuarine and Coastal Habitats with Dredged Sediment: A Handbook. Environment Agency, Bristol, UK. Available online at: https://catchmentbasedapproach.org/wp-content/uploads/2021/10/Restoring-Estuarine-and-Coastal-Habitats-with-Dredged-Sediment.pdf. Accessed 01 November 2023.

273 Preston J., Gamble, C., Debney, A., Helmer, L., Hancock, B. and zu Ermgassen, P.S.E. (eds) (2020). European Native Oyster Habitat Restoration Handbook. The Zoological Society of London, UK., London, UK. Available online at: https://nativeoysternetwork.org/wp-content/uploads/sites/27/2020/11/ZSL00150 %20Oyster%20Handbook_WEB.pdf. Accessed 01 November 2023.

274 Gamble C., Debney, A., Glover, A., Bertelli, C., Green, B., Hendy, I., Lilley, R., Nuuttila, H., Potouroglou, M., Ragazzola, F., Unsworth, R. and Preston, J, (eds) (2021). Seagrass Restoration Handbook. Zoological Society of London, UK., London, UK. Available online at: https://catchmentbasedapproach.org/wp-content/uploads/2021/10/ZSL00168-Seagrass-Restoration-Handbook_20211108.pdf. Accessed 01 November 2023.

"*68. Where in accordance with regulation 64—*

(a) a plan or project is agreed to, notwithstanding a negative assessment of the implications for a European site or a European offshore marine site, or

(b) a decision, or a consent, permission or other authorisation, is affirmed on review, notwithstanding such an assessment,

the appropriate authority must secure that any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000 is protected."

12.2.4 As explained in earlier sections of this HRA Report, the reference to Natura 2000 in Regulation 68 is (under Regulation 3(10) of the Habitat Regulations) to be construed as a reference to the NSN, which in turn is defined as "*the network of sites in the UK's territory consisting of such sites as* (a) *immediately before exit day formed part of Natura 2000; or* (b) *at any time on or after exit day are European sites, European marine sites and European offshore marine sites for the purpose of any of the retained transposing regulations*".

12.2.5 Regulation 68 therefore requires that the compensatory measures "*ensure that the overall coherence of Natura 2000 [NSN] is protected*".

12.2.6 This is a broader test than that which applies pursuant to Regulation 63(5) of the Habitat Regulations which only allows the competent authority to agree to the plan or project "*after having ascertained that it will not adversely affect the integrity*" of the relevant European site(s), albeit that the nature of compensatory measures is to be informed by the relevant AA[275].

12.2.7 Whereas an effective mitigation measure must be targeted at the exact effect which it seeks to prevent or reduce (mitigation measures are "*the protective measures forming part of that project aimed at avoiding or reducing any direct adverse effects for the site, in order to ensure that it does not adversely affect the integrity of the site*"[276]), a compensatory measure is one that 'offsets', i.e. balances out, harm or a risk of harm. By way of illustration, Advocate General Sharpston, in her Advocate General opinion in the CJEU case of C-521/12, stated:

"*36. The basic semantic distinction between mitigation (or minimisation or reduction) and compensation (or offsetting) does not appear to me to be very controversial. In the context of*

275 In the case C-304/05 (Commission v Italy) the Court stated at paragraph 83 "..in order to determine the nature of any compensatory measures, the damage to the site must be precisely identified."
276 C-521/12 TC Briels v Minister van Infrastuctuur en Milieu, paragraph 28

Article 6(3) and (4) of the Habitats Directive, a mitigation measure must be one which lessens the negative effects of a plan or project, with the aim of ensuring, if possible, that (while some insignificant and / or transient effects might not be totally eliminated) the 'integrity of the site' as such is not adversely affected. A compensatory measure, by contrast, is one which does not achieve that goal within the narrower framework of the plan or project itself but seeks to counterbalance the failure to do so through different, positive effects with a view to, at the very least, avoiding a net negative effect (and, if possible, achieving a net positive effect) within a wider framework of some description" (emphasis added).

12.2.8 That important distinction is reflected in the judgment of the Court of Appeal in *Smyth v Secretary of State for Communities and Local Government* [2015] EWCA Civ 174:

"*68. On the other hand, where measures are proposed which would not prevent harm from occurring, but which would (once harm to a protected site has occurred) provide some form of off-setting compensation so that the harm to the site is compensated by new environmental enhancing measures elsewhere, then it cannot be said that those off-setting measures prevent harm from occurring so as to meet the preventive and precautionary objectives of Article 6(3). In the case of off-setting measures, the competent authority is asked to allow harm to a protected site to occur, on the basis that this harm will be counter-balanced and offset by other measures to enhance the environment elsewhere or in other ways. In order to allow the harm to a protected site which Article 6(3) is supposed to ensure does not occur, a competent authority will have to be satisfied that such harm can be justified under Article 6(4), taking account of the off-setting compensation measures at the stage of analysis under Article 6(4). Such measures would not be capable of bearing on the application of the tests under Article 6(3), and so could not be relevant at the Article 6(3) stage*" (emphasis added).

12.2.9 A further difference is that the caselaw concerning the need for certainty as to the absence of an adverse effect on integrity (i.e. leaving no reasonable scientific doubt)[277] is concerned with the application of Regulation 63 and is not engaged by Regulation 68. That is unsurprising, given the different nature and objectives of compensatory measures in this statutory context.

12.2.10 Compensatory measures do not therefore have to negate the precise nature of the risk to site integrity identified in the shadow AA or to deliver a level of benefit that is quantifiably equivalent to the identified risk of potential harm. Indeed in some circumstances to do so will be technically / scientifically impossible. This is a particular issue in the marine environment, a

277 See e.g. Wyatt, R (On the Application Of) v Fareham Borough Council (Rev1) [2022] EWCA Civ 983).

point explained in the consultation version of 'The Best Practice Guidance for developing compensatory measures in relation to Marine Protected Areas' dated 22 July 2021[278] which states at paragraph 46: "*As it will not always be possible to deliver compensatory measures in a like-for-like capacity as is accepted terrestrially, Defra has created a framework to help advisors' regulators and developers to explore and develop compensatory measures. The underlying principle is that* ***compensatory measures that benefit the same feature which is impacted by the development will be the most preferable*** *as they balance the damage caused by the development*" (the emphasis in bold is as given in the Best Practice Guidance).

12.2.11 In applying the Regulation 68 "overall coherence" test, the Secretary of State must therefore make an evaluative judgment of the appropriateness and proportionality of the proposed compensatory package to achieve the statutory objective within that wider framework, informed by the conclusions of the relevant AA.

Guidance and Advice

12.2.12 There are a number of sources of domestic guidance in relation to the compensatory measures requirement which NNB has taken into account when designing its compensatory measures, as follows:

- PINS Advice Note 10, dated August 2022[279];
- Defra and Welsh Government advice at Gov.uk Habitats regulations assessments: protecting a European site[280];
- Defra Habitats and Wild Birds Directives: guidance on the application of Article 6(4) dated December 2012 (now withdrawn but remains useful as a reference nevertheless)[281]; and
- Defra Best practice guidance for developing compensatory measures in relation to marine protected area dated 22 July 2021 (version published for consultation; no final version available)[282].

278 Best practice guidance for developing compensatory measures in relation to Marine Protected Areas (defra.gov.uk) (Accessed 11 December 2023)

279 Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects | National Infrastructure Planning (planninginspectorate.gov.uk) (Accessed 11 December 2023)

280 Habitats regulations assessments: protecting a European site - GOV.UK (www.gov.uk) (Accessed 14 November 2023)

281 Habitats and Wild Birds Directives: guidance on the application of article 6(4) (publishing.service.gov.uk) (Accessed 11 December 2023)

282 https://consult.defra.gov.uk/marine-planning-licensing-team/mpa-compensation-guidance-consultation/supporting_documents/mpacompensatorymeasuresbestpracticeguidance.pdf (Accessed 11 December 2023)

12.2.13 NNB has also received HPC-specific advice from NRW and NE (in consultation with the EA) entitled 'Advice on the principles of compensatory measure provision under the Conservation of Habitats and Species Regulations 2017 (as amended) for the Hinkley Point C nuclear power station' dated March 2023 ('NRW / NE Advice'). This refers in turn to the Defra and Welsh Government gov.uk guidance mentioned above.

12.2.14 Key points arising from the NRW / NE Advice are:

Defining compensation:

"...Compensatory measures are intended to offset the unavoidable adverse effects to the integrity of a site, and consequently to the coherence of the national site network (the 'network'), that is predicted to occur as a result of a plan or project..."

Network coherence:

"*Regulation 16A (paragraph 2) of the Habitats Regulations sets out the management objectives of the national site network, which are [for SACs]:*

(a) to maintain at, or where appropriate restore to, a favourable conservation status in their natural range (so far as it lies in the United Kingdom's territory, and so far as is proportionate)—

(i) the natural habitat types listed in Annex I to the Habitats Directive;

(ii) the species listed in Annex II to that Directive whose natural range includes any part of the United Kingdom's territory..."

"*...Whilst the term 'overall coherence' is not defined by Regulation 68 of the Habitats Regulations, we consider that overall coherence of the network is its ability to sustain the most important areas for, and the full range and variation of, habitats and species of European importance in the UK making a significant ongoing contribution to their favourable conservation status. Network coherence is therefore dependent upon conservation objectives being met in individual European sites. However, the assessment of what is required to maintain overall coherence when developing compensatory measures in a particular case depends upon a number of site-specific factors including:*

The conservation objectives of the site in question that is affected; and

The affected site's contribution to Favourable Conservation Status of its habitats and species, including:

The number and status of protected habitats and / or species in the affected site; and

The role the affected site plays in ensuring the biogeographical distribution of protected habitats and species.

We advise that compensatory measures are targeted at the designated habitats or species of the site which would be adversely affected by the project and are informed by the site's conservation objectives, the nature and the extent of the adverse effects, and the contribution of the site to the FCS of the affected habitats and / or species. To achieve their statutory purpose of maintaining overall network coherence, we advise that compensatory measures seek to offset effects to designated habitats or species within the affected site. Where this is not possible, compensatory measures may be located outside of the affected site, provided they maintain network coherence …"

Scope and Additionality:

"*In general terms, the scope of compensatory measures required will be informed by the nature and scale of the predicted adverse effects…*"

and

"*…Compensatory measures for the adverse effects of the project on site integrity and network coherence must be additional to those measures that would or should reasonably be undertaken to comply with the requirements of the Directives…*"

Sufficiency:

"*The competent authority, having regard to any advice from the ANCBs (and others as necessary) before authorisation is granted must be confident that the proposed compensatory measures will be sufficient to offset the adverse effects…*"

and

"*…Compensatory measures must be of sufficient scale to offset impacts associated with the project throughout its lifetime…*"

and

"*…Monitoring is necessary to determine the effectiveness of compensatory measures against both the project objectives and site conservation objectives…*".

Timing:

"*Compensatory measures must be secured by the competent authority before consent is given for a proposal to proceed. This means that all necessary legal, technical, financial, and* *monitoring arrangements, including a timetable for implementation, should be in place to ensure compensatory measures proceed as agreed and remain in place over the required timescale of the impact or in perpetuity. Wherever possible, compensatory measures should be completed in advance of the adverse effect on the site occurring; so that the coherence of the network is continuous and does not suffer loss. However, there may be circumstances where damage may occur before compensatory measures are fully functioning; functioning; for example, where measures will take a long time to become fully- functioning (e.g. re-creation of saltmarsh). Government has permitted work to commence on plans and projects where the necessary permissions and legal assurances to secure compensatory measures have been obtained, with the expectation being that measures are in place to ensure coherence will be restored".*

and

"*Compensatory measures should be in place 'in time' to provide fully the ecological functions that they are intended to compensate for. Where delivery 'in time' is not fully achievable, compensatory packages should consider additional measures for the interim where this would serve a sound ecological compensatory function*".

Securing compensatory measures:

"*...It will be necessary for the applicant to provide a clear delivery plan and demonstrate that they have held discussions with regulators, landowners and other interested parties to seek in-principle decisions on relevant licences/permissions...*".

12.3 NNB's Proposed Package of Compensatory Measures

Introduction

12.3.1 The compensatory measures package proposed by NNB at this stage includes saltmarsh creation / enhancement at two potential locations (Pawlett Hams and The Island), river weir easements at three locations; and creation / enhancement of three types of marine habitat (seagrass beds, native oyster reef and kelp forest) at locations to be determined.

12.3.2 The package is designed to provide an integrated and ecologically coherent set of measures to satisfy the legal requirement set out in Section 12.2.1 to 12.2.11 above, whilst taking into account the results of the shadow AA in this HRA Report and other relevant factors.

12.3.3 The shadow AA has concluded (see Section 9.16) that there is a risk to site integrity (through HPC fish entrapment), that cannot be excluded beyond reasonable scientific doubt, from the Project, with respect to four European / Ramsar sites through the following qualifying features:

- Severn Estuary SAC: the Estuaries qualifying habitat feature through the risk of an effect on the typical fish species assemblage; and Twaite shad qualifying species;
- Severn Estuary Ramsar site: the Criterion 4 migratory fish assemblage;
- River Usk SAC: Atlantic salmon and Twaite shad qualifying species; and
- River Wye SAC: Atlantic salmon, Twaite shad and Allis shad qualifying species.

12.3.4 Some elements of the compensatory measures package are further developed at this stage than others. The following describes the proposed compensatory measures package and its ecological benefits and then sets out the next steps envisaged by NNB to develop the package further.

NNB's Compensatory Measures Feasibility Assessment Process to date

12.3.5 This section describes the process to date by which the proposed compensatory measures package set out below has been arrived at by NNB.

12.3.6 NNB started the process of selecting the most appropriate compensatory measure options by revisiting a previous piece of work called Habitat Enhancement Measures ('HEMS'). This previous work involved the consideration of habitat creation and enhancement, and several engagements (including meetings and workshops) were held with a number of organisations including the SNCBs to assist with defining a long list of potential options to take forward for feasibility assessment.

12.3.7 The initial long list of options was reassessed by NNB in light of the risk of impacts arising from removal of the AFD requirement and then supplemented with further potential compensatory measure options. These were drawn up into a tabular format to identify and compare the benefits and disadvantages of each so as then to define the options to take forward to a short list.

12.3.8 The short list was refined to reflect the most appropriate and beneficial options with the highest likelihood of successful implementation. These chosen options were then entered into the next phase of feasibility, particularly the saltmarsh and weir easements, to find locations where they could most effectively be implemented.

12.3.9 The saltmarsh feasibility work initially assessed likely locations through reference to the Shoreline Management Plan ('SMP'). Identified locations were then assessed for their likelihood of saltmarsh-typical plant colonisation or enhancement by using the MMO saltmarsh potential, extent and zonation mapping GIS tools. The likely locations were then assessed for a variety of site-specific topics, including, but not limited to: the total area that could become, or be enhanced as, saltmarsh; proximity to households or businesses; geology; proximity to the HPC Site; whether within or outside the relevant European / Ramsar sites; ecological connectivity to other habitats; and current or previous sites of pipelines, power lines or landfill. Consideration of these topics enabled further filtering of the potential locations for saltmarsh creation.

12.3.10 The other marine habitat compensation options were selected via the long list and short list approach; however, further investigations will need to be undertaken to ensure that the best locations with the highest likelihood of success are taken forward. NNB is working with subject matter experts to find the most appropriate locations and identify any further studies that ought to be undertaken.

12.3.11 As work around the marine compensation options develops, targeted site-specific feasibility studies will be undertaken, including the establishment of small-scale trials in areas considered to be appropriate for habitats to develop successfully. Following analysis of the results of these trials, habitat development will be 'scaled up' in the most appropriate candidate areas for each compensatory measure. These studies will be initiated to support the DCO Material Change application.

12.3.12 Through optioneering and engagement with the SNCBs regarding the proposed compensation package, a key element of the approach identified by NNB was the removal / easement of existing barriers to fish migration. The measures are primarily targeted towards the Annex II qualifying species of designated sites (Twaite shad, Allis shad and Atlantic salmon) and the Ramsar site Criterion 4 migratory assemblage for which, in the shadow AA, the risk of adverse effect could not be excluded beyond reasonable scientific doubt.

12.3.13 Whilst targeted at Twaite shad, Allis shad and Atlantic salmon, it is nevertheless NNB's intention to design the barrier removal / easement measures to ensure that the broadest range of fish species will benefit. This will include the Annex II fish qualifying species of the River Wye SAC, River Usk SAC and Severn Estuary SAC together with species making up the

Ramsar Criterion 4 migratory species assemblage and the typical fish species assemblage of the Estuaries feature of the Severn Estuary SAC. Barriers lower in the catchment have the potential to benefit species from the typical fish species assemblage of the Estuaries feature of the Severn Estuary SAC such as thin-lipped grey mullet, European sea bass, European flounder and gobies, all of which are common in the HPB impingement records. Fish passage improvement measures will also increase interconnectivity for freshwater species.

12.4 Proposed Compensatory Measure: Easement of Fish Migration Barriers

Overview

12.4.1 NNB has been working in consultation with the SNCBs and other stakeholders to identify existing weirs in appropriate rivers that currently act as barriers to migratory fish within the Severn Estuary, River Usk and River Wye SAC sites and Severn Estuary Ramar Site.

12.4.2 Work has been undertaken on the identification of priority sites including feasibility studies. This has led to the identification of possible barriers suitable for management works so as to enhance river connectivity by improving upstream or downstream passage of fish.

12.4.3 Improving or restoring connectivity can be achieved through several methods, including by completely removing weirs, partially removing weirs by installing notches, constructing fish passes to facilitate free movement of fish over, through or around obstacles, or manipulating conditions around a structure, such as modifying water flow. Here, the term 'fish passage improvements' is used to encompass the range of different management measures that are available to benefit migratory movements.

12.4.4 Based on the work undertaken to date fish, passage improvements are proposed at three weir sites to be selected from the following list:

- Maisemore Weir, River Severn (this site would be within the DCO Material Change Order Limits);
- Trostrey Weir, River Usk (this site would be within the DCO Material Change Order Limits);
- Upper Lode Weir, River Severn (this site would be within the DCO Material Change Order Limits);

- Manorafon Weir, River Towy (this site would be outside the DCO Material Change Order Limits); and
- One of the following three weirs on the River Lugg, a tributary in the River Wye catchment (each of these sites would be within the DCO Material Change Order Limits):
  - Eyton;
  - Mousenatch; or
  - Coxall.

12.4.5 NNB's preferred proposal at present is to undertake improvements at Maisemore and Trostrey with one further improvement to be selected from the list of sites above.

Summary of Barrier Easement Benefits

12.4.6 Increases in fish production following fish passage improvements are anticipated where barriers cause a bottleneck in production by either impeding adult spawning success, limiting habitat availability or limiting down-stream migration. Measures to improve fish passage at barriers are recognised as important for supporting populations of diadromous species. Removal / easement of fish migration barriers is anticipated to increase catchment level production by allowing fish to reach historically available habitat and also increasing overall habitat availability thus allowing fish to complete their life-cycle.

12.4.7 Removal / easement of barriers may also enhance spawning success by reducing passage delay times and energy demands on spawning adults thereby increasing the likelihood of successful spawning and subsequent return to sea for those species with the capacity to spawn over multiple years.

12.4.8 The easement of upstream / downstream bottlenecks may also reduce mortality in the juvenile and adult stages.

Timescale to Ecological Functionality

12.4.9 Barrier easement to support / improve fish migration on key rivers is a commonly-used technique, including by the EA and others, to restore access to migratory species to their spawning sites. Case studies of successful barrier easement are outlined in TR592 Appendix 13.1 and include:

- River Villestrup, Denmark: A total of six weirs were removed between 2004 and 2013, to remove impediments to downstream migration of wild brown trout, and upstream migration of adult fish.
- River Tees Barrage, UK: Removal of a fish trap at the Barrage showed an increase in upstream movement of spawning salmon and sea trout.
- Coimbra Dam, Portugal: Installation of a fish pass on a previously impassable dam for Allis shad, Twaite shad and sea lamprey on the River Mondego was shown to have restored partial access to upstream spawning habitats.

12.4.10 In the above examples, improvements were noted shortly after works were completed, indicating that benefits to the migratory fish qualifying species of the relevant designated sites will occur in the short-term following delivery.

Timescale for Delivery

12.4.11 Barrier removal and fish pass construction are common interventions, and the process of engineering design and delivery is well understood. Delivery within three years of grant of the DCO Material Change is therefore at this stage considered achievable.

Ability and Rights to Carry out the Works

12.4.12 For those measures that are within the DCO Material Change Order Limits, it is NNB's intention to seek agreement by negotiation with those who hold rights over the relevant land and riverine access / ownership, as appropriate. Compulsory acquisition powers will be included within the amendment Order to obtain the necessary powers to carry out and maintain the works where private agreement is not possible.

12.4.13 For those measures that fall outside of the DCO Material Change Order Limits and are therefore to be consented under other regulatory regimes, it will be necessary to seek private agreement to carry out and maintain the works.

12.4.14 At the time of writing, diligent enquiry and negotiations are ongoing.

12.4.15 At the time of writing, there is currently no reason to believe that there is any impediment to the measures being implemented.

12.5 Proposed Compensatory Measures: Saltmarsh and other Marine Habitats

Overview

12.5.1 As part of NNB's proposed compensatory measures package, the creation and / or enhancement of four intertidal / marine habitat types is being planned:

- Saltmarsh and associated habitats;
- Native oyster reefs;
- Seagrass beds; and
- Kelp forests.

12.5.2 Whilst each of these habitats is able to bring individual benefits to the receiving environment, together they will also support the 'Estuaries' qualifying habitat feature of the Severn Estuary SAC; the Annex II qualifying species of the Severn Estuary SAC, the River Usk SAC and the River Wye SAC; and the Ramsar Criterion 4 migratory fish assemblage.

12.5.3 Further details of each habitat type are provided below, with information on their ecological benefits for the relevant qualifying features (both direct and indirect), presented in Section 12.7.

Saltmarsh Creation / Enhancement

Overview

12.5.4 A key element of NNB's compensatory measures package, following discussions with the SNCBs, is the creation or enhancement of saltmarsh and associated habitats. The total extent of saltmarsh within the Severn Estuary in England is 1,272.3 ha and it has increased in recent years due to managed realignment projects, notably at Steart Marshes (EA, 2022)[283].

12.5.5 Saltmarsh encompasses a variety of habitats and includes Atlantic salt meadows (*Glauco-Puccinellieta maritima* which is the native saltmarsh habitat within the UK) which cover

283 Environment Agency. 2022. The extent and zonation of saltmarsh in England: 2016-2019. An update to the national saltmarsh inventory. (publishing.service.gov.uk)

656 ha of the Severn Estuary SAC[284] (note this figure is from 2009 and may have subsequently changed). Atlantic salt meadows are an Annex I listed habitat in their own right but also forms part of the Estuaries qualifying habitat feature of the Severn Estuary SAC. It also forms part of the typical vascular plant species assemblage within the Estuaries qualifying habitat feature of the SAC (in accordance with the June 2009 Regulation 33 advice, see **Error! Reference source not found.** below).

12.5.6 Atlantic salt meadows develop when halophytic vegetation colonises soft intertidal sediments of mud and sand in areas protected from strong wave action. This vegetation forms the middle and upper reaches of saltmarshes, where tidal inundation still occurs but with decreasing frequency and duration. A wide range of community types are represented, which vary with climate and the frequency and duration of tidal inundation. Grazing by domestic livestock is particularly significant in determining species composition and the habitat's relative value for wildlife. At the lower reaches of the saltmarsh the vegetation is often naturally species-poor and may form an open sward of dominated by common saltmarsh-grass *Puccinellia maritima*.

12.5.7 Two sites along the tidal part of the River Parrett are currently proposed to provide saltmarsh and associated habitats. The two sites are:

- A managed realignment scheme at Pawlett Hams to create saltmarsh habitat; and
- A saltmarsh enhancement scheme at 'The Island'.

12.5.8 The Pawlett Hams area currently comprises permanent semi-improved grassland pasture, and arable land, intersected by drainage ditches. The proposed compensation measure at Pawlett Hams will cover the peninsula on the east bank of the River Parrett, approximately 5 km northwest of Bridgwater. The measure will involve the creation of approximately 313 ha of saltmarsh and associated habitats through managed retreat, by breaching of the soft landscape flood defences and excavating new creeks to allow tidal waters to flood the existing low-lying areas of the Pawlett peninsula, promoting the development of saltmarsh habitat, including Atlantic salt meadow. A mosaic of channels, lagoons and raised areas will be created and existing rectilinear drainage channels modified to maximise habitat diversity. The works are anticipated to be similar to the successful scheme developed at Steart Marshes on the opposite bank of the River Parrett.

284 Natural England & the Countryside Council for Wales' advice given under Regulation 33(2)(a) of the Conservation (Natural Habitats, &c.) Regulations 1994, as amended. June 2009

12.5.9 The proposed compensation measure at The Island will be located approximately three miles northwest of Bridgwater on the east bank of the River Parrett adjacent to the Pawlett Hams site, at the confluence between the River Parrett and River Huntspill. (Note that the land concerned, whilst called The Island, is not an island).

12.5.10 The proposed compensatory measure at The Island will involve the enhancement of approximately 27 ha of existing saltmarsh and associated habitat through excavation of tidal pools and a new tidal creek that will allow tidal waters to naturally flood the land to a greater extent than occurs at present. This will include creation of lower lying areas of creeks to allow increased fish usage and establishment of pioneer marsh[285].

Summary of Saltmarsh Benefits

12.5.11 Creation of the saltmarshes, including Atlantic salt meadows at higher tidal elevations, will enhance the biodiversity of the vascular plant species assemblage in the area. This will include an increase in species of particular nature conservation importance, including nationally rare and scarce salt-meadow / salt-marsh transition species, such as sea lavender (*Limonium vulgare*), glasswort (*Salicornia*), marsh mallow (*Althaea officinalis*), dotted sedge (*Carex punctata*, a ‘typical species’ of the Atlantic salt meadow habitat) and marsh pea (*Lathyrus palustris*). Saltmarshes provide a resource for wading birds and waterfowl, support a high number of invertebrates and provide nursery areas for fish[286]. Saltmarsh also provides socio-economic and ecosystem service benefits in terms of foraging (e.g. samphire), carbon sinks and dissipating storm / tidal wave energy[287].

12.5.12 An increase in the area / size of the saltmarsh habitat (a qualifying habitat of the Severn Estuary SAC in its own right and also forming part of the Estuaries qualifying habitat of the Severn Estuary SAC) will improve its natural functioning and make it more resilient to erosion, storm damage and succession. Saltmarshes in estuaries are particularly at higher risk of increased erosion due to riverine flood events in the future due to climate change[288].

285 ABPmer, (2020). Mitigation and Compensation Opportunity in Marine Consenting, ABPmer Report No. R.3385. A report produced by ABPmer for Welsh Government, March 2020.

286 UK BAP. 2008. Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock). Available (online) at: http://jncc.defra.gov.uk/page-5706 (Accessed 12 August 2023).

287 WWT. n.d. Wetland habitats Saltmarsh. Available (online) at: https://www.wwt.org.uk/discover-wetlands/wetlands/saltmarsh/ (Accessed 12 August 2023).

288 Desmond, M., O'Brien, P. & McGovern, F. (2017) A Summary of the State of Knowledge on Climate Change Impacts for Ireland: Report 11 (2010-2016). Prepared for the Environmental Protection Agency by MaREI Centre, Environmental Research Institute, University College Cork. EPA, Wexford.

12.5.13 Saltmarsh species *Puccinellia maritima* (an important species within the marsh community) and other halophytes provide primary productivity to the ecosystem, where a small proportion of this is used directly by grazers but the majority of it (in the form of dead plant material) enters the detrital food chain[289]. In the saltmarsh systems of the Westerschelde Estuary (on the border of the Netherlands and Belgium), macrofauna biomass was dominated by the amphipod *Corophium volutator*, the polychaete *Nereis diversicolor*, the bivalve *Macoma baltica* and *Oligochaeta* was positively correlated with salinity (Hampel, 2003[290]).

12.5.14 In European marshes, crabs *Carcinus maenas* use marshes, whilst shrimps such as juvenile *Crangon crangon* use tidal creeks at low tide and *Palaemonetes* spp. may occur in pools. Mysid shrimps occasionally occur in vast numbers in tidal creeks. The diet of juvenile European sea bass (*Dicentrarchus labrax*) utilising saltmarshes typically comprises of the amphipods *Corophium volutator* and *Orchestia* spp., polychaetes worms *Nereis diversicolor* and *Nereis integer*, brown shrimp *Crangon crangon*, common shore crab *Carcinus maenas*, mysids, isopods and copepods (Cattrijsse and Hampel, 2006[291]).

12.5.15 Microphytobenthos is also an important source of primary production and may help to bind the surface sediment and facilitate colonization by plants[289,292]. The detritus derived from the saltmarsh can also be further transported to the wider ecosystem of the estuary or bay, providing an important source of organic carbon[289,292,293]. A range of saltmarsh insects are also supported by this biotope including true bugs (*Hemiptera*), thrips (*Thysanoptera*), flies (*Diptera*), butterflies and moths (*Lepidoptera*) and beetles (*Coleoptera*). Vegetation cover and detrital levels are typically lower in newly created saltmarshes than established sites. Insects formed a small part of the diet of European sea bass (*Dicentrarchus labrax*) within recently created re-alignment saltmarshes within the Severn Estuary, whereas planthoppers of the family Delphacidae contributed 14 % towards the diet of European sea bass in established saltmarshes[294].

289 Long, S.P., & Mason, C.F., 1983. Saltmarsh Ecology London: Blackie & Sons Ltd. [Tertiary Level Biology series]

290 Hampel, H. 2003. Factors influencing the habitat value of tidal marshes for nekton in the Westerschelde estuary. PhD dissertation, University of Gent, pp. 162.

291 Cattrijsse, A. and Hampel, H. 2006. European intertidal marshes: a review of their habitat functioning and value for aquatic organisms. Marine Ecology Progress Series, 324, 293 – 307.

292 Adam, P., 1993. Saltmarsh ecology. Cambridge: Cambridge University Press.

293 Packham, J.R. & Willis, A.J., 1997. Ecology of Dunes, Salt Marsh and Shingle. London: Chapman & Hall.

294 Stamp, T., West, E., Colclough, S., Plenty, S., Ciotti, B., Robbins, T. and Sheehan, E. 2023. Suitability of compensatory saltmarsh habitat for feeding and diet of multiple estuarine fish species. Fisheries Management and Ecology, 30(1), pp.44 – 55.

12.5.16 Saltmarshes are documented as important nursery and foraging grounds at high tide supporting juvenile fish species. Studies from across Europe show varying levels of utilisation of saltmarshes by different species[295]. At least thirty of the species identified in HPB impingement sampling are found in northern European saltmarsh habitats with species of mullet and goby as well as European sea bass (*Dicentrarchus labrax*), sprat (*Sprattus sprattus*), sand smelt (*Atherina presbyter*), flounder (*Platichthys flesus*), European eel (*Anguilla Anguilla*) and herring (*Clupea harengus*) commonly utilising saltmarsh habitats (see Appendix 13.1).

12.5.17 Saltmarshes are also used as feeding grounds for waterfowl (wildfowl and waders), grazing the saltmarsh plants directly or preying on the invertebrate fauna. Estimates of the amount of plant material consumed by waterfowl in saltmarsh and seagrass beds range from 1 – 50 %[296]. For example, the brent goose (*Branta bernicla*) grazes *Puccinellia maritima* and *Aster tripolium* in high marsh at end of winter, while white fronted geese feed on *Agrostis stolonifera* and *Puccinellia maritima*. The shelduck *Tadorna tadorna* feeds extensively on *Hydrobia ulvae*.

12.5.18 At low tide waders including red shank (*Tringa tetanus*), curlew (*Numenius arquata*), godwits (*Limosa limosa* and *Limosa lapponica*) use the exposed mud feeding on infaunal and epifaunal communities. Saltmarsh also supports gulls and birds of prey. The abundance of insects and seeds on saltmarshes supports large numbers of small birds such as linnets (*Linaria cannabina*) and greenfinch (*Chloris chloris*), starlings (*Sturnus vulgaris*), pipits (*Anthus pratensis*) and wagtails (*Motacilla alba*). The Severn Estuary Ramsar site has a nationally-important breeding population of lesser black-backed gull (*Larus fuscus*).

Timescale to Ecological Functionality

Pawlett Hams:

12.5.19 Due to the range of environmental factors which contribute to the development of the ecological functionality of saltmarsh, the estimated time within which saltmarsh at Pawlett Hams will be achieved is difficult to predict. However, it is anticipated that vegetation develops rapidly and fish should populate areas between two to five years following

295 Cattrijsse, A. and Hampel, H. 2006. European intertidal marshes: A review of their habitat functioning and value for aquatic organisms. Marine Ecology Progress Series, 324, 293-307.

296 Raffaelli, D.G. & Hawkins, S.J., 1999. Intertidal Ecology 2nd edn. London: Kluwer Academic Publishers.

engineering works. Ecological functioning of created marshes has been estimated to take 15 years [297]. However, ecological functioning occurs at varying time scales for different trophic levels and ecological parameters. Some studies have observed fish densities in created marshes achieving similar levels to natural marshes within 5 years whereas other sites may take 15 years or more[298]. The marsh morphology and period of tidal inundation of the habitat are important factors in determining benefits for fish in created habitats.

12.5.20 This is supported by findings from Cwm Ivy Marsh, where it took three years to develop a mud habitat to a saltmarsh[299]. Studies at the realignment sites at Steart marshes have demonstrated that within three years of flooding, the marshes provided feeding opportunities for European sea bass, thin-lipped grey mullet, and gobies, although not to the same extent as established marshes[300].

12.5.21 To determine the success of the compensation measures, NNB is preparing an Adaptive Management and Monitoring Plan ('AMMP') (Section 12.6 below). Specific habitat objectives will be developed and agreed through the AMMP (see below).

The Island:

12.5.22 Because the proposed scheme at The Island involves enhancing an already established saltmarsh, it is anticipated that the time to reach mature ecological condition will be less than at Pawlett Hams; however, this would still be subject to a range of environmental and ecological variables.

12.5.23 Specific habitat objectives to determine success of the compensatory habitat will be developed and agreed through the AMMP (see below).

---

297 French McCay, D.P., and Rowe, J.J. 2003. Habitat restoration as mitigation for lost production at multiple trophic levels. Marine Ecology Progress Series, 264, pp. 233-247.

298 Strange, E., Galbriath, H., Bickel, S. Mills, D., Beltman, D., and Lipton, J., 2002. Determining Ecological Equivalence in Service-to-Service Scaling of Salt Marsh Restoration. Environmental Management, 29(2), pp. 290–300.

299 National Trust. Our work at Cwm Ivy. Available online at: https://www.nationaltrust.org.uk/visit/wales/whiteford-and-north-gower/our-work-at-cwm-ivy (Accessed October 2023).

300 Stamp, T., West, E., Colclough, S., Plenty, S., Ciotti, B., Robbins, T. and Sheehan, E. 2023. Suitability of compensatory saltmarsh habitat for feeding and diet of multiple estuarine fish species. Fisheries Management and Ecology, 30(1), pp.44 – 55.

Timescale for Delivery

12.5.24 Timescales for delivery will be influenced by the feasibility and field trials undertaken and by the factors identified above. NNB will continue to engage with its technical advisors and ecologists to ensure the proposed works are delivered effectively and promptly and to ensure learning from other such schemes has been captured.

Ability and Rights to Carry out the Works

12.5.25 Managed retreat of the type proposed at Pawlett Hams is anticipated to be readily achievable from a technical engineering point of view and has been successfully completed on a similar site on the opposite side of the River Parrett, at Steart Marshes. The interventions required at The Island should also be achievable, using conventional engineering techniques.

12.5.26 It is NNB's intention to seek agreement by negotiation with those that hold rights over the land at Pawlett Hams. Compulsory acquisition powers will be included within the DCO Material Change Order Limits to obtain the necessary powers to carry out and maintain the works where private agreement is not possible.

12.5.27 The Island site and access is already wholly owned by a subsidiary of EDF Energy.

Native Oyster Reefs Creation / Enhancement

Overview

12.5.28 Following discussions with the SNCBs regarding the development of an appropriate package of compensation, NNB is proposing the creation / enhancement of 1-2 ha of native oyster reef.

12.5.29 Discussions are still ongoing with the relevant bodies with regard to location, scale and approach to implementation. Depending on the outcome of feasibility appraisal and precise location of the proposed sites the work may involve the creation of new native oyster reefs or the enhancement of existing or historic areas of native oyster reef that have become degraded due to overfishing, disturbance or other environmental stressors.

12.5.30 There is a lack of historic native oyster reefs in the immediate locality of the HPC Site. At present, potentially suitable areas off the coast of South-West Wales are being assessed. The work of Mumbles Oyster Company within Swansea Bay to develop wild native oyster reefs by stocking areas with juvenile oysters is noted and will be reviewed as their work progresses.

In addition, the EA have identified potential areas within the English side of the Severn Estuary for potential creation / enhancement, based on key environment variables and these will also be considered as part of the feasibility process.

12.5.31 As stated, a detailed approach is still in development. However, creation / enhancement of native oyster reefs may include the following actions:

- Installation and maintenance of oyster nurseries, whereby mature 'brood stock' oysters are housed in micro-habitats (usually artificial cages), facilitating the release of larvae;
- Re-seeding of suitable existing habitat with juvenile oysters to promote re-establishment and natural recruitment;
- Creation of seabed habitat to support the establishment of cultch; and
- Control and management of invasive non-native species pathogens and parasites.

Summary of Native Oyster Reefs Benefits

12.5.32 Native oysters (*Ostrea edulis*) live on the seabed in shallow coastal waters and estuaries, forming dense reefs where conditions are favourable. Historically, native oyster reefs were widely distributed around UK coasts, however distribution is now limited, with 95 % being lost[301].

12.5.33 Native oysters are a keystone species, providing numerous ecosystem services, including reef formation, erosion control, improvement of water quality (through cycling and purification), raw material supply and food provision[302].

12.5.34 Native oyster reefs are formed when aggregations of living oysters and dead shells form an extensive biogenic habitat on the sea floor. Native oysters can then form complex 'reef' structures, which provides habitat and refuge for a diversity of organisms, such as juvenile fish and invertebrates.

12.5.35 Therefore, successful creation or enhancement of native oyster reefs could have numerous direct and indirect beneficial impacts for the Estuaries qualifying habitat feature of the

---

301 ECSA (2016). Restoring Meadow, Marsh and Reef (ReMeMaRe). Available online at: https://ecsa.international/reach/restoring-meadow-marsh-and-reef-rememare. [Accessed: 04 October 2023]

302 Coen, L.D., Brumbaugh, R.D., Bushek, D., Grizzle, R., Luckenbach, M.W., Posey, M.H., Powers, S.P. and Tolley, S.G., (2007). Ecosystem services related to oyster restoration. Marine Ecology Progress Series, 341, pp.303-307.

Severn Estuary SAC as well as for the Annex II qualifying species of the Severn Estuary SAC, the River Usk SAC and the River Wye SAC and the Criterion 4 migratory fish assemblage of the Severn Estuary Ramsar site. These benefits are described in TR592 (Appendix 13.1) and Section 12.7 below.

Timescale to Ecological Functionality

12.5.36 It is difficult to be precise about the estimated time for this habitat to reach ecological functionality. There is some evidence from South Wales where 40,000 brood stock oysters were introduced off the coast of Mumbles, Swansea in 2015, which successfully spawned over the next two years, and resulted in local recruitment of oyster spat to the bay[303]. The development of the fish community associated with native oyster reef would be expected to take longer.

12.5.37 Successful native oyster reef enhancement projects have been established in multiple locations across the UK, primarily through employing a multi-faceted approach that includes direct habitat enhancement seeding and stocking. The Blue Marine Foundation has been working across 12 oyster enhancement sites in the Solent to establish oyster nurseries, re-seed protected seabed sites with juveniles, and introduce a mature 'brood stock', promoting natural recruitment and re-establishment of wild native oyster reefs. This has resulted in 105,000 native oysters being restored to the area[304].

12.5.38 Similar enhancement work has been undertaken by The Wild Oysters Project in Conwy Bay, Firth of Clyde, and Tyne and Wear, where multiple oyster nurseries have been established to support the recovery of remnant populations of native oysters[305].

12.5.39 A further example of native oyster enhancement is in the Blackwater Estuary, where enhancement has been undertaken by the Essex Native Oyster Restoration Initiative.

Timescale for Delivery

12.5.40 Timescales for delivery will be influenced by the feasibility and field trials undertaken and by the factors identified above. NNB will continue to engage with recognised experts in the field of native oyster enhancement works to ensure the proposed works are delivered effectively

303 Native Oyster Network (N/A). Mumbles Oyster Company. Available online at: https://nativeoysternetwork.org/portfolio/mumblesoyster/. [Accessed 04 October 2023]
304 Blue Marine Foundation (2023). Solent Oyster Restoration. Available online at: https://www.bluemarinefoundation.com/projects/solent/. [Accessed: 04 October 2023]
305 The Wild Oysters Project (2020). The Wild Oysters Project. Available online at: https://wild-oysters.org/. [Accessed: 04 October 2023]

and promptly and to ensure learning from other such schemes has been captured. The details of the feasibility and field trials will be set out within the DCO Material Change application along with commitments to the delivery and ongoing management of the full extent of habitat (to be included in the AMMP) once it has been delivered.

Ability and Rights to Carry out the Works

12.5.41 The methods of restoring native oyster reefs are well documented in the scientific literature and technical guidance is also available which is also based on the practical experience of other enhancement projects (see above). There is no reason to question that the creation of native oyster reefs is achievable from a technical point of view.

12.5.42 For each of the sites that is situated in the marine environment NNB will require a lease agreement and a licence from the Crown Estate.

12.5.43 NNB has met with the Crown Estate to begin the process of obtaining this agreement. There is currently no reason to consider that an agreement cannot be reached, and the relevant lease / licence obtained.

12.5.44 These works will also require a Marine Licence from the MMO or NRW. NNB has already engaged with the MMO on this matter and again there is currently no reason to suggest that a Marine Licence could not be obtained.

Seagrass Habitat Creation / Enhancement

Overview

12.5.45 Following discussions with the SNCBs regarding the development of an appropriate package of compensation, NNB are proposing the creation / enhancement of 5 ha of seagrass habitat.

12.5.46 Discussions are still ongoing with the relevant bodies, with regard to location, scale and approach to implementation. The EA have identified potential areas within the Severn Estuary for creation / enhancement (based on key physical attributes). There are also areas that may be deemed suitable for seagrass bed creation or enhancement on the Welsh side of the Estuary and on both coasts of the wider Bristol Channel.

12.5.47 One of the genera of seagrass present in English waters, *Zostera* sp. Is also found further upstream in the Severn Estuary and planting in this location could be successful due to the more sheltered environment and the presence of suitable sediment substrate.

Summary of Native Seagrass Habitat Benefits

12.5.48 There are two genera of seagrass present in English waters: *Ruppia* sp. And *Zostera* sp. However, commonly, the use of 'seagrass' only refers to *Zostera* sp, which is also known as Eelgrass, with *Ruppia* being a brackish group. Eelgrass (*Zostera* sp.) is part of the typical vascular plant species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC and is also part of the "*hard substrate habitats (including eel grass beds)*" feature within the Estuaries qualifying habitat feature of the Severn Estuary SAC (see Figure 12.1 below). Potential benefits to these species and habitats are described further below.

12.5.49 Seagrass beds are found around the coast of the UK in sheltered areas such as harbours, estuaries, lagoons and bays. However, seagrass extent has declined dramatically over the past century, with up to 92 % of UK seagrass beds being lost[306], 44 % of which has occurred since 1936[307]. This extensive loss is a result of a complex combination of factors (many of which anthropogenically induced), including habitat loss / degradation, poor water quality, INNS and outbreaks of seagrass wasting disease *Labyrinthula zosterae*. These issues will be considered in the wider context of monitoring to be addressed within the AMMP.

12.5.50 Seagrass beds are currently present within the Severn Estuary[308.]. They are not a qualifying feature for the Severn Estuary SAC in their own right, though they form part of the typical vascular plant species assemblage and the "*hard substrate habitats (including eel grass beds)*" of the Estuaries qualifying habitat feature of the Severn Estuary SAC.

12.5.51 Seagrasses are a key component of shallow coastal ecosystems, providing a range of ecosystem functions such as: sediment stabilisation and coastal protection, carbon cycling and sequestration, improved water quality and nutrient cycling, provision of habitat and support of diverse ecological communities. Seagrass beds are recognised as important nursery habitats, where juvenile and larval fish can shelter from predation and take advantage of the feeding opportunities presented. Therefore, successful creation / enhancement of seagrass beds could have numerous direct and indirect beneficial impacts for the typical fish species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC as well as for other Annex I qualifying habitats and Annex II qualifying species that are listed as

306 WWF (N/A). Seas of our Future. Available online at: https://www.wwf.org.uk/wales/seas-of-our-future. [Accessed: 08 October 2023]

307 Green, A.E., Unsworth, R.K.F., Chadwick, M.A. and Jones, P.J.S. (2021). Historical analysis exposes catastrophic seagrass loss for the United Kingdom. Frontiers in Plant Science 12.

308 Natural England (N/A) ArcGIS Map Viewer. Available online at: https://www.arcgis.com/apps/mapviewer/index.html?layers=e009f2adbc9b4028a34842b133c6636b. [Accessed: 04 October 2023]

primary reasons / qualifying features for the selection of the Severn Estuary SAC and other relevant European sites. These are described in Section 12.7.

12.5.52 Natural seagrass beds have significant carbon sequestering capabilities and are estimated to store between 4.2 and 8.4 Pg carbon in the top metre of seagrass soils (of the total earth area covered by seagrass beds estimated to be between 300,000 and 600,000 km^2)[309]. This beneficial effect is also seen for restored seagrass beds. The restored bed in Oyster Bay, Western Australia, had carbon stocks and carbon accumulation rates similar to those of natural beds, with an estimated 15,000 tons of carbon being sequestered after a 10-year restoration project[310,311].

12.5.53 Seagrasses can remove microbiological contamination from the water, producing bioactive secondary metabolites with antibacterial and antifungal properties. This can reduce exposure to bacterial pathogens for fish, humans and invertebrates by up to 50 % compared to sites with no seagrass[312].

Timescale to Ecological Functionality

12.5.54 The estimated time for seagrass habitat to reach ecological functionality is variable and will need to be considered carefully as part of the AMMP. NNB intend to conduct feasibility and trial studies to identify areas where seagrass habitat creation will be most successful, taking a scaling up approach once suitable areas(s) are identified. Seagrass enhancement projects have been established in several locations across the UK. In 2019, Swansea University, Project Seagrass and Pembrokeshire Coastal Forum successfully planted 2 ha of seagrass bed in Dale Bay, Pembrokeshire, with evidence that plants have developed into mature clumps, expanding in density and length over time[313].

---

309 Fourqurean, J. W., Duarte, C. M., Kennedy, H., Marba, N., Holmer, M., Mateo, M. A., et al. (2012). Seagrass ecosystems as a globally significant carbon stock. Nat. Geosci. 5, 505–509. doi: 10.1038/ngeo1477

310 Potouroglou, M., Grimsditch, G., Weatherdon, L. and Lutz, S., (2020). Out of the Blue: the Value of Seagrasses to the Environment and People. United Nations Environment Programme.

311 Reynolds, Laura & Waycott, Michelle & McGlathery, Karen & Orth, Robert. (2016). Ecosystem services returned through seagrass restoration: Restoration of ecosystem services. Restoration Ecology. 24. 10.1111/rec.12360.

312 Lamb, J.B., van de Water, J.A.J.M, Bourne, D.G., Altier, C., Hein, M.Y., Fiorenza, E.A. et al. (2017). Seagrass ecosystems reduce exposure to bacterial pathogens of humans, fishes, and invertebrates. Science 355(6326), 731–733. https://doi.org/10.1126/science.aal1956

313 Unsworth, R.K.F., Furness, E.C. and Rees, S.R. (N/A), Technical report on seagrass restoration in Dale, Pembrokeshire.

12.5.55 As part of the Save Our Seabed project, led by NE (LIFE Recreation ReMEDIES partnership), over 4 ha of seagrass has been planted across Plymouth Sound and Solent Maritime, with evidence it is successfully established[314]. Development in this area has also seen the creation of enhancement guidance, initiatives and delivery plans, which can be used to maximise the achievability / feasibility of seagrass bed creation / enhancement in the Severn Estuary SAC. These resources include The ReSow UK project[315], Restoring Meadow, Marsh and Reef (ReMeMaRe[301]; and Seagrass Restoration Handbook[316]).

12.5.56 The Hornsea Project 4 Offshore Wind Farm, for which consent has been achieved under the DCO regime, includes, as part of the compensatory package, the creation of up to 74 acres (30 ha) of seagrass in the Humber Estuary, commencing with a pilot-scale area of 9.8 acres (4 ha), to be completed by the end of 2023.

Timescale for Delivery

12.5.57 Timescales for delivery will be influenced by the feasibility and field trials undertaken. NNB is engaging with recognised experts in the field of seagrass habitat works to ensure the proposed works are delivered effectively and promptly and the ensure learning from other such schemes has been captured. The details of the feasibility and field trials will be set out within the DCO Material Change application along with commitments to the delivery and ongoing management of the full extent of habitat (to be included in the AMMP) once it has been delivered.

Ability and Rights to Carry out the Works

12.5.58 Seagrass bed enhancement methods are well documented in the scientific literature and guidance documents are also available that detail the approaches taken by other enhancement projects. There is therefore no reason to doubt that seagrass beds can be restored from a technical point of view.

---

314 Save Our Seabed (2023). Restoration in Plymouth Sound. Available online at: https://saveourseabed.co.uk/protecting-our-seabed/restoration/restoration-in-plymouth-sound/. [Accessed: 08 October 2023]

315 SMMR (N/A). ReSOW UK. Available online at: https://www.smmr.org.uk/funded-projects/restoration-of-seagrass-for-ocean-wealth-resow-uk/. [Accessed: 04 October 2023]

316 Gamble C., Debney, A., Glover, A., Bertelli, C., Green, B., Hendy, I., Lilley, R., Nuuttila, H., Potouroglou, M., Ragazzola, F., Unsworth, R. and Preston, J, (eds) (2021). Seagrass Restoration Handbook. Zoological
Society of London, UK., London, UK; Available online at: https://catchmentbasedapproach.org/wp-content/uploads/2021/10/ZSL00168-Seagrass-Restoration-Handbook_20211108.pdf (Accessed 11 December 2023)

12.5.59 For each of the sites that are situatable in the marine environment, NNB will require a lease agreement and a licence from the Crown Estate. NNB has met with the Crown Estate to begin the process of obtaining this agreement.

12.5.60 There is currently no reason to consider that an agreement cannot be reached, and the relevant lease / licence obtained.

12.5.61 These works will also require a Marine Licence from the MMO or NRW. NNB has already engaged with the MMO on this matter and again there is currently no reason to suggest that a Marine Licence could not be obtained.

Kelp Forest Creation / Enhancement

Overview

12.5.62 Following discussions with the SNCBs regarding the development of an appropriate package of compensation NNB is proposing to introduce 15 ha of Kelp Forest.

12.5.63 Kelp is a community of brown seaweed, which can form dense submerged forests in temperate seas. If they form dense forests, they provide a productive habitat that acts as a shelter for marine biota and protects coastal areas by acting as a buffer for high wave energies[317]. Kelp forests establish in the photic zone on hard, rocky substrate, and are distributed across the UK. Kelp forests are highly dynamic systems, exhibiting pronounced spatial-temporal variability, with species composition varying depending on the physical, chemical and biological environment.

Summary of Kelp Forest Benefits

12.5.64 Kelp are ecosystem engineers, creating complex three-dimensional habitats that support diverse and productive communities[318, 319], modifying local abiotic processes such as light[320],

317 The Wildlife Trusts. 2023. Kelp beds and forests. Available (online) at: https://www.wildlifetrusts.org/habitats/marine/kelp-beds-and-forests (Accessed 17 August 2023)

318 Steneck RS, Johnson CR (2014). Kelp forests: dynamic patterns, processes, and feedbacks. In: Bertness MD, Bruno JF, Silliman BR, Stachowicz JJ, editors. Marine Community Ecology and Conservation. Massachusetts: Sinauer Associates, Inc.

319 Teagle H, Hawkins SJ, Moore PJ, Smale DA (2017). The role of kelp species as biogenic habitat formers in coastal ecosystems. Journal of Experimental Marine Biology and Ecology;492:81–98.

320 Wernberg T, Kendrick GA, Toohey BD (2005). Modification of the physical environment by an Ecklonia radiata (Laminariales) canopy and implications for associated foliose algae. Aquatic Ecology.;39:419–30.

sedimentation[321] and water flow[322]. Therefore, successful creation and / or enhancement of kelp forests could have numerous direct and indirect benefits for the Annex I habitats and Annex II species that are listed as qualifying features of the Severn Estuary SAC, the River Wye SAC, the River Usk SAC and the Severn Estuary Ramsar site.

12.5.65 Kelp forests attenuate wave energy and velocity, reducing wave size by up to 60 %[323]. This can serve as a buffer against storm surges[324], providing an indirect benefit with respect to coastal defence.

12.5.66 Kelp plays vital role in the maintenance of fish stocks and ecosystem structure, and therefore indirectly help to sustain regional fisheries and the coastal communities they support. Kelp dominated habitats also offer a range of recreational activities, such as diving and angling[325].

12.5.67 Discussions are ongoing with the relevant bodies, with regard to location, scale and approach to implementation.

Timescale to Ecological Functionality

12.5.68 The estimated time to reach ecological functionality is dependent upon a number of environmental factors, which are themselves variable in nature and will need to be considered carefully as part of the AMMP. NNB intend to conduct feasibility and trial studies to identify areas where kelp habitat creation will be most successful, taking a scaling up approach once suitable areas(s) are identified.

12.5.69 Existing kelp forest enhancement projects in the UK are predominantly focused on promoting natural recovery, primarily achieved through prohibiting / limiting disruptive anthropogenic activities in locations that currently support kelp populations. However, active creation / enhancement projects are also ongoing. There has been a large focus on kelp populations in Sussex, where 97% of historic kelp has been lost. The Sussex Kelp Recovery Project successfully lobbied for the passing of a byelaw that protects 304 km^2 of seabed from

---

321 Eckman JE, Duggins DO, Sewell AT (1989). Ecology of understorey kelp environments. I. Effects of kelp on flow and particle transport near the bottom. Journal of Experimental Marine Biology and Ecology.;129:173–87.

322 Rosman, J. H., J. R. Koseff, S. G. Monismith, and J. Grover. (2007). A field investigation into the effects of a kelp forest (Macrocystis pyrifera) on coastal hydrodynamics and transport. J. Geophys. Res. 112:C02016

323 Mork, M., (1996). The effect of kelp in wave damping. Sarsia, 80(4), pp.323-327.

324 Lovas, S. M. and A. Torum. (2001). Effect of the kelp Laminaria hyperborea upon sand dune erosion and water particle velocities. Coast. Eng. 44: 37–63.

325 Beaumont, N. J., M. C. Austen, S. C. Mangi, and M. Townsend.(2008). Economic valuation for the conservation of marinebiodiversity. Mar. Pollut. Bull. 56:386–396

trawling, and although the byelaw was only passed in 2021, vast new expanses of native mussel beds have been observed, which provide suitable substrate and stability for kelp establishment[326]. This project has undertaken extensive research regarding kelp enhancement pathways and limiting factors, which can be used to guide the approach to be taken within the Severn Estuary. Active enhancement is also being undertaken in the area, with the Sussex Seabed Restoration Project aiming to establish 3 ha of kelp through re-seeding and planting.

12.5.70 International development in this field has also evidenced successful active creation and enhancement of kelp forests. For example, Operation Crayweed re-established kelp forests along the Sydney coastline of Australia by transplanting adult kelp (tied to mesh mats) onto bare rock, acting as propagule sources for subsequent natural establishment. Seven of the sites are now self-sustaining, with natural recruitment and expanding distributions, albeit over a small area (~ 0.43 ha)[327,328]. On a larger scale, over 20,000 ha of seabed has been used for kelp creation / enhancement in a long-term, government-led programme in South Korea[329,328], using a combination of transplanting and seeding on artificial reef, within aquaculture sites and for the enhancement of historic kelp forests.

12.5.71 Experience gained from a range of projects has resulted in the creation of Kelp Restoration Guidebook: Lessons Learned from Kelp Projects Around the World[328], and the British Kelp Restoration Feasibility Report[330] which can be used to maximise the achievability / feasibility of kelp forest creation / restoration in the Severn Estuary.

Timescale for Delivery

12.5.72 Timescales for delivery will be influenced by the feasibility and field trials undertaken. NNB is engaging with recognised experts in the field of kelp habitat works to ensure the proposed works are delivered effectively and promptly and the ensure learning from other such schemes has been captured.

---

326 Sussex Kelp Recovery Project (2023). Rewilding the Sussex seabed. Available online at: https://sussexkelp.org.uk/ [Accessed: 09 October 2023]

327 Layton, C., M. A. Coleman, E. M. Marzinelli, P. D. Steinberg, S. E. Swearer, A. Vergés, T. Wernberg, and C. R. Johnson. (2020). Kelp forest restoration in Australia. Frontiers in Marine Science 7:74.

328 Eger, A. M., Layton, C., McHugh, T. A, Gleason, M., and Eddy, N. (2022). Kelp Restoration Guidebook: Lessons Learned from Kelp Projects Around the World. The Nature Conservancy, Arlington, VA, USA

329 Lee, S.-G., 2019. Marine Stock Enhancement, Restocking, and Sea Ranching in Korea, in: Wildlife Management - Failures, Successes and Prospects. IntechOpen. https://doi.org/10.5772/intechopen.78373

330 Wilding, C.M., Earp, H.S., Cooper, C.N., Lubelski, A., Smale, D.A. British Kelp Forest Restoration: Feasibility Report

12.5.73 The details of the feasibility and field trials will be set out within the DCO Material Change application along with commitments to the delivery and ongoing management of the full extent of habitat (to be included in the AMMP) and protection from trawling once it has been delivered.

Ability and Rights to Carry out the Works

12.5.74 Methods for the enhancement of kelp beds are well documented in the scientific and grey literature. Consequently, there is no reason to doubt whether enhancement is technically achievable. For each of the sites that are situated in the marine environment, NNB will require a lease agreement and a licence from the Crown Estate. NNB has met with the Crown Estate to begin the process of obtaining this agreement.

12.5.75 There is currently no reason to consider that an agreement cannot be reached, and the relevant lease / licence obtained.

12.5.76 These works will also require a Marine Licence from the MMO or NRW. NNB has already engaged with the MMO on this matter and again there is currently no reason to suggest that a Marine Licence could not be obtained.

12.6 Management and Monitoring

NNB's Proposed AMMP

12.6.1 The NRW and NE (in consultation with the EA) 'Advice on the principles of compensatory measure provision under the Conservation of Habitats and Species Regulations 2017 (as amended) for the Hinkley Point C nuclear power station' dated March 2023 explains the need for monitoring of compensatory measures.

12.6.2 The package of proposed compensation measures represents a long-term initiative and as such monitoring of its performance will be very important. NNB will therefore implement an AMMP.

12.6.3 The AMMP will be developed as NNB moves towards the DCO Material Change application. The proposed purpose of the AMMP will be to:

- define appropriate compensation objectives including indicators and associated targets to determine success criteria;

- quantify HPC impingement rates relative to predictions;
- provide evidence to inform the predicted ecological benefits for an array of ecological receptors of the compensation measures; and
- set out a framework for additional monitoring and adaptive management should measures fail to achieve objectives.

12.6.4 As the final compensation measures have not yet been formally agreed or designed, it is not possible to provide specific details of the content of the AMMP. However, a framework outlining the intended purpose of the AMMP is provided below.

Impingement monitoring

12.6.5 The first element of the AMMP is to validate the predicted effects on fish from HPC operation (noting that operation will be undertaken in stages from 2027, as Units 1 and 2 become operational, with cooling water abstraction / impingement also occurring incrementally in line with this). HPC will act as a sampler of the fish present at the location of the cooling water intakes. Impingement rates may increase or decrease proportional to abundance and utilisation of the Severn Estuary by different species. This natural variability will result in fluctuations but over time impingement rates are predicted to reflect trends in abundance. It is envisaged that at least 5 years of impingement monitoring will be required to establish a robust dataset against which natural variability can be considered.

12.6.6 Population dynamics of the spawning stock will be driven by environmental conditions and fishing pressure. Impingement rates will reflect interannual variability in recruitment of juvenile fish from the spawning stock to the Severn Estuary and survival of juvenile stages influenced by environmental and oceanographic conditions such as temperature, prevailing winds and current strengths transporting progeny from offshore spawning areas to inshore nursery habitats. It is noteworthy that an increase in impingement rates may be reflective of increases in the population notwithstanding the operation of HPC. Conversely, impingement rates lower than predicted may not imply reduced effects for populations in decline. As Hinkley Point B is no longer operational, a calibration point against which to scale HPC impingement rates does not exist. Therefore, understanding of changes in impingement relative to predictions will need to consider, to the extent that it is possible, the population sizes and factors that may influence impingement in a given year. The results from multiple years of impingement monitoring would act to reduce uncertainties in impingement predictions for HPC and will allow greater confidence to determine whether observed impingement rates, and population effects, are within the predicted ranges.

12.6.7 It is also necessary to account for interactions between compensation measures and impingement. For example, increases in productivity within the Estuary owing to created habitat may lead to increases in impingement. However, local increases at the scale of Bridgwater Bay or the Severn Estuary SAC may not be reflected at the population level. Accordingly, the collection of data over a number of years will allow analysis of trends in impingement rates and add to the understanding of the estuary dynamics.

12.6.8 Impingement monitoring approaches will be informed by BEEMS Scientific Advisory Report SAR006[331] that recommends:

- 40 x 24-hour samples per annum;
- Systematic random design, in which a number of dates are selected at random within a given month or quarter; and
- Diurnal bias and short-term (~13-h cycle) tidal bias are eliminated by selecting 24-hour sampling units. Longer-term tidal bias is eliminated by randomising sampling dates.

12.6.9 A consistent level of 40-samples per annum has proven to be logistically and operationally challenging especially during periods of outage. An optimised design, noting that monitoring will occur for multiple years, will be determined in consultation with the AMMP Advisory Group ('AMMPAG') (please see AMMP Governance below).

12.6.10 Impingement monitoring will sample:

- the numbers of different fish species impinged;
- the biomass of different fish species impinged;
- the total length of impinged individuals (or a sub-sample thereof); and
- ecological and feeding guilds of impinged individuals.

12.6.11 Additional information will be collected on invertebrate numbers and biomass where applicable.

12.6.12 Data will be used to determine, to the extent possible, population level effects for specific species and effects on the assemblage.

331 BEEMS Science Advisory Report Series (2010) SAR006. BEEMS Expert Panel. Methodology for the measurement of impingement Ed. 2.

12.6.13 Interannual variability in the abundances of species will be accounted for by undertaking 5 years of intensive impingement monitoring during the initial operation of HPC. After the initial period of intensive impingement monitoring, options remain to continue monitoring at a reduced intensity depending on whether the results are in line with predictions. Examples of extended monitoring may include:

- a full CIMP every *x*-years, where *x* is determined at the discretion of the AMMPAG;
- and / or regular monthly 24-hours sampling i.e., a "RIMP+" style program.

12.6.14 Should results indicate greater rates / effects than predicted, monitoring may continue or be adapted to address species-specific questions, e.g., focused sampling effort during sensitive periods.

Monitoring habitats created and enhanced as part of the package of compensation measures

12.6.15 The creation and enhancement of kelp, seagrass, native oyster reef and saltmarsh habitats is intended to provide wide ecological benefits including to the fish typical species assemblage, the waterfowl species assemblage, the vascular plant species assemblage and habitats of the Severn Estuary SAC Estuaries qualifying habitat (as well as some benefits to Annex II and Criterion 4 migratory fish species).

12.6.16 Monitoring will be able to determine the use of created or enhanced habitat by fish, and other receptors, from which biomass and productivity estimates may be derived. Monitoring may be designed to demonstrate the extent to which created habitat is supporting fish relative to the same existing habitat (reference sites), and the extent to which the created habitat is providing enhancements to fish relative to adjacent habitats (controls).

12.6.17 Necessary amendments and enhancements to the compensation measures will be discussed at the AMMPAG and implemented as appropriate. However, monitoring subtidal and intertidal habitats in a dynamic estuarine environment is challenging and subject to limitations of sampling gears. Scientific uncertainty relating to the magnitude of increases in species-specific productivity associated with different created habitats and any synergistic effects of these habitats on neighbouring habitats, and vice-versa, means targeted measures to deliver specific species or address their proportional losses is not technically / scientifically possible. Directly quantifying and attributing population effects to the management measures is challenging due to other factors acting on the population. It is therefore not technically / scientifically possible to demonstrate through monitoring the extent to which the compensatory measures habitat addresses impingement losses on an annual basis. This is because:

- Juvenile fish move into and out of the estuary and use a range of habitat types for feeding and refuge at different stages of the tidal cycle, seasonally and with ontogenetic shifts, limiting the ability to accurately estimate habitat productivity.
- There is no existing quantitative baseline describing the biomass of fishes within the assemblage for the Severn Estuary SAC resulting in challenges of demonstrating increases in total system biomass / production or whether the biomass is simply distributed differently.
- There are monitoring limitations associated with quantifying fish abundance / biomass in estuarine environments. Many of the methods used for determining fish abundance and biomass in kelp, seagrass, native oyster reef and saltmarsh habitats only provide semi-quantitative abundance / density estimate or estimates of Catch Per Unit Effort ('CPUE'). Furthermore, different methods have varying levels of catch / sample efficiently for different species groups.

12.6.18 For these important reasons, the monitoring cannot and will not be designed to determine if year on year fish losses due to impingement are being offset by the created or enhanced compensatory habitat measures. The aim of monitoring will instead be to determine if the created or enhanced compensatory habitats are achieving ecological functionality and providing supporting habitat to fish and other ecological receptors.

12.6.19 Accordingly, an important step of the AMMP will be defining the compensation objectives of the created or enhanced habitat against which monitoring indicators and targets to determine success criteria will be measured. These objectives will be established in consultation with the SNCBs once the sites and measures are further developed.

12.6.20 The success of created / enhanced habitats will therefore be monitored relative to these clearly defined compensation objectives with associated indicators and targets relating to the following:

- Habitat: Indicators may relate to extent as well as specific metrics in relation to the structure and functioning of the compensatory habitat;
- Fish: The utilisation of the habitat by fish in terms of species present, abundance, life-stage and biomass from which productivity may be estimated. Other measures may include residence time, gut fullness and / or diet composition;

- Waterfowl: The abundance and diversity of waterfowl species within areas of created habitat (with particular focus on Pawlett Hams / The Island) can be monitoring through standard ornithological surveys, building on existing surveys in the vicinity;
- Vascular plants: Surveys following National Vegetation Classification ('NVC')[332] approach will provide an indication of vascular plant community development; and
- Other wider Ecosystem Services: Quantification of wider ecosystem services provided by the created habitat.

Monitoring success of barrier easement measures

12.6.21 Benefits to fish populations following barrier easements are based on the reasonable assumption that existing barriers create a bottleneck in production by either impeding adult spawning success or limiting habitat availability. Barrier easement, therefore, increases system productivity (rather than simply redistributing fish over a wider area) and allows fish to reach habitats essential to complete their life-cycle. Removal of barriers may also enhance productivity by reducing energy demands on spawning adults, thereby increasing the likelihood successful spawning and subsequent return to sea for those species with the capacity to spawn over multiple years. The easement of upstream / downstream bottlenecks can act to reduce mortality in the juvenile and adult stages.

12.6.22 Barrier easement is widely regarded as an important management measure for supporting populations of diadromous species and there are multiple examples of successful implementation. However, the population benefits will also depend on other factors acting on catchment production potential and the population size. These factors may be beyond the influence of barrier management measures and include, for example, changes in water quality and at-sea mortality for salmon and shad.

12.6.23 Indicators and associated targets to determine success criteria may include:

- Indicator: Availability of wetted area of catchment or priority habitat.
- Target: Increase in availability of wetted area or priority habitat following fish passage improvements.
- Indicator: The number / proportion of fish passing the barrier.

332 https://jncc.gov.uk/our-work/nvc/ (Accessed 10 November 2023)

- Target: Increase in passage numbers / rates compared to baseline following fish passage improvements.
- Indicator: Time taken to ascend / descend the barrier during migration.
- Target: Reduction in passage time compared to baseline following fish passage improvements.
- Indicator: Abundance of juvenile stages in sections of the catchment upstream of the barriers.
- Target: Increase in abundance of juvenile stages compared to baseline following fish passage improvements.
- Indicator: Emigration rates of Atlantic salmon smolts from selected sections of the catchment.
- Target: Increase in emigration rates following fish passage improvements.

12.6.24 The availability (and quality) of habitat at the sites selected for the implementation of these management measures as part of the compensation package, including the presence of spawning substrates in the case of salmonids, will be established.

12.6.25 Whilst the benefits of barrier easements are recognised, directly quantifying and attributing population effects to these management measures is challenging due to other factors acting on the population. It will not be possible to predict the relative proportion to which migratory fish lost due to HPC entrapment belong to each designated site and to subsequently use these measures to address losses proportionally in each river catchment. Consequently, a body of evidence approach is likely to be required as part of the AMMP.

12.6.26 Given natural fluctuations in populations and environmental conditions over time, monitoring of juvenile density or emigration rates requires data ideally for a minimum of three years to provide a baseline that incorporates interannual variability before fish passage improvement measures are implemented. Such monitoring may use both existing data sources and targeted monitoring. For example, the deployment of rotary screw traps at strategic locations could be used to estimate smolt emigration. After the fish passage improvement measures are implemented, monitoring would be required for a number of years to determine changes relative to the baseline.

12.6.27 It is anticipated that monitoring the success of any of the fish passage improvement measures will involve tagging studies to quantify the proportion of fish passing a barrier and any changes to delay times in migration rates compared to baseline levels (i.e. migration rates as monitored prior to easement works being undertaken). A before / after survey design will be implemented to establish benefits of barrier removal, prior to the DCO Material Change application.

AMMP Governance

12.6.28 NNB will engage with the relevant SNCBs and regulators to establish an AMMPAG. The purpose of this group will be to provide oversight and advice on the implementation of the AMMP. Whilst the details have yet to be agreed with the SNCBs etc., the following is proposed:

- The AMMPAG will be independently chaired (much like the existing HPC MTF).
- The membership of the group is proposed to include (but is not limited to):
  - NNB;
  - NE;
  - NRW;
  - MMO;
  - EA;
  - Devon & Severn IFCA;
  - Somerset Council; and
  - Representatives from appropriate and relevant conservation groups.
- The activities, function and decision-making authority of the AMMPAG will be similar in structure to that of the existing HPC SEAG and TRG which were created as a result of Planning Obligations set out in the Deed of Obligations which formed part of the 2013 DCO and have been operating successfully since 2016.
- The AMMPAG will be supported and advised by an independent group of scientists to be known as the Compensation Expert Panel ('CEP').
  - The CEP will be formed of experts in the various sciences relevant to the effective implementation, monitoring and management of the proposed compensatory measures.
  - The members of the CEP will be nominated and appointed by consensus by the AMMPAG.

  - It is intended that that CEP will provide expert, impartial advice which will be central to the decision-making processes of the AMMPAG.
- The AMMPAG will be established within 3 months of the Secretary of State's decision on the DCO Material Change application and will meet every 6 months (or less or more frequently, where agreed by the AMMPAG) and shall exist until the impingement of fish at HPC ceases.
- NNB shall be responsible for the costs of convening and holding meetings of the AMMPAG
- NNB and the other member organisations of the AMMPAG shall take account of the reasonable representations and any relevant advice given by the CEP when deciding how to implement the AMMP.

12.7 Ecological Benefits of the Proposed NNB Compensatory Measures Package to relevant Qualifying Features

Introduction

12.7.1 In designing its compensatory measures package NNB has considered the following important points:

Consideration of the European / Ramsar site qualifying features at risk under the shadow AA and their conservation objectives

12.7.2 In accordance with the NRW / NE Advice, the compensatory measures in this case are targeted at those designated habitats or species of European / Ramsar sites to which the risk to site integrity relates. The compensatory measures are informed by the conclusions of the shadow AA in this HRA Report and those sites' relevant conservation objectives.

12.7.3 The shadow AA has identified three categories of qualifying feature for which a risk of adverse effect could not be excluded beyond reasonable scientific doubt. These are:

- the Estuaries qualifying habitat feature of the Severn Estuary SAC through impingement of fish from the typical fish species assemblage;
- the qualifying species Atlantic salmon, Twaite shad and Allis shad of three sites: the Severn Estuary SAC (Twaite shad); the River Wye SAC (Atlantic salmon, Twaite shad and Allis shad) and the River Usk SAC (Atlantic salmon and Twaite shad); and
- the Criterion 4 migratory fish assemblage of the Severn Estuary Ramsar site.

Reflecting the nature and extent of the Project's potential effects as identified through the process of AA

12.7.4 In accordance with the NRW / NE Advice, the compensatory measures in this case have also been informed by the nature and the extent of the risk of adverse effect to site integrity identified in the shadow AA. In particular:

12.7.5 There is a risk, but no certainty, of an adverse effect on integrity of certain European / Ramsar sites from the Project. The risk is one that cannot be excluded beyond reasonable scientific doubt, and this is on the basis of a precautionary assessment.

12.7.6 The risk to the integrity of the Severn Estuaries SAC Estuaries qualifying habitat feature from entrapment of fish from the typical fish species assemblage could not be excluded beyond reasonable scientific doubt due to the potential for an effect on the structure of predator-prey relationships. However, the scale of entrapment losses means that any change to the structure of the typical fish species assemblage through this mechanism is likely to be minor relative to natural variability. Also the complexity of the food-web with multiple feeding interactions would be expected to dampen effects to predator-prey pathways, so providing a degree of food-web resilience to any changes in the relative abundance of individual species resulting from HPC impingement (see further details in Section 9.4.141). The Inspector in the WDA Permit inquiry found (see paragraphs IR11.36[333] and IR11.207[334] of his report dated 7 December 2021) that an activity leading to any level of harm to one typical fish species should not be considered as sufficient to result in compromised integrity of the Estuaries feature, albeit that a total loss of a single typical species would; and that (IR11.209) "*... 'any' loss [of a typical species] cannot be considered sufficient to demonstrate impacts on integrity*". Finally, the no adverse effect on integrity test must be considered as against the relevant qualifying

333 The Inspector noted a clear distinction between the status of typical species and qualifying species at IR11.36, as follows: "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".

334 IR11.207 "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".

feature and conservation objectives. In this case, the qualifying feature is the Estuaries qualifying habitat and its relevant conservation objective is: *"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 the Estuaries qualifying habitat*". The focus of the assessment, therefore, is the risk of adverse effect in relation to the structure and function of the Estuaries qualifying habitat as a whole, of which the typical fish species assemblage is just one component amongst many other ecological components. It is against the structure and function of the Estuaries feature as a whole that the effect of entrapment of fish from the typical fish species assemblage must be judged.

12.7.7 Similarly, the predicted impacts of HPC on the three SAC sites in relation to the qualifying Annex II migratory species and on the Ramsar site for the Criterion 4 migratory species assemblage are predicted to be low level, albeit that it is not possible to exclude the risk of an adverse effect on site integrity due to uncertainties in the quantification of effects and the status of the populations.

12.7.8 The risk of adverse effect on integrity arising from HPC is not permanent. The risk will arise during the operation of HPC which is expected to be a 60-year period. A further 4 years during the defueling phase will follow the completion of operation during which the seawater abstraction will be very significantly reduced compared with the seawater abstraction during operation. Thereafter there will be no further risk to integrity through fish entrapment since sea water abstraction will cease.

12.7.9 Operational cooling water abstraction is anticipated to commence in 2027, initially for Unit 1, with Unit 2 abstraction commencing approximately 12 months later. On this basis, full entrapment effects for the operational phase will not occur until Unit 2 is operational.

Reflecting the technical / scientific infeasibility of providing "like for like" compensation in this case

12.7.10 As explained above, the purpose of the compensatory measures is to ensure the overall coherence of the NSN is protected. This does not amount to an obligation to address (through compensation) the precise nature of risk of effects identified in the shadow AA or to replace through numerical equivalence every fish that will be impinged by HPC. This is also not equivalent to negating any risk of adverse effect on the integrity of individual sites identified in the shadow AA.

12.7.11 It is not, in this case, technically / scientifically possible or reasonably practicable to design or deliver compensatory measures to deliver "like-for-like" replacement or to address the specific predator / prey relationship risk resulting from impingement by HPC. In the case of the typical fish species assemblage, a matrix of created and enhanced habitat types will provide direct and indirect benefits to a range of fish species and life-history stages, however, as has been explained above it is not possible to directly compensate for the exact numbers of each fish species and life history stage subject to impingement. Scientific uncertainty relating to the magnitude of increases in species-specific productivity associated with different created habitats and any synergistic effects of these habitats on neighbouring habitats, and vice-versa, means targeted measures to deliver specific species or address their proportional losses is not feasible. The science does not allow for that level of precision. In the case of the Annex II / Criterion 4 migratory fish species predicted to be entrapped at HPC, barrier easement in the catchments of designated sites is the primary measure to address losses but it is not possible to predict the relative proportion to which the migratory fish lost due to entrapment belong to each designated site and to subsequently compensate for losses proportionally in each river catchment. Furthermore, whilst the benefits of barrier easements are recognised, directly quantifying and attributing population effects to the management measures is challenging due to other factors acting on the population.

12.7.12 Therefore NNB has, in respect of the typical fish species assemblage of the Severn Estuaries SAC Estuaries feature, followed the approach of the consultation version of 'The Best Practice Guidance for developing compensatory measures in relation to Marine Protected Areas' dated 22 July 2021[335] which states at paragraph 46: "*As it will not always be possible to deliver compensatory measures in a like-for-like capacity as is accepted terrestrially, Defra has created a framework to help advisors' regulators and developers to explore and develop compensatory measures. The underlying principle is that* ***compensatory measures that benefit the same feature which is impacted by the development will be the most preferable*** *as they balance the damage caused by the development*" (emphasis in bold is as given in the Best Practice Guidance). The "*same feature*", in the case of the typical fish species assemblage, is the Estuaries qualifying habitat feature.

335 Best practice guidance for developing compensatory measures in relation to Marine Protected Areas (defra.gov.uk)

Reflecting the Inspector's findings of the WDA Permit inquiry

12.7.13 It was established and accepted at the time the 2013 DCO was consented and again at the WDA Permit inquiry[336] that large numbers of fish would be lost via impingement (even if an AFD were fitted) without that loss giving rise to any risk of an adverse effect on integrity of the Severn Estuary SAC via the Estuaries qualifying feature. It therefore follows that an outcome in the present case (taking into account NNB's proposed package of compensatory measures) involving an overall net loss of fish would not be inconsistent with ensuring the overall coherence of the NSN is protected.

Ecological Benefits of the Proposed Compensatory Package to the Estuaries Habitat Qualifying Feature of the Severn Estuary SAC

12.7.14 The Annex I Estuaries qualifying habitat is a major attribute of the Severn Estuary SAC (see **Figure 12-1** below (taken from the Regulation 33 advice dated June 2009)). The overarching "Estuaries" qualifying habitat feature (H1130) incorporates subtidal sandbanks (H1110), intertidal mudflats and sandflats (H1140), Atlantic salt meadows (saltmarsh) (H1330), biogenic reefs (H1170), hard substrate habitats (including eel grass beds) and typical species assemblages comprising a typical fish species assemblage, a typical waterfowl species assemblage and a typical vascular plant species assemblage.

12.7.15 The significant and varied benefits of the proposed compensatory measures to these elements of the Estuaries qualifying habitat feature are discussed below (with the exception of subtidal sandflats, because the proposed compensatory measures are not anticipated to benefit this sub-feature directly).

336 For example, it was the Inspector's view (see IR11.209) that assemblage species fish losses could occur without triggering any risk of an adverse effect 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 [we understand that the reference to whiting here is an error and it should read herring]. 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". Clearly fish may be lost via impingement from the typical species assemblage without creating a risk of an adverse effect on integrity of the Severn Estuary SAC via the Estuaries qualifying habitat feature. The scale of losses which could occur without creating such a risk is necessarily a matter of judgment for the competent authority, but it is apparent that the scale of losses predicted as likely to occur with the AFD in place has been judged to be acceptable in that context.

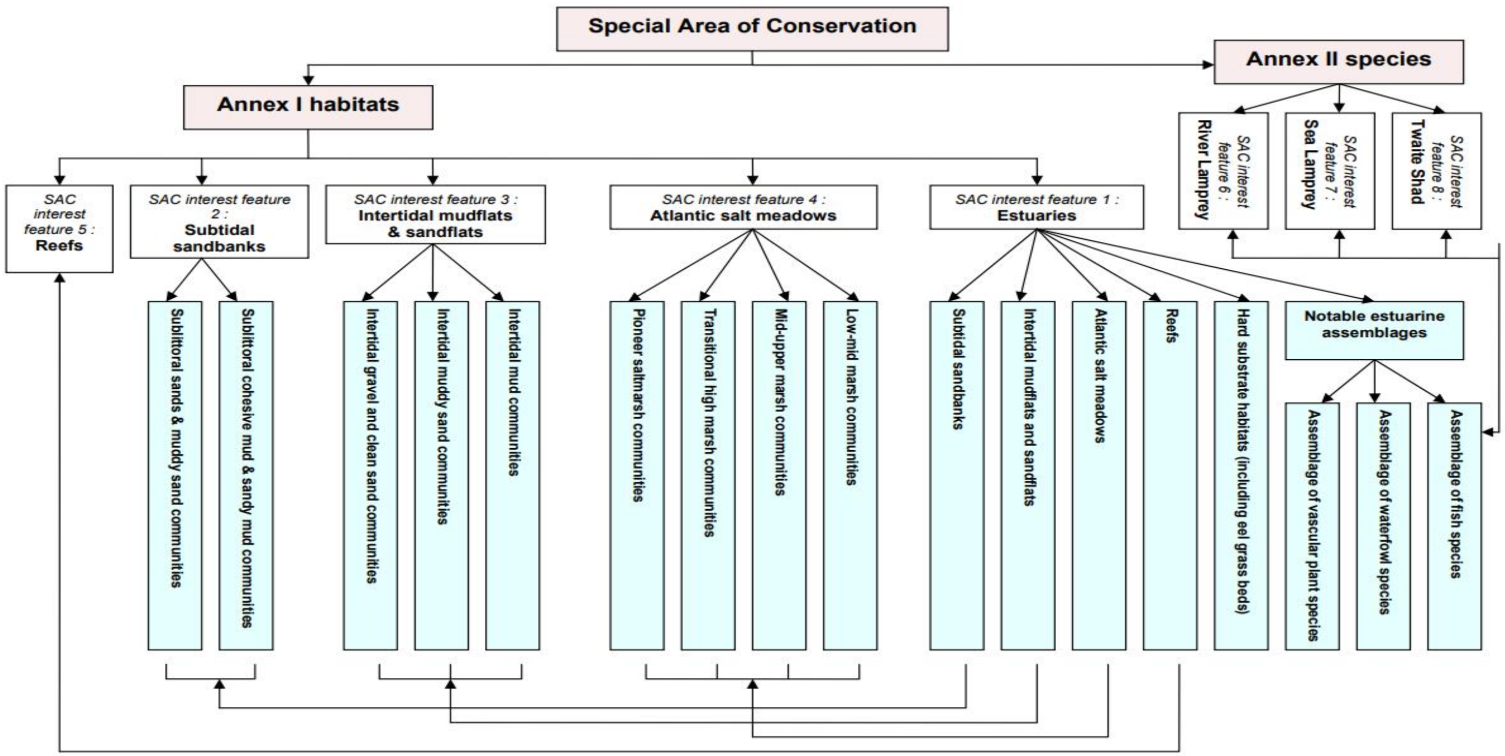


Figure 12-1 Schematic showing the relationship between the interest features of the Severn Estuary SAC (shown in white boxes) and their component sub-features (shown in blue boxes). Source: Severn Estuary SAC, SPA and Ramsar site: Regulation 33 Advice from CCW and NE, June 2009.

Direct Benefits of the Compensatory Measures Package for the Estuaries qualifying habitat feature's habitats

12.7.16 NNB's proposed habitat compensatory measures are intended to deliver benefits to the Estuaries feature of the Severn Estuary SAC through direct creation or enhancement of qualifying habitats and sub habitats, as well as supporting the notable assemblages of typical species.

12.7.17 This section considers the direct benefits of the compensatory measures to the Estuaries qualifying habitat feature's habitats.

Direct Benefits for Atlantic Salt Meadows (H1330)

12.7.18 Saltmarsh is the primary habitat type of the compensation package. The compensatory measures comprise the creation or enhancement of approximately 340 ha of saltmarsh including Atlantic Salt Meadows at higher tidal elevations, as follows:

- 313 ha saltmarsh (and associated habitat) creation at Pawlett Hams; and
- 27 ha saltmarsh (and associated habitat) enhancement at The Island.

12.7.19 This will be a direct benefit to one of the key features of the Severn Estuary SAC by increasing the spatial extent of this qualifying feature and creating new estuarine habitat from existing agricultural land (i.e. an increase in the total intertidal habitat present). Within the English part of the Severn Estuary SAC, there is a total extent of saltmarsh of 1,272 ha, of which the creation of enhancement of habitat at Pawlett Hams / The Island represents >25 %.

Direct Benefits for Hard Substrate Habitat including Eel Grass

12.7.20 It is estimated that the seagrass (eel grass) bed creation / enhancement element of the compensatory measures will add 5 ha of this habitat. The creation / enhancement of seagrass beds will, if located within the Severn Estuary SAC, directly increase the extent of this qualifying habitat within the Severn Estuary SAC. If located outside the Severn Estuary SAC it will still serve to protect overall coherence of the NSN.

12.7.21 The creation of 1-2 ha of native oyster reefs may also have a direct benefit to seagrass, as native oyster reefs provide a suitable substrate for seagrass growth. Studies have shown seagrass density increased following the reef deployment, demonstrating that native oyster reefs are also a key factor in restoring seagrass bed populations through reduction of wave action and increased water clarity[337].

Direct Benefits for Intertidal Mudflats (H1140)

12.7.22 Saltmarsh promotes in-situ sediment deposition, and thereby over time increases the sediment surface elevation allowing the formation of mudflats at the lower fringe of the saltmarsh[338] . The removal of part of the existing sea defences at Pawlett Hams, along with the expansion of the spatial extent of saltmarsh, will therefore increase the extent of the intertidal mudflat qualifying feature of the SAC, directly benefiting this Annex I qualifying feature (which also falls within the Estuaries qualifying feature, see **Figure 12-1**).

Direct Benefits for Reefs (H1170)

12.7.23 Within the wider definition of the Reefs (H1170)[339] qualifying habitat, reefs can be either biogenic or geogenic in nature, rising from the sea floor in the sublittoral and littoral zones, and may support a zonation of benthic communities or algae and animal species.

12.7.24 On this basis, the creation / enhancement of native oyster reefs, if located within the Severn Estuary SAC, will result in an increased extent of biogenic reef, which equates to an increased extent of the Reef (H1170) qualifying sub feature of the Estuaries feature within the Severn Estuary SAC. If located outside the Severn Estuary SAC it will still serve to maintain overall coherence of the NSN. Successful establishment of native oyster reefs may also promote self-sustaining natural recruitment and growth, further extending the area of these protected habitats. The wider indirect benefits of native oyster reefs are discussed below.

Indirect Benefits of the Compensatory Measures Package for the Estuaries qualifying habitat feature's habitats

12.7.25 NNB's proposed habitat compensatory measures are also intended to deliver indirect benefits to the Estuaries feature of the Severn Estuary SAC. This section considers the indirect

337 Oyster reefs — Mass Oyster Project (Accessed November 2023)

338 Potouroglou, M. et al. (2017) Measuring the role of seagrasses in regulation sediment surface elevation. Available online at: https://www.nature.com/articles/s41598-017-12354-y (Accessed November 2023).

339 Interpretation Manual of European Union Habitats (2013) Available online at: https://www.miteco.gob.es/content/dam/miteco/es/biodiversidad/temas/espacios-protegidos/doc_manual_intp_habitat_ue_tcm30-207191.pdf (Accessed 17 November 2023)

benefits to the Estuaries qualifying habitat feature's habitats, of which **Table 12-1** provides a summary.

Localised dissipation of wave energy

12.7.26 The presence of healthy vegetation communities on saltmarsh surfaces increases friction. Over only a 40 m distance, and when inundated to as much as 2 m water depth, this reduces wave energy by an additional 60 % when compared with unvegetated surface.

12.7.27 All the proposed compensatory habitats attenuate erosive wave energy, reduce tidal flow and stabilise sediment, which (depending on location) would benefit soft-substrate habitats of the Estuaries feature, albeit on a localised scale.

12.7.28 For example, seagrass beds can also impact the physical conditions within shallow coastal areas. The network of stem and roots trap suspended sediment, which reduces water depth and consequently attenuates wave energy[340], whilst seagrass canopies reduce current speeds and soften the force of waves by about 40 %[341].

12.7.29 These processes would (depending on the location of the compensatory habitat) indirectly benefit multiple attributes of the Estuaries qualifying habitat feature of the Severn Estuary SAC, such as morphology and sedimentary processes and / or serve to protect overall coherence of the NSN.

Trap / stabilise sediment increase deposition, and reduce erosion

12.7.30 By trapping and stabilising sediment, all the proposed compensatory habitats could (depending on location) indirectly benefit the other habitat features / sub features of the Severn Estuary SAC by reducing exposure to damaging waves and increasing the overall resilience of the estuarine environment and / or serve to protect overall coherence of the NSN.

340 van Katwijk MM, Bos AR, Hermus DCR, Suykerbuyk W (2010) Sediment modification by seagrass beds: Muddification and sandification induced by plant cover and environmental conditions. Estuarine Coastal and Shelf Science 89: 175–181

341 WRI (2022). What to Know About Seagrass, the Ocean's Overlooked Powerhouse. Available online at: https://www.wri.org/insights/understanding-seagrass#:~:text=By%20reducing%20the%20force%20of,adapting%20to%20rising%20sea%20levels. [Accessed: 08 October 2023]

Local water quality improvements – Remove excess nutrients and reduce turbidity

12.7.31 Through removal of excess nutrients and reducing turbidity by trapping sediment and / or consuming detritus in the case of native oysters, local water quality conditions can be improved.

12.7.32 Native oysters for example can locally improve water quality by filtering organic matter, phytoplankton and particulate-bound nitrogen and phosphates from estuarine waters[342].

12.7.33 Poor water quality is a known stressor to saltmarsh (Gedan *et al*., 2009[343]). Therefore, depending on location, improved water quality (as a result of the creation / enhancement of all the proposed compensatory habitats) would be expected to also benefit this habitat feature of the Severn Estuary SAC and / or serve to protect overall coherence of the NSN.

Reduce toxic contamination

12.7.34 Another indirect benefit that the proposed compensatory habitats could have for other habitat features / sub features of the Severn Estuary SAC and / or to protect overall coherence of the NSN is to reduce toxic contamination locally by absorption (or consumption and biodeposition in oysters), trapping contaminated sediments and supporting microorganisms that can break down contaminants.

Table 12-1: Summary table of indirect benefits of the compensatory measures package for the Estuaries qualifying habitat feature's habitats and / or for protection of overall coherence of the NSN

Indirect benefit	Saltmarsh	Seagrass bed	Kelp forest	Native oyster reef
Localised dissipation of wave energy	✓	✓	✓	✓
Trap / stabilise sediment, increase deposition and reduce erosion	✓	✓	✓	✓
Local water quality improvements – Remove excess nutrients and reduce turbidity	✓	✓	✓	✓
Reduce toxic contamination – trapping contaminated sediments,	✓	✓	✓	✓

342 Newell RIE, Langdon CJ (1996). Mechanisms and physiology of larval and adult feeding. In: Kennedy V, Newell R, Eble A, editors. The Eastern Oyster Crassostrea virginica. Maryland Sea Grant, College Park, MD; pp. 185–229.

343 Gedan, K.B., Silliman, B.R. and Bertness, M.D., 2009. Centuries of human-driven change in salt marsh ecosystems. Annual review of marine science, 1, pp.117-141.

and supporting microorganisms that can break down contaminants	

Ecological Benefits of the Proposed Compensatory Package to the Typical Fish Species Assemblage of the Estuaries Qualifying Habitat of the Severn Estuary SAC

Introduction

12.7.35 Over 100 species of marine, freshwater and estuarine fish have been reported from the Severn Estuary / Bristol Channel (Bird, 2008). Impingement monitoring at HPB provides a record of trends in the fish community in Bridgwater Bay. The Severn Estuary / Bristol Channel provides feeding, spawning, nursery areas and a migration route for several conservation species. Some fish species spend their whole lives within the estuary environment, while other species are more transitory, and use the estuary for one or more functions depending on their life history stage.

12.7.36 A total of 90 fish taxa have been reported in the RIMP at HPB between 1981-2019.

12.7.37 Summarising the fish assemblage, Bird (2008)[344] noted that "*The picture that emerges for the fish assemblage in the Severn Estuary and Bristol Channel is one of complex interactions between different species of fish, their predators and prey. The system is characterised by remarkably consistent and robust seasonal cycles in the fish composition, but highly variable inter-annual patterns of abundance that are affected and influenced by a range of environmental variables*".

12.7.38 NNB's proposed creation / enhancement of saltmarsh, kelp forest, seagrass beds and native oyster reefs is expected to provide benefits to a wide diversity of species and functional groups of fish associated with the Severn Estuary and Bristol Channel typical fish species assemblage. This will benefit marine fish species and also some migratory fish species which use these habitats directly or which would benefit indirectly from increases in prey availability.

12.7.39 The application of habitat-based compensation, in response to the risk to the Severn Estuary SAC integrity arising from losses from the typical fish assemblage species of the Estuaries qualifying feature of the Severn Estuary SAC, is underpinned by the reasonable assumption

344 Bird, D.J. 2008. The biology and conservation of the fish assemblage of the Severn Estuary (cSAC). CCW Report No: CCW/SEW/08/1, 79pp.

that existing habitat is a limiting factor for fish production, and that recruitment to the system is sufficient to 'fill' any new habitat. These are reasonable and appropriate assumptions for the assemblage over the longer-term, and habitat enhancement projects are likely to alleviate a bottleneck leading to higher biomass and overall productivity.

12.7.40 Habitat creation and enhancement is likely to benefit the typical fish assemblage species of the Estuaries qualifying feature by enhancing biodiversity, increasing feeding opportunities, providing a nursery refuge from predation for juvenile stages, or providing spawning substrate for adults. Furthermore, biodiversity gains and enhanced production derived from the created habitats may be exported to adjacent habitats and indirectly benefit fish not directly associated with these habitat types. A mosaic of new high-quality habitat, alongside existing habitats, will provide a functionally linked "seascape nursery" [345]environment for fish utilising the estuary.

12.7.41 Over the long-term, an increase in high quality habitat would likely result in increases in fish production, particularly in years when recruitment to the estuary is not limiting. However, habitat availability will not be the only factor limiting system level production. Rates of recruitment of individual species to the estuary will vary from year to year because the annual supply of eggs and larvae is driven by changes in the reproductive output of the spawning populations and because environmental and meteorological conditions influence survival rates and the numbers of young fish transported to, and surviving within, the estuarine habitats. These factors can lead to order of magnitude differences in annual supply of early life stages of fish to estuarine habitats e.g., European sea bass (*Dicentrarchus labrax*), flounder (*Platichthys flesus*), Dover sole (*Solea solea*) and up to two orders of magnitude in sand gobies (*Pomatoschistus spp.*) (Lourenço et. al., 2023)[346].

345 Fish and Fisheries, 16(2) pp.362-371

346 Lourenço, S., Bueno-Pardo, J., Vaz, A., Primo, A.L., Costa, F., Pardal, M.A., Martinho, F. 2023. Short and long term temperature variations drive recruitment variability in marine and estuarine juvenile fishes. Marine Pollution Bulletin 192. https://doi.org/10.1016/j.marpolbul.2023.115093

Benefits from Habitat Creation and Enhancement to the Typical Fish species Assemblage of the Estuaries Qualifying Habitat of the Severn Estuary SAC

Fish Species Supported by the Different Habitat Types in NNB's Proposed Compensatory Habitat Package

12.7.42 A literature review of evidence from UK and northern European seagrass beds, kelp forests, native oyster reefs and saltmarshes identified over 80 fish species that use these habitats to varying degrees. Many of these species are present in Bridgwater Bay and appear in the impingement record (Appendix 13.1).

Saltmarsh

12.7.43 Saltmarsh is the primary habitat type of the compensation package, with the creation or enhancement of approximately 340 ha proposed. Saltmarshes are dynamic environments that flood on the incoming tide and drain as the tide ebbs. Fish access the marsh creeks on the flood tide to feed and seek refuge from predators before moving off the marshes during the ebb tide. There are no European fish species that rely solely on saltmarshes for feeding. However, intensive feeding occurs within these habitats during periods of inundation and energy is exported from marshes to adjoining habitats.

12.7.44 At least 30 of the species identified in impingement sample records at HPB are also found in northern European saltmarsh habitats. In general, saltmarshes primarily benefit detrital feeding mullet species (notable thin-lipped grey mullet, *Chelon ramada*, as well as juvenile European sea bass (*Dicentrarchus labrax*), flounder (*Platichthys flesus*) and gobies that feed on invertebrates, and zooplankton feeding species such as sand smelt (*Atherina boyeri*), sprat (*Sprattus sprattus*) and Atlantic herring (*Clupea harengus*). These species represent estuarine resident, marine juvenile, marine seasonal and diadromous functional guilds. European eel (*Anguilla anguilla*) are commonly recorded in saltmarsh surveys, whilst large numbers of juvenile Twaite shad (*Alosa fallax*) enter saltmarsh creeks in the Wadden sea in late summer (Tulp et al., 2017)[347].

12.7.45 Saltmarshes are highly productive habitats providing organic plant material, a proportion of which can be utilised by coastal food webs. Organic material derived by saltmarsh production

347 Tulp, I., Bolle, L. J., Dänhardt, A., de Vries, P., Haslob, H., Jepsen, N., ... van der Veer, H. W. 2017. Fish. Wadden Sea Quality Status Report 2017. Wilhelmshaven: Common Wadden Sea Secretariat

may be utilised by food webs in-situ or exported from the marshes by tidal processes or mobile fauna. Therefore, the elevation of the marshes and the degree of tidal inundation influences the benefits provided to fish and other receptors. Saltmarshes typically establish between Mean High-Water Neaps (MHWN) and highest astronomical tide (HAT). Based on the MMO (2019[348]) habitat descriptions, saltmarsh zonation can be characterised as:

- Mudflats occur at the base of saltmarsh between the levels of Mean Low Water Springs (MLWS) and MHWN. Mudflats are unvegetated and dominated by benthic associated microalgae (microphytobenthos). In some areas, seagrasses occur below saltmarshes.
- Lower and middle saltmarsh occurs between MHWN and Mean High Water Springs (MHWS). A range of halophytic grasses, rushes and shrubs grow at these marsh levels.
- Upper saltmarshes occur between MHWS and HAT and are dominated by perennial species.
- Transitional grassland occurs between HAT and approximately one metre above HAT (HAT+1).
- Grassland and other terrestrial habitats occur at elevations over one metre above HAT.

12.7.46 A network of creeks and lagoons intersperse lower and middle marshes contributing to the overall function of the saltmarsh habitat.

12.7.47 The elevation of the marshes and the degree of tidal inundation influences the benefits the marsh provides in terms of its potential to stimulate fish production. High production on the middle marsh is rapidly available for food webs, however, only a small proportion of upper marsh production is available with most being mineralised within the saltmarsh itself[349]. Upper saltmarsh habitat would be expected to have a lower functional role in providing refuge and direct feeding opportunities for fish, and indirect fish production through the export of carbon stimulating food webs, than lower and mid-level saltmarshes.

12.7.48 The current concept design for Pawlett Hams and The Island suggests that, of the total estimated area of 340 ha of created/enhanced saltmarsh, approximately half of that total area would be made up of lower and mid-level saltmarsh with intersecting creeks and lagoons. The majority of the remaining areas at both sites would be comprised of upper

---

348 MMO. 2019. Identifying sites suitable for marine habitat restoration or creation. A report produced for the Marine Management Organisation by ABPmer and AER, MMO Project No: 1135, February 2019, 93pp.

349 Bouchard, V. and Lefeuvre, J.C. 2000. Primary production and macro-detritus dynamics in a European salt marsh: carbon and nitrogen budgets. Aquatic Botany, 67(1), pp.23 – 42.

saltmarsh below HAT with small areas of transitional grassland and terrestrial habitat (see Figure 12-2 and 12-3, Appendix 13.3). These areas are indicative and subject to more detailed design and habitat optimisation. The current conceptual design is accounted for when attempting to derive production benefits of the proposed created and / or enhanced saltmarsh habitats, below with further details provided in Appendix 13.1.

Native Oyster Reefs

12.7.49 European native oysters (*Ostrea edulis*) were once much more abundant in the Bristol Channel and 1-2 ha of native oyster reef creation and / or enhancement is proposed by NNB as a compensation measure. In the U.S.A. and Australia, there is a wealth of research surrounding fish enhancements on native oyster reefs (albeit regarding different species of oyster). Native oyster reefs support a variety of flora and fauna with up to 246 species including fish species such as butterfish (*Pholis gunellus*), five-bearded rockling (*Ciliata mustela*) and tompot blenny (*Parablennius gattorugine*) recorded in these habitats (Johnson et al., 2023) [350].

12.7.50 Whilst less information on the direct productivity of native oyster reefs for fish is available in a European context, other important species such as Atlantic cod and European sea bass are associated with this habitat type.

Seagrass

12.7.51 The compensation package proposes to create and / or restore 5 ha of seagrass. Seagrass ecosystems are recognised as important nursery habitats, where juvenile fish avoid predation and take advantage of feeding opportunities (e.g., Lilley & Unsworth, 2014)[351]. Seagrass beds support a different array of species to saltmarshes and are beneficial to the marine juvenile stages of gadoids such as predatory pollock (*Pollachius virens*), Atlantic cod (*Gadus morhua*) and whiting (*Merlangius merlangus*). Bib (*Trispoterus luscus*) and poor cod (*T. minutus*), common in the impingement record, are associated with seagrass. Seagrass also support benthic invertebrate feeding and zooplankton feeding taxa, along with a host of cryptic species including pipefishes and seahorses (Syngnathidae) (Appendix 13.1). There are no known surveys of the fish associated with seagrass within the Severn Estuary, however, seine

350 Johnson, C.L.E., Axelsson, M., Brown, L., Carrigan, K.H.O., Cordingley, A., Elliot, A.L., Downie, A., Gannon, L., Green, B., Jones, J., Marsh, M.K., McNie, F., Mills, S.R.A., Wallace, N.M., and Woods H.J. (2023) Marine Restoration Potential (MaRePo). Natural England Research Report JP054

351 Lilley, R.J. and Unsworth, R.K. 2014. Atlantic Cod (Gadus morhua) benefits from the availability of seagrass (Zostera marina) nursery habitat. Global Ecology and Conservation, 2, pp.367 – 377.

net surveys at Porth Dinllaen in North Wales over sandy sediments and over a 28 ha area of intertidal *Zostera marina* identified 24 fish species in the seagrass habitat, with densities approximately 4.6-fold higher than over sandy substrates[352].

Kelp Forest

12.7.52 Creation and / or enhancement of up to 15 ha of kelp forest is included in the compensation package.

12.7.53 Kelp form multi-dimensional habitats from the intertidal zone to depths of >20 m. They are made up of several different layers; the holdfast; the stipe; and the frond that in turn support distinctive communities of epiphytic organisms. The complexity of kelp forests throughout provides habitat for a range of species groups including pelagic species, benthopelagic gadoids including pollock and Atlantic cod, reef-associated species such as wrasses (*Labridae*) and demersal species including European sea bass[353]. In addition to the gadoids, large bodied predatory species such as conger eel (*Conger conger*) and lesser spotted dogfish (*Scyliorhinus canicula*), that contribute notable proportions of impinged biomass, are associated with kelp forests.

12.7.54 Kelp forests are also particularly effective nurseries and feeding grounds for SAC marine assemblage species, such as Atlantic cod, pollock, ballan wrasse (*Labrus bergylta*) and goldsinny (*Ctenolabrus rupestris*).

Approach to Quantifying Fish Benefits from Different Habitats within NNB's Proposed Compensatory Habitat Package

12.7.55 Creation and / or enhancement of habitats can provide direct benefits to a diversity of fish from different functional and feeding guilds. Quantifying system level increases in fish biomass or production resulting from habitat creation and / or enhancement is, however, challenging. Deriving unit area production estimates for intertidal habitats in dynamic environments is challenging due to the limitations of quantifying fish abundance in-situ and the likelihood that the habitats export energy to the adjacent habitats meaning in-situ abundance is not reflective of the total fish production the habitat supports. Furthermore,

352 Bertelli, C.M. and Unsworth, R.K. 2014. Protecting the hand that feeds us: Seagrass (Zostera marina) serves as commercial juvenile fish habitat. Marine Pollution Bulletin, 83(2), pp.425 – 429.

353 Jackson-Bué, M., Smale, D.A., King, N.G., Rushton, A.G. and Moore, P.J. 2023. Spatial variability in the structure of fish assemblages associated with Laminaria hyperborea forests in the NE Atlantic. Journal of Experimental Marine Biology and Ecology, 564, p.151899.

there is no standard approach to inform scales of compensation for fish losses due to abstraction by power stations and a range of scaling methods have been developed, particularly in the U.S.A.[354]

12.7.56 Habitat creation / enhancement has been shown to enhance ecosystem production, but increases are not evenly distributed across all species groups in the complex estuarine ecosystem. Some species would directly or indirectly benefit from creation / enhancement resulting in increases in biomass, whilst biomass of other species may fall[355].

12.7.57 Appendix 13.1 outlines a series of approaches to estimate broadscale estuarine fish production and habitat specific unit area production estimates. Noting the limitations and assumptions of the approaches, the resulting habitat production estimates can be compared relative to impingement predictions to determine the proportion of losses that may be offset.

12.7.58 Impingement losses (without AFD) but with the inclusion of the FRR and capped head LVSE mitigation for the HPC Project were predicted to cause an annual loss of fish of 45.8 t based on CIMP1 and 18.1 t based in CIMP2 (Table 9-5 of the AA).

12.7.59 Production estimates enable like for like comparisons between gains and losses of young fishes in a created habitat and through impingement respectively, when the age and size distributions may differ. Biomass losses have been converted into production estimates using production to biomass ratios ('P:B'). The advantage of using production estimates derived from P:B ratios is that biomass data from the CIMP (both 1 and 2) can be used directly, and P:B ratios can be applied across a range of species. Furthermore, annual production losses are more representative of the losses of predominantly juvenile stages from the Severn Estuary SAC. A notable limitation when seeking to estimate production is that the age-specific data are rarely available in the literature and there is no established scientific consensus on a suitable method to estimate production in early life stages. Potential methods rely on a series of assumptions that are not tested and provide approximations of P:B.

---

354 Strange, E., Allen, D., Mills, D. and Raimondi, P., 2004. Research on estimating the environmental benefits of restoration to mitigate or avoid environmental impacts caused by California power plant cooling water intake structures. California Energy Commission, PIER Energy-Related Environmental Research, Sacramento, California Available at: https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/diablo_canyon/docs/09_09_05_staff_report/item15_attachment5.pdf (Accessed: 11 December 2023)

355 Frisk, M.G., Miller, T.J., Latour, R.J. and Martell, S.J.D. 2011. Assessing biomass gains from marsh restoration in Delaware Bay using Ecopath with Ecosim. Ecological Modelling, 222(1), pp.190 – 200.

12.7.60 To account for uncertainties in estimating production losses, a P:B range of 2 - 4 has been applied to the biomass of the predominantly juvenile fish impinged. The application of the upper P:B ratio of 4 for the total biomass of species incurring mortality is likely to lead to a highly conservative estimate of annual fish production losses owing to impingement.

12.7.61 In CIMP1, the resulting estimate of annual production lost due to impingement using a P:B ratio of 2 is approximately 91.7 t y^{-1}. The conservative P:B estimate for the whole assemblage leads to an estimated loss of 183.3 t y^{-1}. In CIMP2, the likely estimate of production losses, applying a P:B ratio of 2, is 36.1 t y^{-1}, whereas the conservative (P:B = 4) scenario results in production losses of 72.2 t y^{-1}.

12.7.62 Fish production supported by seagrass, saltmarsh and kelp forest habitats, was estimated based on a number of comparative and model-based approaches. Given the absence of studies in the Severn Estuary, estimates drew on approaches and studies from a range of locations. Therefore, the unit area production estimates provided are indicative.

12.7.63 Estimates based on the available evidence suggested that, once established, the full set of NNB's compensatory habitats proposed may offset 31.4 % of the likely total fish production losses based on CIMP1 impingement estimates and up to 79.8 % based on CIMP2 impingement estimates (see **Table 12-2** below). Applying conservative production loss estimates results in the compensatory habitat offsetting 15.7 % of total fish production losses based on CIMP1 impingement and 39.9 % of fish losses using CIMP2 impingement.

12.7.64 These figures are however precautionary for impingement losses. This is because these estimates account for uncertainty in lost production due to impingement by applying conservative P:B ratios. The uncertainty in the production estimates for created habitats cannot be addressed directly. For this reason, lower estimates of unit area production for saltmarsh, seagrass beds and kelp forest have been assumed. In the case of saltmarshes, it is likely that the habitat production estimates are conservative for established marshes, however it is noted that there would be a lag period between the implementation of habitat restoration measures and the habitat achieving similar functionality to an established saltmarsh (see Appendix 13.1 for further details).

12.7.65 In producing these estimates, no account has been taken of benefits that cannot be assessed in a quantitative manner including (i) design features of the created and / or enhanced habitats that specifically aim to enhance fish production, for example pools of standing water at low within saltmarsh sites; (ii) synergistic effects of the habitats in providing additional benefits to adjacent habitats; (iii) the production benefits of native oyster reefs; or (iv) the benefits to some fish of the typical fish species assemblage of the removal of / easements to barriers. These are considered further below.

Table 12-2 Estimated fish production associated with different types of restored habitat and the proportion of impingement losses offset

Proposed habitat	Area proposed (ha)	Estimated habitat fish production (kg ha^{-1} yr^{-1})	Proportion of losses offset: Conservative P:B	Proportion of losses offset: Likely P:B
CIMP1: Estimated fish production losses from impingement 91.7 – 183.3 t y^{-1}				
Saltmarsh	340	55.2	10.2 %	20.5 %
Seagrass	5	146	0.4 %	0.8 %
Kelp	15	620	5.1 %	10.1 %
Native Oyster reef	1-2	Unknown	N/A	N/A
Sub-total	361 ha		15.7 %	31.4 %
CIMP2: Estimated fish production losses from impingement 36.1 – 72.2 t y^{-1}				
Saltmarsh	340	55.2	26.0 %	52.0 %
Seagrass	5	146	1.0 %	2.0 %
Kelp	15	620	12.9 %	25.8 %
Native Oyster reef	1-2	Unknown	N/A	N/A
Sub-total	361 ha		39.9 %	79.8 %

Note: To account for uncertainties in estimating production, a P:B range of 2 – 4 has been applied to the biomass of the predominantly juvenile fish impinged. The application of a P:B ratio of 4 for the total biomass of species is likely to lead to a highly conservative estimate of annual fish production losses owing to impingement. Lower estimates of production from established habitats have been applied (please see Appendix 13.1 for further details). Estimates for saltmarsh production assume approximately half the marsh area is upper saltmarsh, whilst half is middle or lower saltmarsh with intersecting creeks and lagoons. Production is based upon *in-situ* production and because of export of organic material from the marshes.

Indirect and Synergistic Benefits

12.7.66 In relation to synergistic effects, the 'seascape' approach to habitat creation and enhancement adopted by NNB is anticipated to result in synergistic effects for fish production.

12.7.67 Creation or enhancement of habitat would likely result in increased productivity of adjacent habitat types and increase ecological connectivity. Furthermore, habitat creation and enhancement may also benefit the establishment / recovery of exiting habitats through an increase in seed stock, thereby enhancing the probability of natural recruitment.

12.7.68 The proposed compensation habitats have been shown to support improvements to water quality (including oxygen, nutrients and turbidity) by removing excess nutrients and reducing turbidity by trapping sediment. Improvements to these physico-chemical water quality parameters are likely to have a positive effect for fish.

12.7.69 The proposed package of compensation habitat in the Severn Estuary and Bristol Channel could also have indirect effects on the existing coastal intertidal habitats in the estuary by stabilising sediment, increasing surface elevation and reducing erosion from storms and waves; thereby protecting other intertidal habitats beneficial to fish and other species.

Benefits of Barrier Removal / Easement to the Typical Fish Species Assemblage of the Estuaries Qualifying Habitat of the Severn Estuary SAC

12.7.70 The presence of artificial structures in rivers can lead to significant changes in the characteristics of surrounding ecosystems, with disruptions to connectivity between habitats. Management measures lower in the catchment can enhance connectivity of riverine and estuarine habitats. Such measures can be achieved through several methods, including complete removal of obstacles to migration. However, when complete removal is unachievable, easements can be used to modify the structure or surrounding area and alleviate some of the effects caused by the structure's presence. Easing measures include partially removing obstacles; the construction of fish passes to facilitate free movement of fish over / through / around obstacles; modifying the obstacle to enable movement; or manipulating conditions around an obstacle (e.g. changing water flow).

12.7.71 Barrier removal will assist the Annex II qualifying species / Ramsar Criterion 4 species, but also has the potential to benefit other diadromous species. These species include other members of the Ramsar Criterion 4 assemblage of migratory species (beyond Twaite shad, Allis shad and Atlantic salmon): European eel, sea trout, sea lamprey and river lamprey. In addition to the qualifying migratory species, a wider range of marine and freshwater species may benefit from barrier removal / easements.

12.7.72 WFD fish monitoring data collected in the transitional and freshwater reaches of the Severn suggest that fish passage improvement works proposed as part of the package of compensation measures at Maisemore Weir, for example, may increase access to upstream habitat for the predominantly marine species such as thin-lipped grey mullet, European sea bass, flounder and gobies, all of which are common in the impingement record. Management measures would also increase interconnectivity for freshwater species.

12.7.73 Further upstream towards Upper Lode Weir, reduced salinity due to mixing with freshwater precludes movements of all but the most euryhaline marine species (i.e. those able to tolerate a wide range of salinity), such as gobies and flounder from utilising the riverine habitats. However, barrier removal / easement measures would increase interconnectivity for freshwater species and aid migratory species movements.

12.7.74 For the species that will benefit from the improvements to fish passage within the different catchments being considered, the benefits will be determined by the management measures implemented at the structures. Other factors include the different physiological characteristics, swimming abilities, body sizes, seasonal movements and behaviours of the fish.

12.7.75 Barrier easements have the potential to increase the availability of habitat for a range of fish from the assemblage and ease bottlenecks to movement that may limit productivity, thereby providing benefits to the typical fish species assemblage of the Severn Estuary SAC.

Overall Benefits of the Proposed Compensatory Measures to the Typical Fish Species Assemblage of the Severn Estuary SAC's Estuary Feature

12.7.76 Habitat creation and enhancement projects at the scale of the proposed compensation measures package are long-term initiatives.

12.7.77 In the habitat restoration model proposed by French McCay & Rowe (2003), full ecological functioning of saltmarshes was estimated to take 15 years, although it was noted that vegetation develops rapidly, and fish populate created marshes at similar levels to natural habitat in as little as 2 to 5 years[356]. Due to the range of environmental factors which contribute to the development of the ecological functionality of saltmarsh, the estimated time within which saltmarsh sites will be achieved is difficult to predict though. Specific habitat objectives will be developed and agreed through the AMMP.

356 French McCay, D.P., and Rowe, J.J. 2003. Habitat restoration as mitigation for lost production at multiple trophic levels. Marine Ecology Progress Series, 264, pp. 233-247.

12.7.78 Gut contents analyses of fish utilising realigned saltmarsh sites in the UK provide evidence that the created habitat affords feeding opportunities for fish. One such study at realignment sites at Steart Marshes (adjacent to the proposed sites at Pawlett Hams and The Island) has demonstrated that within three years of flooding, the marshes provided feeding opportunities for European sea bass, thin-lipped grey mullet and gobies, although not to the same extent as established marshes (Stamp et al.,2023)[357]. To determine the success of the compensation measures, NNB is preparing an AMMP (Section 12.6 above).

12.7.79 None of the species impinged are reliant on a single estuarine habitat type throughout their life cycle and the ecological connectivity between adjoining habitats supports overall production. This is particularly true in highly dynamic environments such as the Severn Estuary. The mosaic of proposed habitat types will accordingly support a diversity of fish species from different functional groups. High productivity habitat will provide synergistic benefits with existing habitats to enhance ecological connectivity of the estuarine 'seascape'. Restored habitats in this case are being designed specifically to enhance fish biomass, for example design features are being proposed to allow pools of standing water to remain within saltmarshes following high tide inundation. These measures may increase temporal utilisation by fish of the habitats, thereby increasing fish feeding opportunities, growth rates and survival.

12.7.80 Habitat creation and enhancement supports prey availability for migratory fish species and overall function of the estuary habitat.

12.7.81 As a keystone species, native oysters offer suitable substrate, spawning ground, food and shelter for many species[358]. Bivalve reefs provide physical structure and bio-deposits that support high density of macroinvertebrate prey, as well as shelter for juvenile fish, which in combination support increased fish production (in comparison to unstructured sediment)[359]. Therefore, this compensatory measure may directly benefit the assemblage of notable fish species through increased feeding opportunities and refuge.

---

357 Stamp, T., West, E., Colclough, S., Plenty, S., Ciotti, B., Robbins, T. and Sheehan, E. 2023. Suitability of compensatory saltmarsh habitat for feeding and diet of multiple estuarine fish species. Fisheries Management and Ecology, 30(1), pp.44 – 55.

358 OSPAR (2020). Status Assessment 2020 - European flat oyster and Ostrea edulis beds. Available online at: https://oap.ospar.org/en/ospar-assessments/committee-assessments/biodiversity-committee/status-assesments/european-flat-oyster/. [Accessed: 08 October 2023]

359 Hancock B, zu Ermgassen P. (2018). Enhanced Production of Finfish and Large Crustaceans by Bivalve Reefs, in Smaal et al. (Eds.), Goods and Services of Marine Bivalves. Springer, pp. 295–312

12.7.82 Kelp forests are particularly effective nurseries and feeding grounds for SAC marine assemblage species, such as cod, pollock and wrasses. Therefore, this compensatory measure may directly benefit the assemblage of fish species.

Ecological Benefits of the Proposed Compensatory Package to the Typical Waterfowl Species Assemblage of the Estuaries Qualifying Habitat of the Severn Estuary SAC

12.7.83 As well as providing high quality habitat to fish, the proposed package of compensation measures will have wider benefits to other aspects of the Severn Estuary SAC Estuaries qualifying habitat feature including for the typical waterfowl species assemblage (see **Figure 12-1**).

12.7.84 The Estuarine habitats of the Severn Estuary SAC help to support an assemblage of overwintering waterfowl. In the immediate area close to the HPC Site (as indicated during surveys to inform the 2013 DCO), key species recorded (including species which form part of the assemblage) comprise:

- Dunlin;
- Grey plover;
- Knot;
- Pintail;
- Oystercatcher;
- Avocet;
- Lapwing;
- Golden Plover
- Shelduck;
- Wigeon;
- Redshank;
- Curlew; and
- Teal.

12.7.85 The proposed compensatory measures package will provide benefits for the Estuaries qualifying habitat (and its components) of the Severn Estuary SAC. Through these benefits, there will be indirect benefits on the waterfowl assemblage species, in particular those which rely on saltmarsh and seagrass habitats for key prey resources.

12.7.86 The bird assemblage is also afforded protection as a designated feature of overlapping European sites (Severn Estuary SPA and Ramsar site) and multiple sites of national importance including Bridgwater Bay SSSI. Therefore, there will be further, indirect benefits to the wider network of designated sites for the relevant bird species.

12.7.87 The assessment team is aware that further surveys of birds are ongoing and the results of these surveys will provide an up to date estimate of peak numbers for bird species, including those species which are part of the wider assemblage, and the surveys included areas where the proposed habitat creation measures have the potential to have the greatest positive impact. This data will be incorporated into the DCO Material Change assessment documentation as it progresses to the application stage.

12.7.88 Direct and indirect benefits for birds will be delivered by the various elements of the currently proposed compensatory measures package.

12.7.89 Proposed measures to enhance saltmarsh habitat at The Island on the River Parrett and to create saltmarsh within a managed re-alignment project at Pawlett Hams are anticipated to create valuable feeding, roosting and resting locations for many bird species, including those listed as part of the waterfowl assemblage of the Estuaries qualifying habitat.

12.7.90 The Island is immediately adjacent to the Huntspill Sluice, where the Huntspill River joins the River Parrett. This location is already used by the key species listed above along with a range of other waterfowl and waders including redshank, wigeon, dunlin, grey plover, shelduck, teal and curlew.

12.7.91 Pawlett Hams is currently managed as grazing marsh and grassland with intersecting ditches and watercourses. This area provides feeding and roosting habitat for wader and waterbird species including shelduck, wigeon, teal and curlew as identified through WeBS survey results for Pawlett Hams and the immediate area. All these species will benefit from the creation of saltmarsh and other more natural wetland habitats.

12.7.92 Successful habitat creation and enhancement schemes have already been initiated in the wider area, with the large-scale saltmarsh creation and enhancement at Steart Marshes providing an excellent example of the benefits of creating landscape scale opportunities for birds to overwinter and breed. Other areas of saltmarsh are known to be of benefit to waterfowl within the Severn Estuary including areas of well-grazed saltmarsh with saltpans at the River Axe, and in the upper reaches of the Estuary, which are used by wigeon and other waterfowl. Pools in the higher marsh at Bridgwater Bay and in the saltmarsh above the Severn bridges are also attractive to waders and waterfowl, providing invertebrates and shelter[360]. In the winter, ducks such as teal and pintail feed on seeds of saltmarsh plants such as *Salicornia* sp. and *Atriplex* sp. Probing waders such as curlew also feed on the saltmarsh[360]. These areas of saltmarsh also provide safe havens for feeding waders and waterfowl from the tides that flood areas of mudflat twice per day. In particular, upper saltmarsh makes idea high water roost sites, with a range of vegetation, including short vegetation to enable detection of predators. It is expected that these same opportunities would exist at Pawlett Hams and The Island.

12.7.93 Another example of created saltmarsh bringing significant environmental benefits is the Medmerry managed realignment site, in Sussex. Whilst Medmerry is an example of open-coast managed realignment, since the area's creation in 2013, bird populations at the site have increased significantly, including populations of wading birds such as avocets, lapwings and oystercatchers[361].

12.7.94 The other compensatory habitat measures are less likely to provide direct benefits to the typical waterfowl species assemblage, as the focus is to create and enhance marine habitats or enhance habitats for fish species and other prey resources, including crustaceans and molluscs. However, the wider Severn Estuary does support piscivorous species such as lesser black-backed gull (which are a feature of the Severn Estuary Ramsar site) which may indirectly benefit from the measures including creation and enhancement of seagrass beds, kelp forest or native oyster reefs. Evidence has also shown that seagrass beds are foraged for fish and invertebrates by coastal birds and may also be targeted by herbivorous waterfowl[362].

360 Natural England and Countryside Council for Wales (now NRW) (2009), The Severn Estuary / Môr Hafren European Marine Site. Natural England & the Countryside Council for Wales' advice given under Regulation 33(2)(a) of the Conservation (Natural Habitats, &c.) Regulations 1994, as amended.

361 The National Trust: Case Study: Medmerry Nature Reserve: https://www.nationaltrust.org.uk/our-cause/nature-climate/climate-change-sustainability/case-study-medmerry-nature-reserve. (Accessed 12 November 2023).

362 Unsworth & Butterworth (2021). Seagrass meadows provide a significant resource in support of avifauna. Diversity, 13(8), p.363.

Ecological Benefits of the Proposed Compensatory Package to the Typical Vascular Plant Species Assemblage of the Estuaries Qualifying Habitat of the Severn Estuary SAC

12.7.95 The typical vascular plant species assemblage of the Estuaries habitat feature of the Severn Estuary SAC is noted to include saltmarsh species and eel grass (*Zostera*) species. The saltmarsh species are presented in Table 12-3, which is taken from the Regulation 33 advice dated June 2009.

Table 12-3 Saltmarsh species of the vascular plant species assemblage of the Estuaries feature of the Severn Estuary SAC, as defined in the Severn Estuary SAC Regulation 33 Advice (note that the typical vascular plant species assemblage also includes eel grass (Zostera) species but these are not specifically listed in the Regulation 33 Advice)

Saltmarsh species of the vascular plant species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC	
Festuca arundinacea	*Alopecurus bulbosus*
Festuca rubra	*Althaea officinalis*
Juncus gerardii	*Bupleurum tenuissimum*
Triglochin maritimum	*Hordeum marinum*
Carex extensa	*Puccinellia rupestris*
Agrostis stolonifera	*Trifolium squamosum*
Juncus maritimus	*Lepidium latifolium*
Oenanthe lachenalii	*Allium oleraceum*
Puccinellia maritima,	*Petroselinum segetum*
Salicornia spp.	
Suaeda maritima	
Aster tripolium	
Glaux maritima	
Plantago maritima	
Armeria maritima	
Elytrigia atherica	
Atriplex prostrata	
Phragmites australis	
Spartina anglica	
Spergularia media	
Puccinellia distans	
Cochlearia anglica	

Saltmarsh species of the vascular plant species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC
Cochlearia officinalis
Limonium vulgare
Atriplex portulacoides
Seriphidium maritimum
Plantago coronopus
Beta vulgaris maritima

12.7.96 At the time of writing, the exact species composition of saltmarsh compensatory habitats at Pawlett Hams and The Island is still to be confirmed and will be the subject of ongoing engagement with experts in the field, also taking into account the results of initial trials and review of existing, successful habitat creation / enhancement schemes in comparable environments.

12.7.97 However, it is anticipated that saltmarsh species will include those outlined in **Table 12-3** above, to specifically target those which are part of the typical vascular plant species assemblage of the Estuaries qualifying habitat feature of the Severn Estuary SAC.

12.7.98 It is noted above that the typical vascular plant species assemblage also includes eel grass species, but these are not specifically listed in the Regulation 33 Advice. The introduction of seagrass therefore will result in an increase in eel grass presence within the area, improving habitat coherence, and the availability of associated habitats for species.

12.7.99 At the time of writing, the exact location and composition of created / enhanced seagrass beds is not confirmed, but it is anticipated, as with saltmarsh, that the habitat will be designed to target eel grass preferences, seeking to maximise success for the species.

12.7.100 Therefore, there will be direct benefits to the typical vascular plant species assemblage of the Estuaries qualifying habitat of the Severn Estuary SAC.

Direct Benefits

12.7.101 Creation / enhancement of the saltmarshes at Pawlett Hams / The Island, including Atlantic salt meadows at higher tidal elevations, will enhance the typical vascular plant species assemblage of the Estuaries qualifying habitat feature. This will include an increase in species of particular nature conservation importance, including nationally rare and scarce salt-meadow / salt-marsh transition species, such as sea lavender (*Limonium vulgare*), glasswort

(*Salicornia*), marsh mallow (*Althaea officinalis*), dotted sedge (*Carex punctata*) and marsh pea (*Lathyrus palustris*).

12.7.102 The planned increase in the area of saltmarsh as part of NNB's compensatory measures package equates to more than 25% of the total current extent in the English part of the Severn Estuary SAC.

12.7.103 Saltmarsh also acts as a 'coastal filter' for seawaters, from water-shed derived nitrogen[363]. The main regulating service of saltmarsh vegetation is improving water quality by trapping sediment, absorption of contaminants and uptake of excess nutrients. The accretion of carbon-rich sediments also serves as a carbon sink.

12.7.104 Enhancement of the eelgrass (seagrass beds) has the potential to enhance overall levels of biodiversity in the wider Severn Estuary / Inner Bristol Channel and thereby serve to protect the overall coherence of the NSN. Globally, 1 ha^2 of seagrass habitat can support 80,000 fish and over 1 million invertebrates. Enhancement of eelgrass beds will also (if the beds are located within the Severn Estuary SAC) contribute to the vascular plant species assemblage of the Estuaries qualifying feature of the Severn Estuary SAC.

Indirect Benefits

12.7.105 The indirect benefits described in Section 12.7.25 et seq. above and summarised in **Table 12-1** for the Estuaries habitat qualifying feature from the proposed compensation package, will also provide the same indirect benefits to the typical vascular plant species assemblage of the Estuaries qualifying habitat of the Severn Estuary SAC. This is due to, in particular, the indirect benefits (local improvements in water quality, sediment stabilisation) contributing to conditions favourable for growth.

12.7.106 Seagrass beds are a highly productive sink and source for inorganic and organic carbon. Seagrass roots stabilise the sediment, thus reducing water velocity, and trap significant amounts of particulate organic matter which is remineralised within the system. Therefore,

363 Nelson JL, Zavaleta ES (2012) Salt Marsh as a Coastal Filter for the Oceans: Changes in Function with Experimental Increases in Nitrogen Loading and Sea-Level Rise. PLoS ONE 7(8): e38558. https://doi.org/10.1371/journal.pone.0038558.

seagrass directly contributes to the health and therefore structure and stability of vascular plants[364].

12.7.107 Recent research has shown the significant contribution seagrass provides to the sedimentary lignin pool in an estuarine seagrass bed[365]. They found that sedimentary organic carbon originated in large part from degraded allochthonous vascular plants including roots and up to about 65 % of lignin in the sediments was derived from seagrass.

12.7.108 Seagrass plants are very efficient in retaining suspended particulate matter, including fine sediments and associated nutrients and organic matter[366] thus allowing for clearer water. If seawater is healthier and clearer, then the light will penetrate more effectively and encourage the growth of other vascular plants that require light for photosynthesis. A greater abundance of seagrass will result in a higher quantity of oxygen present through photosynthesis which in turn will contribute to healthier waters for other plants to thrive.

12.7.109 Whilst the scale of native oyster reef creation / enhancement proposed is relatively small, and unlikely to have major effects on the wider Severn Estuary SAC native oyster reefs can have a number of environmental benefits with regards to the vascular plant species assemblage:

- Native oyster reefs' structure can increase the stability of the sediment, thus enabling vascular plant community in the vicinity to strengthen. Swales et al., (2004) researched the influence of wave and sediment dynamics on one species of vascular plant (cordgrass) and showed that spatial patterns of silt, sand and shell resuspension and deposition directly influence the rate of sediment accumulation by Spartina patches and the composition of accumulated sediment on this wave-exposed intertidal flat[367]. Native oysters filter the water thus making it cleaner for vascular plants to thrive.
- Vascular plants can be sensitive to turbidity, decreasing light penetration and affecting photosynthesis and growth of the reefs. Native oysters can improve water quality, filtering

364 Gillis, L., Ziegler, A, van Oevelen, D, Cathalot, C., Herman, P et al., (2014b). Tiny is mighty: seagrass beds have a large role in the export of organic material in the tropical coastal zone. PLOS ONE 9:e111847.

365 Nakakuni, M., Watanabe, K., Khoki, K., Mizuno, Y., Takehara, K., Kuwae, T., Yamamoto, S. (2021). Seagrass contributes substantially to the sedimentary lignin pool in an estuarine seagrass meadow. Science of the Total Environment. Volume 793, 148488. Accessed online at: https://www.sciencedirect.com/science/article/abs/pii/S0048969721035609 (Access 11 December 2023).

366 Terrados, J., and Duarte, C. (2000). Experimental evidence of reduced particle resuspension within a seagrass (Posidonia oceanica L.) meadow. Journal of Experimental Marine Biology and Ecology. Volume 243, Issue 1, Pages 45-53.

367 Swales, A., MacDonald, I., Green, M. (2004). Influence of wave and sediment dynamics on cordgrass (Spartina angelica) growth and sediment accumulation on an exposed intertidal flat. Estuaries. 27. 225-243. 10. 1007/BF02803380.

organic matter, phytoplankton and particulate-bound nitrogen and phosphates from estuarine waters[368]. This, alongside enhanced sediment stabilisation, can significantly reduce turbidity, resulting in deeper light penetration and greater light availability for submerged aquatic vegetation[369].

- Native oysters sequester carbon[370], which would benefit a range of aquatic species and habitats and also mitigate against blooms of phytoplankton and macroalgae (though the scale of the proposed measure in this case is relatively small therefore unlikely to have major effects on wider water quality and plankton dynamics in the estuary).
- Vascular plants can be sensitive to nutrient enrichment as it has previously been observed (Davison & Hughes 1998[371]; Burkholder et al. 1992[372]). Native oyster reefs could also reduce the concentration of toxic contaminants through consumption, bio-deposition, trapping of contaminated sediments and supporting microorganisms that can break down contaminants.

12.7.110 Kelp forests can also contribute to improved water quality through reduced turbidity, dissolved inorganic nitrogen and phosphorus[373]. Improvement to water quality would also mitigate against blooms of phytoplankton and other macroalgae. It would therefore support the typical vascular plant species assemblage.

Ecological Benefits of the Proposed Compensatory Package for the Qualifying Migratory Fish Species of the Severn Estuary SAC, River Usk SAC,

368 Newell RIE, Langdon CJ (1996). Mechanisms and physiology of larval and adult feeding. In: Kennedy V, Newell R, Eble A, editors. The Eastern Oyster Crassostrea virginica. Maryland Sea Grant, College Park, MD; pp. 185–229.

369 Cerco CF, Noel MR (2007). Can oyster restoration reverse cultural eutrophication in Chesapeake Bay? Estuar Coast.;30: 331–343.

370 Native Oyster Network (N/A). European Native Oysters. Available online at: https://nativeoysternetwork.org/#:~:text=WATER%20QUALITY%20IMPROVEMENT,suspended%20material%20in%20the%20liquid. [Accessed: 08 October 2023]

371 D.M.Davison, D.J.Hughes, 1998. Zostera Biotopes (volume I). An overview of dynamics and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project). 95 Pages.

372 BurkholderJ.M. et al. Water-column nitrate enrichment promotes decline of eelgrass (Zostera marina L.): evidence from seasonal mesocosm experiments Mar. Ecol. Prog. Ser. (1992)

373 Jiang, Z., Liu, J., Li, S., Chen, Y., Du, P., Zhu, Y., Liao, Y., Chen, Q., Shou, L., Yan, X. and Zeng, J., (2020). Kelp cultivation effectively improves water quality and regulates phytoplankton community in a turbid, highly eutrophic bay. Science of the Total Environment, 707, p.135561.

River Wye SAC and for the migratory fish species assemblage of the Severn Estuary Ramsar site

12.7.111 Barrier removal / easement in the Severn catchments is the primary compensatory measure proposed by NNB to provide benefits for Twaite shad, Allis shad and Atlantic salmon and other migratory fish species but this measure will also provide benefits to the wider fish assemblage through increasing the availability of habitat and easing bottlenecks to movement that may limit productivity across all the designated sites.

Atlantic salmon

12.7.112 The presence of weirs can limit the distribution and abundance of salmon in impounded rivers and can impede both the upstream breeding migrations of adult salmon, and the downstream movements of juveniles, known as smolts. In some cases, obstacles can prevent a large proportion, or even the entirety, of migrating salmon from accessing critical habitats, thus causing large numbers of mortalities, or limiting breeding success (Thorstad et al., 2008[374]).

12.7.113 The presence of obstructions in rivers can also cause considerable delays to migrating salmon, even in cases where the obstruction would not appear to present a significant physical challenge to their passage. These delays disrupt the timings of upstream and downstream migrations, which can impact on fitness and survival. The aggregation of fish below barriers can also place them at greater risk from opportunistic predators; can increase the spread of certain diseases and parasites; or can increase the risk of mass mortalities from causes such as pollution events.

12.7.114 Significant delays to the downstream migration of salmon smolts may result in de-smoltification[375] and the fish missing the "window of opportunity" for entry into the marine environment which is considered critical to their survival (Moore et al., 1995[376]).

374 Thorstad, E.B., Økland, F., Aarestrup, K. and Heggberget, T.G., 2008. Factors affecting the within-river spawning migration of Atlantic salmon, with emphasis on human impacts. Reviews in Fish Biology and Fisheries, 18, pp.345-371.

375 Smoltification is a process whereby a juvenile salmon (smolt) undergoes physiological changes to adapt from living in freshwater to the marine environment. De-smoltification occurs for fish unable to migrate to seawater.

376 Moore, A., Potter, E.C.E., Milner, N.J. & Bamber, S., 1995. The migratory behaviour of wild Atlantic salmon smolts in the estuary of the River Conwy, North Wales. Canadian Journal of Fisheries and Aquatic Sciences. 52 (9), 1923-1935.

12.7.115 Artificial weirs can also result in the deposition of fine sediments and lower water oxygen levels. In turn, sedimentation and deoxygenation if they occur high in the catchment, can reduce salmon embryo survival, and can produce sub-lethal effects, such as slowing the rate of egg development. Furthermore, gravel sedimentation can have significant effects on alevin[377] development and survival, leading to earlier alevin emergence, and inhibiting a vital predator avoidance behaviour (Louhi et al., 2011[378]).

12.7.116 The presence of weirs may also reduce the availability of suitable spawning habitats, as salmon favour shallower areas with relatively fast-flowing water and clear gravel.

12.7.117 Weir removal is widely regarded as an efficient method of restoring river connectivity, which can also significantly increase the abundance and quality of spawning and rearing habitats for salmon. In cases where complete removal is unachievable, other measures such as the installation of fish passes can greatly benefit salmon. As most conventional types of fish pass types were specifically designed to provide passage for salmonids, their installation often yields greater benefit for these than for other species.

12.7.118 Proposed barrier removal / easements measures in each of the river catchments of the Towy, Wye, Lugg and Severn have the potential to benefit Atlantic salmon and contribute towards network coherence.

12.7.119 Further information on the distribution of Atlantic salmon relative to the proposed barrier removal / easement locations is provided in Appendix 13.2.

Twaite and Allis shad

12.7.120 Obstacles to migration and resulting habitat fragmentation are believed to be among the leading causes of the decline and increased genetic introgression of Allis and Twaite shad. High levels of hybridisation between the two species have been reported for Great Britain, with the hybrids in the River Severn and Towy mainly clustered towards Twaite shad (Antognazza et al., 2022[379]). Allis shad are very rarely recorded in the Severn Estuary leading

377 The alevin stage of the Atlantic salmon directly follows hatching from the eggs. These early juvenile fish burry in the gravel and rely on the egg sac for nutrition.

378 Louhi, P., Ovaska, M., Mäki-Petäys, A., Erkinaro, J. and Muotka, T., 2011. Does fine sediment constrain salmonid alevin development and survival? Canadian Journal of Fisheries and Aquatic Sciences, 68(10), pp.1819-1826.

379 Antognazza, C.M., Sabatino, S.J., Britton, R.J., Hillman, R.J., Aprahamian, M., Hardouin, E.A. and Andreou, D., 2022. Hybridization and genetic population structure of Alosa population in the United Kingdom. Journal of Fish Biology, 101(2), pp.408–413.

to a lack of specific tagging data for Allis shad in the rivers considered for feasibility assessment.

12.7.121 Shads face many of the same challenges from obstacles to migration as salmon. However, some of these impacts are greater for shads because they are relatively poor swimmers when compared to the salmonids, presenting much lower sustained swimming speeds. As such, they are unable to pass certain areas with particularly high flow rates and have difficulty in ascending large drops in water level when migrating upstream.

12.7.122 Fish passage improvements in the catchments of the Severn Estuary would enhance access to historic spawning grounds and support additional production where habitat is a limiting factor. Barrier removal / easement on the River Severn at Maisemore and / or the Upper Lode and at Trostery Weir on the River Usk are likely to be the primary compensatory measure options to support network coherence of shad. It is unlikely that the Manorafon Weir on the Towy and the weirs on the River Lugg would significantly enhance shad access to spawning habitats as the weirs are located higher in the catchment than shad would typically spawn and on the River Towy water temperatures in the catchment above Manorafon Weir are close to the lower thermal limit for shad recruitment (further information, including the presence of other Criterion 4 migratory species in the Lugg that may benefit barrier removal is provided in Appendix 13.2).

12.7.123 Studies undertaken at Maisemore and Upper Lode Weirs as part of the Unlocking the Severn Project have indicated that these are likely to present substantial obstacles to migrating Twaite shad (Davies et al., 2023[380]). Maisemore Weir is generally considered to be the upper limit of the tide on the Severn, but on occasion, notably during the spring, high tides will overtop this weir and will increase water levels up to the Upper Lode Weir. Therefore, both obstacles present a substantial head drop at lower tides, which can present a challenge for shad, and cause migration delays (Davies, 2022)[381]. Further information on the distribution of Twaite shad relative to the proposed barrier removal / easement locations is provided in Appendix 13.2.

---

380 Davies, P., Britton, J.R., Castro-Santos, T., Crundwell, C., Dodd, J.R., Nunn, A.D., Velterop, R. and Bolland, J.D., 2023. Tracking anadromous fish over successive freshwater migrations reveals the influence of tagging effect, previous success, and abiotic factors on upstream passage over barriers. Canadian Journal of Fisheries and Aquatic Sciences

381 Davies, P., 2022. Movement ecology of two threatened anadromous species, Twaite shad Alosa fallax and sea lamprey Petromyzon marinus, revealed by acoustic telemetry (Doctoral dissertation, Bournemouth University).

12.7.124 Acoustic tracking studies in the Severn have indicated that 79 % of the adult Twaite shad tagged during their upstream migration in 2018 left the river with the rate of freshwater mortality thus estimated at 21 % (Davies et al., 2023).

12.7.125 The majority of tagged individuals (98 – 100 %) approached and successfully passed weirs in the lower reaches of the River Severn (Maisemore and Llanthony) in 2019 and 2020, with median passage times of 1 day (range: 0.4 – 3.9 days) and 1.5 days (range: 1.0 – 2.8 days), respectively. Reported migration delays could detrimentally affect fish reproductive success and survival and increase predation risks, particularly when stocks are depleted and there are cumulative barrier impacts further upstream. Upstream at Upper Lode, only 50 % of the shad tagged were able to pass the weir, averaged across 2018 – 2020 (range: 16 – 81 %) with increasing temperature and water levels positively affecting passage rates. Migration delays at the Upper Lode were substantial, ranging from 1.1 to 33 days across all the investigated years. Fish were unlikely to attempt a second passage if they had initially failed to traverse the barrier. Returning fish passed at higher rates than newly tagged individuals (Davies et al., 2023).

12.7.126 Recent count data of shad migrating upstream at Upper Lode indicate a decline in migration in the years since 2020. This is despite the recent in-river measures undertaken including the installation of the fish pass at Diglis near Worcester. The reason for the low run estimate is unclear and could be a result of mortality of sub-adult fish in the marine phase of their life-cycle.

12.7.127 Improving fish passage at the River Severn weirs and at Trostrey, where NRW report indicates that the weir may impede shad migration (Natural Resources Wales, 2022[382]), would contribute towards supporting greater shad production.

Benefits from Habitat Creation and Enhancement

12.7.128 In addition to the proposed barrier removal / easements works, Twaite shad, Allis shad and Atlantic salmon may benefit, either directly or indirectly, through increases in prey availability from the creation and enhancement of habitats.

382 Natural Resources Wales, 2022. Core management plan including conservation objectives for Afon Wysg / River Usk SAC. (2022). Available at: https://afonyddcymru.org/wp-content/uploads/2022/11/river_usk-sac-core-plan.pdf [Accessed 26 September 2023].

12.7.129 Twaite shad have been identified in saltmarshes of the Mira Estuary (Costa et al., 2001[383]) and in the Wadden Sea, juvenile Twaite shad use saltmarsh creeks in late summer (Tulp et al., 2017[384]). Therefore, Twaite shad could be expected to benefit from NNB's saltmarsh creation / enhancement proposals.

12.7.130 Adult Atlantic salmon during the migratory period are unlikely to feed in the estuary, however, smolts feed within the estuary environment and are generalist feeders, preying upon abundant crustaceans and forage fish including Atlantic herring, sprat, European flounder (*Platichthys flesus*), whiting and Atlantic cod.

12.7.131 Twaite and Allis shad also feed on a range of fish including small crustaceans and the abundant early life stages of sprat, herring and anchovy (*Engraulis encrasicolus*).

12.7.132 Habitat enhancement may therefore provide high quality feeding opportunities for these Annex II species.

Overall Benefits to the Qualifying Annex II / Criterion 4 Assemblage

12.7.133 Improvements to fish passage through the removal / easements of barriers have the potential to provide benefits not only to Atlantic salmon and shad, but also other species from the Ramsar Criteria 4 assemblage of migratory species, as well as euryhaline marine and freshwater species.

12.7.134 These benefits may be achieved through increases in connectivity of fragmented habitat, reductions in up or down stream delays to migration, alleviation of predation or disease risks due to aggregation bellow barriers, and improvements to habitat and water quality. Such benefits can increase the productivity of a catchment.

383 Costa, M., Catarino, F. & Bettencourt, A. 2001. The role of salt marshes in the Mira estuary (Portugal). Wetlands Ecology and Management, 9, pp. 121 – 134.

384 Tulp, I., Bolle, L. J., Dänhardt, A., de Vries, P., Haslob, H., Jepsen, N., ... van der Veer, H. W. 2017. Fish. Wadden Sea Quality Status Report 2017. Wilhelmshaven: Common Wadden Sea Secretariat.

12.8 Next Steps

Introduction

12.8.1 At this pre-application consultation stage there are some elements of NNB's compensatory measures package that are further developed than others.

12.8.2 NNB will continue to develop the compensatory measures package and maintain engagement with the SNCBs and relevant subject matter experts in habitat creation, enhancement and barrier easements as it approaches the DCO Material Change application.

12.8.3 NNB's current plans for further work to support the DCO Material Change application include further feasibility studies and field trials for the proposed compensatory measures as outlined below.

Barrier Easement

12.8.4 The presence of artificial structures in rivers can lead to significant changes in the characteristics of surrounding ecosystems. Disruptions to connectivity between habitats can be detrimental to local fish populations and habitat fragmentation is widely accepted as a leading factor in the decline of many diadromous fish species, impacting both their upstream and downstream migrations and limiting access to vital spawning or feeding habitats. Restoring river connectivity is now seen as a vital consideration in the management and conservation of diadromous fish populations.

12.8.5 As the feasibility process develops and the suitability of the chosen locations is confirmed, feasibility studies will move forward to developing design solutions for either fish passes or weir removal and riverbed and bank re-profiling.

12.8.6 A robust baseline will be established prior to implementation of management measures to increase fish passage. Initial assessments will make use of existing data sources supported by targeted monitoring to establish the baseline against which success criteria can be measured.

12.8.7 Feasibility studies will investigate:

- how the barrier easement measures would influence, and be influenced by, surrounding environmental conditions, such as tides and changes in river flow, including consideration of flood risk / prevention;

- detailed engineering optioneering studies;
- the extent to which there may be sensitive ecological receptors around the weir locations which could be affected by barrier easement works (including ecological surveys);
- the habitat availability for fish, both upstream and downstream from each proposed easement location to ascertain the specific benefits for fish of a particular option;
- other potential stressors or impacts on populations of target fish species in the river such as water quality (e.g., pollutants) which might influence the benefits to fish which could arise from weir easement; and
- the resilience of the measures to climate change and the potential for unintended consequences such as introduction of non-native and invasive species, for which risk assessments will be undertaken.

Saltmarsh Creation / Enhancement

12.8.8 Various surveys and investigations will inform the detailed design of the saltmarsh creation and enhancement schemes to support the formal DCO Material Change application.

12.8.9 Key areas of desk and field-based studies will include:

- consultation with recognised experts regarding the design of saltmarsh creation i.e. benefits to fish can be optimised through habitat design.
- hydrogeological appraisal and desk study, expected to include hydrodynamic modelling of the site and the estuary to determine effects on flows and water levels in the wider estuary; and
- ecological surveys, within the potential ZOIs of the measure.

Marine Habitat Creation / Enhancement (Native Oyster Reef, Kelp forest and Seagrass beds)

12.8.10 Work undertaken to date has identified potential suitable spatial zones for the creation / enhancement of native oyster reef, seagrass and kelp forest habitat.

12.8.11 Focussed feasibility work will be undertaken to identify optimum locations for these measures together with initiation of field trials to inform scaling up proposals for implementation and effective delivery of the measures.

12.8.12 The feasibility work will include mapping and consideration of known constraints (including environmental conditions, known historical areas of each habitats, and 'no-go' areas due to existing marine uses which would be incompatible with habitat creation).

12.8.13 The following considers each of the three habitat types below.

Native Oyster Reef Creation / Enhancement

12.8.14 A series of environmental surveys will be undertaken to inform the detailed site selection and design including collection of data on light climate, turbidity, Chlorophyll *a* concentrations, temperature and habitat suitability investigations i.e., substrate and larval dispersal will be used inform creation / enhancement techniques.

12.8.15 Consideration will also be given to the presence of existing *Sabellaria* reefs, as whilst proximity to these reefs may provide suitable conditions for native oyster proliferation, it will be ensured that creation of new oyster habitat does not negatively affect existing *Sabellaria* reef habitat, and that the impacts of native oyster reefs (notably the effect on tidal flow) does not affect the reef building process.

12.8.16 Biosecurity risk assessments will be undertaken, and a biosecurity measures plan developed to ensure identified risks from enhancement activities are minimised. Biosecurity risks can be mitigated by applying biosecurity measures and adopting rigorous hygiene standards upon translocation for example.

Seagrass Bed Habitat Creation / Enhancement

12.8.17 Site feasibility studies will include a series of environmental surveys which will be undertaken to inform the detailed seagrass bed site selection and design including collection of data on light climate, turbidity, nutrient levels, temperature, wave exposure and sediment characteristics. The proximity to other seagrass habitat will also be considered for site selection. As well as ecological consideration, site selection will be informed by logistical considerations in relation to sites access, safety and licencing requirements, including the ability to implement by-laws to protect the site against future damage.

12.8.18 Consideration will also be given to how seagrass impacts physical processes (notably tidal flow and sediment deposition / transportation) to ensure that habitat availability, community composition and reef building potential are not negatively impacted.

12.8.19 For seagrass habitat creation / enhancement, and all marine habitat types, information will be gathered through a combination of desk-based studies and field-survey 'ground truthing'.

12.8.20 NNB will also develop a biosecurity measures plan to mitigate any identified biosecurity risks i.e., translocating seagrass for planting.

Kelp Forest Creation / Enhancement

12.8.21 NNB will characterise key environmental information (light climate, turbidity, temperature, nutrients) and undertake surveys where needed, to support habitat suitability studies.

12.8.22 As part of these investigations, a key first step will be to identify locations where kelp / macroalgae are currently present within the study area, thus indicating that conditions in that area are appropriate, and may support expansion. A study of existing conditions, and mapping of these to kelp habitat preferences will also steer the identification of suitable areas for further, targeted investigation.

12.8.23 Consideration will be given to how kelp impacts physical processes (notably tidal flow and sediment deposition / transportation) to ensure that habitat availability, community composition and reef building potential are not negatively impacted. Additionally, as kelp occupies hard surfaces, it will be ensured that kelp forests do not occupy substrate currently occupied by *Sabellaria* reefs, thereby reducing the extent of biogenic reefs.

12.8.24 NNB will also develop biosecurity measures plan to mitigate any identified biosecurity risks i.e. translocation.

AMMP

12.8.25 In parallel with the feasibility and field trials described above, NNB will further develop the AMMP framework to include the details and governance arrangements applicable to the long-term monitoring and management of the implemented compensatory measures package.

Supporting Assessments, Consents and Control Mechanisms

12.8.26 For each of the creation / enhancement measures, supporting environmental assessments will be prepared for the ES and shadow HRA that will accompany the DCO Material Change application.

12.8.27 The proposed measures which are outside the DCO Order Limits will be subject to separate consenting processes, and there is likely to be need for further HRAs to be undertaken by the relevant competent authorities.

12.8.28 Where appropriate, NNB will commence preparation of the necessary planning applications, licences and consents to support and deliver the compensatory works which cannot be included in the DCO Material Change application. Initial discussions between NNB and the appropriate local planning authorities have commenced with regard to those compensatory works and applications will be prepared in parallel with the preparation of the DCO Material Change application.

12.8.29 NNB will engage with the relevant organisations including, for example, the IFCA and the MMO, to identify suitable control mechanisms so as to protect areas where habitat creation / enhancement will be implemented.

Access Rights

12.8.30 NNB will engage with landowners on land acquisition and access arrangements with a view to securing the necessary rights in advance of the determination of the DCO Material Change application.

12.9 Conclusions

12.9.1 NNB's proposed package of compensatory habitat measures will be developed further as described above.

12.9.2 Once finalised, the Secretary of State will need to make an evaluative judgment as to the adequacy of the proposed package of measures, taking into account in particular the points at Sections 12.2 and 12.7 above.

12.9.3 NNB's proposed package, once finalised, will meet the compensatory measures requirement of Regulation 68.

12.9.4 HPC fully recognises that HPC will impinge fish of the typical species assemblage species and that this is one of the pathways of impact which gives rise to a risk of adverse effect on the integrity of European / Ramsar sites, the others being the impingement of migratory Annex II species and the Criterion 4 migratory assemblage species. It is important to note, however, that large (albeit lower) numbers of fish would also be impinged even if HPC operated with an AFD and this was accepted by the Inspector in 2021 as not generating a risk of adversely affecting the integrity of any European / Ramsar site.

12.9.5 The compensation package is consistent with the NRW / NE Advice that compensatory measures should be targeted at the designated habitats or species of the site(s) which are at risk of being adversely affected by the Project. In relation to fish impinged from the typical fish species assemblage, the package is therefore appropriately focussed on the Estuaries (H1130) qualifying habitat feature of the Severn Estuary SAC (as the typical fish species assemblage is not a qualifying feature in its own right - it is instead part of the Estuaries qualifying habitat feature).

12.9.6 HPC's package will provide significant benefits for the Severn Estuary SAC Estuaries feature typical fish species assemblage. This will be within an overall broader focus of the package on also delivering significant benefits for other aspects of the Estuaries qualifying feature of the Severn Estuary SAC including benefits for the wildfowl species assemblage and the vascular plant species assemblage of the Estuaries qualifying feature. This is an appropriate approach in this case for the reasons explained above.

12.9.7 HPC's compensatory measures will also be targeted at benefiting the Annex II species and the Criterion 4 migratory fish assemblage and will comprise substantial and proportionate measures known to benefit these species.

12.9.8 Like for like compensation (in terms of precise nature of impact and numerical equivalence) is not technically possible in this case, but the compensation package is considered to be both appropriately targeted and proportionate.

12.9.9 HPC considers that the package of compensatory measures will be effective to ensure that the overall coherence of the NSN is protected.

13 APPENDICES

13.1 TR592 – See SHADOW HRA EVIDENCE REPORT - APPENDICES

13.2 TR595 - See SHADOW HRA EVIDENCE REPORT - APPENDICES

13.3 Figures - See SHADOW HRA EVIDENCE REPORT - FIGURES