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MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Outline underwater sound management strategy

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Image of an offshore wind farm

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Prepared for:

Morgan Offshore Wind Ltd.

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Glossary

Term	Meaning
Applicant	Morgan Offshore Wind Limited.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement.
Environmental Statement	The document presenting the results of the Environmental Impact Assessment (EIA) process for the Morgan Offshore Wind Project Generation Assets.
Expert Working Group (EWG)	Expert working groups set up with relevant stakeholders as part of the Evidence Plan process.
Habitat Regulations	The Conservation of Habitats and Species Regulations 2017 (as amended) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended).
High order unexploded ordnance clearance	An unexploded ordnance clearance method which intentionally seeks to detonate the unexploded ordnance.
Low order unexploded ordnance clearance	An unexploded ordnance clearance method which does not seek to detonate the unexploded ordnance.
Marine licence	The Marine and Coastal Access Act 2009 requires a marine licence to be obtained for licensable marine activities. Section 149A of the Planning Act 2008 allows an applicant for a DCO to apply for 'deemed marine licences' as part of the DCO process.
Maximum Design Scenario (MDS)	The scenario within the design envelope with the potential to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor.
Morgan Array Area	The area within which the wind turbines, foundations, inter-array cables, interconnector cables, offshore export cables and offshore substation platforms (OSPs) forming part of the Morgan Generation Assets will be located.
Morgan Offshore Cable Corridor and Access Areas	The corridor located between the Morgan Array Area and the landfall up to Mean High Water Springs (MHWS), in which the offshore export cables will be located and in which the intertidal access areas are located.
Morgan Offshore Wind Project: Generation Assets	This is the name given to the Morgan Generation Assets project as a whole (includes all infrastructure and activities associated with the project construction, operations and maintenance, and decommissioning).
Morgan Offshore Wind Project: Generation Assets PEIR	The Morgan Generation Assets Preliminary Environmental Information Report (PEIR) that was submitted to The Planning Inspectorate (on behalf of the Secretary of State) for the Morgan Offshore Wind Project: Generation Assets.
Outline Marine Mammal Mitigation Protocol	The protocol setting out the appropriate measures to be adopted as part of the Morgan Generation Assets relevant to offshore activities that are likely to produce underwater sound levels capable of potentially causing injury to marine mammals.

Term	Meaning
Pre-construction site investigation surveys	Pre-construction geophysical and/or geotechnical surveys undertaken offshore and, or onshore to inform, amongst other things, the final design of the Morgan Generation Assets.
Project Design Envelope (PDE)	The Project Design Envelope sets out the design assumptions and parameters from which the realistic MDSs are drawn for the Morgan Generation Assets Environmental Impact Assessment (EIA). This is also often referred to as the 'Rochdale Envelope' approach.
Underwater sound	Sound waves made underwater.
Wind turbines	The wind turbine generators, including the tower, nacelle and rotor.

Acronyms

Acronym	Description
ADD	Acoustic Deterrent Devices
CEA	Cumulative Effects Assessment
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
DCO	Development Consent Order
dML	Deemed marine licence
EC	European Commission
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPS	European Protected Species
EWG	Expert Working Groups
GBF	Gravity base foundation
HF	High Frequency
HRA	Habitats Regulation Assessment
IEMA	Institute of Environmental Management and Assessment
JNCC	Joint Nature Conservation Committee
MDS	Maximum Design Scenario
ML	Marine licence
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MMOs	Marine Mammal Observer
MNRU	Marine Noise Reduction Unit
NAS	Noise Abatement Systems
NE	Natural England
NEQ	Net Explosive Quantity

Acronym	Description
NMS	Noise Mitigation System
NRW	Natural Resources Wales
OSP	Offshore Substation Platforms
PAM	Passive Acoustic Monitoring
PDE	Project Design Envelope
PEIR	Preliminary Environmental Information Report
PTS	Permanent Threshold Shift
SEIS	Supplementary Environmental Information Statement
SEL_{cum}	Cumulative Sound Exposure Level
SNCB	Statutory Nature Conservation Bodies
SPL_{pk}	Peak Sound Pressure Level
UWSMS	Underwater Sound Management Strategy
UXO	Unexploded Ordnance
VHF	Very High Frequency

Units

Unit	Description
%	Percentage
dB	Decibel
k*g*	Kilogram
kJ	Kilojoule
km	Kilometre
m	Metre
nm	Nautical mile

1 Outline Underwater Sound Management Strategy

1.1 Introduction

1.1.1 Background

1.1.1.1 Morgan Offshore Wind Limited (the Applicant), a joint venture of bp Alternative Energy Investments Ltd. (hereafter referred to as bp) and Energie Baden-Württemberg AG (hereafter referred to as EnBW) is developing the Morgan Offshore Wind Project: Generation Assets (hereafter Morgan Generation Assets), a proposed wind farm in the Irish Sea.

1.1.1.2 A marine licence is required before carrying out any licensable marine activities (such as piling and Unexploded Ordnance (UXO) clearance) under the Marine and Coastal Access Act 2009. The marine licences (ML) for activities will be deemed under the Development Consent Order (DCO). The deemed MLs (dMLs) will cover works related to the offshore wind farm generation infrastructure (wind turbines, Offshore Substation Platforms (OSPs), inter-array cables and interconnector cables).

1.1.1.3 This Underwater Sound Management Strategy (UWSMS) is applicable to the generation infrastructure and is secured within the dMLs in the Draft DCO (Document Reference C1).

1.1.1.4 Geophysical surveys are not a licensable activity under the Marine and Coastal Access Act 2009. However, a European Protected Species (EPS) licence would be required if the geophysical surveys were predicted to affect marine mammal species listed as EPS. Therefore, the Applicant has included proposed mitigation for geophysical surveys within the outline Marine Mammal Mitigation Protocol (MMMP) (S_D5_10 Outline marine mammal mitigation protocol F03)) for completeness and to inform the EIA and the EPS licensing process. All other activities are controlled through the DCO process and will also be considered for the EPS licensing process. Noting the impact of elevated underwater sound from geophysical surveys is fully mitigatable by measures detailed within the Outline MMMP (S_D5_10 Outline marine mammal mitigation protocol F03)), geophysical surveys are not detailed within this Outline UWSMS. Geotechnical surveys would not produce sound impacts that would require mitigation measures.

1.1.1.5 The Applicant has committed at Examination Deadline 5 to the use of low order clearance only following engagement with the statutory nature conservation bodies (SNCBs) and the Marine Management Organisation (MMO). High order UXO clearance will not be authorised under the DCO. This is reflected in the updated drafting of the deemed marine licence in Schedules 2 & 3, Condition 23 in the draft DCO (S_D5_7). The Commitments Register (S_D5_14) (previously titled Mitigation and Monitoring Schedule) and the Outline MMMP (S_D5_10) have been updated at Deadline 5 to reflect this change (see Co62).

1.1.1.6 The Environmental Statement has been submitted with the application for a DCO under Section 37(3) of the 2008 Act and presents the findings of the Environmental Impact Assessment (EIA) process. The Environmental Statement has been prepared in accordance with The Infrastructure Planning (Environmental Impact Assessment (EIA)) Regulations 2017 (the 2017 EIA Regulations).

1.1.2 Purpose of the Underwater Sound Management Strategy

1.1.2.1 The UWSMS is a consent compliance document that provides a strategy to reduce the magnitude of impacts from elevated underwater sound from the Morgan Generation Assets and consequently contributes to reducing the project's contribution to potential cumulative impacts. The overarching aim is to reduce the magnitude to a level such that any residual effects on sensitive marine mammal and fish receptors can be concluded as a non-significant in the context of EIA. The UWSMS is an overarching document that includes information on any further mitigation measures necessary to reduce the risk of both *injury* and *disturbance* to marine mammals and fish receptors due to elevated underwater sound from those activities assessed within the EIA including piling and UXO clearance.

1.1.2.2 At this stage (Application) an Outline UWSMS (Document Reference J13) has been drafted to provide an overview of the information above that will be detailed within the Final UWSMS which will be developed post-consent based on further refined project design information. To this end, the Outline UWSMS will set out the process for investigating mitigation options (i.e. a strategic look at what could be considered) whilst the Final UWSMS will provide the detail of the approach as determined by the refined project parameters.

1.1.2.3 The detailed project design prior to construction will be shared with the licencing authority and mitigation will be agreed via the Final UWSMS if required. The application project design sets out a range of foundation types (e.g. pin piled jackets, suction buckets, gravity base foundations) and a range of foundation numbers (e.g. up to 96 foundations), however these could be reduced post consent (e.g. if a smaller number of bigger turbines were constructed) and thereby reduce the magnitude of effects. Similar reductions could be applied to hammer energies and durations of piling activity during detailed design and contracting processes. There is also the potential for further detail (such as population status) on key environmental receptors to be applied.

1.1.2.4 There will also be further information incorporated, where available, on other nearby project construction timelines, such as piling schedules. For the purpose of the Cumulative Effects Assessment (CEA) in the Environmental Statement (found within Volume 2, Chapter 4: Marine mammals of the Environmental Statement (Document Reference F2.4)), it was assumed all projects within the CEA screening areas either are already or would be consented, and also could all be piling at the same time as the Morgan Generation Assets. The assessment of cumulative effects from other plans and projects is also based upon the respective Maximum Design Scenarios (MDSs) presented in the Environmental Statements for Tier 1 projects or Preliminary Environmental Information Reports (PEIR) for Tier 2 Projects. The assessment does not consider any further mitigation or reduced/refined Project Design Envelopes (PDEs) for other Tier 1 and/or Tier 2 projects that may be implemented post consent. However it is understood that if other projects are consented, it is reasonable to assume that they will each implement appropriate measures such that any significant effect is reduced to a non-significant level. Following consent of the Morgan Generation Assets, further detail on other projects in the cumulative screening areas may be available.

1.1.2.5 The Final UWSMS will be produced in consultation with the licensing authority and statutory nature conservation bodies (SNCBs) to agree, in detail, the necessary mitigation measures that will be implemented prior to commencement of and during

offshore construction. Production of the Final UWSMS is secured within the dMLs in the draft DCO (Document Reference C1).

1.1.2.6 The Final UWSMS will be in general accordance with the Outline UWSMS, will consider the latest guidance at the time and will be agreed with the relevant authority prior to construction commencing. The Final UWSMS will gather all the relevant information and will allow the Applicant, regulators, and SNCBs to assess the risk (particularly to key receptors highlighted in the Environmental Statement) and decide upon further mitigation, if required at the time.

1.1.3 Linkage with the Marine mammal mitigation protocol

1.1.3.1 The Marine Mammal Mitigation Protocol (MMMP) forms an annex to the UWSMS and is the consent plan focussing solely on the primary and tertiary measures required to mitigate the effects of injury to marine mammals.

1.1.3.2 As part of the application for consent, the Applicant has committed to a range of adopted measures as part of the Morgan Generation Assets (referred to as '**primary measures'** in the Institute of Environmental Management and Assessment (IEMA) guidance 2024) and measures required to meet existing legislative requirements or adopted industry practice (referred to as '**tertiary measures'** in IEMA 2024) to reduce or eliminate the risk of injurious effects of underwater sound due to piling, UXO clearance and geophysical surveys on marine mammals. At this stage (Application) an Outline MMMP (Document Reference J17) has been produced and as described above for the UWSMS, a Final MMMP will be developed post-consent, in consultation with the licensing authority and SNCBs, in consideration of any refinements to the Morgan Generation Assets project design. The Applicant's commitment to the Final MMMP is secured within the dMLs in the draft DCO (Document Reference C1).

1.1.3.3 If, as a result of project refinements determined post-consent (section 1.7) and considering the application of appropriate primary and tertiary mitigation, residual risk of injury and disturbance to marine mammals cannot be fully mitigated, the steps to be undertaken by the Applicant post-consent to reduce the magnitude of impact (such that the effects are non-significant in EIA terms, referred to as '**secondary mitigation'** in IEMA guidance 2024) will be detailed in the Final UWSMS. The role and purpose of the MMMP and UWSMS are detailed in Table 1.1. An overview of the primary and tertiary measures to mitigate injury is provided in section 1.5 of this Outline UWSMS.

1.1.3.4 As the impact of elevated underwater sound from geophysical surveys is fully mitigatable by the primary and tertiary measures detailed within the Outline MMMP (Document Reference J17) (for the purpose of the EPS licencing process), further mitigation measures are not required and therefore geophysical surveys are not detailed further within this Outline UWSMS.

Table 1.1: Role and purpose of the UWSMS and linkage with the MMMP with respect the the DCO.

Document	Purpose	Where it is secured
Final UWSMS, with an Outline UWSMS included as part of the application (Document Reference J13)	The UWSMS provides a strategy to reduce the magnitude of impacts from elevated underwater sound from the Morgan Generation Assets, such that there is no significant effect on fish or marine mammals. The UWSMS is the overarching document considering both injury and disturbance to marine mammals and fish receptors from all activities assessed within the EIA where there is a potential effect of elevated underwater sound. The Outline UWSMS sets out the process for investigating further mitigation options (referred to as secondary mitigation in Institute of Environmental Management and Assessment (IEMA), 2024) to manage underwater sound levels to reduce the magnitude of impacts for the project alone and its contribution to cumulative effects if required. With respect to injury to marine mammals the requirement for further mitigation options is considered where there remains a residual risk of a significant effect after implementation of the measures adopted in the MMMP. The Final UWSMS will be developed in consultation with the licensing authority and SNCBs.	Final UWSMS secured within the dMLs in the draft DCO (Document Reference C1).
Final Marine Mammal Mitigation Protocol, with an Outline MMMP included as part of the application (Document Reference J17)	Details the range of embedded design (primary) and industry best practice (tertiary) measures adopted as part of the Morgan Generation Assets to reduce or eliminate the risk of auditory injury effects of underwater sound (due to piling, UXO clearance) during pre-construction and construction phases of the Morgan Generation Assets on marine mammals. The Final MMMP will be developed in consultation with the licensing authority and SNCBs.	Final MMMP secured within the dMLs in the draft DCO (Document Reference C1).

1.1.4 Structure of the Underwater Sound Management Strategy

1.1.4.1 The Final UWSMS will contain the sections outlined in Table 1.2, as set out in this Outline UWSMS, and will be updated as a live document as more information is assembled on the project design post consent.

Table 1.2: UWSMS document structure.

Section	Title	Overview
1.1	Introduction	Introduction to the UWSMS. Background to the consent requirements; brief outline of the objectives, scope and purpose of the UWSMS, detailing how it will address the conditions in the dMLs and links to other relevant consent compliance plans.
1.2	Overview of environmental sensitivities	Environmental sensitivities in relation to sensitive marine mammals and fish receptors.
1.3	Consultation	A summary of the consultation undertaken with SNCBs with regard to marine mammals and fish for application to the UWSMS.
1.4	Responsibilities for the Underwater Sound Management Strategy	Responsibilities and ownership of the UWSMS, including details of key roles, organisation and change management systems.

Section	Title	Overview
1.5	Measures adopted as a part of the Morgan Generation Assets	A summary of the primary and tertiary measures adopted as part of Morgan Generation Assets, detailed in the Outline MMMP (Document Reference J17).
1.6	Morgan Generation Assets construction activities	Activities likely to result in elevated sound and require further consideration (e.g. piling, UXO).
1.7	Reduction in effects due to the refined Project Design Envelope	Reduction in effects for key species due to refinements in project design post-consent compared to Application.
1.8	Further (secondary) mitigation measures	Summary of steps to be undertaken to reduce magnitude where residual risk cannot be mitigated via measures adopted as part of the Morgan Generation Assets.
1.9	Licences and legal requirements	A summary of additional licences which may be required for the construction activities.
1.10	Reporting and auditing	An overview of the UWSMS related reporting and auditing requirements.
1.11	References	List of cited references.

1.2 Overview of environmental sensitivities

1.2.1 Overview

1.2.1.1 This section will set out the sensitivities in relation elevated underwater sound as highlighted in the application for consent.

1.2.1.2 The information provided here will summarise the results obtained from any pre-construction surveys and monitoring. As mentioned in paragraph 1.4.2.1, as a live document it will reflect the latest available information at the time.

1.2.1.3 This section will also present an overview of the effects with respect to injury or disturbance on sensitive receptors.

1.2.2 Marine mammals

1.2.2.1 In the Environmental Statement, harbour porpoise was identified as being potentially sensitive to injury arising from elevated underwater sound from high-order UXO clearance for both project alone and cumulatively with other projects/plans.

1.2.2.2 Bottlenose dolphin was identified as being potentially sensitive to disturbance arising from the elevated underwater sound from piling during the CEA. Further details are provided in Volume 2, Chapter 4: Marine mammals of the Environmental Statement (Document Reference F2.4). A high-level summary of the baseline ecology of these two species and the potential effect from elevated underwater sound for UXO clearance and piling is presented in Table 1.3.

Table 1.3: Overview of the marine mammals species where a significant effect was identified in the Environmental Statement.

Species	Description of Species Distribution	Potential effect from elevated underwater sound
Harbour porpoise *Phocoena phocoena*	Widespread in cold and temperate northwest European shelf waters, and abundant throughout the Irish Sea. Common inshore species found in high densities in the Irish Sea. Highest relative abundances in the western half of the central Irish Sea. High predicted relative densities in both winter and summer in the Irish Sea.	Classed as a Very High Frequency cetacean species impulsive sound leading to instantaneous injury during clearance of UXOs (based on absolute maximum charge size of 907 kg) could affect harbour porpoise over ranges of up to 15.37 km which, would not be mitigatable using standard primary and tertiary measures (see the Outline MMMP, Document Reference J17). UXO sizes up to 130 kg would be mitigatable using standard primary and tertiary measures. Effects were significant for the Morgan Generation Assets alone when based on the absolute maximum UXO and cumulatively with other plans and projects where UXO clearance may be required.
Bottlenose dolphin *Tursiops truncatus*	Near-global distribution, widely distributed in the North Atlantic and occurs year-round throughout the Irish Sea near-shore. Predominately coastal distribution (though low densities have been recorded offshore). Concentrations of resident populations in Cardigan Bay and off the coast of Co. Wexford. Seasonal differences in dispersion have been noted (e.g. dolphins in summer occurring mainly in small groups near the coast, centred upon Cardigan Bay, dispersing more widely and generally northwards, where they may form very large groups in winter).	Classed as a High Frequency cetacean the CEA assessment concluded a potential significant effect for bottlenose dolphin populations in the Irish Sea Management Unit, where multiple projects could be piling at the same time. The bottlenose dolphin population in the Irish Sea may be declining, and cumulative piling could lead to a larger area of disturbance at any one time, thereby restricting movement of individuals between key areas in Cardigan Bay and around the Isle of Man.

1.2.3 Fish

1.2.3.1 In the Environmental Statement, herring *Clupea harengus* was identified as potentially being significantly affected by elevated underwater sound during piling from the Morgan Generation assets alone and both herring and cod *Gadus morhua* could be significantly affected by elevated underwater sound cumulatively with other projects piling at the same time. Physiological hearing adaptations are known to exist in these species to elicit high sensitivity to sound, particularly impulsive sound during piling. Further details are provided in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document Reference F2.3). A high-level summary of the baseline ecology of these two species is presented in Table 1.3

Table 1.4: Overview of the fish species where a significant effect was identified in the Environmental Statement.

Species	Description of Species Distribution	Potential effect from elevated underwater sound
Cod *Gadus Morhua*	Cod has a wide distribution of high intensity spawning grounds in the east of the Irish Sea, extending north to south, with surrounding extensive low intensity spawning grounds (Ellis *et al*., 2012), with adult populations throughout the entire Irish Sea.	Cod, as a hearing sensitive species, have the potential to be disturbed by underwater sound from piling activities at the Morgan Generation Assets cumulatively with other projects piling at the same time during the spawning period of January to April (peak spawning occurring mid February to end of March) with up to 21.9% of mapped high intensity spawning grounds potentially affected. There were no significant effects on cod due to piling activities for the Project alone.
Herring *Clupea Harengus*	Herring is known to be present to the east and south of the Isle of Man, with two core high intensity spawning grounds surrounded by low intensity spawning grounds in these areas (Coull *et al*., 1998), and adult populations are known to exist throughout the whole of the Irish Sea.	Herring, grouped as one of the most hearing sensitive species, has the potential to be disturbed by underwater sound from piling activities at the Morgan Generation Assets alone and cumulatively with other projects piling at the same time during the spawning period of late September for three to four weeks with up to 54.9% of combined high and low intensity herring spawning ground potentially affected.

1.3 Consultation

1.3.1 Pre-application consultation

1.3.1.1 The pre-application consultation for underwater sound was undertaken through the Evidence Plan which sought to ensure compliance with the Habitat Regulations Assessment and EIA. Expert Working Groups (EWGs) for key topics (marine mammals and fish and shellfish) were also set up to discuss and agree topic specific issues with the relevant stakeholders. Pre-application also included Section 42 responses (Table 1.5).

Table 1.5: Consultation relevant to the UWSMS.

Date	Consultee and type of response	Topic	Relevance to the UWSMS
Marine mammals			
May 2022	Underwater sound technical note – provided to EWG	NE responded to the underwater sound technical note that sound abatement for UXO clearance where deflagration is not an option should also be considered.	Sound abatement systems/NAS is one of the options which is being considered for additional mitigation and its implementation will be decided in consultation with the licencing authority and SNCBs, as part of the Final UWSMS, prior to construction. NAS options are discussed in section 1.8.3 for UXO.

Date	Consultee and type of response	Topic	Relevance to the UWSMS
June 2023	Statutory Consultation (S42) key topics	Marine Management Organisation, Natural Resources Wales, Natural England and Joint Nature Conservation Committee (JNCC) recommended use of Noise Abatement Systems (NAS). Natural Resources Wales highlighted the use of noise mitigation strategies/attenuation technology such as bubble curtains, timing of piling and piling methods have not been proposed as potential mitigation methods.	Sound abatement systems/NAS is one of the options which is being considered for additional mitigation and its implementation will be decided in consultation with the licencing authority and SNCBs, as part of the Final UWSMS, prior to construction. NAS options are discussed in sections 1.8.2 for piling and 1.8.3 for UXO.
December 2023	Sixth Expert Working Group	Initial approach to UWSMS presented at the EWG.	This document presents an Outline UWSMS that will be developed post-consent.
Fish			
February 2022	Centre for Environment, Fisheries and Aquaculture Science (Cefas) – First Evidence Plan Expert Working Group	Cod should be specifically considered for piling noise impacts.	The Final UWSMS will consider measures to reduce the spatial scale of effects where required in order to reduce the residual risk of effects including disruption of spawning activities.
June 2022	The Planning Inspectorate – Scoping Opinion	The Applicant should consider controlling the timing of activities during construction and operation to avoid key and sensitive periods to species, for example fish spawning and migration periods.	The Final UWSMS will consider measures to reduce the duration of any continuous disturbance within a given time period (month, season on year) from cumulative projects (i.e. seasonal scheduling).
November 2022	Natural Resources Wales – Second Benthic Ecology, Fish and Shellfish and Physical Processes EWG meeting	Are spawning areas for cod considered?	The Final UWSMS will consider measures to reduce the spatial scale of effects where required in order to reduce the residual risk of effects including disruption of spawning activities.

Date	Consultee and type of response	Topic	Relevance to the UWSMS
June 2023	Statutory Consultation (S42) key topics	Natural England agrees that there is potential for significant effects on herring spawning, due to the proximity to the nearby herring spawning grounds. Particularly if piling takes place during the spawning period (September- October). The MMO considers that mitigation measures and careful scheduling of piling activity may be necessary to reduce the impacts to fish, particularly with regard to fish considered to have a higher hearing sensitivity (including herring and cod). NRW advise that in the final ES mitigation to either control the noise through deployment of bubble curtains, or timing restrictions to avoid both species are implemented. North West Wildlife Trusts state that piling should not occur during herring spawning periods and recommend considering further mitigation measures to be put in place. Isle of Man Department of Infrastructure agree with approach to investigate mitigation to minimise risks of significant impacts if piling occurs during the herring spawning season	The Final UWSMS will consider measures to reduce the duration of any continuous disturbance within a given time period (month, season on year) from cumulative projects (i.e. seasonal scheduling).
December 2023	Cefas - Expert Working Group 6	The Applicant's suggestion of an Underwater sound management strategy is welcome given the potential impacts of underwater noise to herring and cod. This is also appropriate given the need to manage cumulative impacts of underwater sound produced by multiple projects in the region. Any measures that may reduce these impacts, such as reduced number of foundations and/or hammer energies would be welcome. Mitigation for cod and herring from underwater noise should be agreed at the time of consent, rather than post-consent and should be agreed before any Underwater sound management strategy is accepted.	The Outline UWSMS is provided within the Application with the full strategy to be developed post-consent (when the final details of the refined design and programme will be available) with input from relevant stakeholders to finalise the Final UWSMS which contains appropriate mitigation measures to manage the effects from underwater sound during construction on herring and cod.
December 2023	Natural Resources Wales – Expert Working Group 6	NRW Advisory state that the strategy could be an acceptable approach, however without sight of this strategy in detail and its subsequent iterations we are unable to confirm that it would be acceptable for the management of impacts from underwater sound.	The Final UWSMS will present the mitigation measures that will be required for any residual impacts that are identified based on the final design refinements.

1.3.2 Post-application Consultation

1.3.2.1 This section will detail the consultation undertaken post-application to develop the Final UWSMS, with the licensing authority and relevant statutory advisors. It will clearly set out how the Applicant will engage with the MMO, Isle of Man Government and SNCBs on the development of the Final UWSMS, and the process will be agreed post application. The Final UWSMS will be agreed prior to construction commencing.

1.3.2.2 The Applicant has engaged with SNCBs and other statutory advisors throughout examination of the Morgan Generation Assets DCO application regarding the scope of the outline and final UWSMS.

1.3.3 Post-consent consultation

1.3.3.1 This section will detail consultation undertaken post-consent with the licensing authority and relevant statutory advisors on the Final UWSMS. It will clearly set out how the Applicant will engage with the MMO, Isle of Man Government and SNCBs on the development of the Final UWSMS.

1.4 Responsibilities for the Underwater Sound Management Strategy

1.4.1 Key roles

1.4.1.1 The key roles and responsibilities for implementing the various measures detailed in the Final UWSMS will be described in this section, alongside how communication between the responsible parties involved in construction activities that generate elevated underwater sound (piling, UXO) will be managed. The roles and titles may change as the project progresses, but the Applicant will be responsible for the live management and consultation of the final document.

1.4.1.2 Key contractors for foundation installation and UXO clearance will be detailed in this section and the responsibility for ensuring the day to day implementation of the documented measures in the Final UWSMS will lie with the relevant installation contractors and the mitigation team (including the Acoustic Deterrent Devices (ADD) operator/Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) personnel).

1.4.1.3 Indicative key roles may include:

- A Project Manager (construction phase) (or equivalent) responsible for ensuring that sufficient resources and processes are in place to deliver/comply with the documented measures
- A Project Manager for Offshore Installations (or equivalent) who will ensure that provision is made for matters relating to the delivery of the documented measures and that construction personnel and contractors are fully briefed. The Project Manager for Offshore Installations (or equivalent) will provide reporting to the Project Manager and where necessary address any non-compliances in relation to the Final UWSMS
- Consents Team (or equivalent) who are responsible for monitoring ongoing compliance with the documented measures. Key responsibilities include being the primary contact for the licensing authority, and other statutory bodies or stakeholders and will be responsible for managing and reporting on compliance with dML consent conditions to the licencing authority

- Mitigation team (ADD operator, MMOs, PAM) (see Document Reference J17 for further details of the team) which will be responsible for deployment of mitigation measures, and communication with the full distribution team including the Consents Team.

1.4.1.4 An organisational chart of the identified roles for the implementation of the Final UWSMS during construction will be provided in this section.

1.4.2 Change management

1.4.2.1 The Final UWSMS will set out the proposed methods for piling and UXO clearance at the Morgan Generation assets and procedures to mitigate the effects of piling/UXO clearance if required on the sensitive marine mammal and fish species identified in the relevant consent conditions. It will be a live document, that will be updated at relevant milestones in the light of any new significant information related to operations.

1.4.2.2 Therefore, should it be necessary to update the Final UWSMS, a change management process, such as the example set out Figure 1.1, will be used.

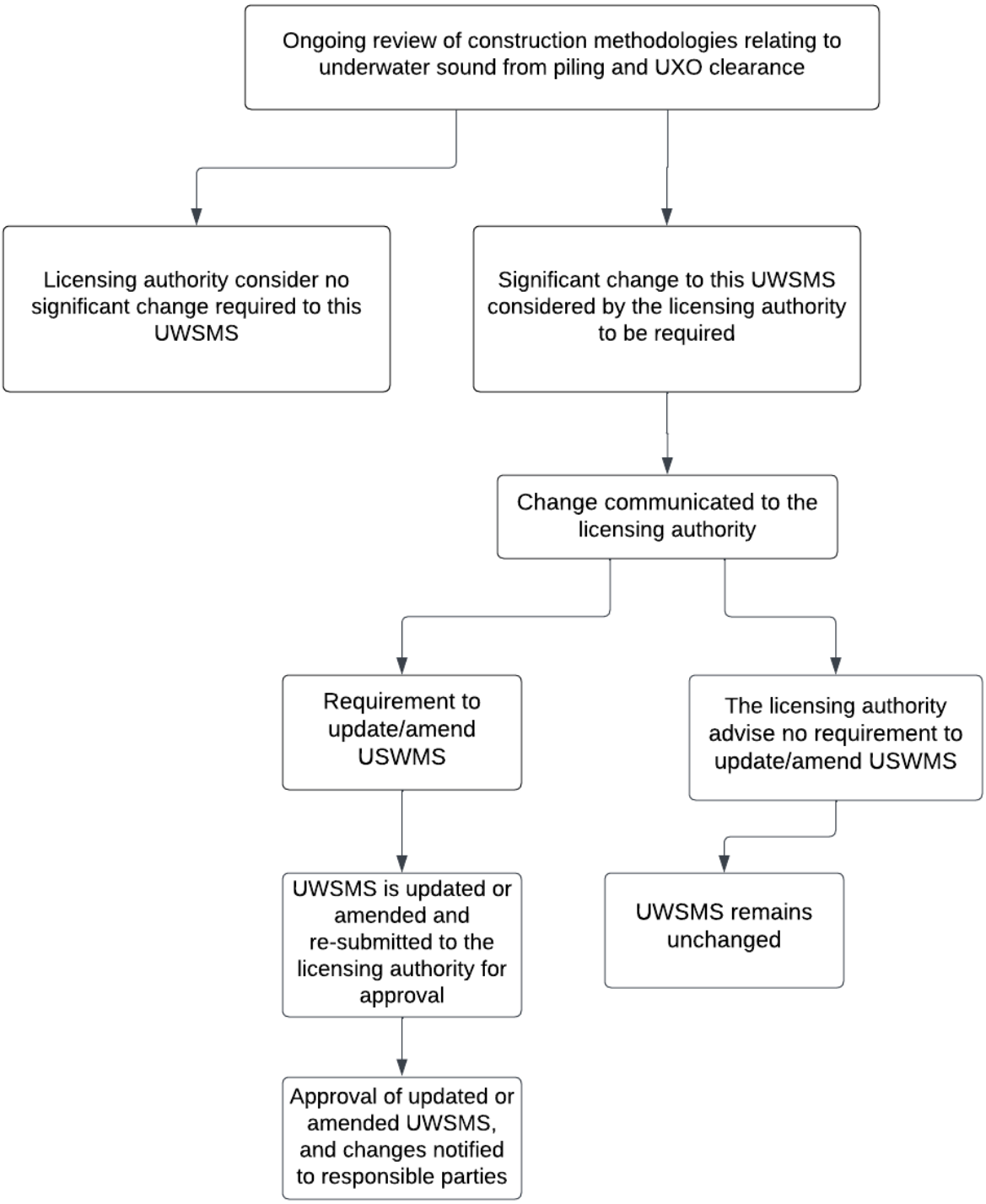

Figure 1.1: Example change management procedure to update the Final UWSMS.

1.5 Measures adopted as a part of the Morgan Generation Assets

1.5.1 Refinements from Environmental Statement post-consent

1.5.1.1 This section will describe any project design refinements based on further information available post consent. At Application stage a project must consider the MDS using relatively limited information, however, experience of other constructed projects in UK waters demonstrates that additional geotechnical data can be used to refine the design such that anticipated pile diameters and/or hammer energies may be reduced.

1.5.1.2 For instance, for the Beatrice Offshore Wind Farm in the Moray Firth refinements were made to the design envelope from those originally submitted for assessment in the Environmental Statement and Supplementary Environmental Information Statement (SEIS). These included reduced number of piles, lower maximum hammer energy at each asset location, lower anticipated duration per pile. Furthermore, after construction of the project analyses of piling data allowed a comparison of the measurements predicted for the Environmental Statement and SEIS with actual piling parameters. Subsequently, the Beatrice Offshore Windfarm Piling Strategy Implementation Report (Beatrice Offshore Windfarm, 2018a) showed that a decrease in piling duration consequently meant a lower duration of piling for the entire development and shorter piling programme. Similarly, on average, the maximum hammer energy reached during piling was 1,088 kJ across all locations, considerably lower than the MDS of 2,300 kJ assessed in the Environmental Statement/SEIS (Beatrice Offshore Windfarm, 2018a). The post-consent Piling Strategy, which was based on further data gathered through geotechnical surveys, provided a more accurate picture, but still predicted a higher average maximum hammer energy (1,200 kJ) than the average realised during piling (Beatrice Offshore Windfarm, 2018b).

1.5.2 Current project refinements PEIR to Environmental Statement

1.5.2.1 It is worth highlighting that the Morgan Generation Assets design has already been refined from the PEIR to the Environmental Statement and includes a reduction in the number of wind turbines from 107 to 96. The number of wind turbines has been reduced by approximately 10% subsequently reducing the number of foundations that require driven piling. The reduction in number of piled foundations from the number presented at PEIR reduced the potential impacts as a result of underwater sound during piling on marine mammals, due to a reduction in the number of planned piling days reducing the number of potential days in which impacts on marine mammals could occur.

1.5.2.2 Monopile foundations (as presented in the PEIR) have also been removed from the PDE and therefore only pin piles are included Environmental Statement. Therefore the maximum hammer of 5,500 kJ which was presented in the PEIR for monopiles, has been reduced to a maximum hammer energy of 4,400 kJ for the Environmental Statement. A proportion of hammer energy is converted into waterborne acoustic energy going into the water column and large hammer energies may result in increased peak sound levels received by marine mammals. As such, the removal of monopile foundations and the maximum hammer energy of 5,500 kJ from the design envelope has reduced the range at which instantaneous injury could occur to marine mammals from received peak Sound Pressure Levels (SPL_{pk}).

1.5.3 Primary measures

1.5.3.1 This section will provide a summary of the primary measures to reduce the risk of injury to sensitive receptors. Relevance of each primary measure for the impact of underwater sound on marine mammals is detailed in Volume 2, Chapter 4: Marine mammals of the Environmental Statement (Document Reference F2.4) and for fish is detailed in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document Reference F2.3).

1.5.3.2 For piling, primary measures include soft start and ramp up phases, commitments to maximum and minimum separation distances for concurrent piling, limits on maximum hammer energies.

1.5.3.3 For UXO clearance, measures include consideration of low-order techniques, noting a more detailed assessment of mitigation will be undertaken post-consent as further information becomes available and will be reflected in the Final UWSMS.

1.5.3.4 Further detail of the primary measures required for the application for consent are provided in the Outline MMMP (Document Reference J17). Whilst the MMMP is focussed on reducing the risk of injury to marine mammal receptors, these primary measures are also relevant to reducing the risk of injury to sensitive fish receptors (noting these measures will not be effective for all fish species and nor is specific mitigation required to avoid significant injurious effects on fish receptors).

1.5.4 Tertiary measures

1.5.4.1 This section will provide a description of standard industry measures to reduce the risk of injury specifically to marine mammals receptors. Relevance of each tertiary measure for the impact of underwater sound on marine mammals is detailed in Volume 2, Chapter 4: Marine mammals of the Environmental Statement (Document Reference F2.4).

1.5.4.2 For piling, tertiary measures included the use of MMOs, PAM and ADDs following the latest JNCC guidance (JNCC, 2010a). For the application for consent it was demonstrated that activation of an ADD for 30 minutes would deter all animals beyond the maximum injury zone predicted using SPL_{pk} at full hammer energy. For cumulative Sound Exposure Level (SEL_{cum}), activation of an ADD 30 minutes prior to commencement of piling of pin piles reduced the likelihood of permanent threshold shift to a level not exceeding the SEL_{cum} injury thresholds during single, concurrent, and consecutive piling for all species except minke whale. Post consent, the injury ranges may decrease due to changes in the project design envelope, and determination of the appropriate use of ADD will therefore be based upon the final detailed Morgan Generation Assets design prior to construction.

1.5.4.3 For UXO clearance, measures including visual and acoustic monitoring, the use of an ADD and soft start charges will be applied to deter animals from the mitigation zone as defined by sound modelling for the largest possible UXO following the latest JNCC guidance (JNCC, 2010b). For the application for consent a range of high order UXO sizes were considered for the purpose of determining effective mitigation measures. The duration of ADD activation presented in the Outline MMMP was up to 60 minutes for harbour porpoise (the most sensitive species) based upon a 130 kg UXO, whilst for all other species a duration of 15 minutes would be sufficient to deter marine mammals from the potential injury zones. Post consent, if UXO size is less than 130 kg, then ADD duration may be reduced as part of the Final UWSMS.

1.5.4.4 Further detail of the tertiary measures required for the application for consent are given in the Outline MMMP (Document Reference J17).

1.6 Morgan Generation Assets construction activities

1.6.1 Piling

Overview

1.6.1.1 An overview of piling will be presented in this section in the Final UWSMS based on the refined project design. Final wind turbine numbers and OSPs will be detailed, with any refinements to the wind turbine layout presented.

1.6.1.2 For the application for consent, the Morgan Generation Assets has put forward a range of foundation options with a total of up to 96 wind turbines and up to four OSPs located within the 280 km^2 Morgan Array Area as presented in Volume 1, Chapter 3: Project description of the Environmental Statement (Document Reference F1.3). The OSPs will be attached to the seabed by foundation structures using either six-legged, four-legged or three-legged piled jacket foundations. The seabed in some sections of the Morgan Generation Assets would preclude the use of driven piling as an installation technique and subsequently it was determined that a maximum of 64 of the maximum number (96) of wind turbines could be installed using piled jackets (three-legged or four-legged). The remainder would be installed using suction bucket jackets and/or gravity base foundations, noting that gravity base foundations would also require some piling for the purpose of ground strengthening. For both marine mammals and fish, the MDS to assess the impact of underwater sound from piling in the Environmental Statement was:

- Up to 64 wind turbine four-legged jacket foundations with a total of 256 driven pin piles
- Up to 32 gravity base foundations, up to 10 of which could require piling for ground strengthening, leading to a maximum of 150 driven pin piles
- Four (OSPs) four-legged jacket foundations with a total of 48 driven pin piles.

1.6.1.3 However, the number of driven piles per foundation and the number of foundations may reduce in number post consent. Details of refined project envelope will be provided in this section of the Final UWSMS.

Piling method and construction sequence

1.6.1.4 Details of the final foundation design and numbers will be presented in this section of the Final UWSMS. Relevant method statements (e.g. the foundation installation methodology) will provide detailed information post consent.

1.6.1.5 This section of the Final UWSMS will include the final design parameters for impacts on marine mammals and fish.

Maximum hammer energies and piling duration

1.6.1.6 This subsection will set out the anticipated maximums based on new geotechnical information and any additional details post consent.

1.6.1.7 For the application for consent, maximum hammer energies are 4,400 kJ for up to 16 pin pile jacket foundations for wind turbines and up to four pin pile jacket foundations for OSPs, and 3,000 kJ for the remaining pin pile jacket foundations. However, as described in paragraph 1.5.2.2, post-consent, these maximum hammer energies may be reduced following further analysis, leading to reduced impact ranges for marine mammals and fish species.

1.6.1.8 Therefore, details of the piling duration, foundation installation programmes, and hammer durations will be presented in the Final UWSMS.

Construction programme

1.6.1.9 A detailed foundation installation programme will be presented in this section of the Final UWSMS. An overview of the programme assessed as part of the MDS for the application for consent is given in Table 1.6 in this Outline UWSMS as an example.

1.6.1.10 Post consent technologies may be refined or adjusted, and this may affect the construction programme. As mentioned in 1.5.1.2, for Beatrice Offshore Windfarm (Beatrice Offshore Windfarm Ltd, 2018b) refinements were made to the design envelope from those originally submitted for assessment in the Environmental Statement and SEIS and included lower anticipated duration per pile and thus a lower duration of piling for the entire development and shorter piling programme.

1.6.1.11 This section would also include any relevant information on refined timescales for piling activities at other projects in the vicinity of the Morgan Generation Assets, where possible.

Table 1.6: Indicative construction programme for the Morgan Generation Assets for activities relevant to the UWSMS.

Activity (time in brackets is time taken for completion, blue colouring denotes window)	Year 1 construction				Year 2 construction				Year 3 construction				Year 4 construction			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Foundation installation (12 months)																
OSP installation and commissioning (9 months)																
Wind turbine installation (9 months)																

1.6.2 UXO clearance

Overview

1.6.2.1 It is possible that UXO may be encountered during the construction of offshore infrastructure. To identify UXO, detailed surveys of the location where infrastructure will be located are required, however, work cannot be conducted before a consent application is submitted because the detailed design work needed to confirm the location of infrastructure is reliant upon pre-construction site investigation surveys. For the PEIR and Environmental Statement, the Applicant commissioned a study to establish the potential for UXO presence at the Morgan Generation Assets. A total of up to 13 UXOs predicted to require clearance was described, with the Net Explosive Quantity predicted to range between 25 kg to 907 kg (absolute maximum), with 130 kg being the most likely maximum.

1.6.2.2 The Morgan Generation Assets has adopted a general hierarchy of preferred mitigation with regard to UXO clearance that follows:

- Avoid UXO
- Clear UXO with low order techniques
- Clear UXO with high order techniques.

1.6.2.3 Avoidance of confirmed UXOs or detonation using low order techniques are not always possible and are dependent upon the individual situations surrounding each UXO. Further information on clearance of UXOs is provided in the following section.

1.6.2.4 The Outline MMMP (Document Reference J17) details the primary and tertiary mitigation which mitigates impacts up to clearance of a 130 kg UXO (the most common likely maximum). However, for UXO sizes larger than 130 kg (e.g. for the maximum UXO size of 907 kg) the use of further sound abatement measures (such as NAS) may be considered as an option (if required) and refined post-consent as a part of the Final UWSMS.

Clearance approach

1.6.2.5 The Final UWSMS will detail, post consent, the UXOs needing clearance and the methodology to clear each UXO target. This information will be available from the pre-construction site investigation surveys. The Morgan Generation Assets will submit a UXO clearance method statement to licensing authority pre-construction once UXO surveys are complete. The method statement will provide confirmation of UXOs for clearance and any specific measures necessary where UXOs may be associated with archaeological/sensitive seabed features. This requirement will be secured within the dMLs in the draft DCO (Document Reference C1).

1.6.2.6 There are several methodologies that may be used to clear UXO targets, including detonation of the UXO using an explosive counter-charge placed next to the UXO on the seabed which seeks to detonate the UXO (referred to as a ‘high order’ technique) or methods that neutralise the UXO to be safe without detonation (referred to as ‘low order’ techniques). These low order techniques include ‘deflagration’ which involves the use of a small charge to ‘burn out’ the explosive material without detonation.

1.6.2.7 The use of the low order techniques is dependent on the condition of the UXO and individual circumstances. Furthermore, the Applicant will not know what condition a UXO is in until it is investigated through the pre-construction site investigation surveys.

Therefore, whilst the use of low order techniques is a potentially viable solution and preferred for clearance of UXO, it is not possible to make a commitment to using them at this stage as it will not be known whether low order clearance is a feasible option until these surveys have been completed. If high order clearance techniques a separate marine licence will be applied for (see paragraph 1.1.1.5).

1.6.2.8 Therefore, the clearance approach will be detailed in the Final UWSMS when more information is available following pre-construction site investigations. As the Final UWSMS is a 'live' document, updates can be made as further information becomes available.

Programme of works

1.6.2.9 The detailed programme of works will be given in this section. The Environmental Statement presented an indicative timeline, with UXO clearance to be undertaken before construction commences following detailed UXO mapping during site-investigation surveys. Site investigation surveys are likely to be carried out in early 2026, but detailed information will be given in the Final UWSMS post consent.

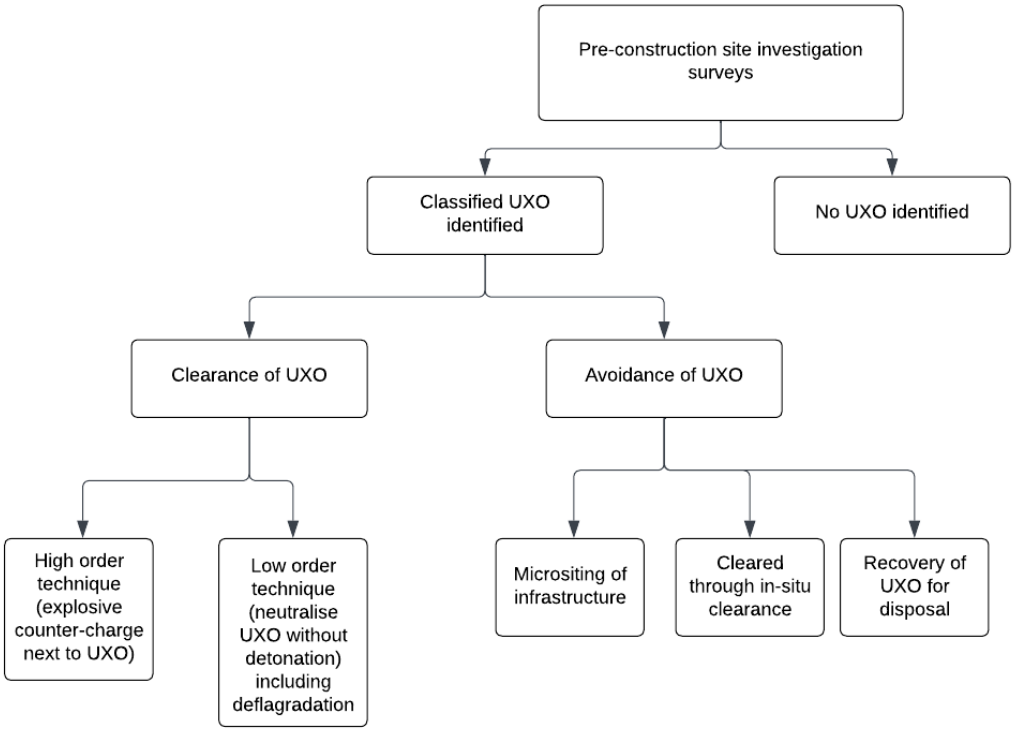

Figure 1.2: Example UXO programme of works.

1.6.2.10 This section would also include any relevant information on refined timescales for UXO clearance at other projects in the vicinity of the Morgan Generation Assets, where possible.

1.7 Reduction in effects due to the refined Project Design Envelope

1.7.1 Overview

1.7.1.1 This section will identify whether there is a sufficient reduction in the project design envelope such that no further secondary mitigation is required or conversely, whether secondary measures are needed due to potential residual effects. Information will be provided on any temporal and spatial reductions in the magnitude of potential elevated underwater sound from piling and UXO clearance.

1.7.1.2 Such refinements in project design are typical and may lead to a substantial reductions compared to the MDS assessed within the EIA. Where there are significant reductions in the project design envelope it may be necessary to update the underwater sound modelling (using the same methodology at Environmental Statement) to demonstrate the effect of the reductions in both pile size and hammer energy. Any updates to the predicted injury ranges and disturbance contours will be presented in the Final UWSMS.

1.7.2 Piling

1.7.2.1 This section will provide further detail on any specific reductions or refinements in piling parameters post consent (Table 1.7). An assessment of how this may affect the injury and disturbance ranges for relevant marine mammals (harbour porpoise and bottlenose dolphin) and fish species (herring and cod) will be provided.

Table 1.7: Summary of the reduction in key engineering parameters relevant to elevated underwater sound for the Morgan Generation Assets (to be updated post-consent).

Parameter	Environmental Statement MDS	Refined Project Design	Anticipated reduction of key engineering parameters from worst case	
			Difference (value)	Reduction (%)
Number of piles	• Up to 256 driven piles for up to 64 wind turbine jacket foundations • Up to 150 driven ground strengthening pin piles for up to 10 gravity based foundations • Up to 48 driven pin piles for four OSPs.			
Anticipated hammer energy at each wind turbine/OSP	• Wind turbines: Maximum hammer energy of up to 4,400 kJ for up to 16 locations, and up to 3,000 kJ for up to 48 locations • OSPs: Maximum hammer energy of up to 4,400 kJ • Gravity base foundations (GBFs): Maximum hammer energy of up to 3,000 kJ.			
Anticipated piling duration (per pile)	• Wind turbines and OSPs: maximum of 4.5 hours piling per pile • GBFs: maximum of 4 hours per pile.			

Parameter	Environmental Statement MDS	Refined Project Design	Anticipated reduction of key engineering parameters from worst case	
			Difference (value)	Reduction (%)
Anticipated duration piling	Up to a total of 114 days of piling (up to 64 days for wind turbines, up to 38 days for (GBFs), and up to 12 days for OSPs).			
Total piling programme	12 month piling phase within a 2 year window.			

1.7.3 UXO clearance

1.7.3.1 This section will provide further detail on any specific changes or refinements in UXO clearance parameters post consent (Table 1.8). An assessment will be made as to how this may affect the injury and disturbance ranges for relevant species, in particular harbour porpoise. Where any clearance activities are required standard primary and tertiary mitigation measures will be implemented as per the MMMP up to a charge size of 130 kg (see Outline MMMP, Document Reference J17). Above this size it will be necessary to consider further secondary measures as described below.

Table 1.8: Summary of the reduction in key engineering parameters relevant to elevated underwater sound for the Morgan Generation Assets (to be updated post-consent).

Parameter	Environmental Statement MDS	Refined Project Design	Anticipated reduction of key engineering parameters from worst case	
			Difference (value)	Reduction (%)
Number of UXOs to be cleared	Clearance of up to 13 UXOs within the Morgan Array Area.			
Maximum UXO size to be cleared	Estimated as 907 kg			
Number of UXOs to be cleared using high-order detonation	A range of UXO sizes assessed from 25 kg up to 907 kg with 130 kg the most likely (common) maximum			

1.8 Further (secondary) mitigation measures

1.8.1 Overview

1.8.1.1 This section will consider further mitigation measures (referred to as ‘secondary mitigation’ in IEMA guidance (IEMA, 2024)) to reduce the magnitude of any residual effects (that cannot be fully mitigated by primary and tertiary measures) to a non-significant level. If none are required then it will be acknowledged in this section of the Final UWSMS.

1.8.1.2 This Outline UWSMS provides a summary of measures currently available or likely to be available in the future, which could be applicable to reducing residual effects from underwater sound from pile driving and UXO clearance at Morgan Generation Assets.

1.8.1.3 The Final UWSMS will detail which mitigation measures are required, if at all, based upon the effects detailed in section 1.7 which is based upon the refined project design parameters and finalised construction programme, post consent. The final design and programme of other plans and projects may also change, and therefore differ from the cumulative scenario assessed at application.

1.8.2 Piling

Spatial and temporal phasing

1.8.2.1 Options for further measures which could be considered post consent for the Final UWSMS include:

- Spatial phasing: whereby the total area of significant disturbance at any one time is reduced (e.g. options for concurrent piling scenarios)
- Temporal phasing: minimising the duration of additional underwater sound generated through piling events over a specific time frame that may cause 'significant disturbance' to key species (e.g. seasonal scheduling).

1.8.2.2 This could be achieved in a variety of measures, as detailed in paragraphs 1.8.2.3 to 1.8.2.16.

Spatial phasing

1.8.2.3 In addition to the commitments on separation distances as outlined in section 1.5, there is the consideration of single piling only as an option, which would reduce the total area of significant disturbance at any one time (noting this would however affect the temporal scale of piling, leading to more days of disturbance).

Temporal phasing

1.8.2.4 Temporal phasing could be used as a measure to reduce the duration of any continuous disturbance within a given time period (month, season, year) from the Morgan Generation Assets alone and cumulatively with other projects.

1.8.2.5 For fish (as detailed in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3), there is potential for a significant project alone effect for piling in the Morgan Array Area (particularly the north and west) during the herring spawning period, which occurs in late September and lasts for three to four weeks (Dickey-Collas *et al.*, 2001). In a temporal sense, spatio-temporal planning of piling could be implemented during the peak herring spawning period (e.g. 15th September to 31st October), if required to avoid piling in certain parts of the Morgan Array Area, particularly if combined with hammer energies which are lower than the maximum modelled hammer energy. This would also represent a reduced impact significance cumulatively, by reducing the potential for contributing to ensonification of the mapped herring spawning ground during the reported spawning period.

1.8.2.6 Temporal phasing could also be used to reduce impacts from the Morgan Generation Assets alone on cod and any contribution to cumulative effects. Should mitigation for cod spawning be required in the final UWSMS, the final UWSMS will include seasonal considerations for piling, covering the peak cod spawning period of mid February to March (15th February to 31st March), as evidenced by the studies reviewed in S D4 6.1

- Annex 6.1 to the Applicant's response to Written Representations from MMO at Deadline 3: Cod spawning period (REP4-010).As presented at Environmental Statement, there are no project alone significant impacts from piling for marine mammals, although a significant effect for disturbance from elevated underwater sound during piling was identified for bottlenose dolphin during the cumulative assessment.

1.8.2.7 Cardigan Bay SAC is designated for bottlenose dolphin, with animals using the inshore waters of Cardigan Bay for both feeding and reproduction, and in the summer months calves and juveniles are often observed with adult individuals or groups. There is evidence of seasonal movement to Manx waters in winter, with Howe (2018) confirmed movement of individuals between Manx waters and Cardigan Bay using comparison of photo ID catalogues in the two areas. Howe (2018a) suggested bottlenose dolphins in Manx waters are highly temporal and sighted only in winter months (between late August and March) where the waters provide a vital habitat during these months. Therefore, piling in the most southern part of the Morgan Array Area closest to Cardigan Bay during winter months where animals may be around the Isle of Man, and then piling the north location during summer months where bottlenose dolphin are likely to be in Cardigan Bay may aid in reducing the Morgan Generation Assets' contribution to potential significant effect from elevated underwater sound from cumulative projects on bottlenose dolphin.

1.8.2.8 Refining the piling strategy following fine-tuning post consent and discussions with other offshore wind projects within the vicinity of the Morgan Generation Assets that may have presented similar piling schedules during application, may be applied to reduce the area of potential continuous cumulative disturbance.

Noise Abatement Systems

1.8.2.9 Sound reduction or Noise abatement (NAS)/mitigation systems are devices currently in use elsewhere or being developed and improved within the industry that enable a reduction of pile driving sound (decibels) at source and could be considered for use following further investigation.

1.8.2.10 Currently, there are already a range of NAS commercially available to reduce underwater sound during piling. Some have been demonstrated to reduce underwater sound by at least 10 dB and up to 20 dB when multiple NAS are combined, dependent partially on local environmental conditions including water depth and seabed characteristics (Verfuss, Sinclair and Sparling, 2019). These technologies are likely to advance quickly, and therefore post consent, the Final UWSMS will present an exploration of the most appropriate NAS on the market at the time for a particular installation method and for the environmental conditions, if required as a secondary mitigation measure.

1.8.2.11 Options for NAS in use for offshore wind piling activities include:

- 'Far field' systems such as Big bubble curtains (BBC) and Double big bubble curtains (DBBC)
- 'Near field' systems such as Grout annulus bubble curtains (GABC), hydro sound dampeners (HSD) (using plastic/air-filled materials to attenuate sound, integrated into a net around the pile), AdBM (sound attenuation using plastic attenuators which are positioned around the pile) and IHC Noise Mitigation System (double wall steeled pipe)

- Source reduction systems that are integrated into the hammer string, such as the MENCK Marine Noise Reduction Unit or the IHC pulse which soften the impact of the hammer reducing the peak force and the pile accelerations and extending the duration of the impact force of the hammer on the pile
- Quieter foundation installation technologies such as vibration hammers which vibrate the pile into the seabed and the BLUE Hammer which uses a large mass of water to pile.

1.8.2.12 Bubble curtains are commonly applied in wind farm construction in continental Europe (Lippert *et al,* 2017) and comprise a weighted air hose with nozzles at regular intervals, laid around the pile driving location on the seabed at a distance of approximately 100 m (far field system). An air curtain is then generated using a continuous air supply that surrounds the piling site, acting as an impedance barrier.

1.8.2.13 In the UK thus far, offshore wind developers have not been required to employ such systems. While there is available guidance outlining measures to prevent harm to marine mammals (JNCC 2020a; 2020b), specific recommendations for how NAS is to be used to mitigate injury and disturbance are scarce in the UK. Instances of such guidance have emerged in connection to particular Marine Protected Areas (MPAs) designated for the well-being of marine mammals, aiming to restrict impulsive sound levels and minimise disturbances (JNCC, 2020a and 2020b).

1.8.2.14 If it is deemed necessary to apply NAS for piled foundations either as a result of forthcoming policy on underwater sound, or it is identified (during discussions with the MMO on the final UWSMS plan following the final scheme design freeze post consent) as the most appropriate mitigation to manage underwater sound from piling, then the Morgan Generation Assets will be in a position (from a programme execution perspective) to implement such measures.

1.8.2.15 NAS have not been used specifically for mitigation of sound impacts on fish species, but it is anticipated any reduction in sound impacts from potential implementation of the NAS will act to mitigate impacts on fish species in the same area. As such, NAS could be implemented, as necessary, during sensitive periods for cod and herring to ensure avoidance of significant effects on spawning fish in the event that the measures outlined above (e.g. project design refinements and spatial and temporal phasing) are not adequate to reduce effects to a non-significant level. The evidence of the effectiveness of NAS as mitigation (e.g. updated underwater sound modelling) would be provided for agreement to stakeholders post consent, as part of the process of agreeing this Strategy.

Other potential measures

1.8.2.16 Given the potential time between consent and the start of offshore construction, it is possible that new measures will become available. The Final UWSMS should not be restricted only to potential measures at the time of consent. The process of the UWSMS allows the consideration and assessment of other relevant technologies or methodologies that may emerge in the future. This will ensure that any new technologies or methods that may develop prior to construction have the potential to be used during construction of the project if deemed appropriate following further investigation, with this being a live document which can be updated as required at set milestones.

1.8.3 UXO clearance

1.8.3.1 As per the mitigation hierarchy commitments by the Morgan Generation Assets, where clearance of UXO is required (i.e. avoidance is not possible) the use of low order UXO clearance will be adopted where feasible (see Outline MMMP, Document Reference J17).

1.8.3.2 The mitigation approach adopted is dependent upon the individual situations surrounding each UXO. A detailed UXO survey would be completed prior to construction. The exact number of possible detonations and duration of UXO clearance operations is therefore not known at this stage.

1.8.3.3 Given that it is possible that high order detonation may be used, the Outline MMMP (Document Reference J17) also includes mitigation to reduce the risk of injury from UXO clearance. Mitigation for high order clearance of UXOs up to a size of 130 kg is secured in the Outline MMMP (Document Reference J17), but for higher charge sizes (e.g. <130 kg) additional secondary mitigation measures may be required, and therefore will be detailed in this section of the Final UWSMS.

1.8.3.4 Secondary mitigation measures that may be considered include:

- Relocation of UXOs - the suitability of a UXO for relocation depends on its condition (sufficiently structurally sound to remain intact) and location (as greater distances represent a higher safety risk, and factors such as weather need to be considered)
- Clustering of UXO devices - in circumstances of multiple UXO located in proximity, UXO may be relocated such that they can be disposed of in a single controlled detonation and therefore limit the total potential area of disturbance and the potential cumulative underwater sound exposure that would otherwise result from successive detonations of UXO devices in discrete areas
- Temporal and spatial phasing – as for piling (described in section 1.8.2), following pre-construction site investigation surveys, temporal and/or spatial phasing could be used for UXO clearance. UXO could be detonated outside of critical times for species at risk of a significant residual effect (such as avoiding key spawning times for cod and herring) or detonated sequentially, such that those furthest from key areas (such as SACs for harbour porpoise or spawning grounds for cod/herring) are detonated first, and those closest to these areas detonated outside of key events
- Sound Reduction/Noise Abatement Systems - as for piling (described in section 1.8.2), NAS could be used for UXO clearance if required, but is likely limited to far field methods rather than near field.

1.9 Licences and legal requirements

1.9.1.1 The European Commission Habitats Directive (92/43/EEC) lists all cetaceans in Annex IV, i.e. species for which a system of strict protection needs to be established. There is a requirement to consider European Protected Species (EPS) through the Habitats Directive which is transposed into UK law by the Conservation (Natural Habitats) Regulations 1994 (as amended) (out to 12 nm). Beyond 12 nm, for all UK administrations, the Conservation of Offshore Marine Habitats and Species Regulations 2017 consolidate and update the Offshore Marine Conservation (Natural Habitats &c) Regulations 2007. The EPS licence will require all piling operations, UXO

clearance and ADD operations to be carried out in accordance with the Final UWSMS and the Final MMMP (Document Reference J17).

1.10 Reporting and auditing

1.10.1 Overview

1.10.1.1 This section will set out how data gathered will be used and reported on for the Final UWSMS, in line with the requirements of the dML conditions.

1.10.1.2 Members will report via the appropriate chain of command on completion and/or compliance with the mitigation measures for each impact (piling, UXO).

1.10.2 Field records

1.10.2.1 This section will detail commitments to reporting in field records in the Final UWSMS.

1.10.2.2 Reports are likely to include, but not limited to, the following:

- Location and piling activity
- Weather conditions during ADD or NAS deployment, including visibility
- Start and end times of soft start piling/UXO and impact piling
- Details of soft-start procedures and hammer energy employed at each piling location, including the duration of full-power piling
- Confirmation that the ADD/NAS has been tested and is functioning as per specifications
- Time and duration of ADD/NAS deployment prior to piling events
- Observations of marine mammals during the testing and deployment of the PAM/ADD/NAS option(s).

1.10.2.3 Reports collated will be produced in pdf format to form a database archive of all records that will be sent to relevant parties (e.g. Consents Team).

1.10.2.4 The Morgan Generation Assets Consents Team will collate and issue relevant data to report to the licensing authority.

1.10.3 Compliance reporting

1.10.3.1 This section will detail compliance reporting for the Final UWSMS.

1.10.3.2 For example, the data provided by the ADD/Project Manager for Offshore Installations (or equivalent) will be used to audit compliance with the Final UWSMS and report to the licensing authority at agreed milestones for the construction period (reporting frequency to be reviewed with following the initial period of piling or UXO clearance activity).

1.10.3.3 This could include an UWSMS compliance report and provision of marine mammal observations and other additional files (such as hydrophone records) if required.

1.11 References

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