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Morlais Project

Rebuttal Proof of Evidence of RSPB and NRW regarding the outline EMMP

Applicant: Menter Môn Morlais Limited
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1. Introduction

1. My name is Frank Fortune and I am a Technical Director at AECOM. I am acting as a witness on the outline Environmental Mitigation and Monitoring Plan (EMMP) for Menter Môn (the Applicant) in relation to Morlais (the Project).
2. The current version of the outline EMMP is a core document to the inquiry (MDZ/A16.8 - MMC447 MOR-RHDHV-DOC-0072 (04) Outline EMMP (Revised) 02/11/2020).
3. This rebuttal is submitted in response to proofs of evidence submitted by the Royal Society for the Protection of Birds (RSPB) and Natural Resources Wales (NRW), and I am responding to issues raised regarding the EMMP. Those documents are:
    - NRW. DNS3234121_Morlais Demonstration Zone_NRW Proof of Evidence_021120.pdf
    - RSPB. The RSPB Proof of Evidence for Morlais 2.11.20.pdf
4. Where I can usefully comment on the content and subject matter in the evidence presented, I have done so. However, any absence of comment by me regarding any particular point in the evidence should not be taken as my agreement to that point.
5. My rebuttals are set out below, with rebuttals to NRW's PoE first, followed by those to RSPB's PoE.

2. Natural Resources Wales – Proof of Evidence

2.1 Real time monitoring and rapid response

6. The requirement for real time monitoring of marine mammals to demonstrate movement or potential collision is raised several times in the PoE.
7. The Applicant is committed to development of real time monitoring for marine mammals as part of the EMMP.
8. In the Introduction (paragraph 19) NRW introduces the requirement to undertake 'real time' monitoring as part of the EMMP and questions how this will be achieved. It is also noted that "there needs to be a commitment not to operate devices until it has been demonstrated and agreed in writing that marine mammal movements and collisions can be detected".
9. The need for real time monitoring is also noted in 4.2.2, with a statement that evidence of efficacy of monitoring and mitigation is limited.
10. Real time monitoring of marine mammals has been achieved by several tidal stream projects since it was first used during the successful deployment of the world's first commercial project, SeaGen, in 2008 and its subsequent operation over several years. An extract from the final report for the Environmental Monitoring Programme for SeaGen is appended to this rebuttal (Appendix 1) and discusses the use of real time monitoring during the operation of that project. While it is true that there have been a small number of deployments of tidal technologies since SeaGen, work to develop methods for monitoring and wider environmental research continues internationally, and the Applicant proposes drawing upon best available technology and the most recent research to inform the detailed EMMP throughout the project.
11. The most recent version of the outline EMMP (Core Document MDZ/A16.8) contains a commitment to real time monitoring as part of a wider monitoring programme and proposes several potential methods for monitoring, detailed in Table 4-1 of that document. The table provides an outline list of methods which may

be used as part of the detailed EMMP, after review of suitability during development of the detailed EMMP and agreement with regulators. A number of the methods proposed can support real time monitoring, these include active sonar, passive acoustic and video systems. The potential for use of such systems (specifically active sonar, passive acoustic and for real time monitoring of the Project) is also noted by NRW in Paragraph 4.2.8.

12. The outline EMMP (Core Document MDZ/A16.8) also incorporates recent advice provided by NRW to the Applicant on incorporation of adaptive management into the outline EMMP (MDZ/F15.3 - MMC 206 MOR-EXT-DOC-009 Advice to Morlais on Marine Mammal Collision & Adaptive Management).
13. The Applicant is committed to agreeing monitoring with the regulators, including real time monitoring of movement of marine mammals and real time monitoring of any collisions or potential / assumed collisions (which would be treated as actual collisions).
14. The proposed process for management of deployment is shown in Plate 2-1 of the outline EMMP (Core Document MDZ/A16.8). Before deployment, the Advisory Group identifies parameters to be monitored and mitigation to be deployed. Only after agreement with regulators is mitigation deployed for testing, and only after mitigation is shown to be effective is Phase 1 deployed.
15. Paragraph 4.2.2 notes the need for rapid response to potential collision as part of real time monitoring and the Applicant agrees. A framework for management of potential collisions has been proposed by NRW Advisory and the Applicant is happy to follow that advice. The advice includes a process diagram showing how a rapid response would be implemented, and that diagram has been incorporated as Plate 2-2 of the outline EMMP.
16. In paragraph 4.2.7 NRW discusses the need for a rapid response to manage real time risk of collision and suggests that the outline EMMP doesn't appear to specifically show a rapid response.
17. The process outlined in the outline EMMP does not preclude a rapid response and the Applicant is committed to development of the mechanism for such a response if required. A figure detailing a framework for response to an incident, such as a collision with a marine mammal, is provided in recent NRW advice and that figure is incorporated into the outline EMMP as Plate 2-1.
18. Methods for implementation of tiers of mitigation will be agreed in advance of deployment. Lower tiers may signal review of data, for example, while higher tiers may trigger rapid responses.
19. NRW advises in paragraph 4.2.12. of the need for real time monitoring to detect or infer collisions with marine mammals. It is further advised that if injury severity cannot be determined, then a worst case of fatality must be assumed.
20. The Applicant is committed to the development of real time monitoring and the outline EMMP demonstrates the intention of the Applicant to agree aims and objectives for the detailed EMMP with the regulator, though an Advisory Group post consent. The process is also graphically illustrated in Plate 2-1.
21. It is the Applicant's intention to use monitoring to determine actual or assumed (worst case) or inferred collision. The Applicant also agrees to a worst-case assumption that collision results in fatal injury in the absence of other data that shows otherwise.

2.2 Deliverability and efficacy of monitoring and mitigation

22. In paragraph 4.2.1 NRW notes that it considers there to be uncertainty over whether the monitoring and mitigation proposed in the outline EMMP will be deliverable and effective.
23. The monitoring and mitigation suggested is in outline form and will be reviewed and brought up to date in the post consent phase, during development of the detailed EMMP. However, the monitoring and mitigation proposed within the outline EMMP is all potentially deliverable depending upon the specific details of deployment. A summary of the rationale for the proposal of each method is provided in Table 4-1 of the outline EMMP, based upon the monitoring methods discussed in the note Marine Mammals Monitoring and Mitigation Options (MDZ/A28.13). Once the location and technology for a deployment is known, all monitoring and mitigation methods with potential for use in the detailed EMMP will be reviewed by an Advisory Group,

informed by details of tidal technology to be deployed, deployment site and most recent evidence for effective use of those methods, seeking approval of NRW before deployment is permitted. This is one of the first stages proposed for development of detailed EMMP. The process proposed for this review is detailed in Section 4 of the outline EMMP and illustrated in Figure 4-1.

24. In paragraph 4.2.13. NRW advises that monitoring systems must be demonstrated as effective prior to device operation.
25. The intention of the Applicant is to demonstrate the effectiveness of monitoring and mitigation through implementation of the detailed EMMP.

2.3 Cessation of operations

26. In the Introduction (paragraph 19) and Paragraphs 4.2.24 and 4.2.15, NRW discusses its requirement for a commitment from the Applicant that operation of tidal devices will cease if an agreed environmental limit or trigger is reached.
27. A commitment to cessation of operation if an agreed trigger point or limit is reached is found within the outline EMMP at Section 1.3.2 (paragraph 46), Section 1.3.7 (paragraph 61) and Section 4.1 (paragraph 128).
28. It is of note that in paragraph 4.2.4. NRW supports the inclusion of tiered mitigation as a commitment within the outline EMMP, including the stopping or removal of tidal devices (cessation of operations) as the highest level of mitigation.
29. NRW discusses maximum collision limits in paragraph 4.2.16. and in their advice to the Applicant on adaptive management (MDZ/F15.3 - MMC 206 MOR-EXT-DOC-009 Advice to Morlais on Marine Mammal Collision & Adaptive Management), requiring the inclusion of those limits in the outline EMMP. The outline EMMP (MDZ/A16.8) incorporates the advice on maximum collision limits.

2.4 Scale of Phase 1 deployment.

30. In paragraph 4.2.3. NRW suggests a further reduction of the scale of deployment beyond that indicated by modelling of potential collision and encounters by marine mammals.
31. The level of potential impact indicated by the modelling is directly related to the number of devices deployed and hence the MW deployed. Therefore any further reduction would indeed reduce potential for impact, however, the rationale for and the scale of, such a reduction is not provided by NRW.
32. This statement by NRW contrasts with the advice provided in NRW's recent advice on adaptive management for the project (MDZ/F15.3). In that advice, an approach is proposed, using the predicted 0.7 dolphin collisions per annum from modelling, to provide a 'not to exceed' value for theoretical collision across a 2-year period for a first phase. That advice from NRW is incorporated in section 1.3.3 (paragraph 48) of the outline EMMP.

2.5 Trigger points

33. NRW welcomes the use of spatial trigger points, as proposed in the outline EMMP, in Paragraph 4.2.5., but states it is not clear if these trigger points will lead to real time management actions.
34. It is the intention that where appropriate, such as to avoid collision, the trigger points will lead to real time management actions.
35. The trigger spatial points detailed in the outline EMMP lead to different tiers of mitigation, depending upon the level of potential risk of collision agreed with the regulator under the EMMP. In the example provided in Section 1.3.8 of the outline EMMP, higher tiers of mitigation may be implemented in real time based on triggers for that mitigation, for example proximity, agreed in advance of deployment. Agreement of aims and objectives, as well as monitoring and mitigation measures is proposed at an early stage in the transition from outline to detailed EMMP, as shown in Plate 2-1.

36. Aims and objectives and associated management measures, such as mitigation tiers, will require agreement with the regulator.

2.6 Precautionary nature of modelling

37. In paragraph 4.2.6. NRW questions evidence for an expectation of high avoidance of tidal turbines by marine mammals and the precautionary nature of modelling.

38. This matter will be discussed by the Marine Mammal witness. However, it is noted that demonstration of avoidance or mitigation of collision risk are key to the management of the Project.

2.7 Monitoring methods

39. In paragraph 4.2.8. NRW asks questions about the proposed use of 4 methods of monitoring for marine mammals, in particular:
    - NRW agreement that passive acoustic monitoring (PAM) is a potentially suitable method. Questions regarding use of PAM and its application to floating devices and its applicability to vocalising animals only;
    - NRW agreement that active sonar is useful for tracking marine mammals and as a monitoring method. Comment that active sonar is still in early stages of development and question regarding range of active sonar for tracking marine mammals, as well as its application to trigger mitigation;
    - NRW agreement as to the use of underwater video and an assumption that this method has been discounted from consideration as a monitoring method;
    - NRW support for development of use of Acoustic Deterrent Devices (ADD) as potential mitigation. Question regarding potential configuration of ADDs to mitigate collision risk.
40. Agreement of aims and objectives for the EMMP and from that agreement the appropriate monitoring and mitigation measures is an early stage in the transition from outline to detailed EMMP and will require agreement with the regulator.
41. The Applicant welcomes NRW's agreement of PAM as a potentially suitable monitoring method. PAM would seek to monitor an area around a device or devices, and this could the area occupied by floating or seabed mounted devices. Floating and mid water devices have a definable area within which they can move based on the characteristics of their anchoring system and the PAM would seek to monitor that area and surrounding buffer area. The project will seek to draw on best available expertise on use of PAM and appropriate deployment when the technology for deployment and deployment site are known. We understand that this method is only suitable for vocalising marine mammals, but also note that such animals include bottlenose dolphins and harbour porpoise, the two species for which there is most potential for AEOSI.
42. The Applicant welcomes NRW's agreement that active sonar is a potentially suitable monitoring method. Regarding range, the Applicant notes that active sonar deployed for SeaGen (see Appendix 1) was device mounted, not seabed mounted, and collected data on movement of marine mammals to a distance from the device in excess of 100 m. Initial adaptive management for SeaGen involved the validation of the use of active sonar to track marine mammals some distance from the device, and its use to trigger mitigation in real time.
43. The Applicant agrees with NRW's suggestion that underwater video is a potentially suitable monitoring method. The Applicant notes that in early versions of the outline EMMP, cameras were not discounted, they were rather not highlighted as being most appropriate to Morlais. After further development and discussion with NRW Advisory, the outline EMMP (MDZ/A16.8) includes cameras as potentially appropriate for Morlais for some monitoring uses.
44. The Applicant welcomes the support of NRW in development of ADD as potential mitigation. Demonstration of the efficacy of any mitigation deployed, such as ADD, will be required under the EMMP before deployment. This part of the process is illustrated in Plate 2-1 of the outline EMMP.

45. The potential for disturbance to marine mammals from the operation of ADDs is considered in the Marine Mammals Rebuttal of NRW PoE produced by Dr Jennifer Learmonth.

2.8 Marine Mammals Monitoring and Mitigation Options document

46. The questions raised by NRW in paragraphs 4.2.9 and 4.2.10 relate to the status and content of the Marine Mammals Monitoring and Mitigation Options document submitted in support of the marine mammal ES chapter.
47. The options document is a separate review of monitoring and mitigation methods from the outline EMMP and considers a range of potential methods, many of which were then included as examples in the outline EMMP. The purpose of the outline EMMP is to demonstrate commitment to the management and mitigation, which also included consideration of potential monitoring and mitigation methods. The monitoring and mitigation methods will be agreed post consent in a detailed form, informed by a detailed review of the evidence base available at that time.

2.9 Adaptive management

48. In paragraph 4.2.11. NRW notes that adaptive management will be essential for the removal or management of potential adverse impacts from the Project. Reference is made to recent advice provided by NRW to the Applicant on adaptive management and the monitoring requirements in that advice, including the need for commitment to:
    - Determine, in the event of a collision, what species or species groups have collided with the devices;
    - Implement adaptive management measures, following any collision,
    - Ensure that the risk of further collisions is reduced;
    - Ensure that a maximum collision limit for any marine mammal species is not exceeded.
49. The Applicant agrees that adaptive management is essential to the management of the project and sees the development of the EMMP as the main tool to achieving this objective.
50. The Applicant welcomes the supplementary advice provided by NRW on adaptive management of Morlais (MDZ/F15.3) and has incorporated that advice into the latest version of the outline EMMP. The Applicant commits to demonstrating the bulleted points detailed in Paragraph 4.2.11 of the PoE post consent though implementation of the detailed EMMP.
51. In the outline EMMP a process for agreement of management measures, monitoring and mitigation is provided. The process proposed is illustrated in Plate 2-1.

3. RSPB – Proof of Evidence

3.1 Introduction

52. I understand that the RSPB will be filing a supplementary proof on 23 November. This rebuttal is being served without sight of this. And, thus the right is reserved to put in a further rebuttal if that supplementary proof deals with EMMP issues.

3.2 Phasing

53. In paragraph 8.1. RSPB recognises the need for flexibility in deployment of Phase 1 and that Phase 1 can be deployed without significant impact on species. However, in Paragraph 8.2, RSPB then suggests that subsequent phases of deployment should be tightened in scope.
54. The Applicant welcomes RSPB's acceptance of the need for flexibility in design of Phase 1 and that Phase 1 can be deployed without significant impacts on species. If flexibility is necessary for Phase 1, then tightening

of the scope for Phase 2, 3 etc. is not possible, given that those phases are further into the future and dependent upon monitoring of Phase 1 to define them. Future phases are logically more difficult to predict and must have an associated greater need for flexibility, not lesser.

55. The outline EMMP (MDZ/A16.8) proposes a process for approval of Phase 1 and subsequent phases, as illustrated in Plate 2-1 of that document. The process required definition of phases for review and regulatory approval prior to each deployment.
56. RSPB propose that the parameters of all future phases of array should be defined now, to avoid 'creep' in paragraph 8.5.
57. The approach proposed in the outline EMMP uses adaptive management to determine the scale of Phase 1 and subsequent phases. Each phase of the project will be fully assessed before deployment is allowed, with monitoring, management and mitigation.
58. It is difficult to understand the reference to 'creep' as it seems to suggest that RSPB believes the regulator is not capable of enforcement of consent conditions. This is unlikely to be the case.
59. The Applicant has proposed that the requirement for an EMMP be legally enforced through the TWAO, with detailed requirement off the EMMP conditioned through the Marine Licence.

3.3 Monitoring methods

60. Paragraphs 8.3, 8.4 and 8.9 of the RSPB PoE discuss the details of monitoring methods proposed and are addressed in Section 5 of the Ornithology rebuttal document.
61. In paragraph 8.6 the RSPB accepts the need for the EMMP to evolve over time but raises concerns regarding the need for effective monitoring and safeguards.
62. The Applicant is committed to the development of appropriate monitoring and mitigation over the lifetime of the project and notes that monitoring methods are expected to evolve and adapt to reflect changes in scientific understanding, changes in technology, and the advice of regulators.
63. In paragraph 8.7 the RSPB suggests that little thought has gone into the fundamental feasibility of the monitoring methods proposed.
64. Monitoring methods and their feasibility are considered in Section 5 of the Ornithology Rebuttal.
65. RSPB states in paragraph 8.14. that there remains insufficient information on how the methods will be developed and applied and how the principles of adaptive management enshrined in NRW's guidance will be followed. It is also stated that phases should be tied more directly to monitoring methods and technology that encapsulate both potential population and collision impacts on birds, focusing on razorbills and guillemots.
66. The development of monitoring and mitigation methods will be undertaken by the Advisory Group post consent, taking account of the characteristics of the technology to be deployed and the characteristics of the deployment location. The process proposed is detailed in the outline EMMP (MDZ/A16.8), and the Applicant is committed to the full implementation of advice provided to the Applicant on the implementation of adaptive management for mitigation and monitoring of the project by NRW (MDZ/F15.3). NRW's advice on adaptive management has been incorporated into the outline EMMP (MDZ/A16.8).
67. In paragraph 8.22 the RSPB helpfully provides advice to the Applicant on appropriate approaches to undertaking colony counts.
68. The Applicant welcomes the advice provided and is committed to improving the evidence base through the collection of suitable data, to allow the development of tidal stream energy. It is proposed that this is done in partnership with regulators, RSPB and academia, through the mechanism of the EMMP. The outline EMMP includes RSPB as a key member of the EMMP Advisory Group.
69. In paragraph 8.24 the RSPB considers tags for tracking seabirds and asks if Manx shearwater will be tagged under the EMMP.
70. No potential for significant impact on Manx shearwater was identified within the Environmental Statement Chapter 11 Marine Ornithology (MDZ/A25.11) of when developing Information to Support Habitats Regulation

Assessment to Support Habitats Regulations Assessment (MDZ/A27.11). Further assessment of the relevant Special Protected Area (SPA) populations of Manx shearwater is provided in MDZ/F16 (updated as MDZ/A31.10) - Marine Ornithology Updated Collision Risk Modelling and Encounter Rate Modelling Note, which also comes to the conclusion of no significant impact. For this reason, Manx shearwater is not included in the outline EMMP.

71. In paragraph 8.25 and 8.26 the RSPB flags the limitations of tag which previous versions of the outline EMMP proposed using to track seabirds.
72. The current outline EMMP (MDZ/A16.8) has updated details of tags proposed for monitoring proposed in Table 4-1.
73. In paragraph 8.28 the RSPB advises as to the challenges faces in the retrieval of data from tags used and the limitations of current technologies.
74. Noting that the agreement of the detailed EMMP and associated monitoring works is expected to take a number of years post consent, it is anticipated that a review of all monitoring methods will be undertaken taking advantage of development of technology for monitoring in coming years. The EMMP will use the best available tags available for the required monitoring at the time of need. The Applicant welcomes the advice provided by RSPB issues to be overcome during development of the monitoring programme post consent.

3.4 Cessation of operations

75. The RSPB states in paragraph 8.8.that an effective stop process for device operation is necessary within the outline and detailed EMMP.
76. A commitment to cessation of operation if an agreed trigger point or limit is reached is found within the outline EMMP (MDZ/A16.8) at Section 1.3.2 (paragraph 46), Section 1.3.7 (paragraph 61) and Section 4.1 (paragraph 128).

3.5 EMMP Status

77. The RSPB proposes in paragraph 8.10. that the submission of a detailed EMMP pre-consent. In Paragraph 9.2 the suitability of an outline EMMP is also questioned.
78. The submission of outline or in principle plans pre-consent, with their agreement in detail with regulators post consent, as a condition of deployment is a standard procedure for many marine renewable projects. Examples of in principle and outline plans can be found on the PINs website, for example, the outline Construction Environmental Management Plan (outline CEMP) for Triton Knoll offshore wind farm. An extract of the relevant sections of the Development Consent Order (DCO) for provided in Appendix 3 of this rebuttal [1].
79. The Applicant proposes that the development of a detailed EMMP and its approval should be a condition of consent for the project.

3.6 Legal relationship between TWAO and ML

80. In paragraph 8.11. the RSPB proposes that management and mitigation of the Project be secured through the Order. Paragraphs 8.16 and 8.17 raise concerns regarding the securing of conditions, while in Paragraph 8.35 concerns are raised about enforceability of conditions.
81. Given the need for a flexible approach to deployment of phasing, agreed by RSPB in Paragraph 8.2. of their PoE, the most appropriate mechanism to secure such an adaptable approach is through the Marine Licence. Conditions relating to implementation of the EMMP may require evolution over time (flexibility). Measures

[1] Outline Construction Environmental Management Plan (2015). https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020019/EN020019-000367-8.7.9%20Outline%20Construction%20Environmental%20Management%20Plan.pdf

under the TWAO cannot be revised without a new order, while Marine Licence conditions can be revised via a simpler process. For this reason, the Marine Licence is proposed as the mechanism to manage the EMMP.

82. The requirement for an EMMP will be captured under both TWAO and ML. The Order will require submission of an EMMP prior to each of the following activities:
    - the commencement of any tidal works; and
    - the repowering of any tidal works.
83. The term 'commencement' is defined to comprise any material operation onshore or offshore but does exclude some works. The requirement to submit a single EMMP for approval pursuant to the Order can be contrasted to the requirement to submit an updated navigational risk assessment prior to the construction maintenance repowering or decommissioning of a tidal device, and the requirement for DDP submission prior to deployment of tidal devices in specified circumstances.
84. The Order therefore requires that an EMMP is submitted before the commencement of any tidal works, and its terms, including how it can evolve, will be approved by the Welsh Ministers (article 3(4)) and the Order also secures implementation (article 3(6)). The Marine Licence can secure further detail as to the management of the EMMP process.

3.7 Avoidance rates

85. The RSPB uses paragraph 8.18 and 8.19 to flag the issues associated with avoidance rate calculation and refinement.
86. Avoidance rate issues are dealt with extensively in Sections 4 and 6 of the Ornithology Rebuttal.
87. The problems involved in determining avoidance rates are recognised, and this will be addressed in the further development of the outline EMMP. However, gaining insight into some elements of avoidance behaviour would be tractable (e.g. macro-avoidance of the development site), whilst monitoring will provide data on other key input parameters of the ERM and CRM.

3.8 Collision monitoring

88. In paragraph 8.20 the RSPB highlights the current limited ability to monitor collision of diving birds with tidal devices.
89. The latest version of the outline EMMP (MDZ/A16.8) does not advocate monitoring of collision, but instead proposes use of a series other monitoring methods to refine consideration of collision risk and wider colony health as follows:
    - Consideration of any evidence for large scale effects by monitoring at the breeding colony;
    - Refinement of the collisions via tracking data to test precautionary nature of certain parameters; and
    - Maintain an open mind to possible collision monitoring using active sonar and video (which it is accepted is unlikely to give species-specific information, but which could inform a worst-case).
90. As detailed in paragraph 5.2 of the Ornithology rebuttal, while it is undoubtedly the case that monitoring will be challenging, it is important to point out that of the three main components proposed for the seabird monitoring programme, technological issues are essentially relevant to only one (the monitoring of collisions at devices using sonar). The work that is proposed to monitor annual numbers and breeding success at the colonies and to track the movements and diving behaviour of individual birds (the other two components of the monitoring programme) have been undertaken on the same species at numerous other sites and, to a large degree, use established methods and techniques. Details are provided in paragraphs 6.10 to 6.14 of the Proof of Evidence for Ornithology ((MDZ/P1) and in Table 4-1 of the latest version of the outline EMMP (MMC 447).

4. Other matters

91. Matters relating to benthic ecology will be considered in a round table discussion and not through Public Inquiry as previously planned. A key document informing those round discussions will be an outline Biodiversity Enhancement Plan, which is provided as Appendix 3 of this rebuttal.

5. Summary and conclusions

92. My rebuttal of proof of evidence identifies a number of areas where NRW has provided advice as to the most appropriate approach to development and implementation of the EMMP. These recommendations are agreed by the Applicant, and this is detailed.
93. The monitoring and mitigation proposed through the EMMP will undoubtably prove challenging to develop and manage, however, the Applicant is aware of the level of challenge this work represents and is committed to use of adaptive management through the EMMP to avoid AEOSI and wider significant adverse environmental impacts.
94. There is precedence for the adaptive management process proposed for the monitoring and mitigation of the Project from a number of previous tidal turbine deployments.
95. Phase 1 of deployment will be at a scale (MW) below any prediction of significant adverse effect on marine mammals or seabirds.
96. Monitoring methods are proposed for marine mammals and seabirds in an outline format, with potential monitoring methods described in the outline EMMP. It is proposed that the development of a detailed EMMP, with detailed monitoring post consent, to be agreed pre-deployment is conditioned via a Marine Licence Condition.
97. Understanding of monitoring and mitigation methods and efficacy is developing, and while understanding is incomplete a precautionary approach will be taken to deployment of all Phases of deployment, to ensure no significant adverse effects on marine mammals or seabirds.
98. NRW has accepted this approach, however, RSPB has suggested that NRW may not be able to manage the discharge of this condition.
99. The RSPB has proposed the provision of detailed descriptions of phases of development and an associated detailed EMMP pre-consent, neither of which is considered realistic. The Applicant has proposed instead a mechanism for management of the phasing of deployment, through an EMMP, with an outline EMMP being provided pre-consent, to demonstrate commitment and approach to EMMP proposed.
100. The relatively early stages of development for the tidal stream sector means that the evidence base to support consenting of such projects is still being developed. As a result, there are some areas of uncertainty regarding the level of significance that can be assigned to some potential impacts on the environment. The Applicant believes that the proposed approach to deployment, with agreement to an outline EMMP pre consent, and development of a detailed EMMP post consent is the only way in which the project can proceed, while also allowing for advances in tidal device and monitoring technologies and knowledge base.

Appendix 1 - Extract from the final report for the Environmental Monitoring Programme for SeaGen

1. The full document is available at https://tethys.pnnl.gov/publications/seagen-environmental-monitoring-programme-final-report
2. Section 2.3.6 Active Sonar states the following:

   An active Sonar monitoring and mitigation system has been in operation on SeaGen since the turbine was commissioned in 2008. This system provided real time sub-surface sonar imagery of large objects within 80m of the turbine whilst it is operating. This system was remotely monitored by operators in real time during all turbine operation and is used to detect potential marine mammal and other large vertebrate targets which may have been at risk of rotor strike whilst the turbine is operational.

   The development of this system has been somewhat iterative and has gone through a number of stages since it was first installed in July 2008. Initially the effectiveness of the active sonar to detect marine mammals underwater in close proximity to the turbine was trialled alongside concurrent pile based visual observations in the early stages of SeaGen commissioning and operation. The trial had two objectives: 1) to determine whether the sonar could detect moving marine mammals in a tidally turbulent environment and provide an effective mitigation tool, and 2) to determine whether the sonar could be used as a behavioural monitoring tool to measure the behaviour of marine mammals around the turbine.

   Two Tritech Super SeaKing DST sonar heads were mounted on the upstream and downstream sides of the SeaGen tidal turbine in Strangford Lough, NI. The Super SeaKing DST is a mechanically scanning imaging sonar with two individual sonar heads; a 300 kHz CHIRP (Compressed High Intensity Radar Pulse) sonar and a 670 kHz CHIRP sonar for high definition images. CHIRP technology is designed to provide relatively good range resolution compared to monotonic frequency sonars and is potentially good for detecting and discriminating between closely spaced targets. The sonar heads were attached to a mounting plate and secured to the hand rail of the ladder on the crossbeam of the turbine. The heads were electrolytically isolated from the turbine using rubber matting between the head and the mounting plate. The depth of each sonar head when the crossbeam was lowered was approximately 11.5m below MLWS. This was close to the middle of the water column (seabed = 23.9m below MLWS). Data transmission from the sonar heads was incorporated into custom built cables within the turbines existing systems cabling.

   Each sonar head provided approximately 120-180o horizontal coverage x 40o vertical coverage around the turbine. This provided full water column coverage from at least 15 metres from the turbine out to approximately 80 metres. A laptop computer located in the turbine control room was used to record and image the sonar data. The Seanet Pro software was used to monitor the sonar signals in real time. As the sonar is a manually scanning system, with these settings, image update rates were around 6 seconds (for a 180^{o} scan).

3. Section 2.3.6.1 Data collection states the following:

   Sonar images were monitored by a user (located on top of the turbine control room) and times when targets were detected were noted. In addition, a visual observer located on the top of the turbine control room simultaneously monitored for marine mammals upstream of the turbine (on both the flood and ebb tides). A wire grid was erected in front of, and perpendicular to, the observers' field of view to divide the view of the study area into the 9 sub-areas on each side of the turbine (18 in total). The grid was constructed using two 2m long wooden poles inserted into aluminium sleeves on the hand rail at the edge of control room roof. Between the poles, lines of 1.5mm thick wire divided the view of the study area sub areas. To ensure that the

grid maintained its position, its alignment was checked each day. Each time a marine mammal was sighted, the visual observer noted species, number of animals, sub area, and time of the sighting.

A total of 135 hours of real-time monitoring using a combination of visual and sonar techniques were carried out. Weather conditions during these periods were variable with sea states ranging from Beaufort 1 to 3 and wind speeds ranging from Beaufort 1 to 5.

Appendix 2 – Extract from DCO for Triton Knoll Windfarm

2 The DCO for Triton Knoll windfarm states:

Pre-construction plans and documentation

9.— (1) The licensed activities shall not commence until the following have been submitted to and approved in writing by the MMO.

(2) A design plan at a scale of between 1:25,000 and 1:50,000, including detailed representation on the most suitably scaled admiralty chart, to be agreed in writing with the MMO in consultation with Trinity House and the MCA which shows —

(a) the indicative proposed layout and location of all wind turbine generators, offshore substations and meteorological stations;

(b) the choice of foundation of all wind turbine generators, offshore substations and meteorological stations;

(c) the height to the tip of the vertical blade; height to the centreline of the generator shaft forming part of the hub; rotor diameter and spacing of all wind turbine generators;

(d) the height length and width of all offshore substations or combined substations;

(e) the height of all lattice towers forming part of meteorological stations;

(f) the length and arrangement of all cables comprising Work No. 1(c);

(g) the dimensions of all steel monopile and concrete monopile foundations;

(h) the dimensions of all gravity base foundations;

(i) the dimensions of all jacket or tripod foundations;

(j) the dimensions of all suction bucket monopod foundations;

(k) all exclusion zones specified under sub-paragraph (9)(d) of this condition as are comprised in the works at paragraph 2(2) of Part 1 (Licensed Marine Activities) of this licence;

(l) the exclusion zone specified in condition 2;

(m) in plan form, the indicative programming of particular works as set out in the indicative written construction programme to be provided under sub-paragraph (3)(d); to ensure conformity with the description of Work Nos. 1 and 2 and compliance with conditions 1 to 5.

(3) A construction and monitoring programme to include details of—

(a) the proposed construction start date;

(b) proposed timings for mobilisation of plant, delivery of materials and installation works;

(c) proposed pre-construction surveys, baseline report format and content, construction monitoring, post-construction monitoring and related reporting in accordance with sub-paragraph (9)(g) and , conditions 13, 14 and 15. The pre-construction survey programme and all pre-construction survey methodologies shall be submitted to the MMO for written approval by the MMO in consultation with Natural England and JNCC at least four months prior to the commencement of any survey works detailed within; and

(d) an indicative written construction programme for all wind turbine generators, offshore substations, meteorological substations and cables comprised in the licensed activities (insofar as not shown in paragraph (b)).

(4) A construction method statement in accordance with the construction methods assessed in the environmental statement and including details of—

(a) drilling methods and disposal of drill arisings;

(b) turbine, meteorological mast and substation location and installation, including scour protection;

(c) cable installation;

(d) contractors;

(e) vessels; and

(f) associated works.

(5) A project environmental management and monitoring plan to include details of— (a) a marine pollution contingency plan to address the risks, methods and procedures to deal with any spills and collision incidents during construction and operation of the authorised scheme in relation to all activities carried out;

(b) a chemical risk assessment to include information regarding how and when chemicals are to be used, stored and transported in accordance with recognised best practice guidance;

(c) waste management and disposal arrangements;

(d) the appointment and responsibilities of a fisheries liaison officer, to include preparation of a fisheries liaison plan as set out in the environmental statement, and an environmental liaison officer. The fisheries liaison officer shall be notified to and approved by the District Marine Officer for the MMO's Eastern District.

(6) A scour protection management and cable armouring plan providing details of the need, type, sources, quality area, volume and installation methods for scour protection and cable armouring and a statement of the total area and volume of scour protection and cable armouring material to be installed, to be within the scope of the environmental impact assessment recorded in the environmental statement.

(7) A marine mammal mitigation protocol to be agreed in writing with the MMO in consultation with Natural England and JNCC and following current best practice as advised by the statutory nature conservation agencies, to include—

(a) identification of a Marine Mammal Monitoring Zone (MMMZ);

(b) appointment of an appropriate number of suitably qualified marine mammal observers;

(c) methods for the detection of marine mammals within the MMMZ whether visually (by the marine mammal observers) or acoustically using Passive Acoustic Monitoring equipment or other means of detection;

(d) a reporting methodology to enable efficient communication between the marine mammal observers and the person responsible for approving commencement of piling;

(e) an appropriate soft start procedure whereby piling activities do not commence until an agreed time has elapsed and during which marine mammals have not been detected within the MMMZ;

(f) where appropriate methods for the application of acoustic deterrent devices, and

(g) where appropriate construction monitoring of marine mammals.

(8) A cable specification and installation plan, to include—

(a) technical specification of offshore cables, including a desk-based assessment of attenuation of electro-magnetic field strengths, shielding and cable burial depth in accordance with industry good practice; and

(b) a detailed cable laying plan for the Order limits, incorporating a burial risk assessment to ascertain suitable burial depths, pipeline and cable crossings and cable laying techniques.

(9) A written scheme of archaeological investigation (WSI) in relation to the Order limits in accordance with industry good practice and after discussions with English Heritage to include—

(a) details of responsibilities of the undertaker, archaeological consultant and contractor;

(b) a methodology for any further site investigation including any specifications for geophysical, geotechnical and diver or remotely operated vehicle investigations;

(c) analysis and reporting of survey data, and timetable, which is to be submitted to the MMO within three months of any survey being completed;

(d) delivery of any mitigation including, where necessary, archaeological exclusion zones;

(e) monitoring during and post construction, including a conservation programme for finds;

(f) archiving of archaeological material, inclusive of any completed and agreed archaeological reports produced through the WSI which are to be deposited by the undertaker within a public archive in accordance with the OASIS (Online AccesS to the Index of archaeological investigationS') system; and

(g) a reporting and recording protocol, including reporting of any wreck or wreck material during construction, operation and decommissioning of the authorised scheme.

Appendix 3 - Document MOR-RHDHV-DOC-0164 Outline Marine Biodiversity Enhancement Strategy

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Morlais Project

Appendix 3 - Document MOR-RHDHV-DOC-0164 Outline Marine Biodiversity Enhancement Strategy

Applicant: Menter Môn Morlais Limited
Document MOR-RHDHV-DOC-0164: Outline Marine Biodiversity Enhancement Strategy
Author: MarineSpace Ltd

Morlais Document No.: MOR-RHDHV-DOC-0164 File No.: MMC555	Status: Draft	Version No: F1.0	Date: November 2020

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Glossary of ABBREVIATIONS

BAP	Biodiversity Action Plan
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ES	Environmental Statement
EUNIS	European Nature Information System
GBS	Gravity Based Structure
HDD	Horizontal Directional Drilling
INNS	Invasive Non-Native Species
MDZ	Morlais Demonstration Zone
ML	Marine Licence
MNCR	Marine Nature Conservation Review
NRW	Natural Resources Wales
ODA	Onshore Development Area
OEL	Ocean Ecology Ltd
OfDA	Offshore Development Area
RPA	Relevant Public Authorities
SAC	Special Area of Conservation
SMNR	Sustainable Management of Natural Resource
VER's	Valued Ecological Receptors
WNMP	Welsh National Marine Plan

Glossary of TERMINOLOGY

Anthozoa(n)	A class of marine animals including sea anemones and coral.
Benthic	The lowest level of a body of water including the sediment surface.
Biodiversity Offsetting	A policy approach that seeks to minimise the environmental impacts of a development project by ensuring that any damage in one place is compensated for elsewhere.
Biogenic	Something that is produced or brought about by living organisms, such as a reef.
Biotope	A region of habitat associated with a particular ecological community.
Circalittoral	The region of a sea or ocean below the infralittoral zone to the maximum depth at which photosynthesis is still possible.
Compensation	A measure to make up for the negative effects of a plan or project. The term should only be used appropriately in the context of the different legislation requirements when referring to specific measures.

Ecological Enhancement	An environmental improvement that may intensify or increase the quality, value or extent of a resource.
Ecology	The relation of organisms to one another, and to their physical surroundings.
Eulittoral	The area of the shore between the spring high and spring low tide lines.
Gravel	Loose, rounded fragments of rock larger than sand but smaller than cobbles. Sediment larger than 2mm (as classified by the Wentworth scale used in sedimentology).
Habitat	The environment of an organism and the place where it is usually found.
Infralittoral	The region of shallow water closest to the shore, excluding the intertidal, dominated by algae .
Intertidal	Area on a shore that lies between Lowest Astronomical Tide (LAT) and Highest Astronomical Tide (HAT).
Littoral	The area of a sea or lake between the high water mark and the edge of the continental shelf.
Mitigation	A measure to avoid, reduce, minimise or cancel out one or more adverse impacts.
OSPAR	OSPAR (Oslo and Paris Convention) Biological Diversity and Ecosystem List of threatened and /or declining species and habitats.
Repowering	The removal of a tenant's infrastructure at the end of a demonstration period and replacement with the infrastructure of a new tenant, and reinstallation via the original construction method.
Restoration	To return an environmental resource, for example a habitat, species, waterbody or landscape feature, to a former known and preferred condition or state.
Section 7	(Formally BAP/Section 42) List of the habitats and species of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales.

Introduction

Background and Scope

1. Menter Môn Morlais Limited ('the applicant', hereafter referred to as Menter Môn) is seeking a Transport and Works Act Order (TWAO) and Marine Licence (ML) for the Morlais Project (hereafter referred to as the Project).

2. The Project is described in the Project Description chapter of the Environmental Statement (ES) (**Chapter 4, Project Description**). In summary, the Project consists of three distinct areas within which components of the Project will be installed:

    - The Morlais Development Zone (MDZ), within which arrays of tidal devices and associated infrastructure such as foundations, array hubs, inter array cables, cable protection and other associated infrastructure will be deployed.
    - The Export Cable Corridor (ECC), within which up to nine export cables and associated cable protection will be laid. The ECC also includes the intertidal area, where the export cables will make landfall via either horizontal directional drilling (HDD) or trenching.
    - The MDZ and ECC areas combined can be referred to as the Offshore Development Area (OfDA).
    - The Onshore Development Area (ODA) shares the export cable landfall with the ECC, with export cables then passing to a landfall substation, and from there via an onshore cable route to a grid substation and connection to grid.

3. Features of conservation importance have been idented within the OfDA. Across the intertidal and subtidal area, three Annex I Reef features have been identified (bedrock; stony; and biogenic reef). These three reef habitats are afforded protection under the Habitats Directive. The extent and quality of these features (as defined by Environmental Impact Assessment (EIA) characterisation surveys undertaken in 2018) is summarised in Section **Error! Reference source not found.**. The ES for the Project identified that the placement of project infrastructure on the seabed would result in the loss of some of these features across areas of the OfDA (summarised in Section 0).

4. Other habitats and species of conservation importance have also been predicted to be present within, and in the region of the Project Area, such as Environment (Wales) Act Section 7 (formally BAP/Section 42) habitats and species, and OSPAR threatened and / or declining species and habitats (e.g. fragile sponge and anthozoan communities) (summarised in Section 0).

5. The Morlais ES had assessed that without mitigation measures, the long term loss of benthic habitat (more specifically, Annex I reef features) via initial placement of project infrastructure (and any subsequent re-powering) would result in a moderate adverse impact. To mitigate this impact, micro-siting of devices away from the most high-quality habitat was proposed.

6. A pre-construction Annex I survey was also proposed that would define the spatial extent of these sensitive habitat closer to actual installation activities which in turn, would increase the effectiveness of micro-siting (Section 0). These measures are captured in draft Marine Licence

conditions proposed by Menter Môn and have been discussed with Natural Resources Wales (NRW).

7. The ES concluded that the successful implementation of these mitigation measures would result in the potential impact to Annex I features being reduced to minor adverse effect.

8. The Annex I reef features in the OfDA are not a designated feature of the North Anglesey Special Area of Conservation (SAC). However, following consultation with NRW it was proposed that should the primary mitigation option of micro-siting away from Annex I reef features not be feasible during planning and installation, additional mitigation would be required to offset the potential loss of some of these habitats.

9. Following a consultation meeting with NRW's Advisory Team on 6 November 2020, NRW have suggested that marine biodiversity enhancement be considered as a suitable additional mitigation measure.

10. Menter Môn have agreed in principle to this and proposed that the production of a Marine Biodiversity Enhancement Strategy be a condition on the Morlais Marine Licence, i.e. produced post-consent but pre-installation. NRW have in turn requested that to provide more certainty on this strategy, an *Outline* Marine Biodiversity Enhancement Strategy be prepared pre-consent.

11. This document, therefore, represents the Morlais Outline Marine Biodiversity Enhancement Strategy.

Data Sources

12. At this initial stage, the Outline Marine Biodiversity Enhancement Strategy (hereafter referred to as the Outline Strategy) will utilise key sources of information to outline the broad enhancement options for the Project, this will include (but not be limited to):

- Eco-friendly design of scour protection: potential enhancement of ecological functioning in offshore wind farms (Bureau Waardenburg, 2017);
- LLe Geo-Data Portal for Wales (Welsh Government, 2020a);
- Morlais Demonstration Zone (MDZ) Benthic Ecology Characterisation Survey 2017 (Ocean Ecology Ltd (2018);
- Morlais Project Environmental Statement Chapter 9: Benthic and Intertidal Ecology (RHDHV, 2019b); and
- Supporting the implementation of the Welsh National Marine Plan: Enhancing marine ecosystems (Armstrong et al. (2019).

13. In addition to this, relevant scientific research and case studies will be referenced where appropriate. It is anticipated that as the Project progresses, the Outline Strategy may be required to be supported further with additional information, following relevant discussions and consultation.

Purpose of this Document

14. This document seeks to set out an outline for appropriate marine biodiversity enhancement options for the OfDA of the Project. The proposed Outline Strategy will focus on enhancement options that may be appropriate to be implemented over the operational lifetime of the Project, i.e. the stage of the Project where long-term habitat loss has been predicted via the EIA process.

15. At this initial (outline) stage, this document does not provide detailed prescriptive measures, but instead focuses on providing a framework for future decision-making, related to marine biodiversity enhancement options for the Project currently judged to be feasible. Information presented is based upon current knowledge of enhancement options.

16. As this is a topic area that is developing at a rapid pace, it is fully expected that additional marine biodiversity enhancement options will emerge over time. Therefore, the Outline Strategy is intended to be a live document that evolves and is updated throughout the project planning and consenting phase, with input from appropriate consultees. Eventually, this Outline Strategy will become the full Morlais Marine Biodiversity Enhancement Strategy document for agreement, post consent.

RELEVANT Marine Policy and Plans

17. The Welsh National Marine Plan (WNMP) was formally adopted by Welsh Government in Autumn 2019. With reference to ecological enhancement, Policy ENV_01 of the WNMP (Resilient marine ecosystems) has the following aim:

'To ensure that biological and geological components of ecosystems are maintained, restored where needed and enhanced where possible, to increase the resilience of marine ecosystems and the benefits they provide. Under this policy, the sensitivities of marine ecosystems and ecosystem impacts should be taken into account when developing proposals and, where possible, proposals should also demonstrate how they will contribute to ecosystem protection, restoration and/or enhancement.' (Welsh Government, 2019).

18. Under ENV_01, the following guidance includes:

'147. RPAs[2] should satisfy themselves that proposals have:

- *adequately investigated and evaluated the significance of identified impacts on marine ecosystems of their proposed activity or development; and,*
- *taken appropriate measures to avoid, minimise or mitigate the identified impacts in a manner that is proportionate to their significance; and/or,*
- *where necessary, submitted a suitable case for proceeding which sufficiently demonstrates the overriding benefits of proceeding'.*

'148. [……..] Proposals should demonstrate how they maintain and enhance these habitats and species, including protecting them from potential impacts or promoting their restoration and/or enhancement.

'149. Proposals are encouraged to contribute to the restoration or enhancement of marine ecosystems. Incorporating restoration and/or enhancement of marine ecosystems into proposals does not have to be expensive or complex. It could include using different substrates for building on the foreshore that are favourable to postconstruction colonisation by a range of species. Small changes to intertidal structures that allow the formation of crevices in walls or pools at low tide as opposed to the structure drying out entirely can provide an additional environment for rock pool species that would otherwise be unable to exist there. Developers should engage with NRW for advice on enhancement to ensure any proposed enhancement is suitable.' (Welsh Government, 2020b).

[2] Relevant Public Authorities.

Sensitive Seabed Habitats Within The Morlais Project Area

Overview

19. As detailed in Section 0, the EIA for the proposed Morlais Project identified a number of sensitive seabed habitats within the Morlais OfDA and intertidal areas. These include three Annex I Reef features (bedrock; stony; and biogenic reef); habitats protected under Section 7 of the Environment (Wales) Act (formally BAP/Section 42 habitats), and OSPAR threatened and / or declining species and habitats (e.g. fragile sponge and anthozoan communities).

20. The following section provides more details of the current understanding of the extent and nature of these habitats in the Morlais OfDA and intertidal areas.

Subtidal Annex I reef habitats

21. Within the EU Habitats Directive, marine reef features are defined as such:

'*Reef can be either biogenic concretions or of geogenic origin. They are hard compact substrata on solid and soft bottoms, which arise from the sea floor in the sublittoral and littoral zone. Reefs may support a zonation of benthic communities of algae and animal species as well as concretions and corallogenic concretions.'* (European Commission, 2013).

22. Chapter 9 of the Morlais ES (RHDHV, 2019) presents the distribution of Annex I reef habitats within the OfDA (**Chapter 9, Benthic and Intertidal Ecology**).

23. Subtidal and Intertidal surveys were undertaken in 2018 by Ocean Ecology Ltd (OEL) in order to characterise the site for EIA purposes. These surveys involved the collection of marine data, including high resolution seabed imagery, grab and core samples, quadrat data and aerial imagery in order to derive a detailed biotope map of the OfDA. Prior to site-specific surveys, a detailed desk-based study was also undertaken.

24. This EIA characterisation exercise showed that the subtidal environment within the OfDA was comprised of a complex mosaic of biotopes, dominated by circalittoral and/infralittoral rock and coarse sediments. A total of 15 subtidal EUNIS habitats were mapped. Figure 0.1 shows the habitat mapping across the MDZ and the south ECC (full extent of the north ECC route was not mapped).

25. Within the OfDA, extensive areas of both Annex I stony and bedrock reef were recorded. The deeper areas of the site from the north east spreading along the eastern central area of the site to the south west of the OfDA were characterised by coarse sediments (A5.14) representative of Annex I stony reef habitat. The amount of overlying sediment was reduced in the slightly shallower waters in central, southern and northern areas where tide-swept and mixed faunal turf communities (A4.11 / A4.13) representative of Annex I bedrock reef were prevalent.

26. Areas of Annex I stony reef habitat were frequently overlain by varying coverage of *Sabellaria spinulosa* tube aggregations representative of Annex I biogenic reef in some areas (A4.22). Biogenic reefs of *S. spinulosa* were observed across 16 stations and the quality of the reefs and levels of 'reefiness' varied, however typically present in 'low' to 'medium' levels of reefiness.

27. All of these reefs were extremely variable, both in structure and in the communities they support. They ranged from vertical rock walls to horizontal ledges, sloping or flat bed rock, broken rock, boulder fields, and aggregations of cobbles.

28. Closer to shore, sediment biotopes dominated which ranged from coarse gravels (A5.14) to subtidal sands (A5.2) and at Abraham's Bosom, transitioning into macrophyte dominated infralittoral rock in the shallow subtidal and sublittoral fringes across the whole area.

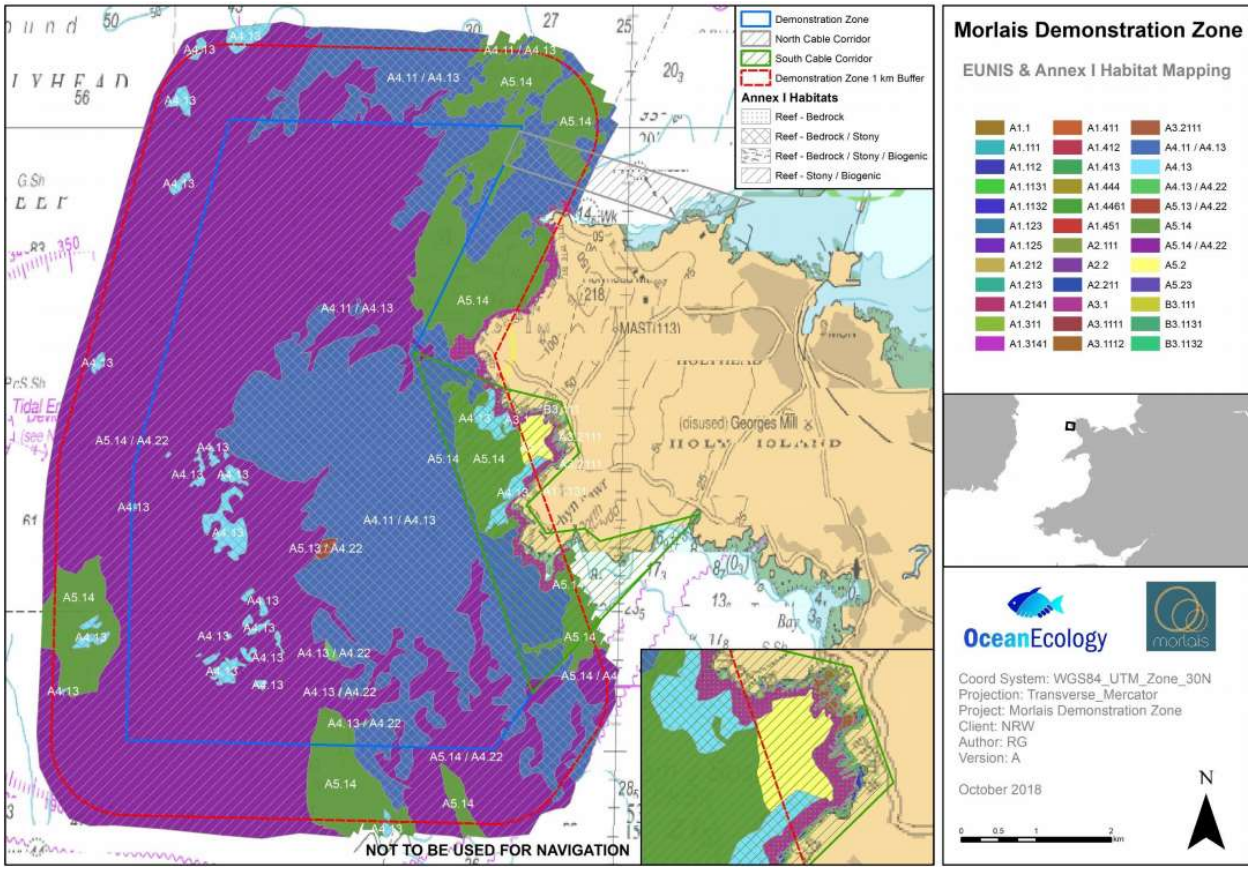

Figure 0.1: EUNIS and Annex I habitat mapping across the subtidal OfDA (MDZ and South ECC) (Landfall location 'Abraham's Bosom' presented in the insert) (From: Ocean Ecology Ltd, 2018).

Intertidal Annex I reef habitats

29. Marine intertidal Phase I and mapping surveys were conducted around the proposed cable landfall at Abraham's Bosom (landfall option for the south ECC route). The intertidal areas support a wide variety of littoral rock biotopes interspersed with discrete patches of barren shingle and occasional areas of sandy substrate.

30. A total of 28 intertidal EUNIS habitats were mapped and the communities identified were those which are typically associated with high energy intertidal habitats, such as:

- A1.111 (LR.HLR.MusB.MytB) *Mytilus edulis* and barnacles on very exposed eulittoral rock;
- A1.1131 (LR.HLR.MusB.Sem.Sem) *Semibalanus calanoids*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock;
- *Fucus* spp. on exposed to moderately exposed upper eulittoral rock; and
- A1.412 (LR.FLR.Rkp.FK) Fucoids and kelp in deep eulittoral rockpools.

31. Within the intertidal zone the immediate seabed was covered by an expanse of bedrock reef, tailing into stony/bedrock reef in the north east and south east of the site. All areas of littoral rock biotopes (A1(LR)) within the intertidal area were representative of Annex I reef (Figure 0.2).

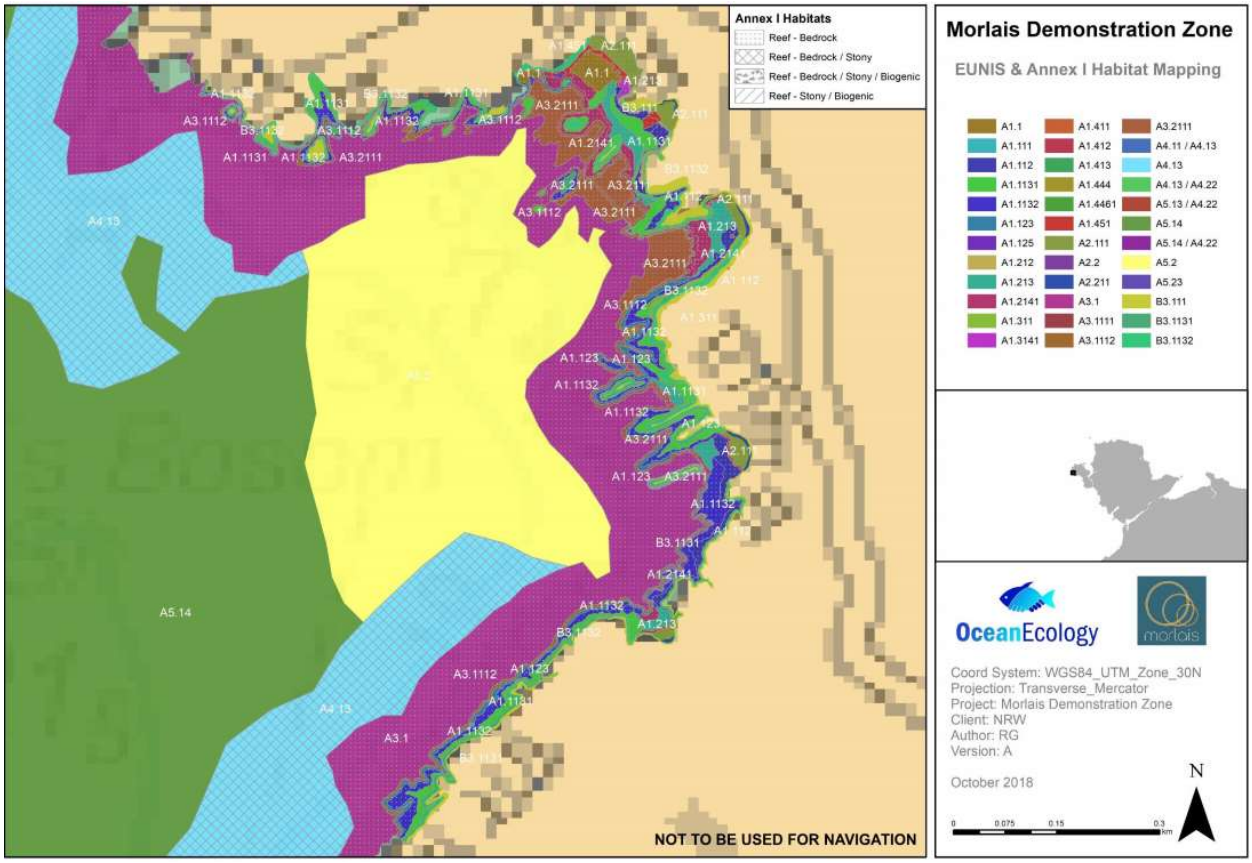

Figure 0.2: EUNIS and Annex I habitat mapping across the proposed Project landfall location 'Abraham's Bosom' (From : Ocean Ecology Ltd, 2018).

Other Important Conservation Features

32. In addition to Annex I reef habitats, there are also Section 7 (formerly BAP/Section 42) and OSPAR threatened and/or declining species and habitats present within or near to the Morlais OfDA and intertidal areas. Much of the data records for these important features are sourced from historic 1994 Marine Nature Conservation Review (MNCR) records (Welsh Government, 2020a).

33. It was reported that *Musculus discors* (discord mussel) bed habitats are present to the North of Holyhead (outside of the Project boundary). Similarly, in shallower waters on the east and west sides of Holy Island, seagrass (recent and historic records) has been reported.

34. To the south of the OfDA, historic (1996) records of *Arctica islandica* (ocean quahog) was recorded as present in tide-swept sandy sediments habitats, and two records of *Haliclystus auricula* (Kaleidoscope jelly fish) found intertidally and subtidally, outside of the Project; both recorded as being associated with kelp communities. It is reported that *H. auricula* populations have declined since 1979 and is rarely reported now (Tyler-Walters *et al.,* 2017). Two records of intertidal under-boulder communities are reported south of the landfall location on the western side of Holy Island.

35. Between 1996 and 1997, three observations of fragile sponge and anthozoan communities was recorded in the area, with one <1km adjacent to the landfall site.

36. Subtidal horse mussel (*Modiolus modiolus*) beds have been recorded between 1966 and 2012 to the south of the OfDA, with some potential overlap along the north-western boundary.

Valued Ecological Receptors

37. For the purpose of the EIA, marine habitats with similar physical, biological characteristics as well as conservation status/intertest were grouped together into "Valued Ecological Receptors" (VER's). This approach enables habitats/biotopes with similar sensitivity to predicted project effects to be assessed together to avoid duplication of assessment effort.

38. Within the OfDA, 3 VER Habitat Groups were identified (Groups 9-11) and of those, Group 9 and 10 dominated in terms of spatial extent (>99%). Both these subtidal groups comprise biotopes relating to Annex I reefs (bedrock, stony and biogenic). Below is a summary description of Group 9 and 10:

- **VER Group 9**: High energy infralittoral and circalittoral rock/coarse sediment with Annex I stony/bedrock reef; and
- **VER Group 10:** Circalittoral *Sabellaria* reefs – Annex I biogenic reefs.

39. It is important to note that the mapping of the spatial extent of these VER's is not suggestive of definite presence, i.e. it cannot be assumed that Annex I reefs are present in all areas which are marked as VER habitat group 9 or 10.

40. However, by assuming that these habitats exist throughout these areas (>99% of the OfDA was assigned as being VER9 or 10), a precautionary assessment was able to be presented within the Morlais ES (**Chapter 9, Benthic and Intertidal Ecology**).

41. It is anticipated that the pre-construction survey (planned to be undertaken no more than 12 months prior to the deployment of any marine project infrastructure) would provide an updated picture of the presence, spatial extent and quality of these Annex I features at a localised scale:

42. At the intertidal area of the landfall location in the ODA (Abraham's Bosom), 9 VER Groups (1-8 and 12) were identified and of those, 6 comprised biotopes relating to sub-features of Annex I reef habitats:

- **VER Group 1:** High energy littoral rock.
- **VER Group 2:** *Fucus* spp. on exposed to moderately exposed eulittoral rock.
- **VER Group 3:** *Pelvetia canaliculata* on sheltered littoral fringe rock and *Ascophyllum nodosum* on full salinity and eulittoral rock.
- **VER Group 4:** Coralline crust, Fucoids and kelps in eulittoral rock pools
- **VER Group 5:** Upper to mid-shore cave walls and wave surged overhanging lower eulittoral bedrock and caves.
- **VER Group 6:** *Ulva* spp. on freshwater influenced and /or unstable upper littoral rock.

43. Although these 6 VER Groups listed above had been identified as present, it was VER Group 1 (high energy littoral rock) and Group 12 (yellow and grey lichens on supralittoral rock) that dominated the intertidal zone; Group 12 does not support sub-features of Annex I reef.

Impacts and Mitigation

44. Chapter 9 of the ES presents the impact assessment and embedded mitigation for the benthic environment of the Project Area (**Chapter 9, Benthic and Intertidal Ecology Section 9.6 Impact assessment**).

Predicted Habitat Loss

45. From the initial placement of project infrastructure directly on the seabed, a direct long-term habitat loss will occur for the duration of the operation phase of the Project. In addition to the initial impact, repowering (removal of a tenant's infrastructure and replacement with infrastructure of a new tenant) of up to 50% of the berths may take place.

46. Following the initial placement of the full 240 MW of infrastructure, an area of up to 2,180,072 m^2 (2.18 km^2) would be lost.

47. Repowering will result in an additional permanent habitat loss of 52,504 m^2 (0.05 km^2). However, it is important to recognise that where original infrastructure has been removed, these seabed habitats will no longer be "lost" and will be in a process of recovery.

48. Overall, the combined permanent habitat loss from initial installation and repowering is therefore predicted to be 2,232,576 m^2 (2.23 km^2).

49. The proposed total area of the OfDA (the MDZ and ECC) and the intertidal area is 39.75 km^2. The MDZ comprises 35 km^2 and the ECC 4.75 km^2, of which the intertidal region is 0.01 km^2. Therefore, given that the worst-case scenario seabed footprint for a maximum design within the construction period of the project could result in the loss of up to 2,232,576 m^2, a worst-case scenario design would result in the loss of a **5.61 %** of the seabed within the Project area.

50. An important point to note is that the majority of this habitat loss (2,055,000 m^2 / 2.06 km^2) comprises the swept area of any catenary chains/cables possibly required as part of the overall project. This is a highly precautionary approach as in many areas, the movement of these chains/cables will not actually lead to a permanent loss of habitat, rather some temporary disturbance.

51. The actual amount of habitat that will definitely be lost over the project lifetime i.e. areas where foundations / mooring blocks / cable protection etc. will be initially deployed / installed via repowering, is 177,576 m^2 (0.17 km^2). This latter figure equates to 0.42% of the overall OfDA area of 39.75 km^2.

52. It was not possible to provide a definitive calculation of the loss of each VER group (VERs summarised in Section 0 above) due to the uncertainty around the exact locations where project infrastructure will be deployed, and thus which VER groups would be impacted. Although the impact would occur at a scale which would be noticeable from monitoring, it would remain within the range of background natural variability. Furthermore, the effect will be slowly reversable, following decommissioning (5-10 years).

53. It was assessed that overall, the impact predicted from the permanent loss of the most frequently occurring VER Habitat Groups (1, 9, 10 and 12) due to the placement of infrastructure from the project, is of a medium magnitude and a medium sensitivity to the receptors, resulting in an overall **moderate adverse impact**.

54. In order to mitigate this impact, the following mitigation measures are proposed.

Mitigation

55. Post-consent and no more than 12 months prior to the deployment of any project infrastructure, a detailed pre-construction surveys will be carried out to identify the presence of any Annex I habitats which may be classified as reef features. Following these surveys, micro-siting of project infrastructure would be used to mitigate impacts to these receptors where possible. This would inform areas which should be avoided and areas which infrastructure should not be placed.

56. The residual impact on VER Habitat Groups 1, 9, 10 and 12, following the successful implementation of this mitigation measure was assessed to be adjusted to **minor adverse**.

57. However, if micro-siting is not possible, then additional mitigation via potential marine biodiversity enhancement may be required – see below.

Process For Implementing Ecological Enhancement Measures

58. The predicted worst-case habitat loss of up to 5.61% of the total Morlais OfDA and intertidal area was assessed as a **moderate adverse impact** with the Morlais ES. This conclusion of moderate adverse was based upon (magnitude of effect = medium x receptor sensitivity = medium).

59. The classification of effect magnitude as medium level was based on the fact that habitat loss of >3% of the proposed study area (5.61%) would arise via placement of project infrastructure.

60. As detailed above in Section 0, the primary mitigation measure that would be adopted to reduce the scale of this impact will be micro-siting of project infrastructure to avoid loss of Annex I reef habitats.

61. If micro-siting was to successfully reduce the amount of Annex I/Section 7/HPI habitat loss to <3% of the total area, then, adopting the logic of the EIA process, the magnitude of effect would change to low, resulting in the minor adverse impact predicted (post-mitigation) in the ES (**Chapter 9, Benthic and Intertidal Ecology Section 9.6 Impact assessment**).

62. However, if, even with micro-siting, habitat loss remained >3% of the total study area, then this is when the use of additional biodiversity enhancement measures would be considered. – see Figure 8.1.

63. Potential exists for such measures to be (a) developed and installed *in situ* on project infrastructure already deployed; (b) factored into the design of project infrastructure not yet

deployed and/or (c) deployed away from actual project infrastructure, i.e. within other parts of the Morlais OfDA.

64. This proposed approach is captured in the following draft Marine Licence condition:

65. *"Where it is not possible to avoid damage/loss of Annex I habitats/HPI[3] and/or Section 7 habitats via micro-siting, then further mitigation via biodiversity enhancement should occur. Details of proposed biodiversity enhancement measures should be presented in a project-specific "Biodiversity Enhancement Strategy (BES)" that should adhere to the principles and approach set out in the "Outline BES" produced by the licence holder pre-consent"*

66. Section 0 below provides an overview of the potential ecological enhancement options for the Project. These cover the proposed intertidal landfall site at Abraham's Bosom (Section 0); the southern ECC route (Section 0); and the subtidal MDZ (Section 0).

67. It is important to note, that at this stage, it is not known where within the OfDA the greatest percentage loss of Annex I reef habitat will occur and/or the quality of the features affected.

68. The potential risk to Section 7 and OSPAR habitats and species that may be present locally will also need to be better defined once pre-construction survey data and project deployment plans are available for review. As such, details of the most feasible options assessed at present, to be appropriate for each of the three defined areas are shown below.

69. In addition, a consideration of off-site options is also presented, and this maybe of relevance should on-site enhancement options be deemed not feasible.

MARINE Ecological Enhancement Options

Overview

70. NRW interprets enhancement as: "*An environmental improvement that may intensify or increase the quality, value or extent of a resource*" (review by Armstrong *et al.*, 2019).

71. Hard structures used in the marine environment are poor ecological surrogates for the natural environment. However, they do provide the greatest potential for ecological enhancement. There is increasing literature available comparing value of natural verses artificial hard materials and structures. There are two types of enhancement approaches that can be applied in the marine environment, Passive and Active.

Passive Enhancement may include:

- Decisions on material type (e.g. colour, roughness of rock);
- Positioning of material (e.g. boulders within rock armour, utilising natural surface heterogeneity);
- Monitoring (e.g. assessing effectiveness of method used); and
- Supporting academic research.

Active Enhancement:

- Can be done at the design stage or retrospectively

[3] Habitats of Principal Importance

- Can involve modifying the chemistry or texture of artificial material (e.g. concrete) for species colonisation;
- Can involve retrofitting structures with habitat features;
- Translocation and restoration techniques (e.g. seagrass);
- Can be done at various scales (e.g. mm to m);
- A technical challenge; and
- Requires understanding of local ecological factors.

72. It is recommended that a combination of both active and passive approaches would be the most effective biodiversity enhancement strategy for the proposed Morlais project.

73. Enhancement options can take place on- and offsite. Onsite options will involve the introduction or modification of structures in order to increase complexity of their surfaces ('greening the grey'). Offsite options are more flexible and may involve the creation or manipulation of natural habitats and may overlap with options undertaken within the Onsite project areas.

74. Table 0.1 below summarises the potential enhancement options that may be appropriate for the Project. These are measures that have been or could be applied to the renewable and subsea cabling sectors (sectors relevant to this Project), for which marine licences tend to be sought in Wales. Where appropriate, examples of these options are presented below for each of the three Project areas in Sections 0 - 0.

Table 0.1 Summary of potential enhancement options for renewable and subsea cabling sector (Modified from: Armstrong *et al.*, 2019). Yes= already employed; P = Potential to; and N/A = not applicable.

Enhancement Options	Renewable Energy	Subsea Cabling
Onsite		
Vertical structure enhancements	Yes	n/a
Rock armouring	Yes	n/a
Scour protection	Yes	Yes
Reef restoration	P	P
Artificial reef creation	Yes	P
Offsite		
Habitat management	Yes	P
Habitat creation	Yes	P
Co-location	P	P

Landfall

75. The proposed landfall site is located at a small inlet 'Abraham's Bosum'. The site consists mainly of steep cliffs and rocky outcrops interspersed with discrete patches of barren shingle and occasional sandy substrate (see Section 0 for summary of biotopes and Annex I reef features present) (Figure 0.1).

Figure 0.1 High resolution aerial image of the upper shore at Abrahams Bosum (From: Ocean Ecology Ltd, 2018).

76. Currently, up to nine cables are to be laid at the landfall site and the preferred option is HDD (Horizontal Directional Drilling). However, if HDD is not viable then open cut trenching of cables (and back-filling) will be undertaken. Should trenching not be possible, then cables will be surface laid, with cables crossing the intertidal area requiring protection, using rock bags or concrete mattresses. Trenching is the worst-case scenario for the landfall site.

77. The estimated habitat loss at the intertidal area is 0.0074 km^2, which equates to 0.02% of the total Project area, this loss is 74% of the OfDA intertidal area, that itself is only 0.01 km^2 in size. Although this proportion loss of intertidal habitat is high, there is a much greater area of foreshore outside of this area available.

78. If trenching is to be done, then a detailed installation survey will first assess how the substratum will be reinstated with the right stratification of layers. Larger boulders will be moved sideways out of the cable trench corridor to an equivalent area of the shore, prior to trenching work commencing. These boulders would then be used as the upper layer after backfilling the trench.

79. The dominance of rocky substrates at this site, and the method proposed should trenching be required, allows for both passive enhancement measures (e.g. positioning of replaced boulders) (Section 0) and active measures (e.g. retrofitting of rock pool) at this site (Section 0).

80. Should trenching not be required and cables will be surface laid, then measures of suitable scour protection design may provide suitable enhancement capabilities (Section 0).

Enhancement during Backfilling

81. During backfilling of the trenches at the landfall site, the simple measure of ensuring that boulders are re-positioned in as such a way so to increase surface heterogeneity will locally increase habitat complexity, providing additional niches and refuges for intertidal species. The benefit of this passive enhancement measure is that it will be using the local, natural material, in order to enhance the existing habitats that are present across the intertidal area.

82. If there is a requirement of artificial material to be placed on top of the backfilled trench, an additional measure may be to ensure the material type is sympathetic to the natural environment. Alongside this, the option of altering the structural heterogeneity can be

undertaken by creating holes or groves into the artificial boulders. Multiple holes will help retain water at low tide thus mimicking natural microhabitats, and grooves will replicate the groove-microhabitats seen on a shore (Figure 0.2).

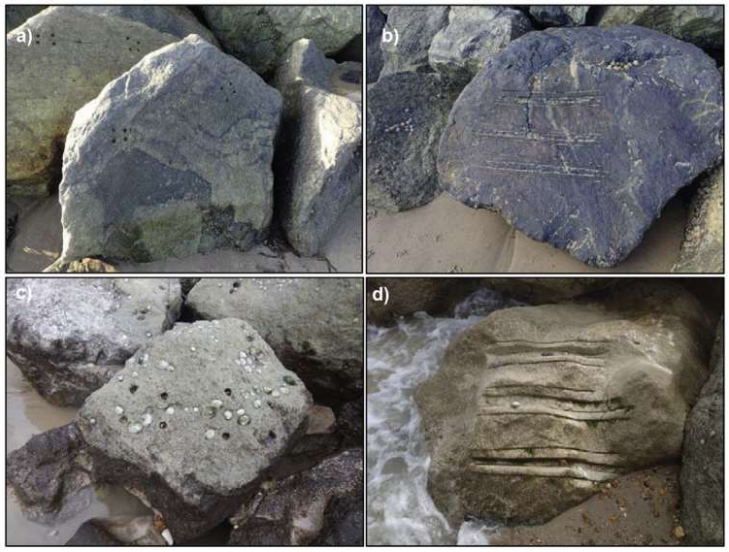

Figure 0.2: Example of holes (a) and (c), and groves (b) and (d)on granite and limestone boulders (Hall *et al.,* 2018).

83. As summarised in Section 0 above, a limited number of historical records of Section 7 and OSPAR intertidal under-boulder communities have been recorded south of the landfall location. Boulder shores can provide an array of fissures, crevices and holes, that will locally modify the local physical shore environment which will increase biodiversity. Local enhancement of these features at the landfall site may provide suitable habitats to support important under-boulder communities.

Vertical Structure Enhancements

84. The intertidal area at the proposed landfall location consists of steep cliffs and rocky outcrops. EUNIS habitats such as A1.412 Fucoids and kelp in deep eulittoral rockpools have been recorded as present, this ascribed biotope belongs to VER Habitat Group 4 which encompasses rock pool biotopes (Section 0).

85. The spatial extent of these features at the site may be locally enhanced through the retro-fitting of pre-cast artificial tide pools to the natural bedrock. There are various options of artificial tide pools available, and a relatively good abundance of data on the effectiveness of these methods of enhancement; an expected artifact given the accessibility to the intertidal zone. The 'Vertipools' system has been used successfully on artificial structures such as seawalls, groynes, gabions and sheet piling (Figure 0.3). They are cast in concrete and finished to provide suitable surface complexity and design to suit the host environment (Hall *et al.,* 2019).

86. These modular pool features however, have been primarily designed to be attached to artificial coastal structures to increase habitat heterogeneity on less complex vertical features. Careful consideration would need to be given on the installation of such pools on natural rock, such as the structural integrity of the bedrock to withstand the installation process.

87. Alternative modular designs that can sit as part of the shore, and not vertically against a surface may offer a suitable practical alternative (e.g. ECOncrete® tide pool, Figure 0.3). These are not

technically vertical structure enhancements, but they are providing a similar ecological benefit through the creation of rock pool habitats. These could be positioned at or near to the backfilled trenches, at an appropriate tidal height.

88. An estimated cost of example models of modular pool structures are provided in Section 0; Table 0.2).

Figure 0.3: (a) 'Vertipools' on a seawall (LEFT) and ECOncrete® tide pools amongst rock armouring/riprap (RIGHT).

Scour Protection

89. For scour protection enhancement options for export cables that need to be laid on the surface at the landall site, refer to options for enhancement, as summarised below in Section 0 for the ECC area.

90. These enhancement options for scour control, may also incorporate the approaches outlined above in 0 and 0 to include: orientation of material to optimise habitat heterogeneity, retrospective drilling of holes or groves and retrofitting small rock pool structures.

Export Cable Corridor

91. Much of the area encompassing the south ECC route, has been predicted to be a mixture of bedrock and stony reef, with a transition to predominantly bedrock at the shallower inshore areas of the ECC (Figure 0.1). Where there are limited areas of sediment, burial of the nine cables in the ECC area may be possible but is not assumed. As such, for the ECC, armoured cables will be used, and cable protection will be deployed only when required to secure the position of cables on the seabed. For example, the limited sediment in the nearshore subtidal section within 'Abraham's Bosom', cable protection is expected.

92. The scour protection system of the nine export cables will involve rock bags, concrete mattresses, and split-pipe protection. As outlined in Section 0, micro-siting of cables and cable protection will be undertaken where possible, following pre-construction surveys, to avoid sensitive habitats.

Scour Protection

93. Options of ecological enhancement of scour (cable) protection in order to promote ecological enhancement has been reviewed in detail for offshore windfarm projects

(Bureau Waardenburg, 2017) and may provide a viable option of direct on-site enhancement where infrastructure (e.g. cables) has been installed. This study was based on North Sea hard substrate habitats, however the broad ecological processes involved will be comparable to the Project area in Welsh waters. A summary of these reviewed measures is listed below.

94. Four broad design principals of ecological enhancement of scour protection was proposed following the review by Bureau Waardenburg (2017):

1. Adding larger structures than conventional scour protection[4] to create large holes and crevices, to provide adequate shelter / holes for large mobile species. i.e. to create more habitat complexity on a large scale. Size of holes or crevices should be 1-2 m diameter or more.

Examples: Reef balls and Xblock

2. Adding more small-scale structures than conventional scour protection to create more small-scale holes and crevices but also attachment substrate and settlement substrate; i.e. to create more habitat complexity on a small scale. Size of holes and crevices should be a few cm-dm. This treatment may improve the habitat of egg-, larvae- or juvenile stages of many species and expected to improve habitat quality for small species (including adult stage), such as the rock gunnel and the shore clingfish.

Example: boulders, scour gravel and BESE-elements®[5].

3. Providing or mimicking natural (biogenic) chemical substrate properties to facilitate species. i.e. provide chalk-rich substrate such as concrete with added chalk, or even natural substrate such as shell material. This treatment may facilitate the settlement of specific target species that seek known- or unknown chemical cues that are normally associated with their natural settlement substrate.

Example: empty mussel or oysters shells.

4. Active introduction of specimens of target species to enhance establishment of new populations. This is to facilitate recruitment at locations where reproduction by naturally occurring adults is absent or to scarce. This treatment may facilitate the establishment of populations in areas beyond the reach of natural recruitment in the current situation.

Example: live oyster cages.

95. Of these measures listed above, a combination of adding larger and smaller structures across the protection area (**Option 1** and **2**) may be the most appropriate means in which to add habitat complexity to this environment, and has the benefit of not being required to be species specific (e.g. active introduction methods).

96. At present, the scour protection options for the ECC includes rock bags and concrete mattresses. The addition of smaller or larger structures (e.g. **Option1** and **2**) along with the initial placement of rock bags may be a suitable and practical option for enhancing this scour control system (see Figure 0.4 below for example of rock bags).

97. Alternatively, the benefit of using concrete mattresses as a scour control system is that there are now emerging products which are designed to provide both the scour protection capabilities and enhancement functions (Figure 0.4).

[4] Conventional scour control protection includes boulders with maximum size of 70 cm.
[5] Biodegradable Elements for Starting Ecosystems (BESE) is a biodegradable three-dimensional solid gride, made of starch from potato waste.

Figure 0.4: Example image of rock bag scour control system (LEFT) and ECOncrete® marine mattress (RIGHT).

98. Examples of scour protection enhancement options (as reviewed by Bureau Waardenburg, 2017) is shown in Figure 0.5 below. An estimated cost of some example scour protection options that may be feasible for the Project, are provided in Section 0; Table 0.2).

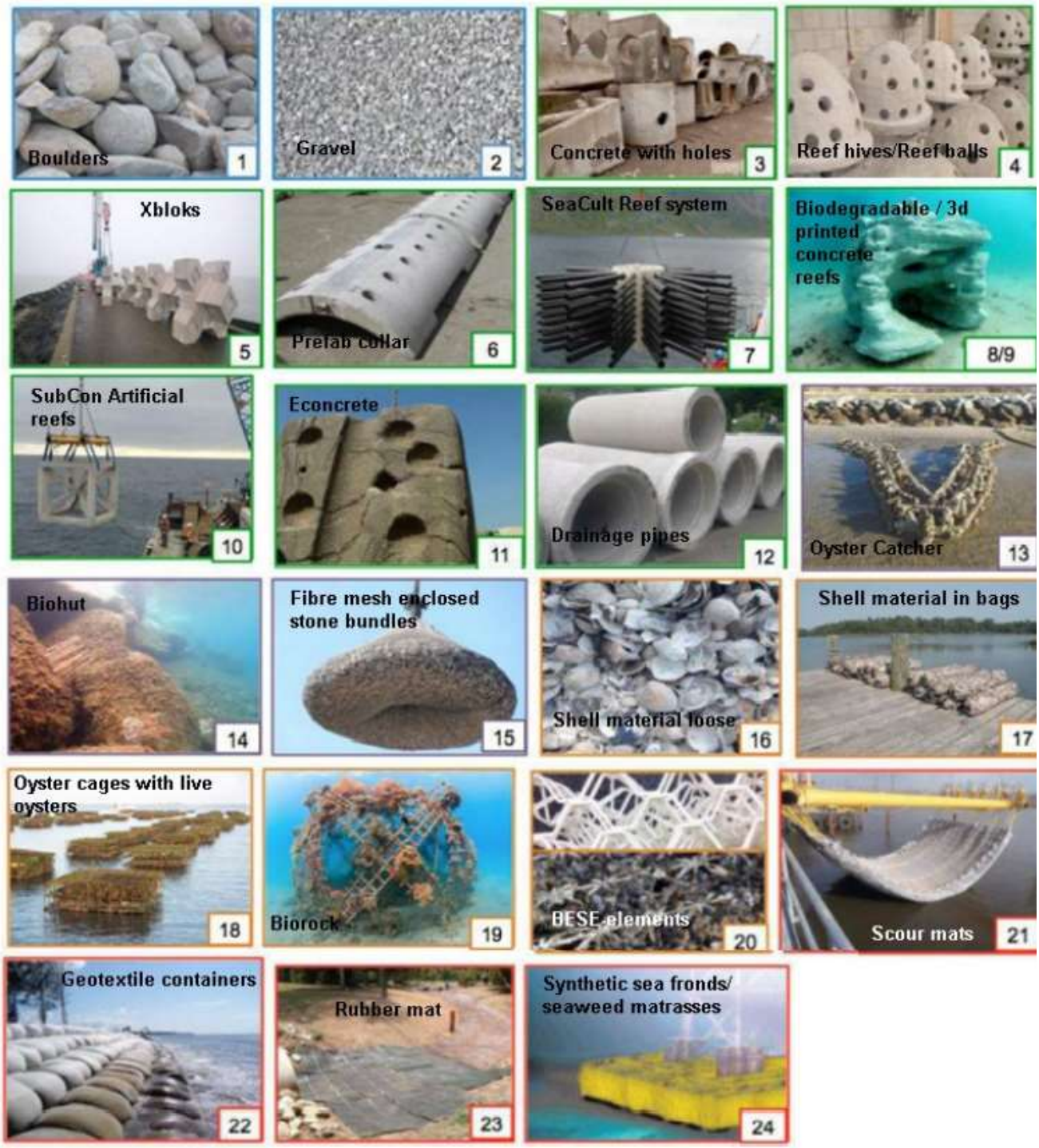

Figure 0.5: Examples of scour protection enhancement options (From: Armstrong *et al.,* 2019 (Source: Bureau Waardenburg, 2019)). Note: not all options shown above are for consideration for the Project.

Marine Demonstration Zone

99. A wide range of project infrastructure will be installed within the MDZ to support the range of possible device types that may be used, including piled and Gravity Base Structure (GBS) foundations; anchor mooring blocks; and cable protection measures. These installations will

occur across a complex mosaic of biotopes, dominated by circalittoral and/infralittoral rock and coarse sediments. As summarised in Section 4, the area is dominated spatially by the VER Habitat Group 9 and 10, which comprise biotopes relating to stony/bedrock reef and biogenic *Sabellaria* reef, respectively. There is a degree of spatial partition within the MDZ, where in the deeper western areas, biotope complexes may support *Sabellaria* reef features (e.g. A4.22 *Sabellaria* reefs on circalittoral rock) alongside Annex I stony reef habitat, and towards the shallower areas of the MDZ, bedrock reef is present (Figure 0.1).

100. Due to the spatial variation in habitat features, and range in infrastructure to be installed on the seabed, there may be a number of different enhancement options available for the MDZ. A more focused approach can be established following the pre-construction surveys, and the determination of localised micro-siting options across the MDZ.

Scour Protection

101. As with the export cables, for certain parts of the MDZ, additional cable protection may be required to secure the inter array cables and prevent movement. For the array cables however, only rock bags and split-pipe protection are to be used. Following the enhancement options outlined in Section 0 for the ECC, a similar approach can, therefore, be applied for the inter-array cables in the MDZ, if enhancement is required at these locations.

102. The foundations for the tidal devices may be piled into the seabed, with monopile or pin-piles installed and/or be GBS. These may all require some form of scour protection. Figure 0.6 below illustrates the four different design example options, as described above in Section 0. Figure 0.6 presents the example for wind turbine mono piles.

103. It is proposed by Bureau Waardenburg (2019) that for **Option 1** ('Treatment 1') that by adding larger structures to existing scour protection should result in a minimum area of 10 m diameter, that is 1-3 m high. For **Option 2** ('Treatment 2'), by adding more small-scale structures on top of other scour protection should result in a minimum 10 m diameter, with a thin layer (few cm) on top. **Option 1** and **2** may be the most feasible options for this Project.

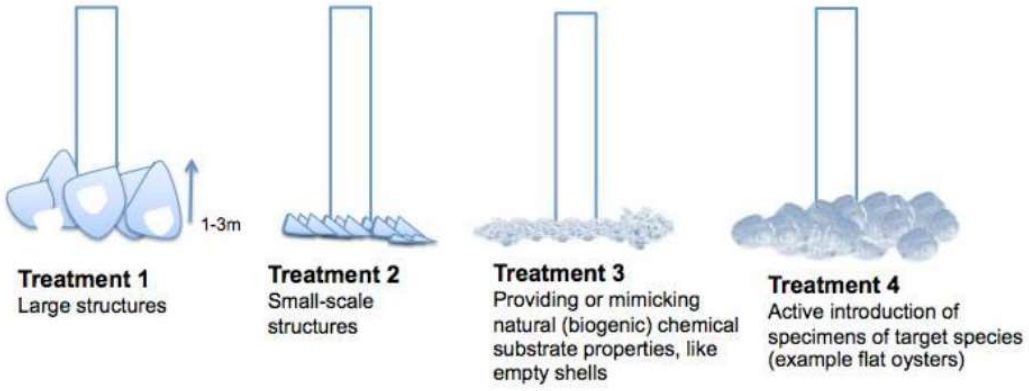

Figure 0.6: Side view of scour control enhancement options (From: Bureau Waardenburg, 2019).

104. These scour control enhancement options for the cables and device foundations in the MDZ (and ECC) will be most suitable for those area where there is predicted loss of Annex I bedrock or stony habitats. Application of the correct measure with an appropriate design, may provide important artificial habitats for colonising epifaunal species, supporting the widely distributed biotope complex of A4.11/A4/13 (very tide swept faunal communities on circalittoral rock/mixed faunal turf communities on circalittoral rock), across the MDZ (Figure 0.1). These artificial

features may also support important commercial/conservation fish species by providing refuge, nursery and feeding grounds (see RHDHV, 2019c for baseline assessment of fish and shellfish species in the Project area).

Artificial Reef Creation

105. The option of artificial reef creation may be a feasible additional enhancement measure if required. This enhancement measure would be deployed remotely from project infrastructure, but within the MDZ, to enhance areas of low-quality bedrock or stony reef. It is important to note that this method of artificial reef creation is not, however, considered by NRW to be a form of enhancement when applied in areas of naturally soft sediment (Armstrong *et al.,* 2019)[6].

106. In 1989, at Poole Bay, an artificial reef was created from concrete blocks and cement stabilised pulverised fuel ash from power stations. The results showed that these blocks were rapidly colonised by a wide variety of epibiota, fish and crustaceans (Review by Armstrong *et al.,* 2019).

107. There will be a design overlap with reef creation and enhancement measures for scour protection, as both will involve the physical placement and appropriate positioning of material on the seabed, increasing surface topography and creating additional reef like habitat for species. Potential products available, may provide duel purposes for a project, where they can be used both for protecting subsea infrastructure as well as creating or restoring marine habitats across other areas of a project (e.g. Reef Cubes®; Figure 0.7).

Figure 0.7: Reef Cubes®

Biogenic Reef Restoration

Management Options

108. Within the MDZ, areas of Annex I stony reef habitat were frequently overlain by varying coverage of *Sabellaria spinulosa* tube aggregations representative of Annex I biogenic reef in some areas (A4.22). The quality of the reefs of *S. spinulosa* observed and levels of 'reefiness' varied, however typically present in 'low' to 'medium' levels. There are previous records of horse mussel (*M. modiolus*) beds around the margins of the MDZ (Section 0), however, none were reported from the 2018 baseline surveys (OEL, 2018).

109. As such, it is the potential loss of biogenic *S. spinulosa* reef habitat from within areas of the MDZ from installation and re-powering activities that is of consideration here. Unlike the enhancement

[6] This method would only be advocated as part of a licensed development where structures such as breakwaters might be needed, and therefore as a method of enhancing the licensed structure.

options as described for scour protection across hard substrates (e.g. stony and bedrock reef habitats), onsite reef restoration has not yet been demonstrated for the renewables and subsea cable sectors (Table 0.1).

110. Numerous translocations or transplanting studies of biogenic features such as seagrasses has been undertaken as a restoration/enhancement technique. However, following an extensive literature review, no evidence has been found for translocation of *S. spinulosa* or other Sabellarid reefs. The exception was a translocation project, as part of the Tidal Lagoon Swansea Bay Project that translocated existing 'blocks' of honeycomb worm *Sabellaria alveolata* reef (sheet formations encrusting boulders and cobbles) from a potential area of impact, to a new viable intertidal 'receptor' site. It was demonstrated that all translocated specimens survived, however, this had been only monitored across a five-week period (review by Armstrong *et al.,* 2019; MarineSpace Ltd, 2015).

111. In consideration of the above it is concluded that at present, that if localised micro-siting away from Annex I *S. spinulosa* reef is not possible, then there may not be feasible enhancement measures to directly counteract the loss of this feature. Adaptive options may however include, placement of infrastructure across area of 'low reefiness', and avoiding areas of 'medium' reefiness'.

112. However, it is important to note the proposed approach introduced in Section 6, namely that all of the enhancement measures described above will only be considered if micro-siting is unable to reduce the amount of habitat loss below 3% of the OfDA. Therefore, there may not be a need to adopt enhancement measures inked to loss of biogenic reefs if the combination of micro-siting and alternative (stony/bedrock reef-related) enhancement measures can reduce the habitat loss to <3% of the OfDA.

Natural Recovery

113. The potential colonisation of introduced artificial structures will be an important consideration during the re-powering process, should structures be removed that have been colonised and formed reef features on them during operation. Such a situation would be assessed on a case by case basis.

OffSite

114. Biodiversity offsetting are conservation activities that are designed to provide biodiversity gain, to compensate for residual losses. It is a policy approach that seeks to minimise the environmental impacts of a development project by ensuring that any impact in one place is compensated for elsewhere. Where appropriate, biodiversity offsetting is an option available to developers to fulfil their obligations under the planning system mitigation hierarchy (UK Government, 2020). Biodiversity offsetting is understood as a 'last resort' in a mitigation hierarchy.

115. Offsite options for the Project should only be considered if it is demonstrated that onsite enhancement or restoration options are not feasible.

116. Offsite enhancement are those that take place away from the Project area, and these can be wide ranging and flexible. They are designed to work with natural processes and to restore natural features. They do not necessarily have to replace or enhance the habitat being impacted by development but instead used to enhance alternative habitat or restore locally scarce recourse. In addition, offsite management options such as habitat creation or modification may

be similar to those occurring within the Project area (Armstrong *et al*., 2019). Options available below to three broad measures of:

- Habitat creation, modification or management (e.g. planting of seagrass in a new site);
- Stock enhancement (e.g. release of cultured organism to enhance, conserve or restore fisheries); and
- Co-location (maximisation of marine space with integrated marine planning).

Additional Considerations

117. There are a series of important considerations with relation to marine ecological enhancement options. These can include social, economic, and environmental (e.g. larval supply, local ecology, hydrodynamic regimes, tidal frame and gradient), Presented below is a summary of some examples of these considerations (cost and biosecurity).

Cost

118. Following the review by Armstrong *et al.,* (2019) of the costs of various marine ecological enhancement measures, Table 0.2 below summarises the estimated costs of various options that may be applicable to the Project (onsite options).

119. Costs for enhancement measures will range from simple, cost effect options such as re-orientation of replaced natural rock and altering microhabitats by drilling holes, up to more costly habitat restoration and creation. is very simple and costs. It will be important that the costs of adopting ecological enhancement measures should be proportionate to the environmental damage, and that interventions should also be cost-effective (Armstrong *et al.,* 2019).

Table 0.2: Cost summary of potential enhancement options for the Project (Review by: Armstrong *et al.*, 2019)

	Enhancement Type	Approximate Cost
Vertical structure enhancements		
Small Pool Structures	'Vertipools'	£175-£600 per unit (excl. installation)
	Confidential 'Vertipool' scheme	£2,500 (incl. installation and monitoring)
	Australian 'Flowerpots'	£170 per unit (incl. installation)
	ECOncrete® tide pools	£990 per unit (exc. tax/installation)
Tiles	ECOncrete® seawall tiles	£350 per m^2
	Hartlepool textured panels	£8 - £30 per m^2 (additional cost)
Scour protection (incl. reefs)		
Large Structures	Reef balls/Hives	£900 per unit
	Xblock	£700 per unit
Small Structures	Boulders, scour gravel	No additional cost to conventional scour protection
	BEDE elements	£3.50 per unit

Biosecurity

120. There are over forty invasive non-native species (INNS) reported to occur within Welsh waters, seven of which are considered invasive with negative effects, these are: *Austrominius modestus* (intertidal barnacle); *Eriocheir sinensis* (Chinese mitten crab); *Botrylloides violaceus* (colonial ascidian); *Magallana gigas* (Pacific oyster); *Crepidula fornicata* (slipper limpet); *Didemnum vexillum* (carpet sea squirt); and *Sargassum muticum* (Japanese wireweed).

121. Furthermore, Anglesey is considered a focal point for INNS due to a high number of hotspots around its coast, including Holy Island and the Menai Strait. E.g. for the colonial ascidian *Didemnum vexillum*.

122. The biosecurity risk associated with the spreading of INNS during the construction and operation of the Project will be mitigated through use of best-practice techniques. An outline Invasive Species Management Plan will also be produced. These control measures will need to also consider the increased risk from INNS into the project area through the introduction of new material into the site from ecological enhancement measures.

Summary

123. This Outline Strategy sets out initial thoughts on the key issues linked to potential biodiversity enhancement measures that may need to be adopted on the Morlais project. It aims to form the starting point for further discussions between Menter Môn and relevant consultees (e.g. NRW) as to the most feasible enhancement options for the Project should they be required. It is expected that this Outline Strategy will evolve during the planning and consenting process and that, post-consent, it will be updated to a full Biodiversity Enhancement Strategy document.

124. The document provides a summary of key seabed habitats in the Morlais OfDA and the potential role of biodiversity enhancement to act as a secondary mitigation measure if/when the primary measure of micro-siting is judged to be insufficient.

125. In order to link to the original assessment presented in the Morlais ES (RHDHV, 2019b), reference is made in the document to aiming to reduce habitat loss (initially via micro-siting) to <3% of the total area of the OfDA and intertidal area (as this would produce a residual impact of minor adverse). However, if, even with micro-siting, habitat loss remained >3% of the total study area, then this is when the use of additional biodiversity enhancement measures would be considered.

126. Potential exists for such measures to be (a) developed and installed in situ on project infrastructure already deployed; (b) factored into the design of project infrastructure not yet deployed and/or (c) deployed away from actual project infrastructure, i.e. within other parts of the Morlais OfDA.

127. There may be a combination of enhancement measures that can be incorporated into the Project, each with a range of technical complexity and cost, which reflects the range of habitats and infrastructure that encompass the Project. Figure 0.1 below summarises the broad decision-making pathways for potentially exploring biodiversity enhancement options for the Project.

128. It will be important that in adopting enhancement measures that they meet the Welsh sustainable management of natural resources (SMNR) principles under the Environment (Wales) Act 2016. These principles are as follows:

- **Adaptive management** – Managed adaptively by planning, monitoring, reviewing and where appropriate changing action;
- **Scale** - Consider the appropriate spatial scale for action; •
- **Collaboration and engagement** - Promote and engage in collaboration and co-operation;
- **Public participation** - Make appropriate arrangements for public participation in decision making;
- **Multiple benefits** - Take account of the benefits and intrinsic value of natural resources and ecosystems; •
- **Long term** - Take account of the short, medium and long-term consequences and action;
- **Preventative action** - Take action to prevent significant damage to ecosystems; and
- **Building resilience** - Take account of the resilience of ecosystems, in particular the following aspects:

- diversity between and within ecosystems;
- the connections between and within ecosystems;
- the scale of ecosystems;
- the condition of ecosystems (including their structure and functioning); and
- the adaptability of ecosystems.

129. In contrast to terrestrial systems, the more open and dynamic marine environment results in complex ecosystem processes occurring over a wider range of spatial and temporal scales. Thus, the principle of 'working with natural processes'/'nature-based solutions' is particularly important when considering the resilience of marine ecosystems and to consider how far to pursue ecological enhancement within a Project area or whether to consider broader offsite enhancement measures (Armstrong *et al.,* 2019).

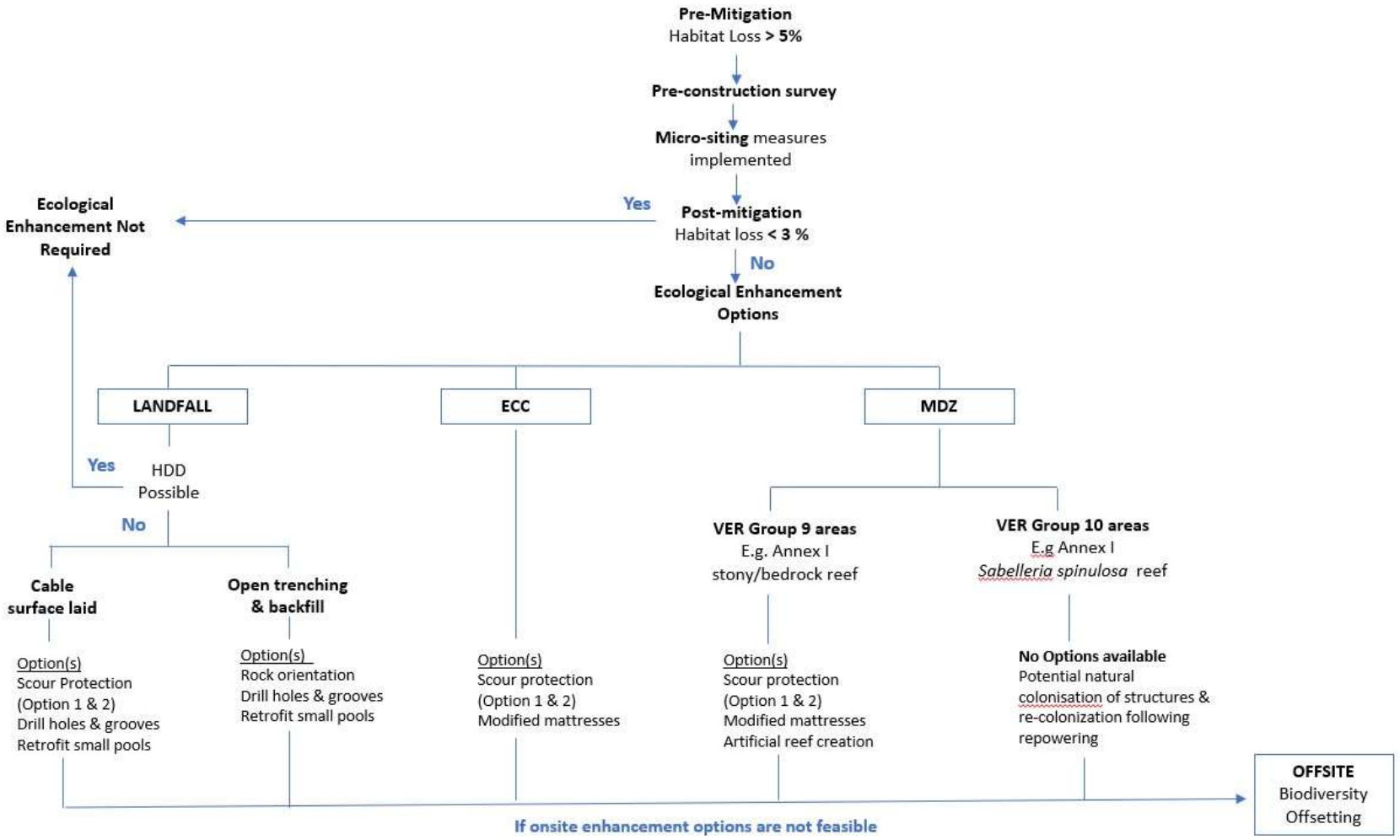

Figure 0.1: Summary decision making process for ecological enhancement for the Project.

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