Department of Energy & Climate Change

RECORD OF THE HABITATS REGULATIONS ASSESSMENT UNDERTAKEN UNDER REGULATION 61 OF THE CONSERVATION OF HABITATS AND SPECIES REGULATIONS 2010 (AS AMENDED).

&

ASSESSMENT OF THE PROJECT UNDER ARTICLE 4.7 DEROGATION FOR THE WATER FRAMEWORK DIRECTIVE.

***Project Title*: Tidal Lagoon Swansea Bay**

Date: **8th June 2015**

CONTENTS

Introduction

Background

1.0 This is a record of the Habitats Regulation Assessment (HRA) that the Secretary of State (SoS) for Energy and Climate Change has undertaken under the Conservation of Habitats and Species Regulations 2010 (as amended) (the Habitats Regulations) in respect of the Development Consent Order (DCO) for the proposed Tidal Lagoon Swansea Bay generating station and its essential infrastructure (the 'Project'). For the purposes of these Regulations the SoS is the competent authority.

1.1 The report also contains analysis and assessment of the potential impacts and benefits of the Project to ensure compliance with the Water Framework Directive (WFD). A derogation under Article 4(7) of the Directive needs to be considered by the Secretary of State in reaching her final decision on the Project. The scheme must meet all of the conditions laid out in Article 4.7 of the Directive. If the Project cannot meet any of these conditions, then it will not be compliant with the WFD. This assessment is included under the WFD article 4(7) assessment section of the report.

1.2 Tidal Lagoon (Swansea Bay) Plc ("the Applicant") has applied to the SoS for a Development Consent Order (DCO) under Section 37 of the Planning Act 2008 (as amended) for the construction and operation of a tidal lagoon generating station with a maximum installed generating capacity of 320MW. The tidal lagoon is located in Swansea Bay within the city and county of Swansea and the County Borough of Neath Port Talbot. The project would use seawalls to enclose an area of some 11.5km², incorporating a new road and footpath. A substation, lighting, landscaped space, maintenance facilities, slipways and/ or jetties will also be located along the new seawall. There will also be turbine and sluice gate housing structure, containing 16 variable speed hydro turbines and up to 10 sluice gates incorporating:

- a switch room;
- scour protection;
- electrical equipment and transformer(s);
- dividing structure(s) and wingwalls; and
- a maximum of four external gantry cranes and such infrastructure works or plant as may be necessary for the purposes of operating and maintaining the sluices and turbines.

The Project application is described in more detail in Section 2 and in the DCO.

1.3 In England and Wales, offshore energy generating stations with a capacity greater than 100 MW constitute nationally significant infrastructure projects (NSIPs) and applications for consent are subject to the requirements of the Planning Act 2008 (as amended). This Project constitutes an NSIP as it has a maximum installed capacity of 320 MW (Panel's report, section 2.1.16 'The Revised Project DCO').

1.4 The Project was accepted by the Planning Inspectorate (PINS) on 6th March 2014 and a five-member Panel of Inspectors ("the Panel") was appointed as the Examining Authority (ExA) for the application. The examination of the Project application began on 10th June 2014 and completed on 10th December 2014. The Panel submitted its report of the examination, including its recommendation ("the Panel's Report"), to the SoS on 10th March 2015.

1.5 The SoS conclusions on habitats and wild birds issues contained in this HRA report have been informed by the Panel's Report, and further information and analysis, including a Report on the Implications for European Sites (RIES) and written responses to it. The SoS also used this evidence to consider the Project's compliance with the Water Framework Directive (WFD) and inform her conclusions on a derogation under Article 4(7) of the Directive. A WFD derogation assessment is provided in this report.

1.6 The Project will need further consents and permits to construct and operate, including (but not limited to):

- A European Protected Species (EPS) Licence if there is likely to be disturbance to species, such as marine mammals, which are protected under the Conservation of Habitats and Species Regulations 2010. These licences are issued by Natural Resources Wales (NRW).
- Environmental permits from NRW will also be required under the Water Resources Act 1991 for activities such as erecting structures offshore.
- Marine licences will be required from NRW under the Marine and Coastal Access Act 2009 for a number of activities such as capital and maintenance dredging, spoil disposal and placing the structure.
- Planning consents will be required from local planning authorities for the associated development, including leisure and recreation facilities.

1.7 Responsibility for determining these necessary consents and permits is devolved in Wales and cannot be authorised by the Secretary of State.

1.8 In carrying out this HRA the SoS has assessed the tidal lagoon as an energy generating project only and has not considered the wider scheme (including for example leisure facilities). The SoS has been mindful of the likely wider nature of the Project and notes that these additional elements of the Project will be subject to separate consents and licences. As such she sees no reason that this should be a barrier to the development being granted development consent.

Habitats Regulation Assessment (HRA)

1.9 Council Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive) aim to ensure the long-term survival of certain species and habitats by protecting them from adverse effects of plans and projects.

1.10 The Habitats Directive provides for the designation of sites for the protection of habitats and species of European importance. These sites are called Special Areas of Conservation (SACs).

The Birds Directive provides for the classification of sites for the protection of rare and vulnerable birds and for regularly occurring migratory species. These sites are called Special Protection Areas (SPAs). SACs and SPAs are collectively termed European sites and form part of a network of protected sites across Europe. This network is called Natura 2000.

1.11 The Convention on Wetlands of International Importance 1972 (the Ramsar Convention) provides for the listing of wetlands of international importance. These sites are called Ramsar sites. UK Government policy is to afford Ramsar sites in the United Kingdom the same protection as European sites.

1.12 Regulation 61 of the Habitats Regulations provides that:

> *…..before deciding to give consent, permission or other authorisation for, a plan or project which is likely to have a significant effect on a European site (either alone or in combination) and which is not directly connected with or necessary to the management of the site, the competent authority must make an appropriate assessment of the implications for the site in view of the site's conservation objectives.*

1.13 Regulation 25 of the Offshore Habitats Regulations contains similar provisions:

> *…..before deciding to give consent, permission or other authorisation for, a plan or project which is to be carried out on any part of the waters or on or in any part of the seabed or subsoil comprising an offshore marine area or on or in relation to an offshore marine installation and which is likely to have a significant effect on a European marine site (either alone or in combination) and which is not directly connected with or necessary to the management of the site, the competent authority must make an appropriate assessment of the implications for the site in view of the site's conservation objectives.*

1.14 This Project is not directly connected with, or necessary to, the management of a European site or a European marine site. The Habitats Regulations require that, where the project is likely to have a significant effect (LSE) on any such site, an appropriate assessment (AA) is carried out to determine whether or not the project will adversely affect the integrity of the site in view of its Conservation Objectives. In this document, the assessments as to whether there are LSEs, and, where required, the AAs, are collectively referred to as the HRA.

1.15 The HRA takes account of mitigation measures which are secured by requirements and conditions within the DCO.

1.16 This report should be read in conjunction with the following documents that provide extensive background information, a fuller list of documents is provided in the References section of this report:

- The Planning Act 2008 (as amended) Tidal Lagoon (Swansea Bay) Examining Authority's Report of Findings and Conclusions and Recommendations to the SoS for Energy and Climate Change. 10th March 2015 the "**Panel's report**".

- Report on the Implications for European Sites Proposed Tidal Lagoon Swansea Bay. An examining authority report prepared with the support of the environmental services team, 11th November 2014 – termed **"the RIES"**.
- Tidal Lagoon (Swansea Bay) plc's Environmental Statement, February 2013 – termed **"the ES"**.
- Tidal Lagoon (Swansea Bay) plc- Updated Report to Inform HRA July 2014 Tidal Lagoon (Swansea Bay) plc - Updated HRA Screening (Appendix 1) July 2014.
- Tidal Lagoon (Swansea Bay) plc - TLSB Plc - Updated HRA Kenfig Clarification (Appendix 5) Submitted for Deadline II of 9 July 2014.
- Tidal Lagoon (Swansea Bay) plc - TLSB Plc - Updated HRA Kenfig, Blackpill and Crymlyn Clarification -R2295TN (Appendix 6) July 2014.
- Tidal Lagoon (Swansea Bay) plc - Updated HRA Screening Matrices (Appendix 3) July 2014.
- Tidal Lagoon (Swansea Bay) plc - Updated HRA Integrity Matrices (Appendix 4) July 2014.
- Tidal Lagoon (Swansea Bay) plc - Shadow report to inform HRA: Cetaceans and Pinnipeds' submitted for Deadline III of 5 August 2014.
- Tidal Lagoon (Swansea Bay) plc - Framework Directive Assessment: Revision 2 (track change from Revision 1 submitted 5 August 2014).
- Tidal Lagoon (Swansea Bay) plc - Water Framework Directive Information to Support Article 4.7 Derogation for Swansea Bay Coastal Waterbody October 2014.
- TLSB Responses to NRW queries on the WFD Information to Support Article 4.7 Derogation for Swansea Bay Coastal Waterbody report, November 2014.
- Natural Resources Wales - Swansea Bay Tidal Lagoon: Article 4(7), Water Framework Directive: Advice note by Natural Resources Wales 09/12/2014.
- Responses to SoS consultation letter of the 14th April 2015.

1.17 The key information in these documents and written representations is summarised and referenced in this report.

The RIES and Statutory Consultation

1.18 Under the Habitats Regulations the competent authority must, for the purposes of an AA, consult the appropriate nature conservation body and have regard to any representation made by that body within such reasonable time as the authority specifies.

1.19 Natural Resources Wales (NRW) is the Statutory Nature Conservation Body (SNCB) for Wales and for Welsh waters within the 12 nm limit.

1.20 The ExA, with support from the Planning Inspectorate (PINS), prepared a Report on the Implications for European Sites (RIES), based on working matrices prepared by the Applicant. The RIES documented the information received during the examination and presented the ExA's understanding of the main facts regarding the HRA to be carried out by the SoS.

1.21 The RIES was published on PINS planning portal website and circulated to interested parties on 11th November 2014 for a period of 21 days for the purposes of statutory consultation. The RIES, and the written responses to it, have been taken into account in this assessment. There were responses to the RIES consultation from the Applicant, Rhossili Working Group, NRW, Neath Port Talbot County Borough Council; City and County of Swansea and Welsh Government.

1.22 The SoS is content to accept the ExA's recommendation that the RIES, and written responses to it, represents an adequate body of information to enable the SoS to fulfil her duties in respect of European sites and species.

Development Description

Location

2.0 The Applicant is proposing to develop a tidal energy generating station (**the Project**) in Swansea Bay, South Wales.

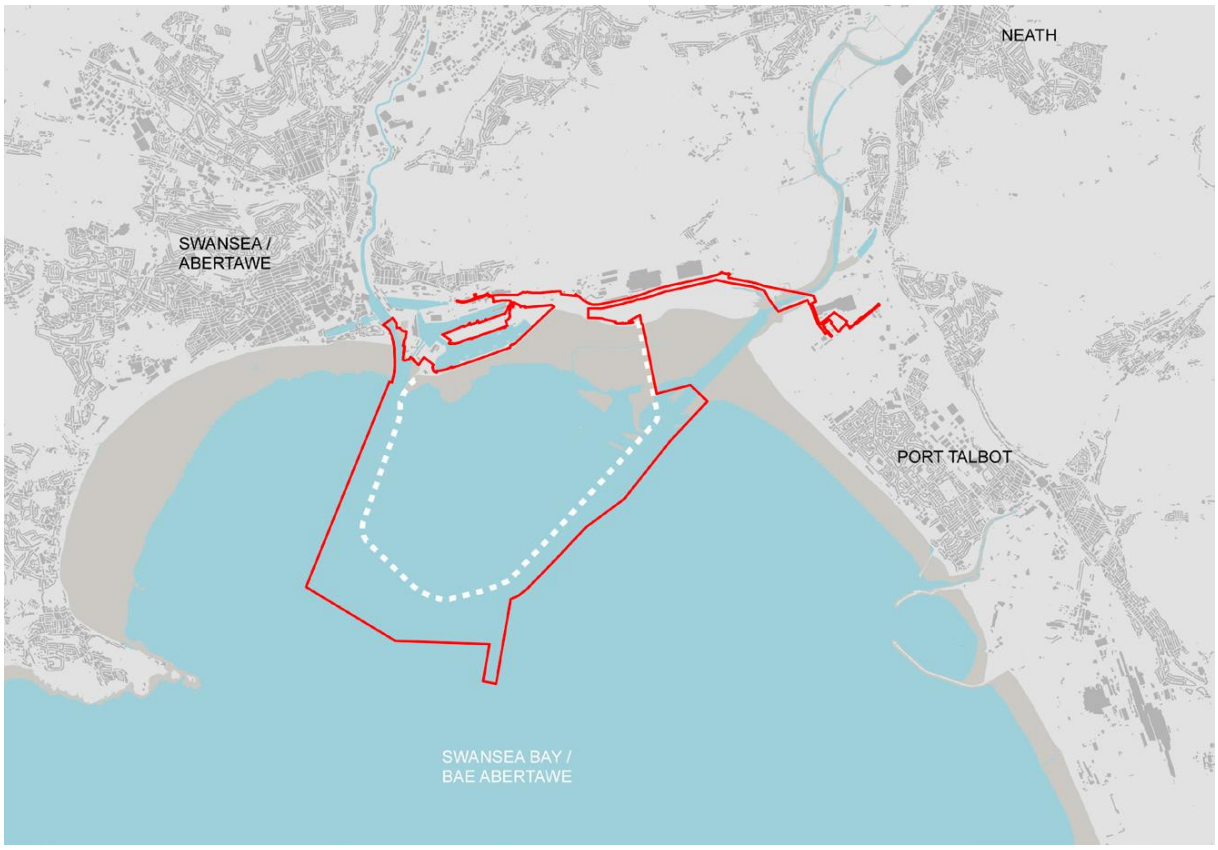

Figure 1 Location of the proposed Swansea Bay Tidal Lagoon *(from the Applicant's ES)*

2.1 The Project is a generating station, which will have a maximum installed generation capacity of 320MW is to be located adjacent to Swansea Port at the eastern gateway to the City of Swansea.

2.2 The Applicant's ES describes the Project as a lagoon enclosing part of the seabed and the foreshore of Swansea Bay, from the eastern side of the River Tawe to the eastern edge of the new Swansea University Bay Campus (SUBC). The new seawalls of the lagoon will extend approximately 1.5km directly offshore from the eastern landfall at SUBC (the eastern landfall), adjacent to Crymlyn Burrows SSSI. The seawalls will then extend in a south-westerly direction along the western boundary of the training wall of the River Neath Channel. A turbine and sluice gate housing structure will be located in the south west of the lagoon, at an oblique angle to the dredged channel of the River Tawe. The seawall will then extend towards Swansea Port, close to the mouth of the River Tawe parallel to the dredged channel for the River Tawe to re-join the land (the western landfall).

2.3 The project would use the seawalls to enclose an area of some 11.5km² or more of seabed and foreshore to create the lagoon. The seawalls will form the enclosure of the lagoon, controlling the water to allow a difference in water level to be created between the lagoon and the sea outside. This build-up of water is needed to store kinetic energy that can be turned into electric power. Electricity can then be generated as water flows through bi-directional turbines, located in the turbine and sluice gate housing, when the lagoon fills and empties after a holding period to create the head required. The Applicant proposes that the electricity generated will be fed into the National Electricity Transmission System (NETS) via National Grid's substation in Baglan by way of an underground cable connection from the generating station.

Development Components

2.4 **Offshore works** (*from the Applicant's ES),* all elements of the Project and associated infrastructure were included by the Applicant in its ES and have been exposed to scrutiny during the examination. However, in Wales, associated development is a devolved matter and will require further assessment and consideration by Welsh authorities. Offshore construction activities will also need separate consents and permits to ensure compliance with the Marine and Coastal Access Act 2009 and, for this reason, are not included within the DCO and for this reason are considered only in outline here.

- turbines and sluice gates, their housing structure, gantry crane and other facilities, such as generators and switchgear;
- temporary cofferdam to facilitate the construction of the turbine and sluice gate housing
- structure; temporary rock storage areas; seawalls and associated dredging works;
- dredging to create boating area;
- access road on the seawalls including public realm works, lighting structures and shelters;
- Offshore Building incorporating operation and maintenance (O&M);
- emergency facilities;
- works to Swansea Port Channel;
- demolition of existing eastern breakwater wall at the entrance to the Port of Swansea;
- works to Neath Harbour Channel including the widening of the entrance to the channel and replacement of its training wall;
- water quality enhancement works (if required or implemented);
- navigation facilities including lighting;
- reef habitat creation works, provision of oyster spatting ponds, herring mitigation and *Sabellaria* habitat works; and
- necessary services.

2.5 **Onshore works:** Provision of construction support sites including access routes for construction traffic and permanent access routes to the Project, decontamination/land remediation works, installation of drainage and services, material handling facilities for deliveries by sea or rail, land creation works, including lay-down areas and temporary rock stockpile areas; Western Landfall Building incorporating O&M facilities including visitor

orientation, recreational boating facilities, laboratory/hatchery building at the western landfall with slipways; vehicle parking; manoeuvring areas, public realm and lagoon side public open space; Site of Special Scientific Interest (SSSI) information facility at the eastern landfall; water quality enhancement works; habitat creation works/mitigation (including beach/dune and saltmarsh creation within the lagoon); access works to the lagoon, including new highway access via the controlled junction on Fabian Way with associated alterations to the Swansea Port road network; necessary services; improvements and additions to River Tawe water shuttle pontoon; and pedestrian and cycle routes.

2.6 **Grid connection works:** The cable connecting the turbines to the NETS will run along the western seawall to the western landfall. The cable will then follow a route through Swansea Port, past the Swansea University Bay Campus, extending through the Crymlyn Burrows SSSI, and across the River Neath by use of constructing new ducts using directional drilling techniques.

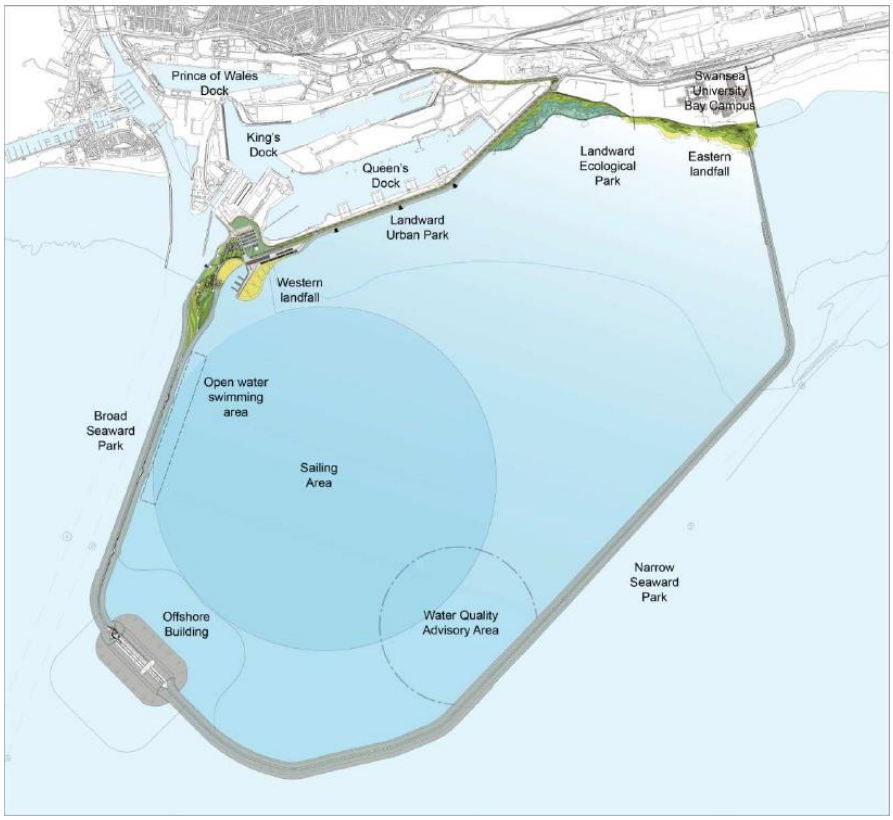

Figure 2 Swansea Bay Tidal Lagoon master plan *(from the Applicant's ES)*.

2.7 Full details of the infrastructure to be used in the Development are detailed in Schedule 1, Part 1A and 1B of the DCO.

Rochdale Envelope

2.8 In this Project the Applicant has adopted a 'Rochdale Envelope' approach within its Environmental Statement (ES).The Rochdale Envelope is a term used in planning to reflect that often a developer will not know all of the details associated with the proposal at the time of application. The Rochdale Envelope allows the Applicant to set out the broad range of options under consideration and then carry out an ES based on the realistic worst case scenario for each of those options.

2.9 Different options are used within the Applicant's ES to assess the significance of the Project's environmental effects. Where an alternative exists, the option with the likely worst case effect has been assessed. Where there is more than one route choice or construction method (e.g. cable route or temporary cofferdam), and where the potential effects of the options are noticeably different, such that a single worst case cannot be determined, or the characteristics of such effects are different, then all variations have been considered in the assessment (Applicant's ES). This allows the Applicant to apply for a DCO that allows some flexibility in the final design of the Project whilst providing certainty that no greater environmental effects than those described in the ES can occur, providing the final project design lies within the options assessed.

2.10 The ES is therefore based on the assessment of the realistic worst case scenario in environmental terms. The Project is however, bound by the DCO application boundary, which sets out areas within which the infrastructure can be located, together with various technical restrictions.

Development stages

Construction

2.11 The Applicant plans that the construction will be undertaken in four phases. It will start as soon as all the necessary consent and permits are in place. The Applicant intends that the four phases will take place over 4 years starting in 2015:

- Phase 1: Mobilisation, western seawall and start of eastern seawall
- Phase 2: Turbine and sluice gate structure construction, continue eastern seawall
- Phase 3: Lagoon Closure and Commissioning
- Phase 4: Finishings

2.12 The Applicant has proposed that the seawalls will be constructed during the summers of 2015, 2016 and 2017, and the closure of the eastern arm of the Lagoon seawall will take place in early 2018. The temporary offshore cofferdam for the turbine and sluice gate housing structure will be installed in 2015, with the construction of the turbine and sluice gate housing structure programmed for between Spring 2016 and Autumn 2017.

2.13 Following commencement of generation, the supporting infrastructure elements of the Project will be completed during 2018 - 2019. It should be noted that this is an indicative timeframe proposed by the Applicant and not a requirement of the DCO.

2.14 The working hours for construction of the Project will vary through the construction phases, but could be up to 24 hours a day, 7 days a week for the offshore works and any operations supporting the offshore works. The Construction Environmental Management Plan (CEMP) defines the measures required to mitigate and monitor the construction of the Project so as to protect the environment, this is secured through requirement 5 of the DCO. This includes all of the seawall construction and supply of rock and concrete. The Applicant has requested this flexibility due to the need to work around the tides and weather conditions for the marine work and also due to programme constraints in respect of the turbine and sluice gate housing structure.

2.15 The Applicant proposes (within the ES) that the seawalls inclosing the lagoon will be constructed with a sediment core held in position, the applicant identified in the ES a variety of options for holding the core in place. Where the seawall crosses the beach on the eastern landfall approach, the seawall will be constructed purely of suitable sediment (sand and gravel). Layers of rock and rock armour will then be placed on the outside of the structure for protection; the thickness and quantity of these layers will vary depending on location.

2.16 The Applicant proposed in their ES obtaining the sediment that is required for the Project, to be taken from areas which need to be deepened for functional purposes (e.g. turbine and sluice gate housing) and from within the lagoon footprint as a whole. For that purpose, two main approaches are being considered and have been assessed in the relevant EIA chapters. The two approaches are (see Figure 3):

i. a large area at a relatively shallow depth, which results in impacts over a wider area
ii. smaller areas of dredging at deeper depths, which allows the impact to be more localised.

Figure 3 Dredging options from the Applicant's ES: An extensive, shallow option and a less extensive, deeper option.

2.17 The extent of the dredging is likely to be between these two extremes. Consideration of these two extreme approaches in their ES has allowed the Applicant to assess a range of outcomes. The Applicant plans for the dredging to take place in the period from April to October, so there is

less potential chance of delay as a result of bad weather. This will be subject to approval of the relevant marine licences from NRW, with any necessary monitoring and mitigation.

2.18 The CEMP sets out provisions for the management, mitigation and monitoring of environmental effects during construction of the Project. It also outlines provisions for auditing, reporting and action to be taken to rectify any breach(es) to the CEMP during the course of construction of the Project and is secured as requirement 5 of the DCO.

Operation

2.19 The Project has a design life of 50 years, ongoing maintenance and repair work will be required to extend the lifespan. The Applicant indicates that its expected overall life expectancy of the Project is 120 years. An Operation Environment Management Plan (OEMP) is a requirement for the Project (Requirement 5). The aims of this are to set out the mitigation measures required for the operation of the Project so as to protect the environment. At the end of Examination an Outline OEMP had been drafted by the Applicant, this plan will be developed and updated in consultation with NRW during detailed design of the Project. As part of the Project a draft adaptive environmental monitoring plan (AEMP) has been prepared and will be further developed in consultation with NRW. The DCO provides in requirements 5 and 6 that NRW would be consulted on the final wording of the OEMP and the AEMP. A key part of any adaptive management approach is to ensure a pre-defined validated package of appropriate corrective measures is agreed and to ensure that these measures allow for mitigation and/or compensatory measures capable of ensuring adverse effects are neutralised. The Applicant's draft AEMP outlines the monitoring in four distinct phases:

i. monitoring which has been undertaken to inform the development of the Project;
ii. pre-construction monitoring;
iii. construction monitoring, and
iv. operational monitoring

2.20 During operation there will be a need for maintenance dredging within the lagoon. The Applicant's ES anticipates that this dredging will not start until 10 to 15 years after the completion of construction and then be performed approximately every two years. However, the need to do so will be monitored. Based on this monitoring, a dredging strategy will be developed and a licence for disposal will be discussed and agreed with NRW. The possible effects of this dredging on European sites is discussed further below.

Decommissioning

2.21 The SoS notes that powers are in place for decommissioning effects to be addressed fully by the relevant authorities, prior to decommissioning.

2.22 The Project has a design life of 50 years and the Applicant reviewed two potential options for decommissioning, namely:

i. replace, upgrade and extend life of the generating station; and

ii. remove turbines, sluice gates and generating equipment. Then continue the leisure use of the Lagoon water area.

2.23 The Applicant expects that, although the lagoon and its power generating capabilities have a 50 year design life, if its components are maintained, and upgrading works are carried out, then its operational life can be extended. They consider that, power generation by tidal lagoons will develop further, and the Project will be progressively updated so that the facility can be kept in use as an energy source, as well as providing a leisure facility. The Applicant's design for the seawalls is for a 1 in 100 year return wave condition. The expected sea level rise for a period of 50 years has been used in the design of the seawall, and it is expected that maintenance work and/or raising of the crest level would be required after this period.

2.24 At the end of the working life of the Project, it is also possible that that the turbines and sluice gates could be removed, and the tide allowed to flow through the resultant gaps in the structure still allowing the lagoon to fulfil its ongoing leisure uses.

2.25 The Applicant did not assess the impacts from removing the seawall and allowing the bay to return to pre-existing conditions (Applicants ES Chapter 4, section 4.9.0.1). They predict that the environmental impact of removing the seawall at this stage would cause further environmental impacts (Applicants ES Chapter 3 section 3.9.0.5).

2.26 Decommissioning for the offshore elements of the project as they are connected to land would not normally be regulated under the Energy Act 2004. However powers conferred in the DCO enable the decommissioning provisions of the Energy Act to apply to this Project. This gives the SoS the powers to require a person who is responsible for an offshore renewable energy installation to prepare a costed decommissioning programme setting out how the project will be removed and ensure that the programme is carried out. The SoS can approve, modify or reject a decommissioning programme at any point. It is not possible at this stage to predict with any certainty what the European and Ramsar site context of the Project will be in the future as sites may increase or decrease in importance over that time. The end of the Project's working life is also not yet determined. Decommissioning activities will need to comply with all relevant UK legislation at the time. Separate authorisations will also be required as part of decommissioning, after the preparation of an ES and HRA by the authorising body (including appropriate consultation with the relevant statutory nature conservation bodies). The need for a decommissioning programme is included as Requirement 42 of the DCO for this project.

2.27 The SoS considers that powers are in place for decommissioning effects to be addressed fully by the relevant authorities, prior to decommissioning and in light of more detailed information on decommissioning processes and environmental conditions at that time. She therefore considers that it is reasonable not to include a detailed discussion on decommissioning impacts in this report and notes that decommissioning is not a barrier to the development being granted development consent.

Development and designated sites

European and International Sites

3.0 The SoS has considered 10 sites within this HRA; these sites are listed in *Table 1* below with the features which are a reason for site designation. There is significant overlap between SPA and Ramsar designations, so for the purposes of this assessment; the Ramsar designations are considered in parallel with the SPA designation and all relevant species are considered together where they are a feature of more than one site.

Table 1 European sites and features considered in the HRA process, from the Applicant's updated report to inform HRA.

Site	Designation	Feature
Burry Inlet	SPA, Ramsar	Overwintering waterfowl assemblage and individually
Cardigan Bay	SAC	Sandbanks, reefs, sea caves, sea lamprey, river lamprey, bottlenose dolphin, grey seal.
Crymlyn Bog	SPA, Ramsar	Mires, bogs, fens, alluvial woodlands, Slender cotton-grass
Kenfig	SAC	Dune habitats, Petalwort, Fen orchid, saltmarsh, oligo-mesotrophic waters
Lundy Island	SAC	Sandbanks, reefs, sea caves, grey seal
Pembrokeshire Marine	SAC	Estuarine habitats, reefs, sea caves, grey seal, migratory fish, otter
Pen Llyn a'r Sarnau	SAC	Estuarine habitats, reefs, sea caves, bottlenose dolphin, otter, grey seal
River Usk	SAC	Water courses of plain to montane levels, mires and bogs, white-clawed crayfish, migratory fish, bullhead, otter
River Wye	SAC	Water courses of plain to montane levels, mires and bogs, white-clawed crayfish, migratory fish, bullhead, otter
Severn Estuary	SAC, SPA, Ramsar	Estuarine habitats, overwintering waterfowl assemblage and individually qualifying species, sea lamprey, river lamprey, twaite shad
Bristol Channel Approaches	Recommended dSAC	Harbour Porpoise

3.1 The RIES lists all the European sites identified by the Applicant and NRW and considered during the examination. In addition the SoS notes that, since the close of the examination, the Outer Bristol Channel (Bristol Channel Approaches) has been included in a list of recommended dSACs by JNCC and for this reason she has decided to consider Bristol Channel Approaches recommended dSAC in this HRA as she does not wish to take a decision on the Project, without first satisfying herself that it would not damage the possibility of future cSAC designation. This site is included in *Table 1* above.

Likely Significant Effects Test

4.0 Under Regulation 61 of the Habitats Regulations, the SoS must consider whether a development will have a likely significant effect (LSE) on a European site, either alone or in combination with other plans or projects. A LSE is, in this context, any effect that may be reasonably predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the site was designated, but excluding trivial or inconsequential effects. An AA is required if a plan or project is likely to have a significant effect on a European site, either alone or in combination with other plans or projects.

4.1 The purpose of this test is to identify LSEs on European sites that may result from the Project and to record the SoS's conclusions on the need for an AA and her reasons for screening activities, sites or plans and projects for further consideration in the AA. For those features where a LSE is identified, these must be subject to an AA. This review of potential implications can be described as a 'two-tier process' with the LSE test as the first tier and the review of effects on integrity (AA) as the second tier.

4.2 This section addresses this first step of the HRA, for which the SoS has considered the potential impacts of the Project both alone and in combination with other plans and projects on each of the interest features of the European sites identified in the RIES and any others drawn to her attention to determine whether or not there will be an LSE. These are:

- Burry Inlet SPA/ Ramsar
- Cardigan Bay SAC
- Crymlyn Bog SAC/ Ramsar
- Kenfig SAC
- Lundy SAC
- Pembrokeshire Marine SAC
- Pen Llyn a'r Sarnau SAC
- River Usk SAC
- River Wye SAC
- Severn Estuary SAC/ Ramsar

4.3 These are all sites where the Applicant concluded in its updated HRA report that the Project has a LSE (RIES, listed in Appendix 2). The original conclusion of the Applicant that just nine European sites had a potential LSE was disputed by NRW during the examination and within their relevant and written representations. Appendix 2 in the RIES also sets out these sites and also the features for which an LSE was identified by the Applicant or NRW.

4.4 In addition the SoS has decided to consider Bristol Channel Approaches recommended dSAC and other Welsh marine sites in this HRA as she does not wish to take a decision on the Project, without first satisfying herself that it would not damage the possibility of future cSAC designation.

Potential impacts

4.5 The potential impacts considered within the likely significant effects test within the Applicant's HRA report, updated HRA report and the RIES include:

- Impacts on **coastal processes** including: Disturbance of contaminated sediments, changes in erosion, deposition, sediment regimes and littoral drift patterns impacting on habitats. Habitat loss through dredging and construction of the Project. Changes in these habitats may cause impacts to foraging birds and feeding fish.
- Habitat loss could impact on **intertidal and subtidal benthic ecology.** The assemblages of species may also be impacted from changes in sediments (deposition, suspension etc.), water quality, introduction of non-native species. There could also be damage or obstruction to planktonic species from the Project's turbines.
- Construction of the Project could cause displacement, disturbance and habitat loss impacts on **Coastal birds.**
- Construction could cause disturbance and mortality on **Fish** (including Salmonids and eels) from the vibrations caused by the piling needed for the dolphin piles. Lighting, suspended sediment, artificial light, habitat loss could impact on fish including leading to barrier effects to migration. During operation of the Project's turbines fish could suffer mortality through being entrained, disturbed, loss of habitat and feeding areas and have their migration routes fragmented.
- The Project during construction could cause a collision risk and disturbance to **marine mammals** through piling, capital dredging and general construction activity. The changes in sediment suspension and contaminants from the sediments could also impact on the **grey seals** features of European sites. Operation of the project could further impact on their foraging habitats, cause a collision risk with the turbines and they could also be disturbed by the noise from the turbines and electromagnetic fields from the cables. The Project could also create a barrier to their movement.

4.6 The area assessed for potential impacts from the Project encompassed Swansea Bay, Crymlyn Bog and the coastline of South Wales up to Pembrokeshire (Applicant's updated HRA report). For mobile species such as fish, birds and marine mammals, the area of potential impact was defined by potential impact pathways. So the geographical scope of the area was defined depending on the mobility of the species and the potential impact pathways from the Project.

Likely Significant Effects (LSE)

4.7 The Secretary of State (SoS) has considered the potential construction and operational impacts of the Project on all relevant interest features to determine whether there will be LSE in the context of the Habitats Regulations. As noted above the SoS recognises that powers are in place for decommissioning effects to be addressed fully by the relevant authorities, prior to decommissioning and in light of more detailed information on decommissioning processes and environmental conditions at that time. She therefore considers that it is reasonable not to include a detailed discussion on decommissioning impacts in this report and notes that decommissioning is not a barrier to the development being granted development consent. LSEs as a result of the

project are summarised in Table 2 below, followed by a site by site description. A list of all of the sites and features considered is provided in Appendix 2 of the RIES.

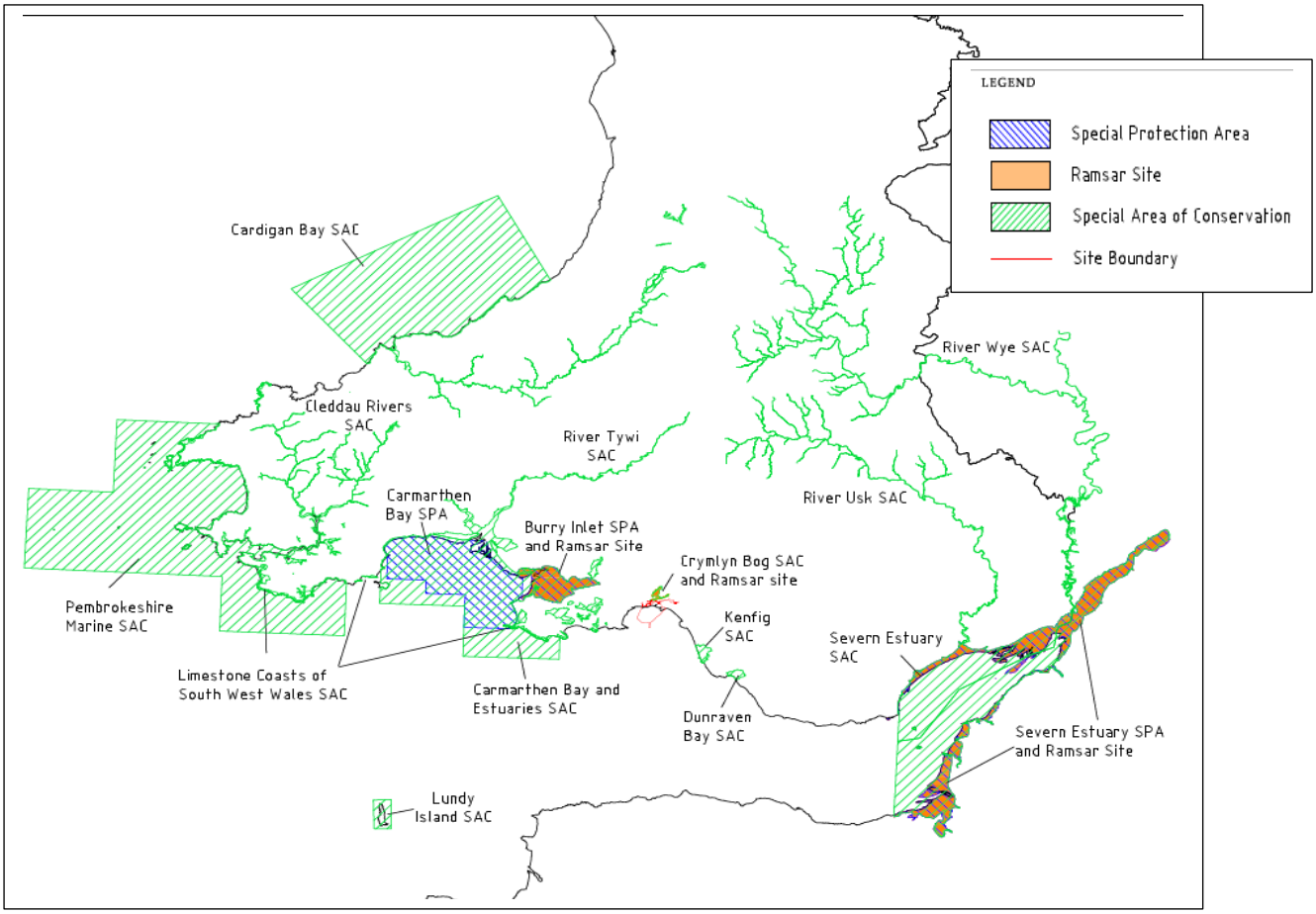

Figure 4 European Sites considered within the Applicant's original HRA (Pen Llyn a'r Sarnau SAC was considered following advice from NRW).

4.8 The main LSEs discussed within the examination and assessed within this report are:

- Dredge disposal impacting on features within the Kenfig SAC;
- Disturbance effects from constructing the Project on seabirds, features of Burry Inlet SPA/ Ramsar;
- Operational impacts on migratory fish including salmonids and clupeids, qualifying features of the River Wye SAC, River Usk SAC and River Severn SAC and Ramsar;
- Construction including piling impacts on grey seals and harbour porpoise. The turbines during operation could also impact on these marine mammals. Grey seals are features of Cardigan Bay SAC, Lundy SAC, Pembrokeshire Marine SAC and Pen Llyn a'r Sarnau SAC. Harbour porpoise would be a qualifying feature of the recommended Bristol Channel Approaches dSAC should it reach candidate cSAC status.

Table *2 Sites and features where an LSE could not be ruled out*

Site	Designation	Feature screened in as the Project having a LSE either alone or in combination with other Projects
Burry Inlet	SPA, Ramsar	teal, dunlin, oystercatchers, curlew, shelduck, redshank
Cardigan Bay	SAC	grey seal.
Crymlyn Bog	SPA, Ramsar	Transition mires and quaking bogs; calcareous fens with *Cladium mariscus* and species of *Caricion davallianae*, valley floodplain topogenous mire and fen, slender cotton-grass, assemblage of vascular plants.
Kenfig	SAC	Dune habitats, Petalwort, Fen orchid, saltmarsh, oligo-mesotrophic waters
Lundy Island	SAC	Sandbanks, reefs, sea caves, grey seal
Pembrokeshire Marine	SAC	Estuarine habitats, reefs, sea caves, grey seal, migratory fish, otter
Pen Llyn a'r Sarnau	SAC	Estuarine habitats, reefs, sea caves, bottlenose dolphin, otter, grey seal
River Usk	SAC	Water courses of plain to montane levels, mires and bogs, white-clawed crayfish, migratory fish, bullhead, otter
River Wye	SAC	Water courses of plain to montane levels, mires and bogs, white-clawed crayfish, migratory fish, bullhead, otter
Severn Estuary	SAC, SPA, Ramsar	Estuarine habitats, overwintering waterfowl assemblage and individually qualifying species, sea lamprey, river lamprey, twaite shad
Bristol Channel Approaches	Recommended dSAC	Harbour Porpoise

Kenfig SAC

4.9 Kenfig/Cynffig SAC includes two separate sand-dune systems (which are two separate SSSIs), Kenfig and Merthyr Mawr[1]. Both demonstrate a transition from small, shifting dunes that are still forming to more fixed and stable dunes further inland. Both systems have extensive areas of dune grassland and low-lying, wetter, dune slacks. These dune slacks are amongst the most species-rich in the UK, supporting communities dominated by a variety of mosses and higher plants. A number of rare plants, notably fen orchid (*Liparis loeselii*) and a rare liverwort, petalwort (*Petalophyllum ralfsii)* can also be found in some of the dune slacks. Although salt marsh makes up less than 2% of the site, this habitat is rare along the Glamorgan coast. Here it includes plant species such as sea heath and samphire (*Salicornia spp*.). Natural processes, largely determine the area of the salt marsh but where possible the area should be maintained or increased.

4.10 The Project's dredge spoil disposal options could impact on the features of this site (RIES and NRW written representation). The implications of long-term dredge spoil disposal from the proposed installation may affect the dune features of the Kenfig SAC. NRW, during the examination, stated that there was potential for changes to occur to the dune features and therefore species dependant on the dune feature due to the long-term maintenance dredge disposal at the Outer Swansea disposal ground (ExA report).

[1] *http://www.ccgc.gov.uk/landscape--wildlife/protecting-our-landscape/special-sites-project/halkyn-to-mynydd-sac-list/kenfig-sac.aspx*

4.11 Detailed scrutiny of the sediment dispersal patterns, sediment deposition, sea bed properties and sediment properties is required to better understand the potential impact of the Project on the conservation features of Kenfig SAC.

4.12 **The SoS agrees with the ExA and NRW that there is a LSE on Kenfig SAC due to changes in the dune feature caused by the long-term maintenance dredge**. The Applicant's comments on the RIES suggest that they disagree with a likely significant effect on Kenfig SAC. This is noted by the SoS but in this case she cannot rule out the potential for impacts on the SAC and has carried this site through for appropriate assessment.

Crymlyn Bog SAC/ Ramsar

4.13 Crymlyn Bog is internationally important for its very wet mires often identified by an unstable `quaking` surface[2]. It is situated in a glacial depression on the eastern edge of Swansea. In addition Bottle sedge (*Carex rostrata)* and bog bean (*Menyanthes trifoliate)* are important components of some stands, together with common cottongrass (*Eriophorum angustifolium)*, water horsetail (*Equisetum fluviatile)*, star sedge (*Carex echinata)*, mud sedge (*Carex limosa)*, and in places, the nationally rare slender cottongrass (*Eriophorum gracile)*. Crymlyn supports the largest area of calcium-rich fen dominated by great fen sedge vegetation in south Wales. Some of these stands are dominated by great fen sedge, but other areas display a more diverse vegetation in which tufted-sedge, royal fern and a range of tall-herb fen species are prominent. Some of these stands are unique in a Welsh context. In addition, there are areas of wet woodland with alder (*Alnus glutinosa)* and willow (S*alix spp)* being the dominant species.

4.14 The fen and swamp vegetation can be impacted by nitrogen deposition. NRW identified during the examination (11th April 2014) that construction of the Project has the potential to increase nitrogen deposition. NRW state that nitrogen deposition born from traffic emissions will increase by up to 2% of the critical load for the Transition Mire and Quaking Bogs feature of this SAC. They therefore advised that this was a LSE and further consideration was necessary to fully satisfy the requirements of the Habitats Regulations. **The SoS agrees with the RIES and NRW that a LSE on Crymlyn Bog SAC/ Ramsar cannot be ruled out due to changes in construction emissions.**

Burry Inlet SPA/ Ramsar

4.15 The Burry Inlet is a large estuarine complex located between the Gower Peninsula and Llanelli in South Wales[3]. It includes extensive areas of intertidal sand and mud-flats, together with large sand dune systems at the mouth of the estuary. The site contains the largest continuous area of saltmarsh in Wales. The Burry Inlet regularly supports large numbers of overwintering wildfowl and waders that feed in the saltmarshes and on the intertidal areas. Among many other species on this site, populations of Oystercatcher (*Haematopus ostralegus)*, Shoveler (*Anas clypeata)* and Pintail (*Anas acuta)* are of international significance.

[2] *http://www.ccgc.gov.uk/landscape--wildlife/protecting-our-landscape/special-sites-project/cors-fochno-to-cwm-sac-list/crymlyn-bog--cors-crymlyn-sac.aspx*
[3] *http://www.ccgc.gov.uk/landscape--wildlife/protecting-our-landscape/special-sites-project/burry-inlet-spa.aspx*

4.16 Construction of the Project including the seawall and operation of the project has the potential to cause displacement and disturbance effects on the foraging resources of seabirds using Swansea Bay (Applicant's updated HRA).

4.17 The site is situated approximately 13km to the north-west of the Project (Applicant's updated HRA). There were no direct or indirect disturbance of birds identified as LSE's at the location of the Bury Inlet SPA. However during examination NRW raised concerns that as Swansea Bay (the location of the Project) supports habitats that are considered to be functionally linked to the habitats of the SPA, protected SPA birds also use the habitats of Swansea Bay.

4.18 The Applicant therefore carried out further assessment (updated HRA) which indicated LSE for the following qualifying features: oystercatcher, dunlin (*Calidris alpina alpina)*, curlew (*Numenius arquata),* redshank (*Tringa totanus)*, shelduck (*Tadorna tadorna)* and teal (*Anas crecca)*. This was on the basis that peak numbers for each species recorded during field surveys exceeded the 1% significance threshold of the SPA population.

4.19 **The SoS agrees with the RIES and NRW that a LSE on the Burry Inlet SPA/ Ramsar cannot be ruled out due to displacement and disturbance impacts on teal, dunlin, oystercatcher, curlew, shelduck and redshank using Swansea Bay.**

Cardigan Bay SAC/ Lundy/ Pembrokeshire Marine and Pen Llyn a'r Sarnau SAC

4.20 As grey seal can travel for an extensive distance during their whole life cycle, the assessment should consider any potential impacts on this feature in the context of all relevant sites within the SW England and Wales and the Celtic and Irish Sea seal management unit, which encompasses Cardigan Bay SAC, Lundy SAC, Pembrokeshire Marine SAC and Pen Llyn a'r Sarnau.

Pembrokeshire Marine SAC

4.21 The seas around Pembrokeshire have long been recognised for their marine conservation importance. Pembrokeshire Marine SAC is a multiple interest site that has been selected for the presence of 8 marine habitat types and associated wildlife (Habitats Directive Annex I habitat types) and 7 Annex II species (Habitats Directive Annex II species)[4]. For the qualifying habitats and species, the Pembrokeshire Marine SAC is considered to be one of the best areas in the UK for: Large shallow inlets and bays (abbreviated to inlets and bays), Estuaries, Reefs, grey seal (*Halichoerus grypus).* The site also support a significant presence of: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), Mud-flats and sand-flats not covered by seawater at low tide (abbreviated to intertidal mud and sand-flats), coastal lagoons, submerged or partially submerged sea caves, Sandbanks which are slightly covered by seawater all the time (abbreviated to subtidal sandbanks), allis shad (*Alosa alosa),* twaite shad (*Alosa fallax),* river lamprey (*Lampetra fluviatilis),* sea lamprey (*Petromyzon marinus),* otter *(Lutra lutra),* shore dock (*Rumex rupestris).*

[4] *http://www.ccgc.gov.uk/landscape--wildlife/managing-land-and-sea/marine-policies/policy--legislation--guidance/regulation-35-advice.aspx*

Cardigan Bay SAC

4.22 This is located from Ceibwr Bay in Pembrokeshire to Aberarth in Ceredigion extending to around 20km from the coast. Southern Cardigan Bay is home to an amazingly rich variety of marine animals and plants, from reef-building worms to bottlenose dolphins. The area is home to Europe's largest population of these iconic animals and there are few places where they are more easily seen in the wild. The site also supports reefs which are slightly covered by sea water all the time, sandbanks, submerged or partially submerged sea caves, grey seals and lampreys are also of international importance[5].

Lundy SAC

4.23 Lundy has a granite and slate reef system and has an outstanding representation of reef habitats in south-west England. There are a wide range of physical conditions around the island, such as wave action and tidal stream strength, as a result of differing degrees of sheltered and exposed coasts and headlands. This range of physical conditions, combined with the site's topographical variation, has resulted in the presence of an unusually diverse complex of marine habitats and associated communities within a small area. The SAC features for protection were identified as reefs, subtidal sandbanks, Submerged or partially submerged sea caves and grey seals *Halichoerus grypus* [6].

Pen Llyn a'r Sarnau

4.24 Pen Llŷn a'r Sarnau SAC[7] supports a number of features that resulted in its selection as a SAC. It is located in Wales and is a large site encompassing the Llŷn peninsula, to the north, and the Sarnau reefs to the south, as well as the large estuaries along the coast of Meirionnydd and north Ceredigion. The Sarnau are three rocky reefs that extend up to 24 km out to sea.

4.25 The site's protected features include 9 different types of marine habitat and associated wildlife (habitats listed in Annex I of the Habitats Directive) and for the populations of 3 mammal species (listed in Annex II of the Habitats Directive) that it supports in particular:

- Reefs
- Large shallow inlets and bays
- Sandbanks which are slightly covered by seawater all the time
- Estuaries
- Coastal lagoons

and to support a significant presence of:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- *Salicornia* and other annuals colonising mud and sand
- Mudflats and sandflats not covered by seawater at low tide
- Submerged or partially submerged sea caves
- *Halichoerus grypus* – grey seal
- *Lutra lutra* – otter

[5] *http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0012712*
[6] *http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0013114*
[7] *http://www.ccw.gov.uk/PDF/Cover%20English.pdf*

- *Tursiops truncatus* – bottlenose dolphin.

4.26 An LSE was identified for the grey seal feature of all these sites. All the other features were screened out by the Applicant and this conclusion was not disputed by NRW during the examination.

4.27 NRW considered that as grey seal can travel for an extensive distance during their whole life cycle, the Applicant's assessment should consider any potential impacts on this feature in the context of all relevant sites within the SW England and Wales and the Celtic and Irish sea, seal management unit, which encompasses all these SACs (NRW written representation, dated 9th July pgs. 20/21). Grey seal movements tend to occur on two distinct scales, long distance travel (up to 2100 km) and local repeated trips to discrete offshore areas (88 % of trips), most seals tend to forage within 145 km from their haul-out sites (Thompson *et al*, 1996).

4.28 Grey seal's extensive travel means that impacts in combination with projects listed in Table 3, on these feature need to be carefully considered. In particular NRW considered that there may also be residual effects on grey seals which could have in-combination effects with offshore wind farms (Burbo Bank) leading to temporary reduced foraging habitat and likely effects on the favourable conservation status of seals. Combined with increased risk of collision from this development and tidal turbine arrays (Skerries, S^{t} David's Head and others in the future), this may lead to adverse effects on seal features of these SACs.

4.29 The Applicant highlighted that the numbers of grey seals found within Swansea Bay is small. Appendix 10.1 of the Applicant's ES (volume 3) reports that surveys and interviews indicate that Swansea Bay may be utilised only very occasionally by a few individual seals. However they considered a LSE for this feature within their updated HRA from the possible cumulative effects of noise and suspended sediment during construction, injury/mortality during operation and potential temporary loss of foraging habitat to grey seals. In particular they identified that impacts on this feature needed to be assessed in combination with the following projects:

- Maintenance (navigational) dredging along the Swansea (Tawe), Neath and Port
- Talbot Channels and at Monkstone cruising and sailing club and Swansea Marina;
- Tidal Energy Ltd DeltaStream Demonstrator Installation, Ramsey Sound, Pembrokeshire;
- Tidal Energy Ltd DeltaStream Demonstration Array, St David's Head, Pembrokeshire;
- Burbo Bank Extension, offshore wind farm, Liverpool Bay;
- Rhiannon Offshore wind farm, Liverpool Bay.

4.30 **The SoS agrees with the RIES and NRW that a LSE on the grey seal feature of Cardigan Bay SAC, Lundy SAC, Pembrokeshire Marine SAC and Pen Lyn a'r Sarnau SAC cannot be ruled out due to changes in suspended sediments during construction, loss of foraging habitat and injury or mortality during operation of the Project.**

River Wye/ River Usk and Severn Estuary SAC / Ramsar

4.31 Three sites were assessed and considered together for their migratory fish and eel qualifying features, the River Severn SAC and Ramsar, River Usk SAC, and River Wye SAC.

4.32 **River Wye SAC** rises on Plynlimon in the Cambrian Mountains and flows in a generally south-easterly direction to enter the Severn Estuary at Chepstow[8]. The Wye provides exceptionally good habitat for migratory and resident fish species, including twaite shad *(Alosa fallax*) and allis shad (*Alosa alosa)*, sea lamprey *(Petromyzon marinus),* river lamprey *(Lampetra fluviatilis)* and brook lamprey (*Lampetra planeri*), Atlantic salmon (*Salmo salar)* and bullhead (*Cottus gobio*). Other species features of the SAC are the native, and rare, white-clawed crayfish and the European otter which breeds along its sheltered banks and hunts for fish in the river and its tributaries. The vegetation in the upland reaches is dominated by mosses and liverworts. The vegetation of the lower river is a European feature, with various water crowfoots, lesser water-parsnip and curled pondweed.

4.33 **River Usk SAC** rises in the Black Mountain range in the west of the Brecon Beacons National Park and flows east and then south, to enter the Severn Estuary at Newport[9]. Of key European importance is the river's migratory and resident fish species, including twaite *(Alosa fallax)* and allis shad, River lamprey *(Lampetra fluviatilis),* Sea lamprey *(Petromyzon marinus),* brook lamprey (*Lampetra planeri*), Atlantic salmon (*Salmo salar)* and bullhead (*Cottus gobio*). Other species features of the SAC are the water crowfoot beds and the European otter which breeds along its sheltered banks and hunts for fish in the river and its tributaries.

4.34 **Severn Estuary SAC/ Ramsar** designation includes an overarching "estuaries" feature within which subtidal sandbanks, intertidal mudflats and sandflats, Altlantic salt meadows and reefs (of *Sabellaria alveolata*) and three species of migratory fish (river lamprey *(Lampetra fluviatilis),* sea lamprey *(Petromyzon marinus),* twaite shad *(Alosa fallax))* are defined as both features in their own right and as sub-features of the estuary feature [10]. In addition hard substrate habitats including eel grass beds, the estuary-wide assemblage of fish species and the assemblage of waterfowl species are identified as notable estuarine assemblages which are an intrinsic part of the estuary ecosystem – these are therefore covered by the "estuaries" feature.

4.35 Spawning populations of Atlantic salmon, sea trout, eel and river lamprey are regularly recorded within Swansea Bay, associated with connected water bodies (River Tawe and the River Neath). Sea lamprey and twaite shad are also sporadically recorded within the Bay (Applicant's updated HRA). The Bristol Channel itself is used as a transit route to the upper Severn Estuary and its tributaries by seven different fish species that migrate between sea and freshwater, of which six are anadromous (i.e. they spawn in freshwater: Atlantic salmon, allis shad, twaite shad, sea lamprey, river lamprey) and one, common eel, is catadromous (spawns in sea water).

4.36 As these fish pass Swansea Bay there is therefore the potential for a LSE on the migratory fish feature on their way to the River Wye/ Usk and Severn Estuary SAC/ Ramsar. These fish could be affected by noise/light disturbance and increased sedimentation during construction and operation, and entrainment and/or injury in the turbines during operation (Applicant's updated HRA).

[8] *http://www.ccgc.gov.uk/landscape--wildlife/protecting-our-landscape/special-sites-project/river-to-usk-sac-list/river-wye-sac.aspx*
[9] *http://www.ccgc.gov.uk/landscape--wildlife/protecting-our-landscape/special-sites-project/river-to-usk-sac-list/river-usk-sac.aspx*
[10] *http://www.severnestuary.net/asera/docs/Regulation%2033%20Advice.pdf*

4.37 The Applicant identified projects in-combination with the Project which are likely to result in an increase in suspended sediments and sediment deposition. This could impact on migratory fish. These projects include:

- Porthcawl regeneration scheme, specifically the Porthcawl Marina Project;
- maintenance (navigational) dredging along the Swansea (Tawe), Neath and Port Talbot Channels; and
- maintenance dredging by the Monkstone cruising and sailing club and Swansea Marina.

4.38 **The SoS agrees with the Applicant, RIES and NRW that a LSE cannot be ruled out on the migratory fish and eel features of these sites due noise/light disturbance, a potential increase in sedimentation during construction and operation, and entrainment and/or injury in the turbines during operation of the Project.**

Bristol Channel Approaches recommended dSAC

4.39 After the close of the examination, NRW published a map and list of sites that have been recommended as draft (d)SACs. This included a site in the Outer Bristol Channel - Bristol Channel Approaches and others off the Welsh coast. These sites have been recommended as there is evidence that they support qualifying populations of **Harbour porpoise** (*Phocoena phocoena*). The site is still at the early stages of consideration for possible future designation with approvals and formal consultation to follow. However, the SoS would not wish to take a decision on the Project, without first satisfying herself that it would not damage the possibility of a future cSAC.

4.40 A report by Evans and Prior (2012) describes the importance of the Bristol Channel area for harbour porpoise. A further report by the Whale and Dolphin Conservation (2013) also discusses the importance of the Outer Bristol Channel to north-west Cornwall recommending this area as an 'area of search' to form part of a wider Marine Protected Area network (Applicant's shadow HRA cetaceans and pinnipeds).

4.41 The Applicant's shadow HRA identified a LSE to cetaceans and pinnipeds from construction and operation of the Project. Piling, dredging and construction activity of the Project has the potential to cause disturbance/ displacement/ mortality/ injury through underwater noise and vibration through piling, visual disturbance and increased collision risk with construction vessels. Operation of the project could impact on porpoise through a reduction in foraging habitat, as the lagoon walls will isolate a section of Swansea Bay. The turbines could also increase noise and vibrations; they could also cause injury or mortality as a result of entrainment. The Applicant also considered that the Project could also cause a barrier to porpoise movement or generate an electromagnetic field.

4.42 NRW highlighted during the examination (16th September 2014) that there was at that time no proposed or existing European site with harbour porpoise as a feature for which the Project could impact. It therefore advised that there was no requirement for an HRA to consider this species

and the RIES agreed. However, given developments since the close of the Examination in identifying new sites, the SoS has decided to take a more precautionary approach.

4.43 **The SoS considers that there is an LSE on harbour porpoise, a qualifying feature of the recommended Bristol Channel Approaches dSAC and other marine sites off the Welsh coast during both the construction and the operation of the project due to dredging, piling, noise, vibration and loss of foraging habitat. She will consider this further in the appropriate assessment section of this report.**

Scope of in combination assessment

4.44 Under the Habitats Regulations, the SoS is obliged to consider whether other plans or projects in combination with the Project might affect European sites. In this case there are a number of other plans and projects which could potentially affect some of the same European sites. These include a number of planned and existing developments within the vicinity of the Project (see Table 3).

4.45 The Applicant found that the main in combination impacts from the Project and other plans or projects are cumulative changes in suspended sediments. In particular existing navigational dredging of the River Tawe, River Neath, Port Talbot and local marinas. The Porthcawl regeneration scheme including the marine project could also add suspended sediments. These projects have the potential to impact on migratory fish, coastal processes, intertidal and subtidal ecology.

4.46 Projects which have an impact on suspended/ deposited sediments and have an increase in noise, directly or indirectly could affect the behaviour and foraging habitats of grey seals. The projects listed within Table 3 and in particular the tidal energy installations at Ramsay Sound and Skerries Tidal Array at St David's Head in Pembrokeshire were identified by the Applicant and NRW as having the potential to contribute to the cumulative effects on grey seals once the Project is operational (updated HRA). NRW also believed that the Burbo Bank and Rhiannon offshore wind farms had the potential to temporarily reduce foraging habitat for grey seals (RIES). Grey seal is a feature of Cardigan Bay SAC, Pembrokeshire Marine SAC and Pen Llyn a'r Sarnau SAC.

4.47 Only Swansea University Bay Campus through disturbance during construction and operation of was found by the Applicant to have the potential to affect the birds of the Burry Inlet SPA.

Table 3 Plans and projects included within the Applicant's in combination impacts assessment. (Source: table 7.1 Applicant's updated HRA).

Project and location	Current status	Further assessment required
Swansea University Bay Campus, adjacent to Crymlyn Burrows.	Construction Feb 2013 – Sept 2015.	Adjacent to Project, potential cumulative effect as a result of disturbance to SPA species throughout construction and operation and increases in air pollution adversely affecting Crymlyn Bog SAC
St Modwens land development - east of Swansea Docks, to west of Neath estuary.	Remediation of land, and potential future developments – no details available.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Mumbles pier, foreshore and coastal strip redevelopment.	Completed by the end of 2013.	Non-concurrent with Project therefore no cumulative effect anticipated.
Construction of new RNLI Lifeboat Station, Mumbles.	Expected completion 2014.	Construction will be completed prior to the Lagoon construction. No impact pathway has been identified with European sites during operation of the Pier, therefore no cumulative effects anticipated.
SA1 development, Swansea.	Development currently taking place, completion date unknown.	Cumulative impacts identified through increase in traffic and air pollution potentially affecting Crymlyn Bog.
Construction of the southern access road to Coed Darcy Urban Village, crossing nearby Crymlyn Bog.	Yet to commence.	Cumulative impacts identified through increase in traffic and air pollution potentially affecting Crymlyn Bog.
Swansea Boulevard project – work between Princess Way and The Strand, and the River Tawe bridges and The Strand.	Phase 1 to be complete in November 2013. Phase 2 to start 2014.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Wind turbine – on Welsh water site on Fabian Way.	Application – Unsuccessful 25/10/2013.	Not considered.
5 wind turbines – at Mynydd Marchywel between Rhos and Cilfrew Neath.	Submitted Jan 2012. Consultation finished Jan 2013. Still in planning.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
16 wind turbines – at Mynydd Y Gwair, Swansea	Approved – unknown construction timetable	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Five wind turbines – at Mynydd Marchywel between Rhos and Cilfrew Neath.	submitted Jan 2012. Consultation finished Jan 2013. Still in planning.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Sixteen wind turbines – at Mynydd Y Gwair, Swansea.	Approved – unknown construction timetable.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Five wind turbines – on land at Mynydd Brombil Farm, Margam Port Talbot.	Submitted June 2012, still in planning. Consultation finishes April 2013.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Atlantic Array Wind Farm – off North Devon Coast approx. 35km distant.	DCO application submitted but withdrawn in November 2013.	Not considered.
Seventy six turbine Pen y Cymoedd windfarm near Neath.	Planning approved – construction 2014.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Llynfi Afan Renewable Energy Park -15 turbine windfarm – on land 500m southwest of Cynnonville Port Talbot.	Planning permission refused. Application was allowed on appeal on 27/08/2013.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.

Mynydd y Betws- 15 turbine windfarm located on land to the east of Ammanford in Carmarthenshire.	Granted planning consent 2009. Started operating April 2013.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Mynydd y Gwrhyd - windfarm in the Upper Amman and Swansea valleys.	Approved on appeal 07/05/2009.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Newlands Farm, single wind turbine- Margam.	Application submitted January 2013.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Swansea Port single wind turbine.	Operational.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Newlands Farm, single wind turbine- Margam.	Application submitted January 2013.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Kenfig Industrial Estate single wind turbine.	Application submitted. Expected decision by Feb 2014.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Port Talbot Harbour redevelopment	Potential future activities/ development. Status unknown.	No information currently available and therefore a cumulative assessment cannot be undertaken at this stage.
Upgrading of the existing coastal defence of Aberavon West Promenade, Sandfields, Port Talbot.	Completed August 2013.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Porthcawl regeneration scheme - includes Porthcawl Marina project and 19th century lighthouse restoration.	Approved by BCBC – timescale unknown.	During both construction and operation of the proposed Lagoon, sediments will be disposed at the Swansea (Outer) licensed deposit ground. Potential exists for cumulative effects on migratory fish should dredging/disposal take place at the same time as the dredging of the Marina. Cumulative impacts on Kenfig SAC as a result of effects on sediment transport from maintenance dredging disposal also require consideration.
Tata Steel works - Internal power generation enhancement for Port Talbot steel works installation of two new boilers and two new turbines housed in new power station building.	Application expected to be submitted 2014.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Underground coal gasification under Swansea Bay.	Licence potentially to be extended.	No further information available. Cumulative assessment cannot be undertaken at this stage.
Underground coal gasification under Llanelli.	Conditional Licence issued.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Maintenance (navigational) dredging along the Swansea (Tawe), Neath and Port Talbot Channels.	On-going.	During the construction phase of the project, there is potential for interaction between sediment plumes arising from the capital dredging and construction works for the Lagoon seawalls with maintenance dredging of the Swansea (Tawe), Neath and Port Talbot approach channels. There may also be the potential for sediment plume interaction at the Swansea (Outer) licensed disposal ground during the construction and operation

		periods of the project (maintenance dredging) with disposals by the Ports of Swansea and Port Talbot. These effects could adversely impact on the passage of migratory fish and the behaviour of grey seals. Cumulative impacts on Kenfig SAC as a result of effects on sediment transport from maintenance dredging disposal also require consideration.
Marine dredging- Monkston cruising and sailing club and Swansea Marina.	On-going maintenance as required.	During the construction and operational phase of the Project, there is potential for interaction between sediment plumes arising from the capital dredging/construction activities with maintenance dredging of the Marinas, should the activities occur at the same time. These effects could adversely impact on the passage of migratory fish and the behaviour of grey seals. Cumulative impacts on Kenfig SAC as a result of effects on sediment transport from maintenance dredging disposal also require consideration.
Mumbles Oyster project: Plan to put 10,000 oysters on seabed off the village of Oystermouth.	Permission granted September 2013.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Severn Barrage.	Not within foreseeable future.	No cumulative assessment undertaken.
Swansea Barrage.	Operational.	Included with main Fisheries assessment, Chapter 9 of ES.
Cardiff Barrage.	Operational.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Baglan Power station.	Operational.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Prenergy Biomass Power Station, Port Talbot - 350MW wood chip fuelled thermal generating station.	Granted condition approval by BERR on the 20 November 2007. While large scale construction has not been begun, the project has been implemented and as such the planning permission remains extant	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Abernedd Power Station was granted conditional approval by DECC on the 23 February 2011 for construction of a 870MW gas fired combined cycle gas turbine power plant.	No lawful start has yet been made to this development.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Nobel Banks aggregate extraction site.	On-going.	No impact pathways with European sites identified, therefore no cumulative effects anticipated.
Ro Ro Ferry – Swansea Port.	Not operational since April 2012. Currently no plans for the recommencement.	Ferry not anticipated to recommence in the foreseeable future. No cumulative assessment undertaken.
The Swansea Bay (Thomas	Ongoing	No impact pathways with European sites

Shellfish Limited) Mussel Fishery Order 2012.		identified, therefore no cumulative effects anticipated.
Rhiannon Offshore Windfarm.	Pre-application stage.	In response to NRW representations (11th April 2014 Section 8 para V) this project has been included in the in-combination assessment due to the potential effects of reduced foraging habitat on the grey seal population of the SACs of south-west England and Wales. The Project is approximately 500km from Rhiannon wind farm by sea.
Burbo Bank Offshore Windfarm extension.	Consent secured April 2014. Installation 2016. .	In response to NRW representations (11th April 2014 Section 8 para V) this project has been included in the in combination assessment due to the potential effects of reduced foraging habitat on the grey seal population of the SACs of south-west England and Wales. The Project is approximately 550km from Burbo Bank wind farm by sea.
Tidal Energy Ltd Deltastream Installation, Ramsey Sound, Pembrokeshire.	Consent secured. Installation 2014	This development is located approximately 125km from the Project and it therefore is considered to be in the range of potential movement of grey seal associated with Pembrokeshire Marine SAC, Cardigan Bay SAC, Pen Llyn a'r Sarnau SAC and Lundy SAC. The potential for increased collision risk during the operation of the turbines cannot be screened out
Skerries Tidal Stream Array.	Consent secured. Installation 2014.	In response to NRW representations (11th April 2014 Section 8 para V) this project has been included in the cumulative impact assessment due to the potential effects of increased risk of collision on the grey seal population of the SACs of south-west England and Wales.
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	An EIA has not yet been completed; however construction is planned to commence in 2017 following the decommissioning of the Ramsey Sound installation.	This development is located approximately 125km from the Project and it therefore is considered to be in the range of potential movement of grey seal associated with Pembrokeshire Marine SAC, Cardigan Bay SAC, Pen Llyn a'r Sarnau and Lundy SAC. The potential for increased collision risk during the operation of the turbines cannot be screened out at this stage.

Transboundary

4.48 The SoS recognises that some species that may be affected by the Project are highly mobile and as such the Project has potential to affect designated sites in other countries. Belgium, Ireland and the Netherlands were invited by the ExA to participate in the examination. The only response received was from the Irish Government after the Examination closed. The response did not indicate that there was likely to be a significant effect on the environment in Ireland. The Applicant did not identify potential impacts on European sites located in other EEA states and the RIES only addressed UK European sites. The SoS has had regard for potential transboundary impacts within this HRA in view of the DECC Guidelines on the assessment of transboundary impacts of

energy developments on Natura 2000 sites outside the UK but has not identified any cross boundary sites that could be affected by the Project.

Conclusion

4.49 **The SoS considers that sufficient information has been provided to inform a robust assessment in line with her duties under the Habitats Regulations. The SoS is unable to exclude LSEs from the 10 sites and 1 recommended draft site identified in *Table 2* when the impacts of the Project are considered in combination with other plans and projects. This is as a result mainly from suspended/ deposited sediments, changing costal processes, disturbance and mortality, to features including coastal birds, fish, grey seals, harbour porpoise, dune systems with extensive areas of fixed dune vegetation and semi-fixed dune grassland and intertidal and subtidal benthic ecology. This is also the view of the ExA and NRW (the only departure is on the SoS's decision to include the recommended Bristol Channel Approaches dSAC and other Welsh marine draft sites for further consideration).**

Appropriate Assessment

Test for Adverse Effect on Site Integrity

5.0 The requirement to undertake an AA is triggered when a competent authority, in this case the SoS, determines that a plan or project is likely to have a significant effect on a European site either alone or in combination with other plans or projects. Guidance issued by the European Commission states that the purpose of an AA is to determine whether adverse effects on the integrity of the site can be ruled out as a result of the plan or project, either alone or in combination with other plans and projects, in view of the site's conservation objectives (European Commission, 2000).

5.1 The purpose of this AA is to determine whether or not adverse effects on the integrity of those sites and features during the LSE test can be ruled out as a result of the Project alone or in combination with other plans and projects in view of the site's conservation objectives and using the best scientific evidence available.

5.2 If the competent authority cannot ascertain the absence of an adverse effect on site integrity within reasonable scientific doubt, then under the Habitats Regulations, alternative solutions should be sought. In the absence of an acceptable alternative, the project can proceed only if there are imperative reasons of overriding public interest (IROPI) and suitable compensation measures identified. Considerations of IROPI and compensation are beyond the scope of an AA.

Conservation Objectives

5.3 Guidance from the European Commission indicates that disturbance to a species or deterioration of a European site must be considered in relation to the integrity of that site and its conservation objectives (European Commission, 2000). Section 4.6.3 of that guidance defines site integrity 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.*

5.4 Conservation objectives outline the desired state for a European site, in terms of the interest features for which it has been designated. If these interest features are being managed in a way which maintains their nature conservation value, they are assessed as being in a 'favourable condition'. An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation (English Nature, 1997).

5.5 There are no set thresholds at which impacts on site integrity are considered to be adverse. This is a matter for interpretation on a site-by-site basis, depending on the designated feature and nature, scale and significance of the impact. Conservation objectives have been used by the SoS to consider whether the Project has the potential for having an adverse effect on a site's integrity, either alone or in combination. The potential for the Project to have an adverse effect is considered for each site in turn.

Kenfig SAC

5.6 The site supports a largely intact dune system with extensive areas of fixed dune vegetation and semi-fixed dune grassland (JNCC, no date). It supports one of the largest series of species rich dune slacks in Wales. The calcareous dune slacks are also amongst the most species-rich in the UK. Communities are dominated by a variety of mosses and rare plants e.g. Fen orchid (*Liparis loeselii*). Other features within this site do not have a likely significant effect from the Project and are not considered at this stage of the AA.

Table 4 Conservation objectives for Kenfig SAC (CCW, 2008)

Conservation Objectives	The vision for Features 1 and 2: humid dune slacks and dune slacks with *Salix repens* ssp *argentea* are for them to be in a favourable conservation status, where all of the following conditions are satisfied: • *Dunes with Salix repens and humid dune slacks will occur as part of the dune system, their location will be determined by natural processes and appropriate grazing management;* • *A range of successional stages will be found in both features;* • *Factors affecting the features will be under control.* The vision for Feature 3: fixed dune with herbaceous vegetation is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • *Fixed dunes with herbaceous vegetation (grey dunes) will occur where older, shifting dunes become more stabilised and in early successional stages become colonised by lichens and other species indicative of the transition from less mobile habitat;* • *The habitat will encompass a range of successional stages throughout the area, determined by patterns of natural factors and grazing;* • *Grey dunes will comprise a significant part of the dune system but will increase and decrease in extent and location as natural processes determine the landscape of the dune systems;* • *All factors are under management control.* The vision for Feature 6: Petalwort, is that it will continue to be found at its current locations within each of the two component SSSIs and for it to be in a favourable conservation status, where all of the following conditions are satisfied: • *The species will be found where conditions are suitable in sufficient numbers to form a viable and sustainable population;* • *The population will vary from year to year depending on conditions, especially in drier years but the long term population will remain steady and sustainable;* • *Suitable dune slacks will have patches of bare ground that is being colonised by jelly lichens (Collema spp.) and Barbula mosses;* • *The factors affecting the feature are under control.* The vision for Feature 7: Fen Orchid, is that it will be in a favourable conservation status, where all of the following conditions are satisfied: • *Sufficient suitable habitat is present to support the populations;* • *The factors affecting the feature are under control.*

Physical Damage

5.7 The proposals for disposal of dredged material could impact on the features of this site (RIES). The main concern highlighted by NRW was whether long term dredging would lead to a gradual increase in the area and thickness of mud and muddy sand to the west of Kenfig SAC. NRW were concerned that this could lead to a reduction or stopping of sand movement between the outer part of Swansea Bay and the Kenfig shoreline thereby contributing to increased rates of beach lowering and loss of dunes and dune processes. NRW were concerned that the evidence

provided still left some uncertainty of the impact on the dune features and species dependant on the dune features, from long-term dredging disposal at the outer Swansea disposal ground (ExA report).

5.8 The ExA's report states that NRW and the Applicant have agreed to manage this risk through an early warning monitoring plan. The aim of this plan would be to identify changes to the shoreline prior to them causing an adverse effect on the feature of the SAC and then to take appropriate remedial action. This agreement had not been reach at the time of consultation on the RIES. At that point, NRW considered that there was insufficient information provided by the Applicant to allow a conclusion that the implications of long-term dredge spoil disposal from the proposed installation would not adversely affect the dune features of the Kenfig SAC (i.e. undermine site feature conservation objectives).

Dredging

5.9 During the examination, NRW's concerns about the sediment disposal site within Swansea Outer licenced deposit ground were:

- That the deposition of dredged material would hinder sand from reaching the dune by natural coastal processes and this would affect the stability of the designated dune features.
- That the dredged material could cause significant accretion on Kenfig Sands.

5.10 The Applicant predicted no adverse effects on site integrity. Their evidence for this conclusion was based on the premise that the maintenance dredging would only be necessary from about 10 - 15 years post construction. The Applicant in their updated HRA predicted that accretion within the tidal lagoon would lead to an annual volume of 570,000 – 920,000m^3 of sediment. In order for the lagoon to maintain efficiency, approximately 1 million tonnes would need to be removed every two years to allow the Project to operate efficiently. This, they state, falls within the historic capacity of the Outer Swansea disposal grounds as utilised between 1986 and 2010 (Applicants updated report to inform HRA). They point to the fact that this is a highly dispersive location. They report that there is little or no change observed to the surveyed depths, despite the disposal of an average of 2.6 million wet tonnes of fine sediment each year. Therefore they did not find evidence that the disposal ground would hinder the transport of sand to the beaches along the eastern shoreline of Swansea Bay (Applicants updated report to inform HRA). The Applicant proposes a monitoring and mitigation programme within requirement 34, which would identify a departure from the predicted change to the Kenfig Shoreline as a result of the deposition of maintenance dredge arisings. Mitigation may include but not be limited to the use of an alternate disposal ground in parallel with or in substitution for the use of Swansea Outer disposal ground.

5.11 NRW's concern takes into account that the Project could operate for over 100 years. They felt that there is not sufficient information to rule out adverse effect from disposal of dredging for this length of time. NRW however did accept that the principle that an early warning system would allow the potential for adverse effect caused by the Project to be avoided.

5.12 The Applicant reports in their updated HRA that modelling of the sediment disposal from the maintenance dredge will be controlled by the rectilinear flows found within the Central Bristol

Channel. The total extent of the sediment plume is predicted to be approximately 12km to the west and 20km to the east (just beyond Porthcawl). However, due to the tidal characteristics of the Bristol Channel, they predict very limited exchange of suspended sediments from the deposit ground to Swansea Bay, even when disposal activity takes place immediately prior to the flood tide. Furthermore, the assessment found that any predicted increase in suspended sediment concentrations would mainly be constrained to the deeper central region of the bay.

5.13 The Applicant found a number of potential impacts including a sediment plume approaching Kenfig SAC as a result of disposal operations and predicted changes in suspended sediment concentrations adjacent to the SAC site. However their assessment considered that these would be short-lived and within the range of background variation. The Applicant concluded that there would be no long-term sedimentation across the Kenfig Sands. Any sediment deposited over slack water is shown to be remobilised on the subsequent tide and further dispersed. They support this finding due to the fact that there has been no distinguishable accretion of mud across Kenfig Sands between 1986 and 2010, even though dredging and disposal activities have been on-going. They reported that there was no observed accretion of mud across either Kenfig or Margam Sands during 1996, when the greatest volume of sediment (9.1 million wet tonnes) was disposed at the licenced deposit ground as a result of the Port Talbot capital dredge.

5.14 The licenced deposit ground was selected as a highly dispersive site with little to no change observed to the surveyed depths, despite the disposal of an average of 2.6 million wet tonnes of fine material each year.

5.15 In paragraph 3.2 of Annex 1 in NRW's Deadline VI submission dated 25 November 2014 NRW confirmed that agreement had been reached with the Applicant as to the wording of a suitable requirement concerning the disposal of dredged arisings and protection of Kenfig SAC. NRW reiterated this in response to the DECC consultation on 27 April 2015. The agreed wording has been incorporated as Requirement 34 of the DCO.

5.16 The SoS considers that the LSE on Kenfig SAC from dredging disposal from the Project will be adequately mitigated by Requirement 34. This will prevent any potential impacts on Kenfig SAC from dredge disposal causing an adverse effect. This view was supported at the end of the examination by the Applicant, the ExA and NRW. **The SoS is therefore satisfied that the Project alone will not have an adverse effect upon the integrity of the sand dune features of Kenfig SAC.**

In combination

5.17 The Applicant assessed the potential effect of the dredging needed for the Project in combination with other ongoing dredging campaigns, including maintenance dredging along the Tawe, Neath, and Port Talbot channels, and dredging at Monkstone Cruising and Sailing Club, Swansea Marina and the Porthcawl Regeneration Scheme (Applicants updated report to inform HRA, section 13.4.0.1). The Applicant concluded that the potential impact of the Project in combination with other dredging campaigns would not have an adverse effect or likely significant effect on Kenfig SAC for the same reasons as the project on its own.

5.18 NRW stated in their response on the 7th October [Rep 747] that the inclusion of an early warning monitoring and mitigation scheme, secured through Requirement 34 within the DCO, would provide a mechanism to ensure no adverse effects on site integrity (RIES). This would protect Kenfig SAC from any potential impacts coming from the Project alone or in combination with other dredging operations.

Conclusion

5.19 NRW and the ExA confirm that they could conclude no adverse effects on integrity of Kenfig SAC for the Project alone and in combination with other projects and plans due to the requirement for monitoring of impact and mitigation, which would be managed through Requirement 34 of the DCO. **The SoS is therefore satisfied that the Project (alone and when considered in combination with all relevant plans and projects) will not have an adverse effect upon the integrity of the Kenfig SAC.**

Burry Inlet SPA and Ramsar

5.20 Burry Inlet is a large estuarine complex located between the Gower Peninsula and Llanelli in South Wales (Applicant's updated HRA). It occupies an area of 6,628ha and includes extensive areas of intertidal sandbanks and mudflats, together with large sand dune systems at the mouth of the estuary. The site contains the largest continuous area of saltmarsh in Wales (approximately 2,200 ha).

5.21 The Burry Inlet regularly supports large numbers of overwintering wildfowl and waders that feed in the saltmarshes and on the intertidal areas, and it is for these species the SPA and Ramsar are designated.

Table 5 *Conservation objectives for Burry Inlet SPA (CCW, 2009) extracted from the Applicant's HRA.*

Conservation Objectives	*To achieve favourable conservation status all of 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 favourable conservation status*. *i. The numbers of all SPA bird species are stable or increasing.* *ii. The abundance and distribution of suitable prey are sufficient and appropriate to support the numbers of all SPA bird species.* *iii. All SPA birds are allowed to inhabit their feeding grounds and resting areas with minimum disturbance, and are allowed to move unhindered between them.* *iv. All states of the Conservation Objectives for the supporting habitats and species, subject to natural processes, are fulfilled and maintained in the long-term.* *v. Supporting habitats for bird species of the Burry Inlet SPA include: Estuaries, mudflats and sandflats not covered by seawater at low tide, Atlantic salt meadows, Salicornia and other annuals colonising mud and sand.* *vi. The management and control of activities or operations likely to be of significant effect to the oystercatchers,*

5.22 Burry Inlet SPA/Ramsar is situated approximately 13km (overland) to the north-west of the Project (Applicant's updated HRA). Therefore, the Applicant felt that there would be no direct or indirect disturbance of birds whilst using the SPA habitats during construction, operation or decommissioning.

5.23 NRW however raised concerns that, as Swansea Bay supports habitats that are considered to be functionally linked to the habitats of the SPA, some birds which are features of the SPA may also use the habitats of Swansea Bay.

5.24 The Royal Society for the Protection of Birds (RSPB) stated in their Comments on the Applicant's Written Representations and the Responses to the Panel's 1st Written Questions on 5 August [REP 650] that they recognised that there is significant doubt that many of the birds using Swansea Bay are directly linked to Burry Inlet SPA and Ramsar. However they did raise a number of other points including the need to assess sanderling (*Calidris alba)* and ringed plover (*Charadrius hiaticula)* which the RSPB indicate are part of the assemblage of Burry Inlet SPA. The applicant screened out likely significant effects on the assemblage qualifying features of Burry Inlet SPA and Ramsar as the number of birds recorded in Swansea Bay that are species of the SPA and Ramsar assemblage was less than 10% of the assemblage population. The figure of 10% was stated to be applied by the applicant due to the distance between Swansea Bay and Burry Inlet SPA and Ramsar, approximately 13km.

5.25 The Applicant, during further assessment, screened in the following qualifying features for further assessment: oystercatcher (*Haematopus ostralegus)*, dunlin (*Calidris alpina alpina)*, curlew (*Numenius arquata)*, redshank (*Tringa totanus)*, shelduck (*Tadorna tadorna)* and teal (*Anas crecca)*. This was on the basis that peak numbers for each recorded during field surveys exceeded the 1% significance threshold of the SPA population.

5.26 The potential effects identified by the Applicant and agreed with NRW included displacement and disturbance throughout construction and operation, and effects on foraging resources as a result of changes in coastal processes.

5.27 A number of mitigation measures were identified during further assessment. The key mitigation measure identified is to undertake the main offshore seawall construction during April to October to ensure it is outside the overwintering period. This will avoid indirect displacement/disturbance effects on SPA birds using parts of Swansea Bay, in particular on the eastern side of the Bay as the works are considered to occur within disturbance distances recorded for birds. The Construction Environmental Management Plan (CEMP) includes two points relating to phasing and timing of the seawall construction works. The CEMP is secured through requirement 5 of the DCO.

5.28 The applicant has also proposed that dredging works will primarily be undertaken outside of the overwintering period, thereby avoiding indirect effects on prey species utilised by birds during construction.

5.29 In the Applicant's updated report to inform the HRA, it is noted that additional mitigation has also been proposed to reduce the impacts on coastal birds during operation which should also benefit any SPA species during construction. This includes the provision of an artificial high tide roost within a quiet zone at the north-eastern end of the Lagoon to accommodate birds, and access restrictions along parts of the Lagoon seawall to minimise disturbance of intertidal foraging / roosting habitat adjacent to the Project.

5.30 These mitigation and enhancement measures are included in DCO requirement 28 and in the AEMP, CEMP, and the OEMP which are secured by requirements 5 and 6 of the DCO.

5.31 Following further assessment and the identified mitigation the applicant reached a conclusion of no adverse effects on site integrity of Burry Inlet SPA and Ramsar. This conclusion was not disputed during the examination by NRW.

5.32 NRW confirmed in their representation at Deadline III of 5 August 2014 that having reviewed the updated HRA-related documents provided by the applicant, they agreed that there would be no adverse effects on any European site, alone or in-combination, with the exception of Kenfig SAC.

5.33 In conclusion, following agreed mitigation the ExA and NRW have agreed that there will be no adverse effect on oystercatcher, dunlin, curlew, redshank, shelduck and teal of Burry Inlet SPA. **The SoS is therefore satisfied that the Project (alone and when considered in combination with all relevant plans and projects) will not have an adverse effect upon the integrity of Burry Inlet SAC and Ramsar with the mitigation as secured by Requirements 5, 6 and 28.**

River Severn SAC/ Ramsar, River Usk SAC, River Wye SAC

5.34 Three sites were assessed for their migratory fish and eel qualifying features, the River Severn SAC and Ramsar, River Usk SAC, and River Wye SAC.

River Severn SAC/Ramsar

5.35 The Severn Estuary is one of the most important British Estuaries for a number of species, twaite shad (*Alosa fallax)*, river lamprey (*Lampetra fluviatilis)* and sea lamprey (*Petromyzon marinus)* all of which are designated features of the Severn Estuary SAC.

5.36 With regards to the Ramsar designation, the Severn Estuary qualifies under Ramsar criterion 4 and 8, supporting animals at a critical stage in their lifecycle and as a feeding and nursery ground. The area of the Ramsar site is smaller than that of the SAC as it is restricted to terrestrial and intertidal areas (and excludes all subtidal areas). In addition to the species listed under the SAC designation, Atlantic Salmon (*Salmo salar)*, sea trout (*Salmo trutta*), allis shad (*Alosa alosa)* and European eel (*Anguilla anguilla*) are also listed as features of the Ramsar site.

5.37 The River Severn is a cross boundary site and so the views of Natural England are also relevant.

Table 6 Conservation objectives for sea lamprey of the Severn Estuary SAC (Natural England and CCW, 2009) extracted from the Applicant's HRA

Conservation Objectives	*The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:* • *The migratory passage of both adult and juvenile sea lamprey through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;* • *The size of the sea lamprey population in the Severn Estuary and the rivers which drain into it, is at least maintained as is at a level that is sustainable in the long term;* • *The abundance of prey species forming the sea lamprey's food resource within the estuary, is maintained;* • *Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above.*

Table 7 Conservation objectives for river lamprey of the Severn Estuary SAC (Natural England and CCW, 2009)

Conservation Objectives	*The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:* • *The migratory passage of both adult and juvenile river lamprey through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;* • *The size of the river lamprey population in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term;* • *The abundance of prey species forming the river lamprey's food resource within the estuary, is maintained.* • *Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above.*

Table 8 Conservation objectives for twaite shad of the Severn Estuary SAC (Natural England and CCW, 2009) extracted from the Applicant's HRA

Conservation Objectives	*The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:* • *The migratory passage of both adult and juvenile twaite shad through the Severn Estuary between the Bristol Channel and their spawning rivers is not obstructed or impeded by physical barriers, changes in flows or poor water quality;* • *The size of the twaite shad population within the Severn Estuary and the rivers draining into it is at least maintained and is at a level that is sustainable in the long term;* • *The abundance of prey species forming the twaite shad's food resource within the estuary, in particular at the salt wedge, is maintained;* • *Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above.* • *The size of the population is subject to non-anthropogenic factors relating to natural fluctuations of external factors such as food availability in the Bristol Channel and more widely breeding success in the River Severn and other rivers draining into the Severn Estuary.*

Table 9 Conservation objectives for the assemblage of migratory fish species of the Severn Estuary Ramsar Site (Natural England and CCW, 2008) extracted from the Applicant's HRA.

Conservation Objectives	*The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:* • *The migratory passage of both adults and juveniles of the assemblage of migratory fish species through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;* • *The size of the populations of the assemblage species in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term;* • *The abundance of prey species forming the principle food resources for the assemblage species within the estuary, is maintained;* • *Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above."(Natural England and CCW, 2008).*

River Usk SAC

5.38 The River Usk enters the Severn Estuary at Newport. It is one of only four sites in the UK where a breeding population of Twaite shad is known. Sea lamprey, brook lamprey, river lamprey, twaite

shad and atlantic salmon are all primary reasons for selection of the River Usk as a SAC. Allis shad is present as a qualifying feature but not a primary reason for site selection.

Table 10 Conservation objectives for the assemblage of migratory fish species of the River Usk (CCW, 2008) extracted from the Applicant's HRA.

Conservation Objectives	The conservation objectives for the migratory fish features are for them to be in a favourable conservation status, where all of the following conditions are satisfied: • *The conservation objective for the water course must be met;* • *The population of the feature in the SAC is stable or increasing over the long term;* • *The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future;* • *There is, and will probably continue to be, a sufficiently large habitat to maintain the features population in the SAC on a long-term basis.*

River Wye SAC

5.39 The River Wye forms one of the longest, near-natural rivers in England and Wales. The river and its tributaries form a large, linear ecosystem which provides an important corridor for wildlife, an essential migration route and a key breeding area for many internationally important species, including river and sea lamprey and Atlantic salmon.

5.40 Sea lamprey, brook lamprey, river lamprey, twaite shad and atlantic salmon are all primary reasons for selection of the River Wye as a SAC. Allis shad is present as a qualifying feature but not a primary reason for site selection.

5.41 The River Wye is also a cross boundary site and so the views of Natural England are also relevant.

Table 11 Conservation objectives for the assemblage of migratory fish species of the River Wye (CCW, 2008) extracted from the Applicant's HRA.

Conservation Objectives	The conservation objectives for the migratory fish features are for them to be in a favourable conservation status, where all of the following conditions are satisfied: • *The conservation objective for the water course must be met;* • *The population of the feature in the SAC is stable or increasing over the long term;* • *The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future;* • *There is, and will probably continue to be, a sufficiently large habitat to maintain the features population in the SAC on a long-term basis.*

Table 12 Conservation objectives for the assemblage of migratory fish species of the River Wye (Natural England, 2008) extracted from the Applicant's HRA.

Conservation Objectives	*Avoid the deterioration of the qualifying habitats and the habitats of qualifying species and the significant disturbance of those qualifying species, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving Favourable Conservation Status of each of the qualifying features.* *Subject to natural change to maintain or restore:* • *The extent and distribution of qualifying natural habitats and habitats of qualifying species;* • *The structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species;* • *The supporting processes on which qualifying natural habitats and habitats of qualifying species rely;*

	• *The populations of qualifying species;* • v. *The distribution of qualifying species within the site*.

5.42 A number of potential effects on migratory fish were identified including:

Construction Effects

- Mortality, injury, and behavioural effects due to piling, dredging and lagoon sea wall construction.
- Disturbance of sediments and disposal of sediment at the licensed deposit ground.
- Increases in Artificial light
- Habitat Modification

Operational Effects

- Entrainment and Injury in turbines
- Fragmentation of migratory routes due to the presence of the lagoon
- Behavioural disturbance from turbine operation
- Increased mortality from recreational fishing
- Increases in artificial light
- Behavioural effects as a result of electromagnetic fields from export cables

5.43 Mitigation measures for migratory fish have been included in the latest CEMP and AEMP and are as follows:

- A short period of piling during construction (10-15 days) which will predominantly comprise of vibro-piling in preference over impact piling. Where impact piling occurs, the Applicant states that this will be of short duration and a soft start procedure will be applied.
- The Applicant states in their updated report to inform HRA that during operation, fish that are hearing specialists would be deterred from the turbines through the implementation of Acoustic Fish Deterrents (AFDs). The DCO includes for a 'fish and shellfish mitigation strategy' as Requirement 27. Fish behavioural guidance devices were included in the Applicant's fish and shellfish mitigation strategy within earlier versions of the draft DCO. The Applicant proposed to only include for acoustic fish deterrents should STRIKER modelling of the selected turbines predict a level of mortality of 2% in relation to Sea Trout.
- Directional lighting and minimising light spill. A construction and security lighting scheme is included as Requirement 24 in the DCO. A permanent lighting scheme is included as Requirement 25.
- Reducing the release of suspended sediment into the water column during construction. The applicant has included measures for impacts on fish and shellfish as a result of suspended sediment and deposition within the CEMP.

5.44 The CEMP and AEMP are secured by Requirements 5 and 6 of the DCO.

5.45 NRW have not disputed the Applicant's conclusion of no adverse effects on the integrity of these four European Sites. However, in NRW's response of the 4 November they have disputed the Applicant's proposal to not install acoustic fish deterrents for the operational scheme, unless

monitoring of sea trout determines they are necessary. NRW recommend that the DCO include a requirement to ensure that no part of the authorised development shall commence until a written specification for the acoustic deterrent measures and their performance levels for fish has been submitted and approved in writing by the Local Planning Authority in consultation with NRW.

5.46 NRW have stated that the AFD operation should be optimised for the benefit of salmonids and clupeids and that no turbine operation shall commence until the AFD have been installed and shown through trials to be operating at the agreed performance levels. In addition they state that the AFD must be deployed for the lifetime of the turbine operation. The RIES noted that this matter was still to be agreed.

5.47 Natural England have not commented on the applicant's conclusions of no adverse effects on the integrity of the cross boundary sites of the River Wye SAC, Severn Estuary SAC and Severn Estuary Ramsar, in relation to potential effects on migratory fish.

5.48 NRW noted in their response on the 25 November [REP 907] that the evaluation of likely fish impact is based upon the application of highly efficient AFD mitigation measures. They state that in their view the installation of AFD prior to commencement is essential. The ExA recognised the concerns of NRW with regards to AFD and recommended that the DCO includes the installation of AFDs on the turbines in advance of the operation of the scheme, together with a robust monitoring programme of fish impacts. The SoS supports this view and has included Requirement 27 in the DCO to require the installation and assessment of effectiveness of AFD.

5.49 The SoS noted that requirement 27 as proposed contained only monitoring and did not refer to acceptable thresholds of impact and further action to be taken if those thresholds are exceeded. This is key to an adaptive management approach. Consequently the SoS has made an addition to the wording of requirement 27 to include "*agreement of acceptable thresholds of impact and further action to be taken if those thresholds are exceeded*". This addition corresponds with the request from NRW in their written response of the 4 November [REP 860] which was reiterated in their 25 November [REP 907] response.

5.50 The response from NRW of 25 November 2014 [REP 907] confirmed that having reviewed the updated HRA-related documents provided by the Applicant, they agreed that subject to appropriate mitigation secured by requirements there would be no adverse effects on any European site, alone or in-combination, with the exception of Kenfig SAC. The ExA accepted that NRW do not dispute the Applicant's conclusion of no adverse effect on site integrity for River Severn SAC and Ramsar, River Usk SAC, and River Wye SAC sites.

In combination

5.51 Other projects and activities in the Bristol Channel and Severn Estuary that have the potential to effect migratory fish associated with the River Usk, River Wye and River Severn SAC in combination with the project are those that are likely to result in an increase in suspended sediments and sediment deposition as follows:

i) Porthcawl regeneration scheme, specifically the Porthcawl Marine Project;

ii) Maintenance (navigational) dredging along the Swansea (Tawe), Neath and Port Talbot channels; and

iii) Maintenance dredging by Monkstone cruising and sailing club and Swansea Marina.

5.52 Following modelling the Applicant's Updated Report to inform HRA noted that should maintenance dredging and sediment disposal take place at the same time as the Project, predicted changes in suspended sediment concentrations (SSCs) are in the order of background variation (and relatively short-lived) and therefore there will be no adverse impact on the migratory movement of fish or their food source.

5.53 The Applicant has stated in their updated HRA that the number of migratory fish in Swansea Bay that are associated with European sites is low, however they have proposed a number of mitigation measures to minimise impacts on migratory fish during construction and operation.

5.54 NRW and the ExA confirmed that they could conclude no adverse effects on integrity of the River Severn SAC and Ramsar, River Usk SAC, and River Wye SAC for the Project alone and in combination with other projects and plans. This is on the basis of the installation of an AFD in advance of the operation of the Project and of ongoing and robust performance monitoring and mitigation. This is secured in Requirement 27. **The SoS is therefore satisfied that the Project (alone and when considered in combination with all relevant plans and projects) will not have an adverse effect upon the integrity of the River Severn SAC and Ramsar, River Usk SAC, and River Wye SAC**.

Cardigan Bay SAC, Lundy SAC, Pembrokeshire Marine SAC and Pen Llyn a'r Sarnau SAC (grey seal)

5.55 Grey seal is the only feature of all four sites where an LSE was identified. As grey seal can travel for an extensive distance during their whole life cycle, the assessment should consider any potential impacts on this feature in the context of all relevant sites within the SW England and Wales and the Celtic and Irish Sea seal management unit, which encompasses all these SACs. Seals observed around Swansea Bay are considered likely to be part of the Celtic and Irish Sea community, most likely to form part of the Lundy SAC, Pembrokeshire Marine SAC or Cardigan Bay SAC resident populations.

Cardigan Bay SAC

5.56 Cardigan Bay SAC is located in the southern part of Cardigan Bay off north Pembrokeshire. The site is over 100km across its westernmost extent from the Lleyn peninsular to St David's Head. Grey Seal are a qualifying feature of the SAC but not a primary reason for notification.

Table 13 Conservation objectives for Grey Seals for Cardigan Bay (CCW, 2009) extracted from the Applicant's HRA

Conservation Objectives	*The species features will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:* *i. The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements include: population size, structure, production, condition of the species within the site.*

	ii. As part of this objective it should be noted that for bottlenose dolphin and grey seal contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. *iii. Grey seal populations should not be reduced as a consequence of human activity.* *iv. The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.* *v. As part of this objective should be noted that for bottlenose dolphin and grey seal: their range within the SAC and adjacent interconnected areas is not constrained or hindered; there are appropriate and sufficient food resources within the SAC and beyond; the sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing.* *vi. The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.* *vii. As part of this objective it should be noted that: the abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; the management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term; Contamination of potential prey species should be below concentrations potentially harmful to their physiological health".*

Lundy Island SAC

5.57 Due to the variation in sheltered and exposed coasts and headlands, Lundy Island is exposed to a wide range of physical conditions. Lundy SAC has a granite and slate reef system which extends over 1km offshore, dropping steeply into deep water areas. The site is approximately 70km to the south west of the application site. There is a large variety of habitats and associated species on the reefs. Grey Seal are a qualifying feature of the SAC but not a primary reason for notification.

Table 14 Conservation objectives for Grey Seals for Lundy SAC (Natural England website) extracted from the Applicant's HRA

Conservation Objectives	The following conservation objectives are noted for the site: *i. Avoid significant disturbance to qualifying species;* *ii. Ensure integrity of the site is maintained;* *iii. Ensure site makes full contribution to achieving Favourable Conservation Status of each of the qualifying features;* Subject to natural change, the following objectives are to maintain or restore: *iv. The extent and distribution of qualifying natural habitats and habitats of qualifying species;* *v. The structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species;* *vi. The supporting processes on which qualifying natural habitats and habitats of qualifying species rely;* *vii. The populations of qualifying species;* *viii. The distribution of qualifying species within the site.*

Pembrokeshire Marine SAC

5.58 Pembrokeshire Marine SAC is located in south west Wales and has a number of important characteristics including a wide range of physical habitats, species diversity and the presence of rare and ecologically important habitats and species.

5.59 Pembrokeshire is representative of grey seal *Halichoerus grypus* colonies in the south-western part of the breeding range in the UK. It is the largest breeding colony on the west coast south of the Solway Firth, representing over 2% of annual UK pup production (JNCC, accessed 26/05/15). Grey seal are a primary reason for the selection of the site as a SAC.

Table 15 Conservation objectives for Grey Seals for Pembrokeshire Marine SAC (CCW, 2009) extracted from the Applicant's HRA

Conservation Objectives	The conservation objective for the grey seal feature of the Pembrokeshire Marine SAC is to maintain the feature in favourable condition, as defined below: *"The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:* *ix. The population size, and the ability of the grey seal population to determine and maintain its size are no more degraded or inhibited as a consequence of human action than at the time the site was classified a candidate SAC.* *x. Pup production is unsuppressed by sub-optimal physiological health caused by human action, and pup production, and processes determining it are no more degraded or suppressed as a consequence of human action than at the time the site was classified a candidate SAC.* *xi. Pup mortality as a consequence of human action is at or below levels existing at the time the site was classified a candidate SAC, and processes determining survival are no more degraded or suppressed as a consequence of human action than at the time the site was classified a candidate SAC.* *xii. The population structure is not selectively modified by human activity.* *xiii. The physiological health and reproductive capacity is no more degraded by human action than at the time the site was classified a candidate SAC* *xiv. Contaminant burdens derived from human activity remain below levels that may cause physiological damage, or immune or reproductive suppression.* *xv. the range, access to and use of natural habitat throughout the site necessary for any stage of the grey seal's biological cycle are no more restricted by human action than at the time the site was classified a candidate SAC".*

Pen Llyn a'r Sarnau SAC

5.60 The Pen Llyn a'r Sarnau SAC is located in north-west Wales (approximately 275km by sea from Swansea Bay) and includes areas of sea, coast and estuary that support a wide range of marine habitats and wildlife, some of which are unique in Wales.

5.61 Grey seals present within the SAC are thought to be part of a wider North Wales population. It is not known at present to what extent they form a discrete colony as part of the larger assembly of seals found in Pembrokeshire or whether they are part of a larger population. In 2002, grey seal numbers were tentatively estimated at 365 individuals within the SAC based on pup data and calculations. Grey Seal are a qualifying feature of the SAC but not a primary reason for notification.

Table 16 Conservation objectives for Grey Seals for Pen Llyn a'r Sarnau SAC (CCW, 2009) extracted from the Applicant's HRA

Conservation Objectives	The following conservation objectives have been taken from the Regulation 33 Advice for Pen Llyn a'r Sarnau SAC (CCW, 2009): ***Populations*** *The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements are population size, structure, production, and condition of the species within the site.* *As part of this objective it should be noted that :* *xvi. for grey seal contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression* *xvii. grey seal populations should not be reduced as a consequence of human activity.* ***Range*** *The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future. As part of this objective it should be noted that for grey seal:* *xviii. their range within the SAC and adjacent inter-connected areas is not constrained or hindered* *xix. There are appropriate and sufficient food resources within the SAC and beyond* *xx. The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing* ***Supporting Habitats and Species*** *The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.* *Important considerations include;* • *distribution,* • *extent,* • *structure,* • *function and quality of habitat,* • *prey availability and quality.* *As part of this objective it should be noted that;* *xxi. The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term.* *xxii. The management and control of activities or operations likely to adversely affect the species feature, is appropriate for maintaining it in favourable condition and is secure in the long term.* *xxiii. Contamination of potential prey species should be below concentrations potentially harmful to their physiological health.* *xxiv. Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour.*

5.62 A number of potential effects on grey seals were identified as follows:

i) Construction

a. Collision risk
b. Visual disturbance
c. Noise disturbance
d. Release of contaminants associated with the dispersion of suspended sediments
e. Changes in suspended sediment

ii) Operation

a. Changes to foraging habitats
b. Collision risk
c. Barrier to movement
d. Noise disturbance
e. Electromagnetic fields

iii) Cumulative Effects

a. Suspended sediments and noise
b. Operation of the turbines
c. Temporary loss of foraging habitat

5.63 The Applicant's Summary note on the distribution on grey seal [App 347] in Swansea Bay reports that dedicated surveys in relation to Swansea Bay are limited. A literature review identified that during land-based surveys a total of 21 seal sightings were observed. Three seals were observed during vessel surveys. Pre-construction monitoring for the Scarweather Sands Offshore windfarm recorded nine sightings of grey seal over a 24 month period between 2005 and 2007.In the absence of dedicated survey data of grey seal abundance and distribution in the inner Swansea Bay area, the Applicant conducted brief interviews with local sea "users" (e.g. fishermen) and coastal wildlife enthusiasts, bird observers and other marine mammal watchers. The survey found most frequent "users" of the area report having seen grey seals within the Bay area sometime within the last 36 months. However, the sightings are not common and typically consist of a single seal. None of the seven people interviewed had observed evidence of grey seal pupping anywhere within Swansea Bay. Based on the above, the Swansea Bay grey seal population has been assessed as very small, with occasional visits of single animals to the area who feed within the Bay, and sometimes the Tawe and Neath river mouths. There are no known haul-out locations or pupping beaches within the bay, leading to the conclusion that grey seal are assumed to occur relatively frequently in Swansea Bay but usually only in small numbers.

5.64 NRW's written representation submitted on 9 July 2014 stated that due to the relatively low number of grey seals in the vicinity of the Project, they considered it unlikely that it would adversely affect the integrity of Cardigan Bay SAC, Pembrokeshire Marine SAC and Pen Llyn a'r Sarnau SAC alone: however NRW could not agree to no adverse effects on the integrity of these sites due to insufficient information on in-combination projects.

5.65 Following the above representation from NRW, the Applicant carried forward the consideration of adverse effects on site integrity on the grey sea qualifying features of the above four sites in the Updated HRA report as a result of potential in-combination effects with the following projects:

Burbo Bank Wind Farm, Rhiannon Wind Farm and the Skerries Tidal Array. The applicant concluded in their Updated HRA report no adverse effects on all four European sites.

5.66 The Applicant proposed a number of mitigation measures in the submitted Environmental Statement (chapter 10) and their updated HRA report to minimise impacts on grey seals during construction and operation. Mitigation measures for grey seals have been included in the applicant's latest CEMP and AEMP. The CEMP and AEMP are secured by Requirements 5 and 6 of the DCO.

5.67 The mitigation measures include the following;

- As noise mitigation during construction the Applicant has proposed mitigation in their Updated report to inform HRA in the form of a short period of piling during construction (10 to 15 days), comprising predominantly of vibro-piling. Where impact piling occurs, the Applicant states that this will be of short duration and a soft-start piling methodology is proposed to be employed for all piling. The Applicant stated that they will adopt JNCC's 'Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals during piling' (Applicants updated report to inform HRA).
- No piling will be undertaken during the hours of darkness or poor visibility. However the ExA noted that the latest version of the CEMP states that there will be no piling 'during the hours of darkness and in poor visibility'; however, the latest piling plan submitted for Deadline IV of 7 October 2014 includes for piling of Area F 'Slurry wall in bund wall' 24/7 over a period of 6 weeks.
- In respect of piling associated with the installation of the dolphin piles, marine mammal monitoring will be carried out by a Marine Mammal Observer and acoustically using appropriate Passive Acoustic Monitoring (PAM), within an established 500m mitigation zone around the piling activity. The applicant has included an objective in the AEMP relating to minimising and further understanding the potential effects of construction on marine mammals.
- To mitigate for potential collision risk impacts during construction, the Applicant has proposed speed restrictions for vessels. The CEMP includes for a speed restriction of 6 knots maximum for work vessels when moving about the site and in addition a proposal to follow JNCC guidance on reducing the risk of corkscrew injuries.
- In respect of turbine collision risk impacts during operation, the Applicant states given the low number of grey seals recorded the risk of collision with the turbines is low. The Applicant also states that notwithstanding this, a package of adaptive monitoring and mitigation measures will be agreed with NRW. In addition, the Applicant states that the AFDs proposed for fish will also provide some early acoustic warning for marine mammals. The applicant stated that turbine collision risk monitoring as part of the adaptive monitoring and mitigation strategy may include the detection of mammals using both surface detection (using a qualified Marine Mammal Observer) and an active sonar system. The Applicant has also proposed that prior to the installation of acoustic deterrents, acoustic modelling of the proposed devices should be undertaken to ensure the spread of noise is not excessive,

which might interfere with the natural movement of marine mammals. To assess the potential noise effects of the operational turbines and the effectiveness of AFDs, the applicant had proposed to examine marine mammal reaction to noise, by using both acoustic data loggers and visual observation from survey vessels. The Applicant states that carcass surveillance and reporting of collision events or near misses will also be used to inform the mitigation and monitoring protocols. The AEMP includes for monitoring and management of the potential for interaction of marine mammals with the project during operation, including reference to modelling of acoustic deterrents and surface detection and PAM monitoring of marine mammals during operation.

- The Applicant has considered that the lagoon does not form a barrier to grey seal movement, but a capture and release protocol is proposed to be developed by the Applicant with guidance of appropriate stakeholders. The Applicant has included in the draft Operational Environmental Management Plan (OEMP) a capture and release procedure to be implemented. The OEMP is secured through Requirement 5 of the DCO.

5.68 NRW confirmed in their representation at Deadline III of 5 August 2014 that having reviewed the updated HRA-related documents provided by the Applicant, they agreed that there would be no adverse effects on any European site, alone or in-combination, with the exception of Kenfig SAC. On this basis the ExA accepted that NRW do not dispute the Applicant's conclusion of no adverse effect on site integrity for Cardigan Bay SAC, Pembrokeshire Marine SAC and Pen Llyn a'r Sarnau SAC which are within the remit of NRW.

5.69 As noted above, mitigation measures for marine mammals have been included as part of the Applicant's CEMP and AEMP, however NRW have also suggested (in their response dated 4 November) that a requirement be included in the DCO to ensure that no part of the authorised development shall commence until a written strategy for the monitoring and mitigation of the impacts of the authorised development on marine mammals has been submitted and approved in writing. The SoS agrees with this advice and has included Requirement 39 (Marine Mammal Mitigation Strategy) in the DCO. This requires monitoring and mitigation to minimise the potential for disturbance during construction and operation and potential for collisions with turbines during operation.

5.70 Natural England's submission of 20 October 2014 [HE-41] stated that they agree with the Applicant's conclusion that with adequate mitigation there will be no adverse impact on site integrity (in relation to Lundy SAC which is within NE's remit). Natural England also stated that they would like the developer to follow the proposed mitigation in the Environmental Statement to ensure that impacts to grey seals are minimised.

5.71 In conclusion, following agreed monitoring and mitigation the ExA, NE and NRW have agreed that there will be no adverse effect on the Grey Seal feature of Cardigan Bay SAC, Pembrokeshire SAC, Lundy SAC and Pen Llyn a'r Sarnau SAC. **The SoS is therefore satisfied that the Project (alone and when considered in combination with all relevant plans and projects) will not have an adverse effect upon the integrity of the grey seal feature of**

Cardigan Bay SAC, Pembrokeshire SAC, Lundy SAC and Pen Llyn a'r Sarnau SAC with the mitigation and monitoring as secured by Requirement 39.

Crymlyn Bog SAC/ Ramsar

5.72 Crymlyn Bog is a large lowland fen situated on the eastern edge of Swansea. The site occupies an area of 299.45ha (JNCC, accessed 26/05/15). The predominant habitat type is lowland topogenous fen, which comprises a diverse range of mire, tall-herb fen and swamp communities.

5.73 Within the site are localised areas of Annex 1 habitat types 'calcereous fens' and 'transition mires and quaking bogs' which are the primary reason for selection of this site as an SAC. Also present on the site are strands of Wet Woodland which are an Annex 1 habitat type but not a primary reason for selection of the site.

5.74 With regards to the Ramsar designation the site qualifies under: Criterion 1 as the largest example of valley floodplain topogenous mire in south Wales, and one of the largest surviving fens in the West of Britain; Criterion 2 for supporting a substantial population of nationally rare Slender Cotton-grass and a rich invertebrate fauna; and Criterion 3 for supporting 199 vascular plants.

Table 17 *Conservation objectives for Crymlyn Bog (CCW, 2010) extracted from the Applicant's HRA*

Conservation Objectives	The vision for Feature 1: Calcareous fens with *Cladium mariscus* and species of the *Caricon davallianae* is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • *Calcareous fen will occupy at least 15 ha of Crymlyn Bog SAC.* • *Most of the remainder of the site will comprise related fen vegetation.* • *The following plant species will be common in the calcareous fen vegetation: Cladium mariscus, Carex elata, Osmunda regalis, Phragmites australis.* • *Although Cladium mariscus may form dense stands in places, the majority of the calcareous fen at Crymlyn Bog will be the more open, species-rich form, with Cladium typically present at less than 20% cover.* • *Similarly although Phragmites australis is a frequent constituent of calcareous fen vegetation, this species will not generally exceed 20% cover.* • *Scrub species such as willow Salix and birch Betula will be largely absent.* • *All factors affecting the achievement of these conditions will be under control.* The vision for Feature 2: Transition mires and quaking bogs is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • *Transition mire vegetation will occupy at least 12 ha of Crymlyn Bog SAC.* • *Most of the remainder of the site will comprise related fen vegetation.* • *The transition mire will comprise varying mixtures of the following plant species: Schoenus nigricans, Carex rostrata, C. echinata, C. limosa, Equisetum fluviatile, Eriophorum angustifolium, E. gracile, Menyanthes trifoliata, Sphagnum spp.* • *Although Phragmites australis and Cladium mariscus may be present, these species will not attain high cover.*

	• *Scrub species such as willow Salix and birch Betula will be largely absent.* • *All factors affecting the achievement of these conditions will be under control.*

5.75 NRW raised concerns in their Relevant Representation (July 2014) that Nitrogen Deposition from construction traffic emissions could affect the transition mires and quaking bogs feature of the SAC. NRW advised in this response that, as the emissions will be short-lived (i.e. only during the construction period) and relatively minor (2% of relevant critical load) it would be possible to reconcile the effects with the conservation objectives for this site in an assessment. In response to the ExA's first round of written questions, NRW stated that they did not consider that the emission would have an adverse effect on site integrity.

5.76 In response to the points raised by NRW, the Applicant provided further information in their updated HRA (July 2014) in relation to this. The Applicant concluded that there will be no adverse effects on the site integrity for the site on the basis that the emissions will be temporary in nature and the predicted increase in emissions of just over 1% of the Critical load for the European site will be "adequately mitigated by overall reductions in pollutant deposition across Wales, due to improvements in industrial and vehicle emissions and the fact that the emission is short lived". The SoS also notes that this emission will be short-lived and only occur during the construction period. The emission will also only be 2% of relevant critical load.

5.77 NRW stated in their submission for deadline III of 5th August that they agreed with the Applicant's conclusion of no adverse effects on site integrity alone or in-combination.

5.78 NRW and the ExA confirmed that they could conclude no adverse effects on integrity of Crymlyn Bog SAC and Ramsar site for the Project alone and in combination with other projects and plans. **The SoS is therefore satisfied that the Project (alone and when considered in combination with all relevant plans and projects) will not have an adverse effect upon the integrity of the Crymlyn Bog SAC and Ramsar Site as emissions will be temporary and mitigated by overall reductions in industrial and vehicle emissions across Wales.**

Bristol Channel Reaches recommended dSAC (Harbour porpoise)

5.79 The ExA's Report notes that Harbour porpoise are the most numerous and commonly recorded species of porpoise within Wales. There is a relatively high density of sighting of harbour porpoise in Swansea Bay and off the Gower Peninsular. However, at that time, there were no proposed or existing SACs in the UK that supported qualifying populations of Harbour porpoise (*Phocoena phocoena*). NRW therefore highlighted (16th September 2014) that was no legal requirement for an HRA to consider this species.

5.80 However, in February 2015, NRW published a list of possible new marine Special Areas of Conservation and Special Protection Areas in Wales [11](NRW, 2015). These are sites recommended for draft (d)SAC status. This included a site in the Outer Bristol Channel - Bristol Channel Approaches, Pembrokeshire (West Wales) Marine and North Anglesey Marine. These

[11] *http://www.naturalresources.wales/media/3135/possible-new-marine-special-areas-of-conservation-and-special-protection-areas-in-wales.pdf?lang=en*

sites have been recommended as there is evidence that they supports qualifying populations of **Harbour porpoise** (*Phocoena phocoena*). A map of the recommended dSAC sites in Wales is given in *Figure **5***5 (taken from NRW's publication).

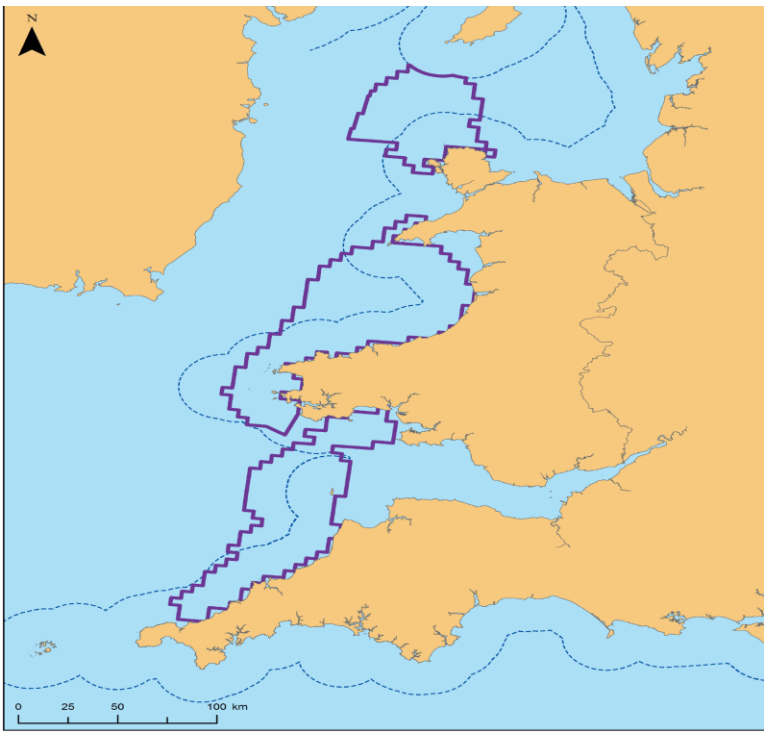

Figure 5 Recommended dSACs in Wales (May 2015)[12]

5.81 The sites are still at the early stages of consideration for possible future designation with approvals and formal consultation to follow during 2015. The SoS has decided to consider this and other Welsh marine sites in this HRA as she does not wish to take a decision on the Project, without first satisfying herself that it would not damage the possibility of future cSAC designation. As the Bristol Channel Approaches recommended dSAC is the closest to the Project, this will be considered here and if adverse effects can be ruled out for this site, then the conclusions would also apply to more distant sites. This approach recognises the highly mobile nature of harbour porpoise. Harbour porpoise are widespread across much of the Celtic Sea, with the majority of individuals sighted off the South West coast of Wales, South coast of Ireland and West of the Isles of Scilly (Baines and Evans, 2012). In its submission of 16 September 2014, the Rhossili Working Group cited evidence that harbour porpoise are a full time inhabitant of the Outer Bristol Channel and that Swansea Bay is an important breeding location, with high numbers of porpoise and newborns in the peak breeding season of May-August.

5.82 As sites are still at an early state of consideration, no specific conditions for Favourable Conservation Status have yet been agreed. However under Article 1 of the Habitats Directive, a species is considered to be at 'Favourable Conservation Status' when the conditions identified in *Table 18* are met.

[12] *http://www.naturalresources.wales/media/3135/possible-new-marine-special-areas-of-conservation-and-special-protection-areas-in-wales.pdf?lang=en*

Table 18 General favourable Conservation Status as noted in the Shadow report to inform HRA: Cetaceans and Pinnipeds

Conservation Objectives	Under Article 1 of the Habitats Directive, a species is considered to be at a 'Favourable Conservation Status' (FCS) when the following conditions are met: • population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and • the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and • there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

5.83 The Applicant provided a 'Shadow report to inform HRA: Cetaceans and Pinnipeds' for the 5 August deadline to ensure that the SoS would have all relevant information to inform a decision.

5.84 In this 'Cetaceans and Pinnipeds' report, the Applicant notes that a combination of the detailed assessment undertaken in Chapter 10 (Marine Mammals and Turtles) of the ES and statutory consultee comments have resulted in the identification of potential effects on marine mammals. The report notes that there are a number of elements of the project which could affect Harbour Porpoise these include piling, dredging and construction activity through the potential to cause disturbance/ displacement/ mortality/ injury through underwater noise and vibration through piling, visual disturbance and increased collision risk with construction vessels. Operation of the project could impact on porpoise through a reduction in foraging habitat, as the lagoon walls will isolate a section of Swansea Bay. The turbines could also increase noise and vibrations; they could also cause injury or mortality as a result of entrainment. The Applicant also considered that the Project could also cause a barrier to porpoise movement or generate an electromagnetic field. The Applicant also noted that there is the potential for in-combination effects.

5.85 The 'Shadow report to inform HRA: Cetaceans and Pinnipeds' provides an assessment of how Harbour Porpoise may be affected by the activities associated with the construction and operation of the project noted above.

5.86 Modelling was undertaken to predict the potential distances at which a significant behavioural response to piling noise will occur in harbour porpoise. It is expected that there will be only a small likelihood of impact piling taking place as the majority of activity will be vibro-piling. Impact piling will only be used when hard patches of substrate are encountered. When this occurs, the duration of any impact piling is expected to be short (a matter of hours during daylight). A soft start piling methodology would also be employed for all piling to allow marine mammals to move away from the source of the noise.

5.87 The Lagoon will cause a direct loss of habitat and it is considered likely that harbour porpoise would use habitat in the general area of the Lagoon. The Applicant notes that there is no indication from surveys undertaken to date that the area of Swansea Bay where the Lagoon will be situated is a key foraging area. Given the high mobility and large foraging range of this

species, loss of habitat due to the Lagoon will only constitute a very small fraction of the total area used by harbour porpoise for foraging.

5.88 Modelling undertaken in Chapter 10 of the ES predicted that harbour porpoise will exhibit no behavioural response even at the source of noise during the operational phase of the Project.

5.89 Marine mammals are not considered to be electrosensitive (Hanke and Dehnhardt, 2013; Gill et al, 2005). No cables will cross any migratory route or will be buried in any foraging habitat. As such, no effect on any harbour porpoise that may be present within the Swansea Bay area are expected from electromagnetic fields during operation.

5.90 Modelling of sediment deposition was undertaken in the ES and concluded that sediment plumes will be limited to the near-field zone of Swansea Bay and temporary in nature. Marine mammals are known to have acute hearing capabilities which allow to them to function in low visibility turbid conditions. In addition as no samples taken exceeded Cefas Level 2 it is considered that the release of contaminated sediment through dredging is low risk.

5.91 The Lagoon will not block any migratory routes or access to key foraging grounds.

5.92 The Applicant's Shadow report to inform HRA: Cetaceans and Pinnipeds' notes that dedicated survey data for the inner part of Swansea Bay which overlaps with the footprint of the Project is limited. However, anecdotal observations of mammals within Swansea Bay recorded en route to dedicated survey areas or transects, as well as casual sightings, indicate that harbour porpoise are regularly recorded within the inner part of Swansea Bay but at lower densities than other areas. In the absence of dedicated effort based survey data for the inner part of Swansea Bay and using a precautionary approach, the assumption has been made that harbour porpoise occur at similar frequencies to other parts of Swansea Bay such as Port Talbot. The Applicant considered that the probability of a collision occurring with a vessel is low. The implementation of mitigation measures, including speed restrictions and the temporary nature and extent of the construction phase of the development the Shadow report to inform HRA: Cetaceans and Pinnipeds' concludes it is highly unlikely that individual harbour porpoise would be affected to the degree that they would suffer severe injury or mortality as a result of collision with vessels.

5.93 Entrainment is a risk to Harbour Porpoise. In order to minimise any potential for impacts a package of adaptive mitigation and monitoring measures to reduce significance levels is being developed and agreed with NRW. Measures will be put in place to ensure that should any marine mammal enter the Lagoon and not successfully leave via the sluice gates, a capture and release protocol is developed with guidance from stakeholders. Mitigation measures for marine mammals have been included as part of the Applicant's CEMP and AEMP (see below), however NRW have also suggested (in their response dated 4 November) that a requirement be included in the DCO to ensure that no part of the authorised development shall commence until a written strategy for the monitoring and mitigation of the impacts of the authorised development on marine mammals has been submitted and approved in writing. The SoS agrees with this advice and has included Requirement 39 (Marine Mammal Mitigation Strategy) in the DCO. This requires monitoring and

mitigation to minimise the potential for disturbance during construction and operation and potential for collisions with turbines during operation.

In combination

5.94 The effects of potential overlap of construction dredging with other capital/maintenance dredging activities on harbour porpoise are considered to be insignificant as harbour porpoise are considered to be well adapted to turbid conditions and therefore not sensitive to the predicted changes in suspended sediment concentrations.

5.95 Consideration was given to the in-combination effects of temporary loss of foraging habitat during construction of the project and construction of two offshore windfarms Rhiannon wind farm and Burbo Bank extension. The distance between these sites and the Project means that movement of Harbour Porpoise between the sites is unlikely. In addition the sites together constitute a small fraction of harbour porpoise foraging grounds.

5.96 Two tidal stream energy demonstration installations located off the Pembrokeshire coast and one located off the coast of Anglesey were identified as having potential in-combination impacts with the operation of the Project through an increased risk of collision with turbines. One site will be decommissioned before the Project is operation and due to the distance between the Project and the other two installations it is assessed that there will be no in-combination effect (particularly with relevant mitigation in place).

Mitigation

5.97 The ExA report notes that mitigation to reduce the impacts upon mammals was expanded and updated through CEMP to take into account some of the concerns raised by the Interested Parties about the possible impacts of the development on Harbour porpoise.

5.98 The 4 December 2014 CEMP [REP-994] included the following mitigation:-

- The retention of an Marine Mammal Observer (MMO) during offshore works associated with the installation of the dolphin piles;
- The use of low-noise piling techniques, such as vibro-piling would be used wherever possible; the piling required for the installation of the dolphin piles would only be undertaken during hours of daylight and in good visibility (that is in conditions which would enable the MMO to be able to observe any mammals near the development site);
- Where percussive piling is required, a series of steps would be implemented to minimise impacts, including using 'soft start' procedures, establishing a mitigation zone of radius 500m around the piling site for the dolphin piles, within which the observer and passive acoustic monitoring (PAM) would detect any marine mammal activity;
- Piling would not commence if marine mammals were detected in the mitigation zone, and then work starts 30 minutes after the after the last visual or acoustic detection and;
- Work vessels would avoid speeds above 6 knots when moving about the site and JNCC guidance on the risk of corkscrew injuries (linked to the use of ducted propellers) would be followed.

5.99 The 25 November 2014 AEMP [REP-922] included the following mitigation:-

- Pre-construction surveys including the deployment of C-PODS for continuous acoustic monitoring;
- Implementing various mitigation during construction including following the JNCC protocol for the installation of the dolphin piles, noise monitoring during piling and other activities;
- The use of ADDs for mitigation for potential turbine collision; and
- Turbine collision monitoring, surface detection and the use of a monitoring devise (PAM) during operation and the management of any marine mammals found.

5.100 It was concluded that with mitigation impacts on harbour porpoise are predicted to be minor. Mitigation measures for Harbour porpoise have been included in the Applicant's latest CEMP and AEMP. The CEMP and AEMP are secured by Requirements 5 and 6 of the DCO.

5.101 Despite concerns raised by Interested Parties there was no mitigation for marine mammals proposed by the Applicant in any versions of the draft DCO. The Panel proposed a requirement for Marine Mammals Mitigation in their consultation draft DCO of the 11 November 2014. The Applicant did not agree to its inclusion, as it considered that the requirement provides for events which are not predicted to happen. The ExA recommended that the requirement for Marine Mammals is included in the final DCO, with a minor addition so that any actions that are necessary in response to Potential Biological Removal (PBR) do not include prolonged cessation of the turbines. In the unlikely event that limitation of operation is the only way to mitigate the impacts of the Development the SoS has removed this restriction from Requirement 39 in order to ensure all options are available to protect marine mammals if needed.

5.102 After the close of the examination, members of the Rhossili Working Group wrote to express their concerns over the impact of piling during construction of the Development. They requested that piling be restricted so as to avoid the calving period for harbour porpoise. The SoS has considered these concerns and believes that the evidence presented during the examination indicates that the adoption of a Marine Mammal Mitigation Strategy, secured by Requirement 39 in the DCO, can address those concerns.

5.103 I**n conclusion, the SoS is satisfied that the Project alone and in combination will not have an adverse effect on the Harbour porpoise feature of the proposed Bristol Channel Approaches dSAC (nor on the Pembrokeshire (West Wales) Marine dSAC and North Anglesey Marine dSAC) with the mitigation and monitoring as secured by Requirement 39. She agrees with NRW and the ExA that these measures should be put in place to ensure the protection of Harbour porpoise and other marine mammals.**

5.104 Furthermore, all cetaceans (including harbour porpoise) are fully protected in UK waters under the EU Habitats Directive, irrespective of whether they are likely to be present within or outside a SAC. The level of protection is high, and enforced by law, and includes the prevention of disturbance that could have an adverse effect on the population and its conservation status. The Applicant will need to obtain a European Protected Species Licence from NRW if it is considered

that the Project could lead to disturbance of harbour porpoise or any other European protected species.

Habitats Regulations Assessment Conclusions

6.0 The SoS has carefully considered all of the information presented before and during the Examination, including the ES, the Applicant's HRA and updated HRA, representations made by Interested Parties including NRW, and the ExA's report itself. She considers that the Project has the potential to have an LSE on 10 European sites and one recommended draft site when considered alone and in combination with other plans and projects. These are as set out in Table 2 and comprise sites in Wales and England. The sites are:

- Burry Inlet SPA/ Ramsar
- Cardigan Bay SAC
- Crymlyn Bog SPA, Ramsar
- Kenfig SAC
- Lundy Island SAC
- Pembrokeshire Marine SAC
- Pen Llyn a'r Sarnau SAC
- River Usk SAC
- River Wye SAC
- Severn Estuary SAC, SPA, Ramsar
- Bristol Channel recommended dSAC

6.1 The SoS is confident that, with the mitigation measures in the Requirements of the DCO, there will be no adverse effect on the integrity on any of these sites.

6.2 Mitigation for the Project will be secured and delivered through the DCO within:

- Requirement 5- Construction Environmental Management Plan
- Requirement 5 – Operational Environmental Management Plan
- Requirement 6 - Adaptive Environmental Management
- Requirement 7 – Provision of landscaping
- Requirement 19 – Piling
- Requirement 24 – Construction and security lighting scheme
- Requirement 25 – Permanent lighting
- Requirement 27 – Fish and shellfish mitigation strategy
- Requirement 28 – Avian Enhancement Strategy
- Requirement 29 – Habitats creation strategy
- Requirement 30 – Honeycomb worm translocation strategy
- Requirement 34 - Disposal of dredged arisings and protection of Kenfig SAC
- Requirement 39- Marine Mammal Mitigation Strategy

6.3 The SoS has undertaken an appropriate assessment in respect of those European sites' Conservation Objectives to determine whether the project, either alone or in combination with other plans and projects, will result in an adverse effect upon the sites' integrity.

6.4 The SoS notes that the Project will need further consents, permits and licences before construction and operation and responsibility for determining these necessary consents and permits is devolved in Wales and cannot be authorised by the Secretary of State.

6.5 In carrying out this HRA the SoS has assessed the tidal lagoon as an energy generating project only and has not considered the wider scheme (including for example leisure facilities). The SoS has been mindful of the likely wider nature of the Project and notes that these additional elements of the Project will be subject to separate consents and licences. As such she sees no reason that this should be a barrier to the development being granted development consent.

6.6 **The SoS has determined that the Swansea Bay Tidal Lagoon, with mitigation and monitoring regimes in place, will not have an adverse effect upon the sites' integrity either alone or in combination with other plans or projects. She has undertaken a robust assessment using all of the information available to her, not least the views of the various Interested Parties.**

Water Framework Directive Assessment

7.0 Consideration of Water Framework Directive (WFD) compliance was a significant matter for the Examination of the Project. Natural Resources Wales (NRW) and the Applicant agreed that a derogation under Article 4(7) of the Directive will need to be considered by the Secretary of State in reaching her final decision on the Project. The scheme must meet all of the conditions laid out in Article 4(7), 4(8) and 4(9) of the Directive. If the Project cannot meet any of the conditions then the scheme will not be compliant with WFD.

Background

7.1 The WFD (Directive 2000/60/EC) of the European Parliament and of the Council establishes a framework for the Community action in the field of water policy and was implemented in the UK by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.

7.2 By means of the Framework Directive, the EU provides for the management of inland surface waters, groundwater, transitional waters and coastal waters in order to prevent and reduce pollution, promote sustainable water use, protect the aquatic environment, improve the status of aquatic ecosystems and mitigate the effects of floods and droughts (EC, 2009).

7.3 The WFD sets the objectives for all water bodies in Europe classified under the WFD and it creates a mechanism through which each signatory has to aim to bring its water bodies to an accepted biological and chemical standard (good ecological/chemical status for natural water bodies; and good ecological potential/good chemical status for artificial/heavily modified water bodies) by 2015; this is based on a series of parameters (quality elements) dependent on the type of water body considered (i.e. rivers; lakes; transitional waters and coastal waters) and its hydromorphological designation (i.e. natural; artificial or heavily modified).

7.4 The environmental objectives are defined in Article 4 of the WFD. The aim is long-term sustainable water management based on a high level of protection of the aquatic environment. Article 4.1 defines the WFD general objective to be achieved in all surface and groundwater bodies, i.e. good status by 2015, and introduces the principle of preventing any further deterioration of status. There follow a number of exemptions to the general objectives that allow for less stringent objectives, extension of deadline beyond 2015, or the implementation of new projects, provided a set of conditions are fulfilled.

7.5 The environmental objectives in the Directive are manifold and include the following elements (for details see Article 4.1, (a) surface waters, (b) groundwaters and (c) protected areas):

- No deterioration of status for surface and groundwaters and the protection, enhancement and restoration of all water bodies;
- Achievement of good status by 2015, i.e. good ecological status (or Potential) and good chemical status for surface waters and good chemical and good quantitative status for groundwaters;

- Progressive reduction of pollution of priority substances and phase-out of priority hazardous substances in surface waters and prevention and limitation of input of pollutants in groundwaters;
- Reversal of any significant, upward trend of pollutants in groundwaters;
- Achievement of Standards and objectives set for protected areas in Community legislation.

Heavily modified water bodies (HMWBs)

7.6 Article 4.1(a) (iii) of the WFD sets out "specific objectives" for heavily modified water bodies (HMWBs). HMWBs are required to achieve 'good ecological potential' (GEP). The assessment of GEP is linked to the possible mitigation measures identified for the water body. For HMWBs the reference conditions on which classification is based represent the maximum ecological quality that could be achieved for a HMWB once all mitigation measures for the water body have been applied. Hydro-morphological conditions which are impacted by the physical alteration will primarily dictate the ecological potential of a HMWB. Maximum ecological quality is intended to describe the best approximation to a natural aquatic ecosystem that could be achieved given the hydro-morphological characteristics that cannot be changed without significant adverse effects to the specified use or the wider environment. GEP allows for a slight deviation from maximum ecological quality. The proposed scheme is a new scheme and therefore outside of the HMWB designation and will act as an added pressure to the water body in addition to those pressures identified at the time of designation.

7.7 Swansea Bay is classified as a HMWB for flood defence and navigation purposes, due to the presence of extensive artificial shoreline structures and the occurrence of dredge related activities within the water body.

Project location

7.8 The Project is proposed to be situated within the Western Wales River Basin District (RBD) (Environment Agency, 2009). This is shown in *Figure **6**6,* the river basin district extends across the entire western half of Wales from the Vale of Glamorgan in the south, to Denbighshire in the north and includes the island of Anglesey off the north-west coast of North Wales.

7.9 During the examination the Applicant updated their WFD assessment following discussion with NRW. The Applicant considered the impact of the project on a number of water bodies. This included:

Coastal water bodies

- Bristol Channel Outer North
- Swansea Bay

Transitional (estuarine) water bodies

- Tawe Estuary
- Neath Estuary
- Afan Estuary

Groundwater

- Swansea Carboniferous Coal Measures

River Water bodies

- River Afan (6 water bodies)
- Afon Cynffig (5 waterbodies)
- River Neath (16 water bodies)
- River Tawe (17 water bodies)
- Clyne River (2 water bodies)
- Pennard Pill (2 water bodies)

Figure 6 Western Wales River Basin District

7.10 The Applicant proposes that the majority of construction and operation relating to the Project will be located within the marine environment within the Swansea Bay water body. A small proportion of the structures associated with the Project will be located within the Tawe Estuary water body.

Impact of the proposed project on the Swansea Bay water body

7.11 It was NRW's view (9th July 2014 written representation) that the development would change the condition of components that define the status of Swansea Bay water body and it will cease to function as a discrete physical and ecological unit. NRW advises that the development is likely to cause deterioration in quality elements at water body level and result in a failure of Swansea Bay water body to achieve Good Ecological Potential (GEP). At the timer of examination the status of this water body was assessed as moderate. NRW based this view on this evidence:

- UKTAG (Technical Advisory Group) guidance states that, for coastal waters, failure of a standard or condition limit over more than 1.5km² of contiguous surface area of a water body is expected to have a significant effect on the ecological status of a water body and is inconsistent with high, good, moderate or poor ecological status (UKTAG, 2007).
- Clearing the Waters guidance (EA, 2012) for the assessment of new projects, applied to the metrics of the capital dredge component of the lagoon development only, results in an area of 5.44% of the water body being impacted; the guidance states that an area of >5% of the water body would trigger the need for a full deterioration assessment and an activity of this scale will have the potential to cause deterioration at water body level.
- In NRW's expert judgement the development is likely to cause deterioration of this water body through loss of integrity of the water body as a whole and degradation of its habitats.

In addition, the development is incompatible with some of the mitigation measures, thus compromising the achievement of Good Ecological Potential (GEP) by 2027.

7.12 The Applicant's updated WFD assessment of the Swansea Bay Coastal water body found a potential risk of deterioration of the benthic invertebrate quality element and the biological quality element supporting hydromorphological conditions. This was from the physical presence of the lagoon (including its component structures), its resultant effects on water flow and the need for ongoing maintenance dredging.

7.13 The Western Wales River Basin Management Plan (EA, 2009) identifies thirteen possible mitigation measures for the Swansea Bay water body, but these have not yet been implemented. In order for the water body to achieve its target of GEP by 2027, mitigation measures must be implemented by then. However, in the view of the NRW (9th July 2014 written representation) the proposed Project is incompatible with the achievement of the following measures in the RBMP:

- Measures II, III, IV and VI relating to reducing dredging and dredge-related impacts. The development will entail significant increase in dredging, as there is a capital dredge, new maintenance dredging and further dredging requirements of the existing shipping channels associated with the scheme.
- Measure VII concerns the operational and structural changes to locks, sluices, weirs, and beach control. The objective of this mitigation measure is to reduce artificial impacts. This development constitutes a significant addition to the infrastructure of Swansea Bay. It is therefore incompatible with reducing artificial impacts on the water environment.
- Measure VIII Preserve and where possible, enhance the ecological value of marginal aquatic habitat, banks and riparian zone. The development will cause a reduction of the ecological value of the "marginal aquatic habitats", as intertidal habitat will be lost as a result of the project, and by reducing connectivity and other environmental changes brought about by the scheme (as detailed above), will have impacts to the rest of Swansea Bay.
- Measure XI Preserve, and where possible restore historic aquatic habitats. The development will change the aquatic habitats within the lagoon, although the extent of change is unknown. There is no restoration proposed, and therefore appears it will fail to preserve, although creation of new habitat is proposed.
- Measure XII removal of hard bank reinforcement or replacement with soft engineering solutions. The Project includes the creation of significant additional hard bank in the form of the lagoon wall.

NRW did however consider that the Project would be compatible with one of the as yet undelivered measures. Measure XIII is to remove obsolete structure(s). The proposal includes a plan to remove a length of obsolete flood wall at Swansea Docks. The development is compatible with, and contributes towards the achievement of this measure. Based upon this evidence, NRW advised (9th July 2014 written representation) that the Project is incompatible with the implementation for some of the mitigation measures for Swansea Bay water body.

7.14 The Project will create a sea wall impounding an area of approximately 11.5km^2. There is therefore a risk that the benthic invertebrate and the biological quality elements supporting hydromorphological conditions may also deteriorate (Applicant's updated WFD assessment). Changing the hydrodynamic and morphological processes within the water body has the potential to impact on the benthic invertebrate communities (NRW advice note 9th December 2014).

Impact of the proposed project on the Tawe Estuary water body

7.15 The construction of the Project will include structures being placed within the Tawe Estuary water body. This water body was found classified as being in Good Status in 2013 by NRW. This is a heavily modified water body.

7.16 Elements considered by the Applicant that could be impacted by their proposed Project include;

- Biological elements: Phytoplankton, Macroalgae, Benthic invertebrates, Fish
- Physico-chemical elements: Salinity, Dissolved Inorganic Nitrogen, Dissolved Oxygen, Specific Pollutants (Annex III)
- Hydromorphological elements: Depth variation, Quality structure and substrate of estuarine bed, Structure of the intertidal zone, Wave exposure, Direction of dominant Currents.

7.17 **Phytoplankton** is not assessed within the WFD monitoring programme in the Tawe Estuary. The predicted changes resulting from the Project (lagoon seawalls and outfall extension) would not be expected to affect the WFD status for nutrients (dissolved inorganic nitrogen) in the Tawe Estuary transitional water body, or compromise the future achievement of the objectives. It follows that these predicted changes are not expected to significantly alter the distribution of phytoplankton in the Tawe Estuary, or lead to significant changes in primary production.

7.18 The 2013 classification data for the Tawe Estuary for **macroalgae** identifies that the quality element is at 'high' status. As the Project will result in an increase in the overall area of rocky intertidal and subtidal habitat that has the potential to be colonised by macroalgae within the Tawe Estuary water body, it is considered that the Project (lagoon seawalls and outfall extension) will not result in deterioration in status for macroalgae within this water body, or compromise the future achievement of the objectives. The presence of opportunistic macroalgae will be monitored during the intertidal surveys which will be carried out post construction as detailed in the AEMP.

7.19 **Benthic invertebrates** are not assessed within the Tawe Estuary under WFD. However, as identified above, the ongoing dredging within the Tawe Channel for navigational purposes results in a habitat that experiences regular physical disturbance with resultant effects on colonising species. There will be a loss of a small extent of the *Sabellaria alveolata* reef but mitigation is proposed for this loss, although it is recognised that a novel methodology is proposed. Loss of habitats resulting from the construction of the western seawall within this water body will be balanced by habitats created by the removal of the existing breakwater. On the basis that the benthic habitats already experience routine disturbance, and thus already support habitats associated with disturbance, the Project (lagoon seawalls) is not predicted to result in the

deterioration of the status of the Tawe Estuary water body in relation to the benthic invertebrate quality element, or compromise the future achievement of the objectives.

7.20 The key effects of the Project on migratory **fish** considered by the Applicant will occur within the Swansea Bay coastal water body and to a lesser extent the Tawe Estuary water body. The effects of the Project on the fish quality element of the Tawe Estuary water body and upstream water bodies are: increases in suspended solids, increased noise and vibration, artificial light, habitat modification and loss during dewatering of the cofferdam and entrainment in the turbines. As these impacts are on migratory fish the Applicant also assessed the indirect effect on the status of the fish quality element on water bodies upstream of the Project.

7.21 The Applicant has proposed mitigation for the Projects impact on Invertebrates and Fish as a result of increased suspended sediment. This will be secured within the CEMP as Requirement 5. This enabled the Applicant to conclude that there is no impact on the fish quality element from suspended sediments:

- Selection of dredging equipment by the contractor will be appropriate to the depths and material types to be dredged and to minimise the creation of plumes.
- Marine habitat disturbance or seafloor clearing for the construction of the Project will be limited to the red line footprint of the development. Operations outside the scheme footprint will be prohibited. Boundaries will be enforced and distribution of worker awareness information will take place.
- The Project will adhere to Best Practice Guidance identified in Marine Minerals Guidance 1: Extraction by dredging from the English seabed (Office of the Deputy Prime Minister, 2002), or other industry standards with respect to dredging and disposal of dredged material.
- Disposal of the dredge spoil not suitable for seawall construction will be undertaken at Swansea Bay licensed outer disposal grounds thereby presenting minimal risk of impact to sites outside the development area.
- Dredging will generally be undertaken between April and October.
- Preventing on-board screening or minimising material passing through spillways when outside the dredging area to reduce the spread of the sediment plume.

7.22 The main concern with regard to fish is the potential for underwater noise and vibration to exclude marine fish from near shore and intertidal habitats and to deter migratory fish from entering or leaving the Tawe river mouth, which is adjacent to the Project. The main concern would be the impact on fish during construction piling needed for the Project.

7.23 Piling is needed for the dolphin piles and it will occur for approximately 15 days during the daytime only. These would be installed at the start of the construction programme to afford protection to the offshore cofferdam. Currently this is expected to be either March/April or June/July and therefore does not extend significantly into the key migratory periods of any of the fish species. Modelling was also carried out which specifically considered the likely range at which injury and behavioural responses may be expected for a range of migratory fish species (Applicant's ES).

Table 19 Modelled ranges at which migratory fish will be impacted by construction noise (from the Applicant's updated WFD assessment).

Species	dB above hearing threshold**	Behavioural response range (m)		
		Dredging	Dolphin Vibro-piling	Dolphin Impact piling
Eel/lamprey	75	3	25	1000
	90	ORR*	4	177
Salmon/trout	75	3	20	1000
	90	ORR*	4	177

*Outside of Response Range
**75dB is taken as the threshold at which 50% of fish can be expected to show avoidance behaviour; 90dB is the threshold where strong avoidance behaviour will occur in most species.

7.24 In the case of dredging and vibro-piling, the Applicant states that the ranges of impact are highly constrained and do not extend into critical intertidal habitat or the river mouths. The use of impact (or percussive) piling, if required for the dolphin piles, would have a greater impact range, potentially excluding these species from areas of subtidal and intertidal habitats in periods when pile driving was taking place.

7.25 The Applicant expects that there will be only a small likelihood of impact piling being utilised and the majority of piling will be low-noise vibro-piling. Impact piling will only be employed when hard patches of substrate are encountered. When this occurs, the duration of any impact piling is expected to be short (a matter of hours during daylight). A behavioural response range of up to 1000m from the source of impact piling does not form a barrier effect to fish entering the Tawe as the source of the noise is at least 3km offshore from the Tawe river mouth and 4.5km from the shoreline of Mumbles Bay. In addition, the standard use of 'soft start' piling methodology, in line with Joint Nature Conservancy Guidance (JNCC, 2010), will be rigorously enforced to allow any fish in the vicinity to move away from the source of the noise. This temporary and reversible effect is therefore not predicted to impede salmon, sea trout or eel migration routes, either across the Bay or to and from the Tawe river mouth. In order to ensure the limited potential impact from piling anticipated by the Applicant the SoS will rely on Requirement 19 to ensure that construction remains within this level of impact.

7.26 The Applicant's assessment concludes that the impact on migratory fish from disruption to migratory routes as a result of increased noise and vibration during construction and operation will be negligible on all species so there would be no deterioration in the classification of the water body or those further upstream. Mitigation measures will however, be implemented through the DCO Requirements 19 and 27 as identified above and it is considered that the measures proposed are practicable and appropriate for the level of impact predicted.

7.27 Light can impact on the behaviour response of fish acting to repel or attract fish depending on species and/or life stage. Species such as eel are repelled by light at all life stages. Both the movement of glass eel and elver into freshwaters and of pubescent silver eel to sea typically occur at night (Bruijs & Durif, 2009) and light falling onto their migratory pathway may have a marked obstructive impact on their movement (Sorensen, 1951) to and from the River Tawe (Applicant's updated WFD assessment).

7.28 The Applicant has proposed the following mitigation measures will be implemented to reduce the potential effects of artificial light on migratory fish:

- Illumination of the site would be directional.
- The illumination of the water surface, especially outside the Lagoon, would be avoided where possible.
- The use of white mercury vapour lamps should be avoided.

The Applicant's updated assessment concludes that the impact on migratory fish from disruption to migratory routes as a result of increases in artificial light will be negligible on all species. These will be secured through Requirements 24 and 25.

7.29 Hydroelectric turbines have the potential to injure or kill fish which are entrained within the generating flow. This can occur as a result of collision with the rotating turbine blades, or due to changes in pressure, severe turbulence or hydraulic shear stress. Risks typically increase as fish increase in length and mass, and sensitivities vary amongst species. The Applicant and other interested parties have discussed this impact during the examination and at the close of examination there was still a difference in opinion of the potential impact of operating the turbines on fish. Of those fish entering or leaving the Lagoon, a proportion will pass through the sluice gates (open during periods near high and low water) and others will pass through the turbines. Water velocities passing through the turbine housings are estimated to be 10- 11 ms^{-1} during power generation, hence they are well in excess of swimming abilities of any fish likely to be present and any passage through the turbines is likely to be in the direction of flow only (Applicant's updated WFD assessment).

7.30 In order to manage this potential impact Requirement 27 will be included within the DCO. This enables NRW as the statutory regulator to agree thresholds of impact and further action to be taken if those thresholds are exceeded and the impact on fish is too great. The location of the turbines and the use of variable speed turbines as noted in Requirement 33 will also further reduce the impact of the turbines on fish. The Applicant has also proposed the use of pumping at the end of the tidal cycle as this has the potential to further reduce the impact on ecology through the reduction in loss of intertidal habitat. As the impact of this is not yet fully understood we suggest that it is trialled and the impact monitored and reviewed through the AEMP (requirement 6).

7.31 The Applicant updated the AEMP during the examination (Requirement 6) to include modelling and monitoring to develop appropriate mitigation, including the use of an Acoustic Fish Deterrents (AFDs) system (also secured in Requirement 27) to achieve predicted outcomes following variable speed turbine procurement. This mitigation works best on hearing-sensitive species (herring) or salmonids, which are hearing generalists. Requirement 27 enables NRW as the statutory regulator to agree thresholds of impact and further action to be taken if those thresholds are exceeded and the impact on fish is too great.

7.32 The Applicant's updated WFD assessment found that the lagoon aspect of the Project will tend to increase **salinity** in the coastal waters adjacent to the Tawe estuary. This effect occurs as the

plume from the Tawe becomes attached to the Lagoon wall reducing dispersion to the east. Furthermore the Lagoon also tends to cause greater mixing with offshore water. These factors cause a local increase in average salinity in the inshore waters to the west of the Lagoon.

7.33 These local changes in salinity are not protected to impact on the WFD quality elements as they are within natural variability. The Applicant did not predict that they would affect shellfish waters within the transitional water body. These are located within the estuary, its approaches and within Swansea Docks.

7.34 In the Applicant's updated WFD assessment the revised modelling found that the changes in **nitrogen concentration** in the Tawe Estuary water body would not be expected to compromise the future achievement of the objectives. Their conclusions therefore also predicted that changes are not expected to significantly alter the distribution of phytoplankton in the Tawe Estuary, or lead to significant changes in primary production or biology. The Applicant therefore predicted that that the Project will not result in deterioration of the status of the Tawe Estuary water body in relation to the Dissolved Inorganic Nitrogen quality element, or that the Project will compromise the future achievement of the objectives.

7.35 The results of the Applicant's model applications show that the effects of the Project are limited and restricted to the transitional waters of the Tawe below the barrage. High nitrogen concentrations in the river Tawe are caused by high river load and the impounding effects of the barrage, which considerably reduces natural tidal dilution. The impacts of the Lagoon are limited to periods when the barrage is overtopped, and are predicted by the Applicant as resulting in a less than 0.1% increase in average nitrogen concentration

7.36 On the neap tides, when tidal dilution is lowest, an increase in concentration is seen with the lagoon in place. However this situation is reversed on spring tides when the tidal Lagoon causes greater exchange with offshore waters which reduces seawater nitrogen concentrations entering the estuary. Overall the net effect is a small 60µg/l (9%) increase in average concentration with the lagoon in situ. Within the Tawe transitional water body the impacts of the Lagoon are small and restricted to short periods around high water. Upstream of the barrage these effects will only occur when the barrage is overtopped. This gives the Applicant's overall predicted average concentration as an increase of less than 0.1% upstream of the barrage.

7.37 Levels of **Dissolved Oxygen (DO)** in Swansea Bay are above the WFD High class boundary of 5.6 mg/l (Applicant's ES). DO is required for respiration of marine organisms, and is a primary indicator of the ability of an aquatic system to support marine life. DO is not monitored by NRW within the Tawe Estuary for WFD. The findings of the Applicant's updated WFD assessment predict that the Project will not result in deterioration of the status of the Tawe Estuary water body in relation to the DO quality element, or that the Project will compromise the future achievement of the objectives. The Project is not predicted to cause changes to the level of DO in Swansea Bay or the Tawe Estuary.

7.38 **Specific Pollutants** could be mobilised during dredging needed for the Project. However as there is already routine dredging carried out within the Tawe Estuary water body, so any ongoing

dredging required to maintain access for navigational purposes is not predicted by the Applicant to result in further effects in relation to specific pollutants. So the Project is not predicted to cause deterioration of its status, or compromise the future achievement of the objectives regarding specific pollutants.

7.39 The Applicant's ES within chapter 6 Coastal Processes, Sediment Transport and Contamination has considered the potential effects of the Project on hydromorphological elements that are relevant for the Tawe Estuary water body. In summary the Applicant's findings where:

- ***Construction*** *– some localised predicted increases to suspended sediment concentrations and sediment deposition as a result of construction activity in the western part of the bay.*
- ***Operation*** *– predicted effects on Tawe approach channel can generally be split into two regions:*

  1. Outer part of approach channel (offshore of the present lagoon extent) – predicted increases to current flow during ebb generation phase; small predicted increase in significant wave height as a result of reflection of SW waves off of the lagoon wall. As a result, it is considered unlikely that increased sediment deposition will occur in this part of the channel.

  2. Inner part of approach channel (adjacent to the western arm of the lagoon wall) – predicted decrease in mean flow speed; predicted decrease in significant wave height from SW and SE waves as a result of sheltering from the lagoon. As a result, it is considered that increased sediment deposition (predominantly muds) is likely within this part of the approach channel. Maximum deposition within the channel of approximately 1.5mm is predicted over a 24 hour period during a 10 in 1 year storm event (i.e. this level of deposition might be expected to occur 10 times over an annual period). Calmer periods (which have less potential to mobilise sediment from the bed) and larger storm events (which have the potential to increase erosion), have been shown to result in lower levels of deposition, and over a reduced spatial extent.

7.40 The Applicant's assessment did not find that the Project would cause deterioration in the depth and variation; Quality, structure and substrate of coastal bed; Structure of the inter-tidal zone; Wave exposure; Direction of dominant currents, status of the Tawe Estuary water body.

7.41 NRW in their Advice note from the 9th December had limited confidence in the Applicant's assessment of no deterioration in this and the Tawe Estuary water body due to their limited confidence of the conclusions of the coastal processes assessment at this stage. The SoS sort further clarification following the close of examination. NRW were considering further information, and would use this as part of their own WFD assessment for the Project as part of the Marine Licence. However NRW did not advise that the Neath and Tawe transitional waterbodies should be considered within an Article 4.7 assessment. If NRW assessments do show a potential impact for the Project as part of their own licensing regime these water bodies could be considered again at this point. As more detail is being produced for these operation licences the AEMP will be revised. As part of the AEMP (secured within Requirement 6 of the DCO), the effects on all water bodies, including the Tawe and Neath, will be monitored and the findings considered in relation to

the status of the water bodies concerned. If a risk to deterioration in status is predicted, mitigation will be discussed with NRW.

Practical steps to mitigate the adverse impacts from the Project

7.42 The Applicant within their updated WFD report considered all practicable steps to mitigate the adverse impacts from the Project on the status of the Swansea Bay coastal water body. This included the effects on benthic invertebrates, supporting hydromorphological conditions and the mitigation measures proposed for the water body within the RBMP. These are listed below.

7.43 The Applicant states that they have implemented mitigation measures that are technically feasible and not disproportionately costly, throughout the design process and any that are relevant for the construction, operation and decommissioning phases have been identified. These are secured within the OEMP, CEMP and AEMP Requirements 5 and 6 within the DCO. The Applicant also proposes to monitor the predicted effects of the Project on the affected quality elements of the Swansea Bay water body and to implement mitigation measures as detailed within the AEMP.

7.44 Swansea Bay water body is at risk of deterioration of its benthic invertebrate quality element and the biological quality element supporting hydromorphological conditions. This is from the direct impacts of loss of benthic habitats and species, NRW in their advice note highlight that there is no technically feasible mitigation without compromising other design mitigation such as the reflection coefficient of slope of wall.

7.45 NRW in their advice note of the 9th December 2014 considered all the mitigation proposed by the Applicant below (they provide an asterisk where they have low confidence in a measure). NRW state that they consider the Applicant has made a reasonable case that all practicable steps will be taken to mitigate the adverse impact on the status of the body of water:

Mitigation during the design phase

- Removal of the existing Swansea eastern breakwater and replacement with lagoon wall which has a reflection coefficient greater than the existing vertical wall.
- Soft engineering within the lagoon impoundment where appropriate. The Project involves removing the existing seawall within the port and re-profiling the bank where appropriate to incorporate soft engineering options including coastal grassland, **salt marsh***, beach and sand dune.
- Minimisation of environmental impacts through structural design of lagoon wall to minimise wave reflection and associated impacts.
- Variable speed turbines with pumping option selected to enable natural tidal conditions to be replicated as closely as possible within the lagoon impoundment, thereby reducing intertidal losses.
- Location of turbine and sluice gate housing to reduce the potential quantity of material for disposal offsite.
- Enhancement measures incorporated into the design of the Project including:
  I. Incorporation of bio-blocks and rock pools
  II. Rocky habitat creation in form of lagoon wall to encourage re-colonisation

Mitigation during the construction phase

- Re-use of capital dredged material for lagoon wall construction where possible to minimise disposal requirements.
- Implementation of best practice during capital dredging. An appropriate dredging strategy (for example, “Best Practice Guidance identified in Marine Minerals Guidance 1: Extraction by dredging from the English seabed (Office of the Deputy Prime Minister, 2002), or other appropriate industry standards with respect to the dredging and disposal of dredged material will be applied.
- Capital dredging will generally be undertaken between April and October to minimise dispersion of sediment which could impact upon habitats and species.
- Strategy for management of invasive and non-native species (INNS) which may impact upon biological communities.

Mitigation during the maintenance and operational phases

- Implementation of best practice during maintenance dredging. Due to the uncertainty in predicting the requirement for maintenance dredging, the detail of mitigation associated with maintenance dredging events will be covered under the provisions of the marine licence/s which the Applicant will be required to obtain for maintenance dredging activities within the lagoon. The Construction Environmental Monitoring Plan (CEMP) and the Operational Environmental Monitoring Plan (OEMP) specifically identify that Best Available Techniques and industry guidance will be used as appropriate in the development of all mitigation measures for the lifetime of the Project.

- The proposed operational life of the structure is 120 years, although as set out in paragraph **Error! Reference source not found.**, the design life is some 50 years. Within this timeframe, some unidentified impacts may become apparent. These will be considered by the AEMP, subject to pre-commencement agreement on its content and associated provisions which form a long term commitment to monitoring and adaptive mitigation in consultation with NRW and the local planning authorities. This will serve to improve the understanding of responses to hydro-morphological pressures
- ***Sabellaria* translocation has been proposed***
- **Reintroduction of the native oyster has been proposed***
- Management strategies detailed within the AEMP and OEMP will seek to encourage natural recovery of disturbed areas.
- **Invasive Non-native Species Strategy** for management of invasive and non-native species which may impact upon biological communities

NRW did highlight concern with some of the proposed mitigation for example the proposed use of granite within the Project is not a type of rock that occurs locally, therefore there is low confidence that it will create a similar habitat. The AEMP should be used to monitor the mitigation measures, however due to the uncertainty of the impacts of the Project it should also provide a wider monitoring to identify any impacts that have not been foreseen by the Applicant. As this is a 'first of a kind' Project the adaptive monitoring process needs to allow changes in future of the management/ operation of the Project. This is an important aspect of balancing innovation whilst protecting the environment. The SoS supports the view of the NRW that the AEMP needs to be deliverable, effective and enforceable.

7.46 NRW and a number of interested parties still remained concerned around the level of uncertainties surrounding the information presented by the Applicant in particular concerning mortality levels to fish and grey seal species. Fish legal raised concern over the combined impact on migratory fish "from the turbines; overall population changes and mortalities taking into account the turbines, increases in predation, adverse changes in supporting habitats for spawning and foraging etc. should also be included to account for all potential impacts arising from the presence of the Lagoon." The Applicant did predict an adverse impact on fish based on their modelling (Applicant's ES). The concern raised was over the certainty of the level of that impact and impacts occurring that may not be accounted for (NRW Annex 1st November 2014).

7.47 There are a number of Requirements through management strategies that would allow adaption of the Project during its operation e.g. Requirements 5 and 6 for the OEMP and AEMP. Consideration of the precautionary principle is necessary where the impact on the environment is not certain. In order to reduce the uncertainty of entrainment the SoS does require a strategy for turbine impacts on fish which must include the use of Acoustic Fish Deterrents and monitoring of turbine impacts upon fish populations, including migratory fish and clupeids. This has been secured through Requirement 27 which enables NRW as the statutory regulator to agree thresholds of impact and further action to be taken if those thresholds are exceeded and the impact on fish is too great.

7.48 NRW after reviewing all of the proposed mitigation measures for the Project concluded that the Applicant had made a reasonable case that all practical steps had been taken to mitigate the adverse impacts of the Project. The ExA concurred with NRW's assessment that the Project has included all practicable steps to mitigate the adverse impact on the status of the water body.

7.49 The SoS considers that the Requirements listed below will mitigate impacts of the Project on the Swansea Bay water body.

- Requirement 5- Construction Environmental Management Plan
- Requirement 5 – Operational Environmental Management Plan
- Requirement 6 - Adaptive Environmental Management
- Requirement 7 – Provision of landscaping
- Requirement 11 – Operational surface and foul water drainage
- Requirement 12 – Contamination and groundwater
- Requirement 19 – Piling
- Requirement 24 – Construction and security lighting scheme
- Requirement 25 – Permanent lighting
- Requirement 27 – Fish and shellfish mitigation strategy
- Requirement 29 – Habitats creation strategy
- Requirement 30 – Honeycomb worm translocation strategy

Alternate locations/ modifications for the project

WFD Test this refers to - Can the beneficial objectives served by those modifications or alterations of the water body be achieved by other means which are technically feasible, do not lead to disproportionate cost and are a significantly better environmental option?

7.50 To assess the Project impact on the Water Framework Directive the Applicant has to make a reasonable case that there is not a significantly better environmental option.

7.51 An option may be a significantly better environmental option if (SEPA, 2013):

- the benefit it delivers is at least equivalent to the benefit that would be delivered by the proposal;
- its environmental cost is significantly less than the environmental cost of the proposal (SEPA advice assess the environmental cost of a proposal by identifying the significance of the proposal's adverse impacts using the method set out in *WAT-SG-67: Assessing the Significance of Impacts - Social, Economic, Environmental*); and it is economically viable and hence a realistic option.

7.52 For there to be a significantly better environmental option, the adverse impacts of the proposal must be of reasonably high significance. If the impacts of a proposal are not of reasonably high significance, an alternative option might be a slightly or moderately better option but it cannot be a significantly better environmental option. SEPA supporting guidance (WAT-SG-68) sets this out, they describe an option as an alternative means of securing the benefits expected from a proposal:

Table 20 Options to be considered in relation to different types of activity

Purpose of proposal	Option A	Option B	Option C
Modifications for hydropower Options should provide equivalent energy benefits	Use an alternative site for the hydropower development	Improve the output of existing hydropower schemes	Use an alternative but comparable renewable energy technology

7.53 The extract from SEPA guidance within table 20 is the closest type of development to the Project. However as tidal lagoons have not been built in the UK these considerations are not directly applicable.

7.54 The Applicant provided an assessment of this test within their updated WFD assessment on Swansea Bay water body. NRW reviewed this work as part of their advice note.

7.55 These assessments both consider The Crown Estate's work in 2012 to identify areas suitable for a tidal lagoon or tidal barrage. The Crown Estate identified a discrete number of potential sites in the UK for tidal lagoons see *Figure 7*. These opportunities are primarily limited to the north and south coast of Wales and maximised towards the east. For a lagoon site to be economic, it needs to have a large volume of water subject to a high dynamic tidal range and be sited in relatively shallow waters to minimise seawall construction cost.

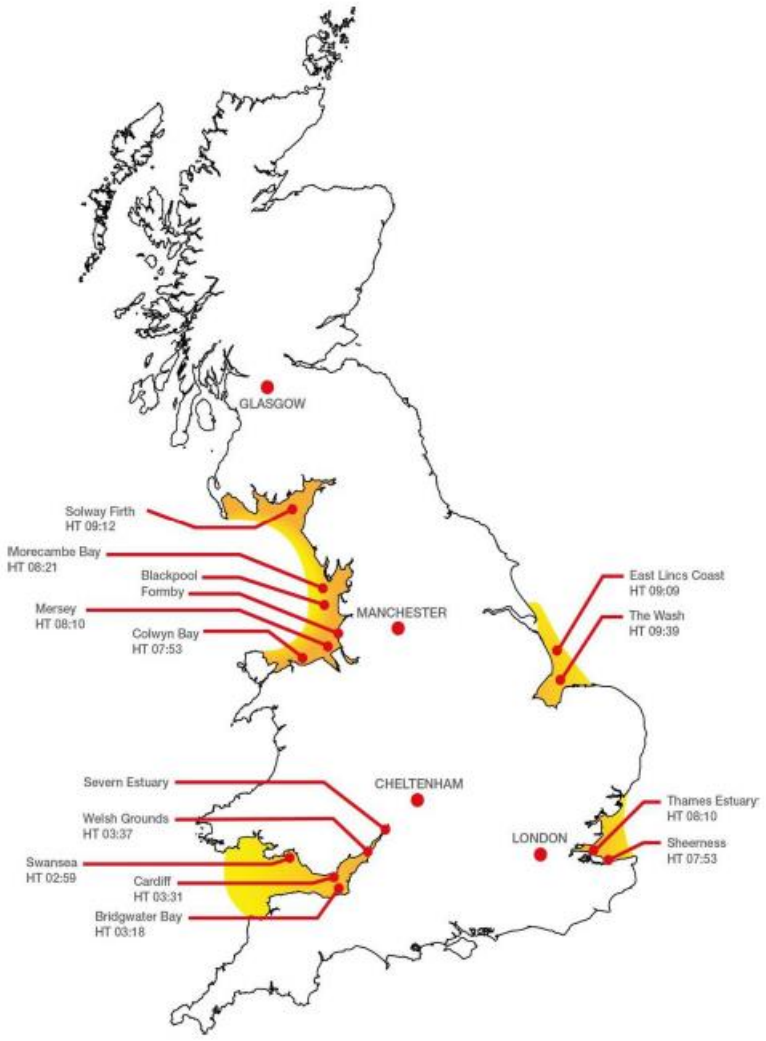

Figure 7 Tidal range areas suitable for tidal lagoon projects identified by the Crown Estate from the Applicant's updated WFD assessment

7.56 As part of a high level review of these site the Applicant examined the following key elements as part of this process:

- High tidal range (>8m);
- Suitable bathymetry (sloping seabed to the -5-10m CD contour range that would then support the lagoon wall structure plus the combination of a deeper section for submerged turbines);
- Grid connection – capacity or upgrade programmed within timeline of project development;
- Population proximity – opportunities for enhancements e.g. recreation, flood defence;
- Environmentally designated areas – avoiding an internationally designated site was considered to be significant aspect in relation to siting a First of a Kind (FOAK) lagoon in that they added to the complexity of gaining development consent for a pilot nationally important infrastructure project;
- Enclosure of a river – avoiding enclosing a river would reduce impacts on potential environmental receptors, e.g. fish, water quality, navigation.

- Local community and stakeholder views (are the community and local stakeholders receptive to the idea of a lagoon, from consultations to date -noting that public engagement cannot be expected across all sites as part of a feasibility exercise).

7.57 The Applicant considered (in their updated WFD assessment and ES) that to achieve the objective of constructing the FOAK Project, a balance was sought between optimum tidal range, an appropriate scale, environmental considerations and opportunities for providing additional benefits to the local area (e.g. recreation and regeneration). Swansea Bay was chosen as it held a number of key factors listed below:

- Tidal range;
- Size of the Bay and location of pilot project;
- Beach profile and depth of water;
- Grid connection;
- Existing knowledge of the area for use to develop a pilot project;
- Landfall existing land use;
- Recreational use;
- Navigation; and
- Environmental.

7.58 NRW agreed that other WFD coastal water bodies in Wales would not offer significantly better environmental locations as they are of the same or higher status and of less common typologies as the Swansea Bay water body. Swansea Bay is categorised as the most common coastal water body 'type' in Wales: 'moderately exposed, euhaline, macrotidal'. The Swansea Bay water body is at moderate status and not considered to serve a disproportionately large role, ecologically, in the wider Western Wales river basin. Other WFD coastal water bodies in Wales are of the same or less common typologies and at good or moderate status (2013 classification).

7.59 Much of the Welsh coastline and sea is designated as a Special Area of Conservation or Special Protection Area. The north and south coast of Wales beyond Swansea Bay supports a range of designated sites for habitats and species. The area between Gower and Barry is the only coastal area in the north or south Wales coast that does not host any marine SACs or SPAs, however does host coastal SACs and SSSIs. NRW considered in their advice note that it is unlikely that an area with designated sites would offer significantly better environmental options because of the potential impact to biodiversity. NRW also considered recreational impacts and shellfisheries but felt at the end of examination that they could not provide advice on whether other significantly better environmental options on these bases exist.

7.60 Within NRW's advice note they confirm that they did not consider other lagoon designs to be significantly better environmental options. However NRW did ask the Applicant for information on the detailed selection of locations for the turbines and sluices. The Applicant acknowledged in their response, to NRW queries on the WFD Information to Support Article 4.7 Derogation for

Swansea Bay Coastal Waterbody report (November 2014[13]), that what they refer to as Option A, would be less attractive than Option B and that it may have greater effects on subtidal benthic ecology, fish and navigation and greater dredge requirements. The WFD test means that if Option B is a technically feasible scheme and would be a significantly better environmental option it should be a requirement of the Project. The ExA view was that while Option B would seem to some degree to be better in environmental terms the differences are likely to be marginal rather than significant.

- Option A is on southwest straight of lagoon seawalls – positioned at northeast extent of micro-siting area.
- Option B is on southwest straight of lagoon seawalls – positioned at southeast extent of micro-siting area.

7.61 During the examination NRW's advice note found that the information provided by the Applicant for test 4(7)d was not sufficient to allow NRW to be confident that a limited range of other locations in Wales could provide a better environmental option and would be significant, technically feasible and not of disproportionate cost. NRW wanted further information to exploring alternative options for the location of the project between Gower Peninsula and Barry Island. Noting that these areas may be considered to have the appropriate tidal range and are outside of a European Protected Site.

7.62 Further information was received by NRW and PINS following NRW's letter of the 23rd March[14]. The Applicant clarified their assessment of potential other sites in which they had structured their assessment into three discrete stages. In this way it can be ensured that a significantly better environmental option, that was also technically feasible, and not of disproportionate cost was not overlooked for this First of a Kind (FOAK) project.

First stage

7.63 Identification of potential environmental constraints that could significantly delay or prevent development of a FOAK. Initially, this involved discounting any sections of coastline within the study area where a tidal lagoon would potentially significantly affect protected areas, such as making landfall within or adjacent to, or impounding land or sea designated as the following:

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Ramsar Site
- Site of Special Scientific Interest (SSSI)
- National Nature Reserves (NNR)
- Area of Outstanding Natural Beauty (AONB)
- National Park
- Heritage Coast

This lead to six sections of coastline being identified.

[13] *TLSB Responses to NRW queries on the WFD Information to Support Article 4.7 Derogation for Swansea Bay Coastal Waterbody report (TLSB, November 2014)*

[14] *http://infrastructure.planningportal.gov.uk/wp-content/ipc/uploads/projects/EN010049/2.%20Post-Submission/DECC%20Consultation/Responses%20to%20consultation/Tidal%20Lagoon%20(Swansea%20Bay)%20Plc%201.pdf*

Second Stage

7.64 The sections of coastline identified above were then reviewed by the Applicant in terms of anthropogenic constraints such as operational port facilities and notable tourist beaches. In addition, as the Project does not impound a river, the mouths of rivers were also discounted. Finally those sections of the coastline with high cliffs were also discounted due to the restrictions on accessibility for construction and operation, making them technically infeasible.

7.65 After this test the Applicant was left with the sections:

- Swansea Bay from east of river Tawe to Crymlyn Burrow;
- Margam Sands extending from Port Talbot Harbour to Kenfig SAC;
- Small section of coast by west Aberthaw.

7.66 **Aberthaw** – The Applicant considered that the option at Aberthaw would not provide a significantly better environmental option, as defined above, due to the potential interaction with the Aberthaw Power Station and any discharges from this facility. In addition to this, a lagoon of the scale required for a first of its kind would not be able to be accommodated at this site.

7.67 **Port Talbot** - To site a lagoon of a sufficient size at Port Talbot would involve the inclusion of two outfalls within the Lagoon footprint, namely Afan Waste Water Treatment Works long sea outfall and Afan storm water outfall. Encompassing long sea outfalls, as has been demonstrated with the Project, results in potential effects on water quality particularly for use of the impounded area as a recreational resource. Extension of two outfalls outside the footprint of the lagoon would therefore probably be required to minimise constraints for future recreational use within the lagoon. In addition to this, the site lies immediately adjacent to Kenfig SAC and changes to coastal processes resulting from construction and operation of the lagoon could potentially affect the SAC. Finally, the southern section of the coastline is within the within the Merthyr Mawr, Kenfig and Margam Burrows Registered Historic Landscape. It was therefore considered that the potential environmental effect of a lagoon at this site would be greater than the other option at Swansea Bay and as such it was not the best environmental option.

7.68 Based on the above, the Applicant concluded that along the coastline between the Gower Peninsula and Barry Island, there are no significantly better environmental options for a FOAK project.

Economic Impact

Overriding public interest and benefits comparison tests

7.69 The reasons for the modifications or alterations of overriding public interest and/or the benefits to the environment and to society of achieving the WFD objectives are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development. This condition has two alternatives:

- Overriding public Interest
- A benefits comparison test

7.70 If the Project is not justified by overriding public interest, then the scheme is only compliant with Article 4.7 if the benefits of achieving the WFD's objectives are outweighed by the benefits of the Project to human health, human safety or sustainable development. The SoS refers to these conditions as the "Overriding Public Interest Test" and the "Benefits Comparison Test". The SoS has recognised the importance of the WFD and has therefore undertaken an assessment of both alternatives to ensure compliance.

7.71 The Applicant has provided evidence that it considers demonstrates that the Project passes both the Overriding Public Interest test and also that the benefits to sustainable development outweigh the benefits of achieving the WFD. The SoS has assessed both components of the condition.

7.72 To assess the Overriding Public Interest Test, the SoS has reviewed the evidence presented, by assessing to what extent the public interests attached to the Project override those attached to enhancing Swansea Bay in line with the WFD, consistent with EU Guidance.

7.73 In considering the Benefits Comparison Test, the SoS has assessed whether sustainable development benefits of the Project are greater than the benefits to the environment and the society arising from enhancing Swansea Bay in line with WFD GEP objectives. In doing so the SoS has considered the robustness of the evidence and analysis provided by the Applicant and considered relevant opinions and evidence provided by NRW and the ExA.

Assessment of Overriding public interest test

7.74 In considering the Overriding Public Interest test the SoS has assessed whether the Project has a public interest more important than the public interest in achieving GEP in the Bay through the WFD, where public interest relates to:

- Actions or policies aiming to protect fundamental value for citizen's lives (health, safety, environment);
- Fundamental policies for the state and society;
- Carrying out activities of an economic or social nature, fulfilling specific obligations of public services.

7.75 The Applicant has argued that *"The EU, UK and Welsh legislative and policy context particularly in relation to renewable energy and climate change, provides a public interest case for the development of this Project"* and also that the *"public interest case is strengthened further by the contribution of the Project to sustainable development in Wales, the city region and the local area".* The Applicant notes that the policy objectives to which the Project would contribute relate

to the promotion of sustainable energy, fighting climate change and contributing to secure energy supplies through enhancement of the UK's electricity infrastructure. The EU has developed several policies towards the achievement of the above objectives and the UK, through the Climate Change Act, has introduced a legally binding objective to reduce emissions by at least 80% in 2050 from 1990 levels. At the regional level, the Welsh Government has committed to a path towards sustainable development in its Energy Policy Document, which assigns particular importance to the marine energy market.

7.76 The Applicant also notes the presence of a National Policy Statement (NPS EN-1) addressing the need to promote renewable energy. While the ExA notes in its Report that tidal lagoons are not explicitly encompassed in NPS EN-1, stakeholders have acknowledged that the goals and the importance of the Project would contribute to increasing electricity from renewable energy sources. Also, the local Western Wales RBMP recognises that environmental protection could be sacrificed in cases where alterations would produce sustainable development.

7.77 The Applicant notes that the Project is a Nationally Significant Infrastructure Project. In addition the Project has attracted support from local residents, as demonstrated by the results of the questionnaire completed in 2013 which showed that 86% of local people were then in favour of the development. Finally, the Applicant considers that the Project could provide significant opportunities for local economic development. This is secured by Requirement 41 of the DCO, requiring the applicant to produce a local employment and skills plan.

7.78 Based on the evidence available, the SoS is satisfied that there is a reasonable case for Overriding Public Interest of the Project. Specifically, there is satisfactory evidence demonstrating the future contribution of the Project to safeguarding the environment through the production of renewable energy, its necessary contribution toward meeting core state commitments and societal preferences on meeting carbon targets and its part in meeting the public service obligation of the state to provide security of electricity supply. The SoS notes that NRW achieved a similar opinion on the basis of the evidence provided, concluding that "*on the basis of the evidence available, a reasonable case has been made for the Project being of overriding public interest*".

Assessment of the Benefits Comparison Test

7.79 To pass this test the benefits to the environment and to society of protecting the water environment (in line with the WFD) must be outweighed by the benefits of the Project to one or more of the following:

- Human Health
- The maintenance of human safety; or
- Sustainable development

7.80 The Applicant considers that the benefits to sustainable development outweigh the benefits of achieving the WFD and has submitted evidence setting out the economic, social and environmental impacts related to sustainable development.

Economic Impacts

7.81 The Applicant has relied on modelling from the Welsh Economy Research Unit Cardiff University (WERU) to argue that the Project could bring a significant economic contribution to the local economy of Swansea Bay and, more widely, Wales. The WERU report states that during the construction phase:

- Capital spending will be in the region of £756m;
- An estimated £299m of development for supplies, services and components could be sourced within Wales;
- Regional spending evenly spread over a three year development period will result in a total of an additional £454m of additional output in Wales and to the creation of an estimated £173m of gross value added (GVA);
- Around 5,540 person years of employment across Wales will be supported and around 1,850 full time equivalent jobs across the region for the three year construction period.

7.82 Furthermore during the operational phase

- Spend might be worth over £5m in extra output in Wales, and £2.2m in GVA annually for the region and generate some 60 full time equivalent jobs.
- In addition, the WERU reports that "*by assuming a modest 70-100,000 leisure trips per annum to a redeveloped area enclosed by the Lagoon*" a "*further £1.5-£2.1m of gross value added and 65-90 full time job equivalents could be realised*".

7.83 Finally, the Applicant states that it "*Will implement a supply chain strategy, which aims to maximise the potential to develop a supply chain and achieve the target Project spend of 50% in Wales and 65% in the UK*".

7.84 The SoS considers that the analysis the Applicant has developed is reasonable. The baseline is appropriately developed and provides evidence on all key current local economic activities. Also the model rationale appears sound in terms of estimating changes to recreation and tourism, as the counterfactual seems reasonably well developed. Finally, the multiplier used to estimate overall impacts along the value chain appears reasonable and in line with established practice, drawing on a tailored Welsh economy input-output model.

7.85 The SoS is satisfied that the Applicant has presented a reasonable case regarding the positive economic benefits to Wales and the local economy of Swansea Bay arising from the Project. However, the SoS notes that the extent of the local benefits depend on the proportion of the supplies, services and components sourced within Wales and that the analysis does not directly take into account any costs from potential support provided to the Project by electricity consumers – recognising that these costs would likely be spread across the UK.

Social Impacts

7.86 The Applicant has argued that the project will provide "*significant public realm and landscaping benefits, including visitor facilities, public art, children's play area, boating facilities, sailing training and activity for young, old and disabled visitors alike, an ecological park and natural recreational*

area, improved access to the seafront and an attractive venue for the provision of events of local, regional and national importance".

7.87 The SoS has reviewed the Applicant's submission relying on the framework developed by SEPA and identified Recreation, Visual Impacts, Traffic and Noise, Human Safety (Flooding) and Human Health (Water quality) as key social impacts to consider in Projects altering water bodies. Her assessment is presented below:

- **Recreation** – The Applicant has argued that during construction the Project would create "minor" and "negligible" impacts for several recreational activities, as parts of the Bay would need to be closed off. However, once the Project is operational, a range of new recreational facilities would be available.

  The SoS, by assessing the evidence on the net addition to existing recreational facilities, and the interim nature of disruption, considers that there is a reasonable case for positive recreational benefits. While the magnitude of the benefits of the new facilities is hard to quantify, the SoS considers that the relatively high level of local support emerging from surveys and questionnaires provides a satisfactory indication that the benefits would be perceived as larger than the existing ones. The SoS however notes the need to obtain separate planning permissions in order to deliver the recreational facilities as described elsewhere in this report and in her decision letter.

- **Visual Impacts –** The Applicant has identified a permanent significant change in visual amenity across several locations once the Project is operational. This is based on surveys of predicted visual changes performed across several Swansea Bay locations.

  The ExA noted that their assessment of the seascape impact is more negative than the applicant's assessment during construction, and that the overall impact is significant in relation to seascape for both construction and operational phases. The ExA noted there are minor negative impacts on some of the viewpoints.

  On the basis of the evidence available, the SoS supports the ExA's conclusion regarding the largely neutral impact for the majority of viewpoints. However, she notes that the views from near locations such as the Seascape in Swansea Bay would be negatively impacted. The information submitted regarding the visual impact, together with other evidence showing the level of local support for the Project, and the current existing HMWB status of Swansea Bay, provide satisfactory ground for the largely neutral impact.

- **Traffic and Noise** - The Applicant has identified minor or negligible adverse impacts on public transport, cyclists and pedestrian amenities during the operational phases, while significant noise impacts would be temporary and limited to the construction phase. The Applicant has

justified the “minor” magnitude on the basis of the ‘Construction Phase Travel Plan’ and on the noise mitigation measures.

On the basis of the evidence provided the SoS agrees that the overall long term impact will be minor if not negligible.

- **Flooding/ Human Safety** - The Applicant states that there should be “*no notable increase in surface water runoff compared with the existing situation*,” and that the “*effects of the Lagoon on both water level and wave height have been assessed as insignificant*.” This is based on the fact that structurally, the Project would sit in an area where flood structures are already present and where the probability of flooding in any year is 0.1%. Also, wave modelling indicates positive benefits from the presence of the Lagoon seawall. In addition, flood risk warning notices will be erected to inform people entering the site.

  On this basis the SoS considers that the case for insignificant impacts on flooding and human safety from the Project is reasonable.

- **Water quality/ Human Health** – The Applicant expects that the Project would have minimal impacts on water quality and human health as a result of small changes in the levels of salinity, temperature, nutrient distributions and nitrogen concentration. This is based on modelling of the impact of construction on contaminants.

  On the basis of the available evidence, the SoS is satisfied that the changes in water quality arising from the Project are unlikely to increase risks for human health. This view is supported by the fact that the ExA has similarly concluded that “*there is no risk to human health arising from the development.*”

7.88 Overall, considering the evidence available on impacts across all key relevant social categories, the SoS is satisfied that the Project would not have a negative social impact on the Swansea Bay area and has the potential to provide a positive social impact once operational, noting that separate planning permissions would be required for the additional recreational facilities.

Environmental Impacts

7.89 The SoS, NRW and the ExA have dedicated particular attention to environmental impacts throughout the WFD and HRA assessments.

7.90 As discussed in more detail above, the evidence provided suggests that deterioration will occur in the composition and abundance of benthic faunal species, in the hydro-morphological dynamics of Swansea Bay, and in the range of mitigation measures that can be implemented to achieve WFD GEP.

7.91 With regard to estimating the potential environmental impacts of the Project, the SoS has compared the value of the foregone environmental benefits with the environmental benefits associated with the low carbon electricity that the Project would produce. This is on the basis of

the residual impacts after mitigation, monitoring and adaptive environmental management as secured by the DCO and future consents. These aspects are discussed in more detail below.

Estimation of Foregone Environmental Benefits

7.92 In order to estimate the order of magnitude of potential impacts, the SoS has relied on the contingent valuation that NRW has referred to. The SoS considers that this provides an alternative illustration of the environmental impacts to that of considering ecosystem services.

7.93 NRW has referred to the National Water Environment Benefits Survey (NWEBS) to monetise the benefits foregone as a result of not achieving the WFD objectives. NWEBS was commissioned by the Environment Agency and the survey was undertaken with members of the public who stated a Willingness to Pay (WTP) for a range of environmental conditions, allowing derivation of a value per square kilometre of different WFD ecological statuses. The estimation is consistent with Government appraisal principles, given that it is underpinned by the EA methodological guidance for estimating the value of water bodies under the WFD.

7.94 The survey estimates that the Net Present Value (NPV) of the foregone environmental benefits could be valued at around £36.7m. The SoS recognises that this estimation method suffers from some weaknesses. For instance, WTP approaches are structurally exposed to the risk of overestimating the value people could attach to environmental protection. In addition, it could be sensitive to the amount of information available on the possible degradation or enhancement opportunities. Also, this approach could exclude the positive (though lower) benefits that people from other areas could attach to Swansea Bay.

7.95 Nonetheless the SoS considers that as a whole the contingent valuation is a reasonable indication of the order of magnitude of environmental benefits that could be foregone by developing the Project.

Impact on CO_2Emissions

7.96 The Applicant states that the Project could be CO_2 neutral in about four years, with emissions during construction offset by the production of renewable energy. To assess in more detail the potential contribution to emissions reductions throughout the lifetime of the Project, the SoS has drawn on Supplementary Green Book Guidance on GHG valuation.

7.97 The emissions impact of the Project during its operational phase depends on the alternative forms of electricity generation it would displace. This is highly uncertain, but in order to provide an illustration the SoS has used the estimated long-run marginal emissions factor for grid electricity in the guidance on GHG valuation. This reflects the fact that over-time the proportion of grid electricity that is low carbon is expected to increase.

7.98 The estimated total amount of emissions saved during operation to 2100 is up to around 2 million tonnes of CO_2e. Note that this excludes emissions arising from construction, and decommissioning. Valuing the emissions using the traded sector value of carbon set out in the GHG guidance, and discounting using the social discount rate in the Green Book, results in an NPV benefit of around £69 million (real 2014 prices) during the operational phase of the Project. The SoS notes that, whilst there is an inherent uncertainty in the value of emissions saved, this estimate compares favourably with the estimated environmental benefits foregone.

Conclusions and Recommendations

7.99 The SoS is satisfied that the Project fulfils the conditions contained in Article 4.7 c) necessary to obtain derogation from the WFD. The SoS considers that a reasonable case has been made to pass the Overriding Public Interest test, which therefore provides sufficient ground for fulfilment of the condition. In addition, the available evidence shows with reasonable confidence that Sustainable Development benefits will be larger by developing the Project than by achieving the GEP objectives of the WFD.

7.100 With regard to the Overriding Public Interest Test, the SoS considers that by providing low carbon energy the Project would provide a greater contribution to public interest than achieving GEP in Swansea Bay through the WFD.

7.101 With regard to the Benefits Comparison Test, the SoS considers that the evidence available demonstrates a greater contribution to Sustainable Development arising from the Project than from achieving GEP in Swansea Bay. This opinion is based on the positive magnitude of the economic case, on the overall positive social benefits, and on the positive contribution to renewable energy and associated environmental benefits. These benefits appear to outweigh the foregone benefits to the environment and to society of protecting the water environment to achieve GEP.

Scope of Article 4.7

7.102 Article 4.7 sets out circumstances in which failure to achieve certain WFD objectives are permitted. An extract from the Directive is set out below.

> **Article 4(7) of the Water Framework Directive**
> Member States will not be in breach of this Directive when:
> - failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or
> - failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities and all the following conditions are met:
>
> (a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;
> (b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;
> (c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and
> (d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

7.103 Under Article 4.7, exemptions can be applied for new modifications and new sustainable human development activities.

7.104 New modifications relate to modification of the physical characteristics of water bodies. This means modifications to their hydro-morphological characteristics. The impacts may result directly from the modification or alteration or may result from changes in the water quality brought about by the modification or alteration. For example, the hydro-morphological characteristics of impoundment created for hydropower and water supply can affect the dissolved oxygen and temperature resulting in a deterioration of ecological status in impounded water and in the downstream river.

7.105 The impacts of those modifications and alterations may be limited to the water bodies in which modification works are undertaken; or extend to water bodies beyond those in which the modification works are undertaken. The Applicant and NRW have looked at the effect of the Project on adjacent water bodies within their assessment of the project against Article 4.8.

7.106 There is no definition of “new sustainable human development activities” within the Directive. The European Commission’s (EC) Common Implementation Strategy guidance 2009 states that these activities will depend on the time, scale, involved stakeholders and information on the activity available. Relevant process requirements are provided in the WFD itself, the Strategic Environment Assessment, Environmental Impact Assessment and "Aarhus" Directives, and should be guided by the principles of the EC Treaty, being the "polluter pays principle, the precautionary principle and preventive action, and the principle of rectification of pollution at source"'. Guiding principles on sustainable development can be found in the Renewed EU Sustainable Development Strategy. Furthermore, the decision making process should follow the

principles of "good governance", including policy coherence, social inclusion and transparency and make best use of the availability of alternatives.

7.107 Deterioration of good ecological status (or good ecological potential) of a water body is expressed in terms of “classes” (e.g. high, good, moderate, poor or bad). Ecological status and potential classes are established on the basis of specific criteria and boundaries in accordance with Annex V of the WFD. In the context of Article 4.7, the objectives of preventing deterioration of ecological status (or the potential) refer to changes between classes rather than within classes.

7.108 A temporary deterioration in water status is allowable and can occur due to fluctuations in the condition of water bodies from short-duration human activities, such as construction or maintenance works. If the condition of each affected water body is adversely affected for only a short period of time and recovers within a short period of time without the need for any restoration measures, such fluctuations will not constitute deterioration of status. The application of Article 4.7 will not be required (CIS, 2009).

7.109 Regarding Article 4(7)b of the WFD ‘*the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;*’. NRW (advice note 9th December 2014) has confirmed that should this Project be constructed this modification would then be reported in the following publication of the Western Wales River Basin Management Plan.

7.110 Below is an example of an assessment approach given as a practical tool when considering the application of Article 4.7 (CIS, 2009). This CIS guidance highlights that they have swopped the order of box 3 and 4 from the exact text of the Directive. **The SoS has used this guidance from Europe to set out her assessment of this Project under the WFD.**

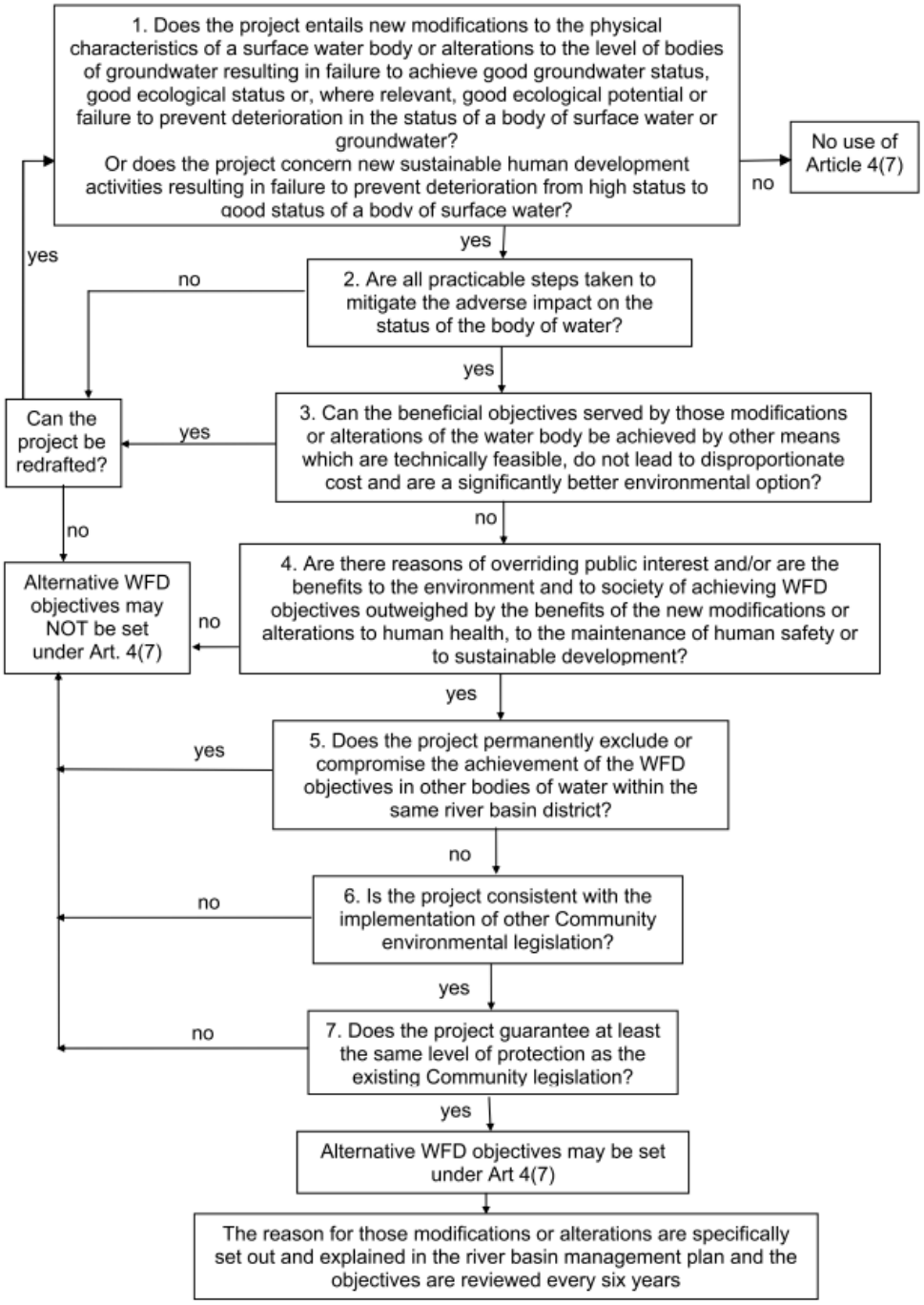

Figure 8 Flow chart from the EC's CIS (2009) for WFD guidance document 20 on exemptions to the environmental objectives.

Step 1 *Does the Project entail new modification to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater resulting in failure to achieve good groundwater status or, where relevant, good ecological potential or failure to prevent deterioration in the status of a body of surface water or groundwater?*
Or does the Project concern new sustainable human development activities resulting in failure to prevent deterioration from high status to good status of a body of surface water?

7.111 **The SoS agrees with the Applicant and NRW and considers that the Project does have the potential to change the condition of components that define the status of Swansea Bay water body.** She agrees that the water body will cease to function as a discrete physical and ecological unit causing deterioration in quality elements at water body level and result in a failure of Swansea Bay water body to achieve Good Ecological Potential (GEP). There is also a risk that the benthic invertebrate quality element and the biological quality element supporting hydromorphological conditions may also deteriorate. The reasoning for this view is set out within sections 7.11 - 14 of this report.

Yes – the Project does entail new modification to the physical characteristics of a surface water body resulting in failure to achieve good ecological potential.

Step 2 *– are all practical steps taken to mitigate the adverse impact on the status of the body of water?*

7.112 **The SoS agrees with the Applicant and NRW and considers that the Project does take all practical steps to mitigate the adverse impact on the status of the body of water.** In order to be compliant with the WFD the SoS has included the Requirements as listed in Section 8.1 within the DCO. The reasoning for this view is set out within sections 7.422 - 7.49 of this report.

Yes – the Project through the DCO and future licensing does take all practical steps to mitigate the adverse impact on the status of the body of water.

Step 3 *- Can the beneficial objectives served by those modifications or alterations of the water body be achieved by other means which are technically feasible, do not lead to disproportionate cost and are a significantly better environmental option?*

7.113 An option may be a significantly better environmental option if (SEPA, 2013):

- the benefit it delivers is at least equivalent to the benefit that would be delivered by the proposal;
- its environmental cost is significantly less than the environmental cost of the proposal (SEPA advice assess the environmental cost of a proposal by identifying the significance of the proposal's adverse impacts using the method set out in *WAT-SG-67: Assessing the Significance of Impacts - Social, Economic, Environmental*); and it is economically viable and hence a realistic option.

7.114 For there to be a significantly better environmental option, the adverse impacts of the proposal must be of reasonably high significance. If the impacts of a proposal are not of reasonably high significance, an alternative option might be a slightly or moderately better option but it cannot be a significantly better environmental option.

7.115 NRW view in their advice note and during examination was that there are other places in Wales where this lagoon could be put and it would have less environmental impact. The Applicant has since responded to NRW's questions. Their response is summarised in section 7.62 - 7.68. The ExA did not consider at the end of examination that any of the alternative locations were likely to be a significantly better environmental option. The further information provided by the Applicant allows the SoS to confirm that there are no other places in Wales where this lagoon could be put and it would have less environmental impact.

7.116 The Applicant in their response to questions from NRW[15] during the examination stated that the 'Option B' location is a technically feasible and may potentially be a better environmental option (see section 7.60). The ExA view was that while Option B would seem to some degree to be better in environmental terms the differences are likely to be marginal rather than significant. The SoS agrees with the view of the ExA.

7.117 **The SoS confirms that her assessment of '***can the beneficial objectives served by those modifications or alterations of the water body be achieved by other means which are technically feasible, do not lead to disproportionate cost and are a significantly better environmental option'* **meets the test within Article 4(7)d of the WFD.**

NO – *Can the beneficial objectives served by those modifications or alterations of the water body be achieved by other means which are technically feasible, do not lead to disproportionate cost and are a significantly better environmental option?*

Step 4 *- Are the reasons for those modifications or alterations of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development?*

7.118 Section **Error! Reference source not found.** -**Error! Reference source not found.** sets out the SoS requirements and assessment of the Applicant's report. **The ExA report stated that the evidence presented during examination supported the balance of argument that the benefits to the environment and society was found from building the Project and generating tidal energy. The SoS in agreement with NRW and the ExA is satisfied that the Applicant provides a reasonable case to fulfil condition 4.7 (c) of derogation from the Water Framework Directive.** The SoS support is based on the presence of a reasonable case of

[15] *http://infrastructure.planningportal.gov.uk/wp-content/ipc/uploads/projects/EN010049/2.%20Post-Submission/Representations/Further%20Information%20Requested%20by%20the%20Examining%20Authority%20(Rule%2017)/04-12-2014%20-%20Responses%20to%20questions%20in%20letter%20issued%2027%20Novmeber/TLSB%2014_Appendix%204%20to%20Response%20to%20representations%20made%20at%20Deadline%20VI.pdf*

Overriding Public Interest, which itself provides justification for derogating from the WFD. In addition, the SoS considers that the case for derogation is reinforced by the reasonable expectation that contribution to Sustainable Development will be larger by constructing the Project than complying with Water Framework Directive requirements.

The SoS confirms that her assessment of overriding public interest meets the test within Article 4(7)c of the WFD.

Yes - Are the reasons for those modifications or alterations of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development?

Step 5 *Does the Project permanently exclude or compromise the achievement of the WFD objectives in other bodies of water within the same river basin district?*

7.119 The impact of the proposed Project on other water bodies is considered within sections 7.155 – 7.41. See next section on Article 4.8.

Scope of Article 4.8

7.120 Article 4.8 sets out circumstances in which failure to achieve certain WFD objectives are permitted. The WFD requires that where Article 4.7 is to be applied, you need to ensure that the Project does not permanently exclude or compromise the achievement of the objectives of the WFD in other water bodies within the same river basin district and is consistent with the implementation of other Community environmental legislation.

Article 4(8) of the Water Framework Directive
When applying paragraphs 3, 4, 5, 6 and 7, a Member State shall ensure that the application does not permanently exclude or compromise the achievement of the objectives of this Directive in other bodies of water within the same river basin district and is consistent with the implementation of other Community environmental legislation.

Test 5 - *Does the Project permanently exclude or compromise the achievement of the WFD objectives in other bodies of water within the same river basin district?*

7.121 NRW in their Advice note from the 9th December had limited confidence in the conclusions of the coastal processes assessment in the Applicant's assessment of no deterioration in the Neath and the Tawe Estuary water bodies. The SoS sort further clarification following the close of examination. NRW were considering further information, and would use this as part of their own WFD assessment for the Project as part of the Marine Licence. However NRW did not advise that the Neath and Tawe transitional waterbodies be considered within an Article 4.7 assessment. If NRW assessments do show a potential impact for the Project as part of their own licensing regime these water bodies could be considered again at this point. As more detail is being

produced for these operation licences the AEMP will be revised. As part of the AEMP (secured within Requirement 6 in the DCO) and the fish mitigation strategy (Requirement 27 of the DCO) the effects on all water bodies, including the Tawe and Neath, will be monitored and the findings considered in relation to the status of the water bodies concerned. If a risk to deterioration in status is predicted, mitigation will be discussed with NRW and implemented.

NO - the Project will not permanently exclude or compromise the achievement of the WFD objectives in other bodies of water within the same river basin district.

Test 6 *– Is the Project consistent with the implementation of other Community environmental legislation?*

Go to next section on Article 4.9

Scope of Article 4.9

7.122 Article 4.9 sets out that the new provisions, including the application of Article 4.7, guarantee at least the same level of protection as the existing Community legislation. The ExA considers that the examination provided an opportunity for evaluation of matters covered by the full range of Community legislation and there has been thorough examination of directly relevant legislation, most notably the Habitats Directive. Nothing was raised during the examination directly in respect of Article 4.9. The ExA view is that if there is a derogation under Article 4.7, there would have been no relaxation of the level of protection provided by existing Community legislation and that therefore the terms of Article 4.9 of the WFD have been met.

Article 4(8) of the Water Framework Directive
Steps must be taken to ensure that the application of the new provisions, including the application of paragraphs 3, 4, 5, 6 and 7, guarantees at least the same level of protection as the existing Community legislation.

Yes the Project is consistent with the implementation of other Community environmental legislation.

Test 7 (part 1) – *Does the Project guarantee at least the same level of protection as the existing Community legislation?*

Yes **- the Project does guarantee at least the same level of protection as the existing Community legislation.**

Test 7 (part 2) – *Alternative WFD objectives may be set under Art 4(7)*

7.123 None have been suggested as part of the examination. NRW can consider this as part of future licences and permits.

Test 7 – (part 3) – *The reason for those modifications or alterations are specifically set out and explained in the river basin management plan and the objectives are reviewed every six years.*

7.124 NRW (advice note 9th December 2014) has confirmed that should this Project be constructed this modification would then be reported in the following publication of the Western Wales River Basin Management Plan. **The SoS agrees that this confirmation from NRW meets the test within Article 4(7)b of the WFD.**

Yes - The reason for the Project will be specifically set out and explained in the next river basin management plan which is published.

Water Framework Directive Conclusions

8.0 The Secretary Of State is satisfied that the Applicant has provided a reasonable case to fulfil the condition 4.7 of derogation from the Water Framework Directive. The SoS view is based on the assessment above and this conclusion is supported by the ExA and NRW. In order to meet these tests the SoS has included mitigation measures in the Requirements of the DCO. Any future permits and licences needed for this Project will also need to be compliant with the requirements of the Water Framework Directive.

8.1 Mitigation for the Project will be secured and delivered through the DCO within:

- Requirement 5- Construction Environmental Management Plan
- Requirement 5 – Operational Environmental Management Plan
- Requirement 6 - Adaptive Environmental Management
- Requirement 7 – Provision of landscaping
- Requirement 11 – Operational surface and foul water drainage
- Requirement 12 – Contamination and groundwater
- Requirement 19 – Piling
- Requirement 24 – Construction and security lighting scheme
- Requirement 25 – Permanent lighting
- Requirement 27 – Fish and shellfish mitigation strategy
- Requirement 29 – Habitats creation strategy
- Requirement 30 – Honeycomb worm translocation strategy

8.2 The SoS has carefully considered all of the information presented before and during the Examination, including the ES, the Applicant's WFD assessment and updated WFD assessment, NRW's advice note, responses to the SoS consultation letter, representations made by Interested Parties, and the ExA's report itself.

Authors: **Toni Scarr, Environment Manager, Siobhan Browne, Environment Manager, Paul Bailey, Analyst and Antonio Ciavolella, Analyst.**

Department of Energy and Climate Change

Date: **8th June 2015**

References

Baines, M.E. and Evans, P.G.H. (2012) Atlas of the Marine Mammals of Wales. 2nd Edition. CCW Monitoring Report No. 68.

Bruijs, M.C.M. & Durif, C.M.F. (2009). Silver eel migration and behaviour. Springer.

Department for Energy and Climate Change (2015) Guidelines on the assessment of transboundary impacts of energy developments on Natura 2000 sites outside the UK.

European Commission (2009) Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance document on exemptions to the environmental objectives. Luxembourg: Office for Official Publications of the European Communities.

English Nature. (1997) Habitats regulations guidance note 1.

Environment Agency (2009) Western Wales River Basin District .

Environment Agency (2012) Clearing the Waters: Marine Dredging and the Water Framework Directive.

European Commission (2011) The implementation of the Birds and Habitats Directive in estuaries and coastal zones with particular attention to port development and dredging.

Evans and Prior (2012) Protecting the harbour porpoise in UK seas - Identifying a network of draft SACs for the harbour porpoise in the UK.

Gill, A.B., Gloyne-Phillips, I., Neal, K.J. & Kimber, J.A. (2005). The Potential Effects of Electromagnetic Fields Generated by Sub-sea Power Cables Associated with Offshore Wind Farm Developments on Electrically and Magnetically Sensitive Marine Organisms – A Review. Cowrie Report COWRIE-EM FIELD 2-06-2004.

HM treasury (2011) THE GREEN BOOK Appraisal and Evaluation in Central Government.

Hanke, W., & Dehnhardt, G. 2013. Sensory biology of aquatic mammals. Journal of Comparative Physiology *A*, 1-4.

JNCC Kenfig/ Cynffig SAC http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0012566 Accessed 26/05/2015.

Office of the Deputy Prime Minister (2002) Best Practice Guidance identified in Marine Minerals Guidance 1: Extraction by dredging from the English seabed.

SEPA (2013) Regulatory Method (WAT-RM-34) Derogation Determination – Adverse Impacts on the Water Environment.

SEPA (2013) Supporting Guidance (WAT-SG-68) Assessing Significantly Better Environmental Options.

Sörensen, I. (1951). An investigation of some factors affecting the upstream migration of the eel. Institute of Freshwater Research, Drottningholm, Rep 32.

Thompson, P.M, McConnell, B.J., Tollit, D.J., Mackay, A., Hunter, C., and Racey, P.A. 1996. Comparative distribution, movements and diet of harbour and grey seals from the Moray Firth, N.E. Scotland. Journal of Applied Ecology, 33: 1572-1584.

UKTAG (2008). Guidance on the Classification of Good Ecological Potential for Heavily Modified and Artificial Waterbodies.