

GUIDANCE FOR DEVELOPERS AT EMEC GRID-CONNECTED SITES: SUPPORTING ENVIRONMENTAL DOCUMENTATION



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Important preliminary note – Disclaimer

These guidelines have been developed to assist developers intending to test marine energy conversion devices at EMEC. For developments of 1 MW or less, these guidelines, which have been agreed with Marine Scotland and Scottish Natural Heritage, should be used in the production of all documentation in support of licence applications. Developers wishing to test devices or arrays >1MW will also require formal Environmental Impact Assessment (EIA). These developers should also refer to the Marine Scotland guidance available at: <http://www.scotland.gov.uk/Topics/marine/Licensing/marine/LicensingManual> which provides specific guidance on the EIA process for wave and tidal developments.

The purpose of these guidelines is to encourage and assist developers to consider as fully as possible the range and scale of risks and impacts that might result from the testing of their device(s) at EMEC.

The guidelines reflect EMEC's understanding of the relevant legislation and procedures and whilst we make every effort to ensure the accuracy and reliability of the information, it is not guaranteed and EMEC will not be responsible for any errors or omissions. In particular, EMEC will not be liable for any loss, however arising, from the use of, or reliance on these guidelines. The guidelines should not be relied on as a substitute for formal advice where appropriate. It is the responsibility of developers to ensure that their devices and all operations that they carry out are fully compliant with all current legislative requirements.

Over time, this document is likely to be revised to reflect the growing knowledge and experience in marine energy conversion devices and environmental interactions. Developers must ensure that they refer to the most up to date version which will be available on the EMEC website (<http://www.emec.org.uk>).

This document should be used in conjunction with the EMEC document ***Marine Operating Guidelines for Operations at EMEC Wave and Tidal Test Sites GUIDE010-01***.

1 Introduction

1.1. Background and Context

The European Marine Energy Centre (EMEC), as the first centre of its kind in the world and as one of the leading organisations in the testing of commercial scale wave and tidal technologies, recognises the importance of establishing high standards for environmental protection and an early understanding of the range and significance of potential environmental impacts. This will ensure that the marine energy industry considers environmental implications of its projects/technologies in the early stages of design and development, leading to best practice being carried forward into commercial scale developments. In addition, EMEC operates an Integrated Management System (IMS), which demonstrates a clear commitment to the standard of quality, health, safety and environmental (QHSE) management. The system has been developed to meet the requirements of the internationally recognised environmental standard, ISO 14001, to ensure the highest standard of environmental protection from employees, developers and those visiting the centre.

EMEC have in place Crown Estate leases covering the marine test sites, together with planning consents for substations and associated lay-down areas. Developers have full and sole responsibility for obtaining any marine licences required for the installation and operation of their device(s), plus any additional planning consents that may be required.

1.2. Legislative and Consent Requirements

Legislation relevant to marine renewables can be found in the “Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland Part Two – Legislation and Documentation – Marine Renewables” report published by the Scottish Government available at <http://www.scotland.gov.uk/Topics/marine/Licensing/marine/LicensingManual>. This is one report from a four part series written for devices requiring EIA, however many of the principles and governing legislation are relevant for smaller scale devices.

1.3. Activities Outwith EMEC Test Sites

EMEC does not have any responsibility for offsite activities undertaken by developers. However developers are strongly encouraged to fully consider the impacts associated with their activities outwith the EMEC test areas and to promote high standards in all aspects of their operation. Appendix V indicates the type of activities that should be considered, and EMEC would encourage developers to consult with relevant stakeholders where appropriate.

1.4 Process and Timing

EMEC uses the following terminology when referring to the different stages of the pre-application and planning process for devices not requiring EIA (numbers in brackets correspond to steps in Figure 1.1):

Project Information Summary (1) – in this part of the process the developer formally notifies the Regulator and statutory consultees of its intention to deploy at EMEC. The Project Information Summary should be submitted to EMEC soon after contract signing. EMEC will review it and submit it to the Regulator and key consultees. The Project Information Summary document should be two to three page brief detailing the device, berth location, timeline for deployment & decommissioning (as known), and key milestone dates (including dates for submission of licence applications).

Scoping (3) - the process by which the developer describes their proposed development in detail, identifying potential environmental and navigational impacts and risks. The Project Information Summary and subsequent discussions and advice from EMEC, Regulators and key statutory consultees informs the basis of the Scoping Report. The Scoping Report is used by EMEC, statutory and other consultees to evaluate the potential impacts of the development. Consultees will provide feedback on the proposal which should be incorporated into the final documentation in support of licence application(s). A meeting with consultees may be appropriate post scoping (EMEC would usually facilitate these meetings).

Environmental Appraisal - detailed assessment carried out by the developer of the potential environmental impacts, including mitigation measures and assessment of residual impacts. This process will require to be an EIA should the development be >1MW.

Environmental Report (ER) (6 & 8) - document that provides details of the full environmental appraisal process, including survey methods, results, mitigation and justification of any decisions reached on the impacts. If the development requires an EIA then this document will be referred to as an Environmental Statement (ES). This will be used by the Regulators and their consultees (including EMEC) to evaluate the survey results and potential impacts. The ER should be submitted at least 6-9 months prior to the proposed deployment date, to allow sufficient time for assessment by the consultees and dialogue with the developer to resolve any outstanding issues.

The overall process is displayed in Figure 1.1 below and full details can be found in the EMEC Consenting Description document, available to download from the secure area of the EMEC website <http://www.emec.org.uk/dms/index.asp> (username & password required). It is important that developers are aware that late submission may lead to delays in installation.

Full details of the process for Marine Licencing in Scotland can be found on the Marine Scotland website (<http://www.scotland.gov.uk/Topics/marine/Licensing/marine>).

Figure 1.1 Consenting Process at EMEC

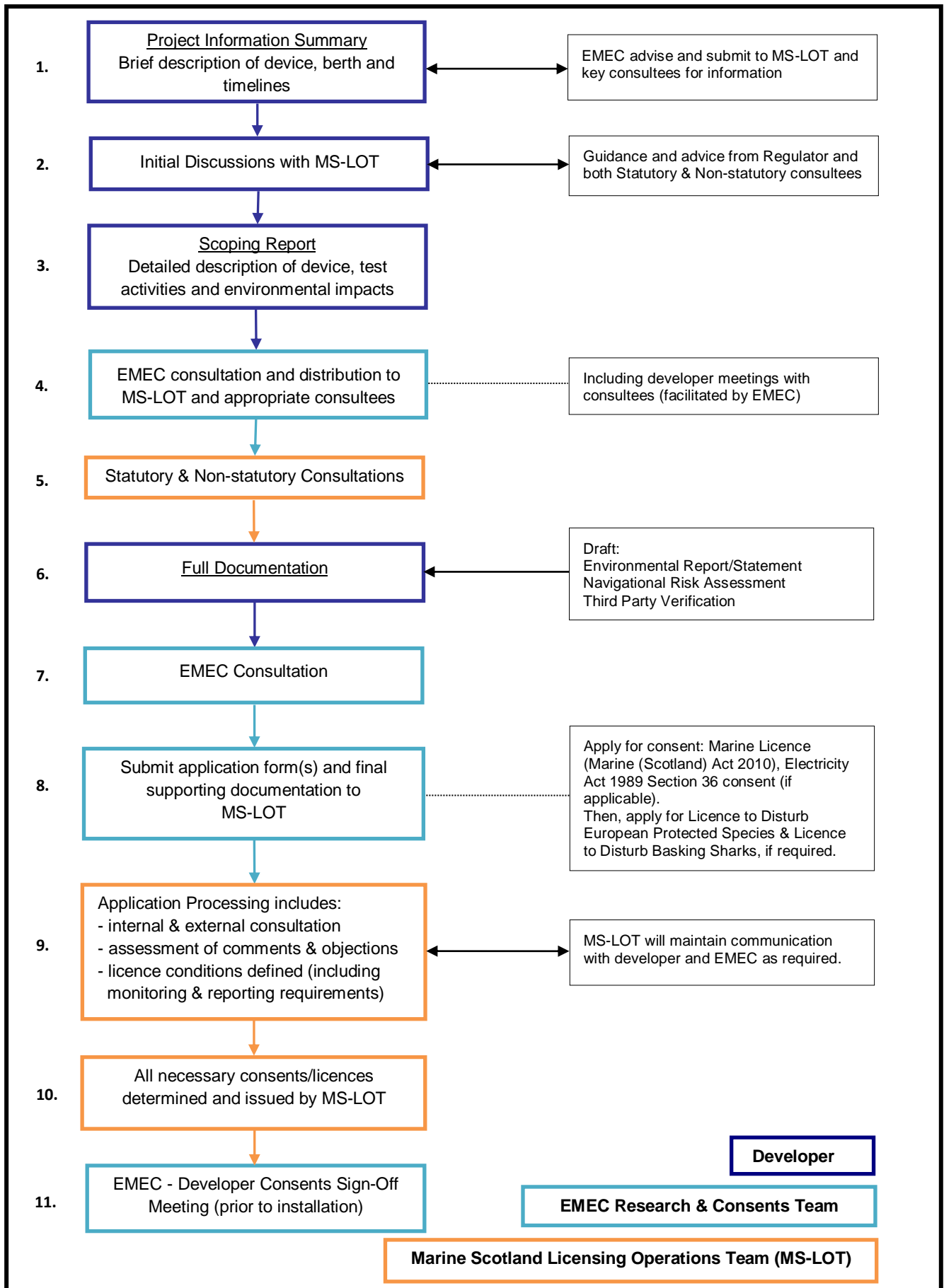
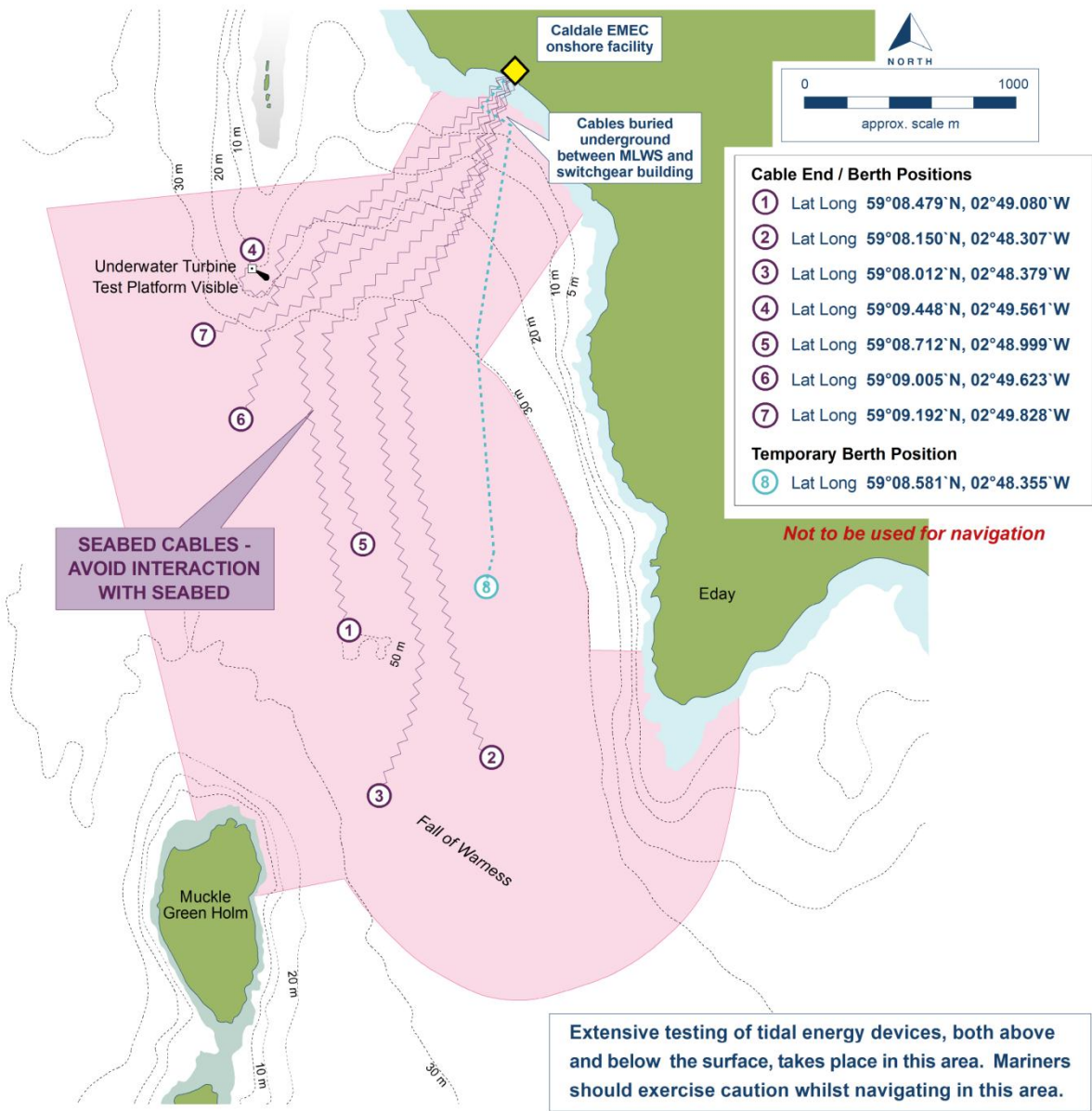
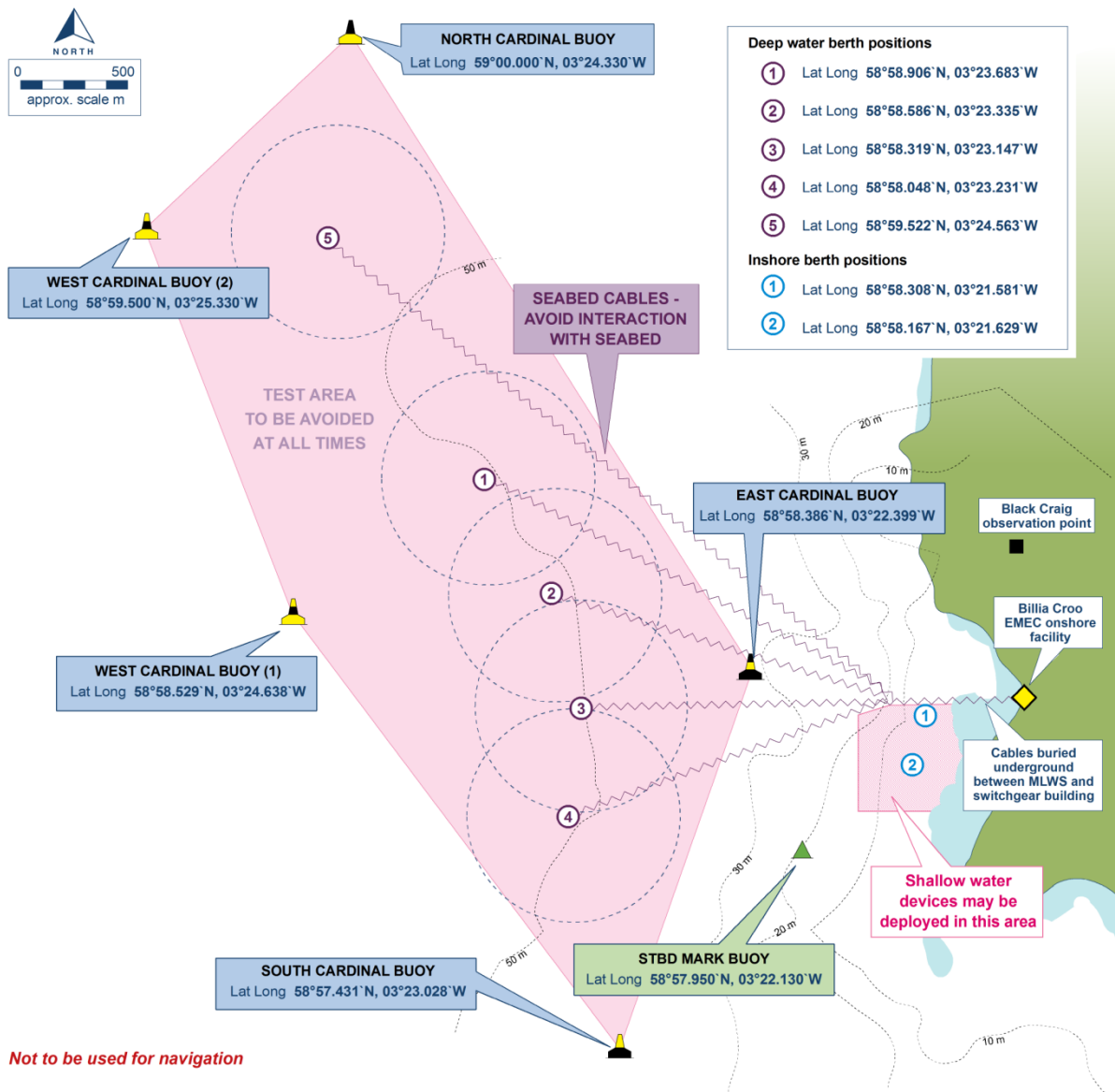


Figure 1.2: Location of Fall of Warness Tidal (below) and Billia Croo Wave (far below) Test Sites





2. Environmental Appraisal Process

2.1. Introduction

The Environmental Appraisal process which each developer must undertake covers a series of steps through initial notification to scoping and consultation in order to produce the Environmental Report (ER). The ER starts with a description of the proposed activities and the site environment. The possible environmental and navigational interactions are then identified and entered into a Summary Impact Matrix (see Appendix I). For each potential impact the scale of impact is assessed. Management and mitigation measures are then identified and predictions of anticipated residual impacts made. This information should be summarised in the Impact Assessment table (see Appendix II).

The final stage is to compile a list of commitments for the project (see Appendix III).

2.2. Project Information Summary

The Project Information Summary serves as a formal first notification to the Regulator and statutory consultees of a developer's intention to deploy at EMEC. This 2-3 page document should be submitted to EMEC soon after contract signing. EMEC will review the document and submit to the Regulator and key consultees, and arrange for a feedback meeting to discuss key environmental and navigational issues to address in the Scoping Report. The Project Information Summary should provide brief details of the following aspects of the proposed project:

1. Introduction.
(Company, technology and project, including deployment location)
2. Device description.
(Schematic diagram of device, mooring arrangements, mode of operation)
3. Project description.
(Installation method & duration, maintenance schedule, vessel types, projected vessel traffic frequency, device monitoring systems, recovery method & duration)
4. Project schedule.
(Gantt chart showing main project stages: submission of consent application(s), installation and decommissioning).

2.3. Environmental Scoping

To ensure the early identification of key potential impacts, developers should provide outline project scoping information to EMEC for consideration. This should demonstrate a good understanding of the key environmental issues and how these will be reduced and monitored, and will include:

- Pictures/drawings of the device and its approximate dimensions
- Principle construction materials
- Proposed device location
- Proposed timescale – for all aspects of the project (eg key EMEC milestones, installation period and dates (including contingency), commissioning, operation, decommissioning).
- Summary table of deposits
- Outline description of installation (including method and vessels), operation and decommissioning
- Preliminary description of receiving environment, including protected areas and species/habitats. This should include all receptors (Appendix I should be completed – receptors will form the header row of this table).
- Preliminary analysis of the main environmental impacts/risks (relate to point above). “Activity” column of Appendix I should be populated with this information.
- Consideration of any proposed mitigation measures.
- Preliminary analysis of main marine safety issues (based on EMEC Navigational Risk Assessment)
- Contingency measures (eg if deployment does not go to plan, etc) including environmental contingency.

The analysis of environmental impacts should consider potential impacts on natural heritage interests of conservation importance eg designated sites, European Protected Species, United Kingdom Biodiversity Action Plan (UKBAP) species.

Analysis of navigational impacts should consider device specific navigational safety risk assessments taking into account the generic hazards identified and the mitigations put in place for the site as a whole such that the risks could be considered tolerable. Reference should be made to the Maritime and Coastguard Agency’s (MCA) Marine General Notice MGN 371 (M+F) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues (available to download at <http://www.mcga.gov.uk/c4mca/mcga07-home/shipsandcargoes/mcga-shipsregsandguidance/marinenotices.htm>) and the EMEC site specific Navigational Risk Assessments (NRA), which can be downloaded from the secure area of the EMEC website <http://www.emec.org.uk/dms/index.asp> (username & password required).

A Summary Impact Matrix (see Appendix I) should be completed as part of the Environmental Scoping process. Columns 1, 2 & 3 of the Impact Assessment table (see Appendix II) should also be completed at this stage.

2.3.2 Consultation

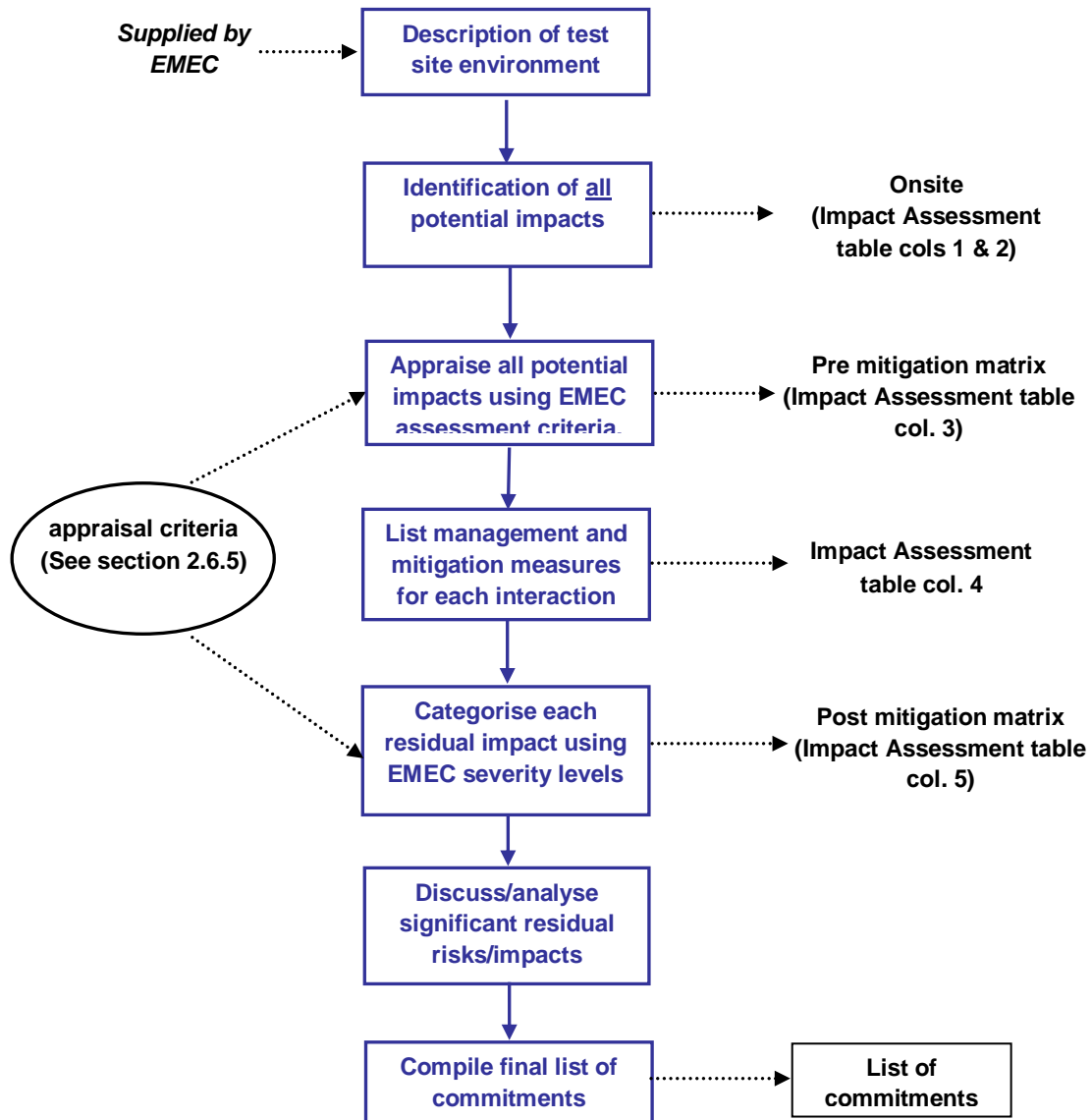
Once the project scoping has been agreed, EMEC will submit the documentation to the Regulator(s) and appropriate consultees for review. Consultees may provide individual feedback, via EMEC, to the Regulator and developer. This consultation period will last for 20 working days, at the end of which the Regulator and consultees will provide written feedback. An extension to this consultation period may be requested by some consultees, and developers should bear this in mind when planning their deployment timescales.

At this stage scoping meetings between the developer and individual consultees may be appropriate. These meetings will be arranged and facilitated by EMEC, and their key purpose is to address any issues/concerns raised (by both parties) and clarify any points made in the review of the scoping documentation. The output from such meetings and the above formal written advice should be used to inform development of the Environmental Report and associated licence applications.

2.4. The Environmental Report

The Environmental Report (ER) is the documented output of the Environmental Appraisal process, which the developer is responsible for producing. This process is described in Figure 2.1 below.

Figure 2.1: Summary of Environmental Appraisal Process



The key purpose of the ER is to provide the Regulator and other assessors of the proposal with a comprehensive and transparent account of the developer's decision making process and its findings. The ER should take into account the feedback provided by stakeholders from the scoping process, as well as providing details of management and mitigation measures proposed. Columns 4 & 5 of the Impact Assessment table (Appendix II) can now be completed. The length of the ER will vary between projects, but wherever possible unnecessarily long ER documents should be avoided.

As a minimum the ER should contain the following sections:

- **Non-technical Summary**
- **Environmental Description**
- **Project Description** (including detailed description of the device, key impact issues associated with different aspects of the device, timing, and consideration of logistics and support requirements throughout the lifetime of the project.)
- **Environmental Appraisal Summary**
- **Navigational Risk Assessment (NRA) Summary** from device specific NRA
- **Commitments** table completed by the developer to ensure negative environmental impacts are minimised and possible benefits optimised.

Developers should provide full details in the ER of any baseline studies, monitoring and other measurements used in support of their application. This could include studies that they have undertaken or plan to undertake and/or existing data.

To ensure consistency and comparability of data collected, it is important that environmental monitoring plans are developed in liaison with Marine Scotland, SNH and EMEC. ***Developers should be aware that monitoring requirements may be stipulated in licence/consent conditions.*** Also, it should be noted that as new legislation is developed and implemented, there may be changes to the monitoring requirements. If developers have considered post-construction environmental monitoring at this stage, this information should be included (developers should be aware of the value of obtaining good post-construction data while at EMEC for later commercial deployments).

The following sections of this document provide guidance on the level of detail required in each section of the ER, together with a recommended method for Impact Appraisal.

2.4.1 Non-Technical Summary

This section of the ER should summarise the project in layman's terms and be easily understood by someone not familiar with specialist terminology. It should be clear, concise, and provide an overview to the whole ER document. Where practical, the use of graphics to illustrate issues rather than the use of lengthy text is recommended.

2.4.2 Environmental Description

In this section developers should fully describe the receiving environment including connectivity to any Special Protected Areas (SPA) and Special Areas of Conservation (SAC). This should take into consideration the zone of likely environmental impact for all stages of the project associated with EMEC, and provide a description of environmental conditions prior to development.

EMEC will make available the most up to date, relevant site information for developers' use in the preparation of their documentation. This includes:

- Original site description/EIA
 - includes wave & tidal resource data, environmental & geological data, weather information, seabed surveys, and environmental statement
- Site sensitivities tables
 - Summaries of the environmental sensitivities at both the wave and tidal test sites
- Wildlife observations data/reports

- available to developers on request for both wave and tidal test sites
- Acoustic baseline site characterisation
 - available to developers on request for both wave and tidal test sites
- Data from any EMEC monitoring projects.

The original EMEC site descriptions and site sensitivity tables can be downloaded from the secure area of the EMEC web site <http://www.emec.org.uk/dms/index.asp> (user name & password required). The EMEC site sensitivities tables will be periodically updated as information becomes available. Developers are encouraged to contribute any suitable information that they gather through their activities for this purpose. Additional relevant information may be available from other sources.

2.4.3 Project Description

The project description forms a major part of the ER and should cover all aspects and phases of the proposed development, from installation and commissioning through operation, maintenance and decommissioning. The developer is required to provide a comprehensive description of their device and associated activities, with particular focus on the issues that are important from an environmental perspective. Where appropriate, this section should cover at least the following headings:

- Developer's Management System/Structure:
 - location of key personnel/decision makers
 - communication plan with EMEC
 - mechanisms in place for efficient, effective, and timely decision making
- Pre-installation Activity:
 - provide details of any pre-installation works required (eg core sampling, any other investigative activities, installation of moorings, etc)
- Testing Schedule:
 - timing and length of testing activities
 - details of any non-work periods
 - plans to temporarily remove device (if known)
- Device Structure & Operation:
 - general description to include diagrams/photographs of device, showing in and out of water profiles
 - full dimensions (metres)
 - weight (tonnes)
 - if sub-surface, depth below sea surface, ie draft (metres) and height above the seabed (metres relative to lowest astronomical tide (LAT))
 - physical dimensions in all operational modes
 - potential for scour induced by or around device
 - location of device within the test berth, eg central, off-centre, orientation with regard to current/waves (latitude/longitude of centre and radius of reach)
 - description of how device functions operationally
- Mooring or Foundation System:
 - general description to include but not be limited to size (metres, tonnes), area covered (m²), depth of seabed penetration (metres), installation method, materials, movement of device around moorings (deviation from test berth centre), timings
- Installation Requirements:
 - description of installation process, including pre-installation requirements
 - timing considerations (eg ecologically sensitive periods) and any mitigation proposed
 - vessel requirements (expected vessel GRT, length, draft, etc)
 - generation of on-site waste/litter (m³ or tonnes for each type of waste)
- Power Requirements:

- details of power requirements, including requirement for and location of any external power sources
- diesel or other fuel requirements including inventory (litres), bunkering procedures, regularity, etc
- Materials:
 - inventory of materials (m^3 or tonnes), eg metals, plastics, seals, greases & lubricants (litres), oils (litres) and description of types, paints (litres) and description of types, adhesives (litres) and description of types, batteries, ballast (tonnes, type of material, and source)
 - chemical requirements/treatments (names and function, quantity in litres)
 - details of compliance with a recognised standard (eg ISO or equivalent)
- Hydraulic Systems:
 - general description of hydraulic systems to include oil requirements, containment, potential discharge (litres/day), etc
- Corrosion Protection:
 - general description of corrosion protection to include any sacrificial anode requirements, composition, replacement schedule, etc
- Antifouling System:
 - type of antifouling system, including compliance with any recognised international/national standards
 - surface area of device covered (m^2)
 - frequency of reapplication/replacement (application rate per year)
 - if no antifouling, detail how fouling (eg marine growth, bird guano, etc) will be removed
- Power Conversion System:
 - general description of power generation module/generator, including number and arrangement of modules and mechanisms for power extraction (eg propeller, buoyancy, venturie etc)
 - device generation capacity, design power output profile (kW)
 - swept area (surface area in m^2 and water depth range in metres)
 - energy capture area (m^2 , Joules) and proportion of energy flux (as percentage of local and overall flux)
 - frequency/speed of moving parts (cycles per minute)
- Noise and Vibration Levels:
 - frequency of any noise generated (Hz)
 - amplitude (dB re $1\mu Pa$ @ 1 m in water or dB re $1\mu Pa$ @ 20 m in air) of device as whole or different parts of device
 - if no data available provide details of dynamics of all moving parts of the device (e.g. bearings, pistons, pressurised systems, motors, gearboxes, pumps, rotors, air turbines wildlife scaring devices etc), list of parts and any noise data
 - details of any tensioned wires or other components that could resonate in water (resonant frequency)
 - details of any vibrating systems
- Device Marking:
 - consult with the Northern Lighthouse Board (NLB) to determine device marking requirements
 - above surface visibility (diagram, metres above waterline)
 - colour (description & photograph)
 - lighting arrangements (range of visibility, flashing sequence, etc)
 - low visibility warning signals (eg fog horns, radar reflectors, etc)
 - device station verification
 - possible device failure modes (e floating, sinking, fire, collapse)
- Electrical Systems:
 - voltage (Volts) and current (Amps) patterns from generated power in umbilical

- impressed currents corrosion systems
- frequency (Hz) and harmonics of any electrical currents
- lightning protection
- Heating and Cooling Systems:
 - water abstraction & discharge requirements
 - chemical requirements/treatments (names & function and quantities in litres)
- Communication Systems:
 - general description of device communication systems (eg fibre optic, high energy radio antennae, microwave, wireless LAN, etc)
 - licence requirements/arrangements
 - frequency (Hz) and amplitude of signals
- Shore Connections:
 - details of any shore connections (eg cables and pipelines required in addition to those provided by EMEC)
 - electromagnetic and electrical fields from any cables (strength, frequency and wavelength)
- Shore Facilities:
 - details of any facilities required in addition to those provided by EMEC
- Energy Storage:
 - details of energy storage requirements
- Energy Sink:
 - details of energy sink requirements
- Chemical Use and Management:
 - details of any chemical management system
 - list of all chemicals (including any alternatives considered), why required, and how used including potential for discharge (litres per month)
 - provide Material Safety Data Sheets (MSDS) and any ecotoxicology data for all proposed chemicals
 - spill prevention strategies/measures
- Potential Discharges to Sea:
 - details of any systems/components that will discharge/leach etc into the marine environment (eg bilges, hydraulic fluids, sacrificial anodes, sewage, etc) including estimate of discharge/leaching rate (litres per year)
- Potential Discharges to Air:
 - details of any systems/components that will result in atmospheric emissions (eg combustion emissions, vented gases, etc), to include emissions from device and any support vessels
 - annual total emissions (tonnes) for all greenhouse gases (reported in CO₂ equivalents)
 - emissions with potential impacts on air quality (eg nitrogen and sulphur oxides, BETX, etc)
- Maintenance Requirements:
 - description of likely maintenance requirements (frequency, where carried out, etc)
 - resources required to support maintenance activities (eg vessels, manpower, equipment, etc)
 - will maintenance operations be contained within test berth area (including anchors/mooring lines)?
 - frequency of vessel operations onsite (if known, vessel names/numbers and frequency/timing of visits)
 - anchoring requirements of support vessels (anchor, length of chains, radius of mooring facilities, etc)
 - onsite requirements (eg utilities periodically used by maintenance personnel)
 - any requirements for seabed maintenance (eg dredging or scour protection)
 - potential for generation of onsite waste/litter (m³ or tonnes) and disposal methods

- debris recovery (m³ or tonnes) and disposal method
- Decommissioning:
 - general description of device and mooring recovery/removal activities/ requirements
 - will all operations be contained within device test berth area (including anchors/mooring lines)?
 - vessel & other requirements (expected vessel GRT, length, draft, etc)
 - anchoring requirements of vessels
 - cutting/removal techniques for any embedded structures
 - onsite requirements (eg utilities periodically used by decommissioning personnel)
 - potential for generation of onsite waste/litter (m³ or tonnes) and disposal methods
 - debris survey details, recovery and disposal
 - seabed reinstatement requirements
 - provisions for decommissioning bond
 - **note: a separate device-specific Decommissioning Plan is also required**
- Environmental Monitoring:
 - include any plans for device-specific environmental monitoring (provide outline details of what is planned)
 - **note: depending on the nature of the device, there may be specific monitoring required by the Regulator. This is likely to take the form of an Environmental Monitoring Plan (EMP). EMEC has a number of environmental monitoring and other projects on-going that may assist developers in preparation of these plans.**
- Accidental Events:
 - description of accidental/emergency situations which may result in interference with other sea users, wildlife and environmental pollution (to include assessment of likelihood and scale of consequence of each event)
 - spill prevention strategy/measures (for oils & chemicals)
 - outline of response procedures for possible device failure modes and dropped objects
 - details of insurance in place (details of policies and monetary limits)
 - **note: EMEC requires a full hazard identification and risk assessment to be carried out prior to any onsite activity**

When providing information under the above headings, developers should consider the key impact issues associated with the different aspects of their device. Appendix IV of this document highlights the main environmental issues to be considered and why they are important. **The headings above should not be considered as an exhaustive list and any other information/issues which may be important from an environmental perspective should also be included.**

2.4.4 Environmental Appraisal Summary

This section of the ER should highlight proposed mitigation and/or adaptive management measures, together with justification for any residual impacts. Detailed information in this section may be presented using the formats suggested in Appendices II and III of this document. The Environmental Appraisal Summary should be presented in the tabular format as detailed in Appendix II. This will help to control the volume of work undertaken whilst maintaining its comprehensiveness. The following information is required in the Environmental Appraisal Summary section.

2.4.4.1 Summary Impact Matrices

Summary matrices should be produced which give an overall picture of the potential pre-mitigation impacts and residual impacts. The format of these matrices is provided in Appendix I. The exact terminology for describing the activities listed in the left hand column should match that used in column 1 of the summary impact table.

2.4.4.2 Key issues

Appendix IV explains why the various issues outlined in this document are of concern. It should be used as a checklist to ensure that all potential impacts from the devices and associated operations have been assessed. It should not be considered an exhaustive list and if there are other issues that are important from an environmental perspective they should also be included in the assessment.

The issues identified in Appendix IV are the mechanisms by which impacts can occur. When producing the summary matrices in the ER (see Section 2.3.4.1 and Appendix I) potential impacts must be judged against receptors (i.e. as listed across the top of the table in Appendix II). Note that Appendix IV does not need to be reproduced in the ER, but Appendix I should be included.

2.4.4.3 Impact Evaluation

The requirements for filling in the table presented in Appendix II are outlined below:

- Developers should identify which activities have the potential to cause impacts in column 1 of the table. The exact terminology for describing the activities listed in column 1 will be specific to each project, but the range of activities addressed should be guided by the activities listed in the developer's Project Description.
- The basis for these impacts, including the mechanism involved and the environmental component affected, should be described in column 2 of the table. It should be noted that there may be more than one mechanism and affected component for each activity. ***It is important that in column 2 of the table developers make an attempt to quantify the significance of impact using the criteria provided in Section 2.3.4.5, e.g. extent and intensity that they expect, and that they identify any seasonal variations in impacts based on the site specific environmental sensitivities. Where appropriate, monitoring (developed in liaison with EMEC) should be used to verify predictions made.***
- The level/significance based on the defined criteria (see Section 2.3.4.5) assuming a worst case impact, i.e. with no management or mitigation measures in place, should be entered into column 3 of the table. Where there are uncertainties in the significance of impact these should be noted.
- Following this, developers should identify management and mitigation measures that will be employed against each issue and list these in column 4 of the table.
- This will in turn allow assessment of the residual impacts that are anticipated to arise following implementation of these management and mitigation measures. Residual impacts should be rated using the same criteria as used earlier for the possible unmitigated impacts. The results should be entered into column 5 of the table.

2.4.4.4 Discussion of Residual Impacts

Any potential residual impacts, ranked as Moderate or Major should be discussed in more detail in the main text of the ER document. Where a significant potential impact is predicted the document should fully explain why the proposed activity is required. This description should highlight why the impact is potentially significant, the scale of impacts that could arise under different circumstances if appropriate, possible mitigation principles and the level of residual impacts. The appraisal should consider positive as well as negative aspects arising from activities.

This section should present a succinct and well-argued case for the proposals and explain why further mitigation is not possible. Where there is established literature or case history this should be highlighted and referenced.

As agreed with MS-LOT, monitoring is likely to be required for any major or moderate residual impacts. Developers are likely to be required to produce an Environmental Monitoring Plan and the need for this will be advised by MS-LOT during the scoping process. EMEC has a number of environmental monitoring and other projects on-going that may assist developers in preparation of these plans.

Minor and negligible impacts must still be considered and the proposed management and mitigation measures included and tracked within the commitments list (see Section 2.3.6). The comments within the Impact Assessment table should generally be sufficient to address these issues.

2.4.4.5 Criteria Used to Assess Potential Impacts

The following definitions should be used to categorise potential and residual impacts (i.e. columns 3 and 5 in the Impact Assessment table). For each decision made on the magnitude of the impact, full justification and reasoning should be supplied.

Developers should recognise that whilst an impact may be deemed minor for an individual device, it could potentially contribute to a major impact when considered cumulatively or in combination with the impacts of other devices or marine activities. Developers should also ensure that the necessary consents/licenses are in place to avoid breaching legislative requirements.

	Ecological effects	Socio-economic effects	Stakeholder concerns	Consequence for developers
Major	Degradation to the quality or availability of habitats and/or wildlife with recovery taking an ecologically important period.	Change to commercial activity leading to a loss of income or opportunity beyond normal business variability/risk. Potential short term effect upon public health / well-being, real risk of injury.	Breach of EU legislation for European Protected Species or Natura sites. Breach of domestic legislation for protected species and habitats. Consideration of other stakeholder concerns (eg local concerns).	Introduce mitigation measures so as to reduce the impact to a level that can be accommodated and/or avoid a breach of legislation. Likely to be a requirement to closely monitor areas of residual impact.
Moderate	Change in habitats or species beyond natural variability with recovery potentially within a period of low ecological importance.	Change to commercial activity leading to a loss of income or opportunity within normal business variability/risk. Possible but unlikely effect upon public health/well-being. Remote risk of injury.	Breach of EU legislation for European Protected Species or Natura sites. Breach of domestic legislation for protected species and habitats. Consideration of other stakeholder concerns (eg local concerns).	Introduce mitigation measures so as to reduce the impact to a level that can be accommodated and/or avoid a breach of legislation. Likely to be a requirement to closely monitor areas of residual impact.
Minor	Changes in habitats or species which could be measured, but of a scale unimportant relative to natural variability.	Possible nuisance to other activities and some minor influence on income or opportunity. Nuisance but no lasting effect upon public health/well-being.	Breach of EU legislation for European Protected Species or Natura sites. Breach of domestic legislation for protected species and habitats.	Be aware of potential impacts, manage operations to minimise impacts and interactions.

	Ecological effects	Socio-economic effects	Stakeholder concerns	Consequence for developers
Negligible	Changes in habitats or species so small as to be difficult to measure relative to natural variability	Noticed by, but not a nuisance to other commercial activities. No discernible effects upon the health and well-being of the public.	Breach of EU legislation for European Protected Species or Natura sites. Breach of domestic legislation for protected species and habitats. Stakeholder awareness but no concerns.	No positive intervention needed, but ensure they do not escalate in importance.
No interaction	None.	None.	None.	Ensure changes to activities do not lead to new impacts.
Positive	An enhancement of ecosystem or population parameter. Be sure to consider indirect impacts that a positive impact may have – eg enhancement for a habitat may be to the detriment of a set of species.	Benefits to local community.	Benefits to stakeholder issues and interests.	Actively work to maximise specific benefits whilst minimising any indirect adverse effects.

2.4.5 Navigational Risk Assessment (NRA) Summary

Developers are required to undertake a device specific NRA, using the relevant EMEC site NRA. The guidelines for doing so are found in the EMEC Consenting Description document which can be downloaded from the secure area of the EMEC website <http://www.emec.org.uk/dms/index.asp> (user name & password required). The ER should contain a brief summary of the main findings from the NRA and reference the full NRA.

2.4.6 List of Commitments

The developer should summarise all realistic and tangible commitments made in the ER in a Commitments Table/Register. The format for this is provided in Appendix III of this document. Developers will be expected to adhere to these commitments.

Some of the commitments made by the developer may affect the final design. If a material change to the design is subsequently made, then the impacts and list of commitments will need to be reviewed before work can proceed.

Developers should ensure that they discuss appropriate commitments with EMEC as there may be operational implications to be considered.

The issues shown in Appendix III are by way of example only and should not be considered as an exhaustive list. Any other issues/commitments which may be important from an environmental perspective should also be included in the Commitment Register.

3. Bibliography and References

The following will provide some useful background/reference for environmental impact assessment for marine renewable energy projects. The list will be added to as and when new publications become available.

ABOmer (2005). Potential nature conservation and landscape impacts of marine renewable energy developments in Welsh Territorial Waters. CCW policy research report No. 04/8.

Boehlert, G. W. & Gill, A. B. (2010) ENVIRONMENTAL AND ECOLOGICAL EFFECTS OF OCEAN RENEWABLE ENERGY DEVELOPMENT A Current Synthesis. *Oceanography*, 23, 68-81.

Centre for Environment, Fisheries and Aquaculture Science (CEFAS) (2001) Offshore wind farms: Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements.

CEFAS website: <http://www.cefass.co.uk/renewables/Default.htm>

Centre for Marine and Coastal Studies (CMACS) (2003) A baseline assessment of electromagnetic fields generated by offshore windfarm cables.

Collaborative Offshore Wind Research into the Environment (COWRIE) Report EMF - 01-2002 66.
http://www.thecrownestate.co.uk/15_our_portfolio_04_02_16/33_energy_and_telecoms_04_02_09/34_wind_farms_04_02_07/35_cowrie_04_02_07/35_cowrie_electromagnetic_fields_04_02_07.htm

COWRIE website: <http://www.offshorewindfarms.co.uk/Pages/COWRIE/>

Davies J, Baxter J, Bradley M, Connor D, Khan J, Murray E, Sanderson W, Turnbull C and Vincent M eds (2001). Marine monitoring handbook. Natura 2000. UK marine SACs project. Joint Nature Conservation Committee, Peterborough.

DEFRA is presently conducting two research projects; the reports will become available at the end of March 2005:

- (AE0262) Development of Generic Guidance for Sediment Transport Monitoring Programmes in Response to Construction of Offshore Wind Farms; and
- (AE1227) Assessment of the Significance of Changes to the Inshore Wave Regime as a Consequence of an Offshore Wind Array.

DTI Noise Project: <http://www.og.dti.gov.uk/environment/callprop2.htm>

EMEC (2008) Consenting Description - REP113

Gill AB and Taylor H (2001). The potential effects of electromagnetic fields generated by cabling between offshore wind turbines upon elasmobranch fishes. CCW Science Report No 488.

Grecian, W. J., Inger, R., Attrill, M. J., Bearhop, S., Godley, B. J., Witt, M. J. & Votier, S. C. (2010) Potential impacts of wave-powered marine renewable energy installations on marine birds. *Ibis*, 152, 683-697.

Hiscock K, ed. (1996). Marine Nature Conservation Review: rationale and methods. Peterborough, Joint Nature Conservation Committee. (Coasts and seas of the United Kingdom MNCR series).

Langhamer, O., Wilhelmsson, D. & Engstrom, J. (2009) Artificial reef effect and fouling impacts on offshore wave power foundations and buoys - a pilot study. *Estuarine Coastal and Shelf Science*, 82, 426-432.

MCA Marine Guidance Note (MGN) 371. Proposed UK offshore renewable energy installations (OREI) guidance on navigational safety issues. Published in September 2008.

Nelson PA, D Behrens, J Castle, G Crawford, RN Gaddam, SC Hackett, J Largier, DP Lohse, KL Mills, PT Raimondi, M Robart, WJ Sydeman, SA Thompson, S Woo. 2008. Developing Wave Energy In Coastal California: Potential Socio-Economic And Environmental Effects. California Energy Commission, PIER Energy-Related Environmental Research Program & California Ocean Protection Council CEC-500-2008-083

[Scottish Natural Heritage \(2004\). Marine renewable energy and the natural heritage: an overview and policy statement. SNH policy statement 04/01. Available on the SHN website.](#)

Scott Wilson and Downie AJ (2003). A review of possible marine renewable energy development projects and their natural heritage impacts from a Scottish perspective. Scottish Natural Heritage Commissioned Report F02AA414.

Appendix I: Summary Impact Matrix

Appendix IV identifies the mechanisms by which impact may occur. The summary matrices provided in the ER should rank impacts against receptors, having considered the mechanisms by which impacts may occur. Full explanation and justification should be provided in supporting text to explain what the potential impacts are, what magnitude the impact is from the individual device and cumulatively with other devices that will be in operation/being deployed at the same time as the device being assessed, how the impacts will be minimised and managed, and what the residual impacts will be.

Activity	Receptor	Geology/geomorphology	Sediment distribution and movement	Hydrography and hydrographic processes	Seascape/landscape	Atmosphere	Coastal species	Water column species	Seabed species	Sea mammals (inc otters)	Fish	Marine birds	Protected species and designated site	Onshore wildlife	Commercial sea and harbour users	Local economy	Other site others/developers	Recreation and amenity sea users (inc tourism)	Local residents and communities
Construction and installation																			
<i>Vessel presence</i>																			
<i>Mooring installation</i>																			
<i>etc</i>																			
Device operation and maintenance																			
<i>Removal of energy from marine environment</i>																			
<i>Noise emissions</i>																			
<i>etc</i>																			
Accidental events																			
<i>Oil spill</i>																			

etc																		

Appendix II: Impact Assessment Table

1	2	3	4	5
Identified activity	Prediction of potential impact	Potential impact significance	Proposed management and mitigation measures	Residual impact significance
*EXAMPLE				
Energy balances and flows	Changes to water column characteristics: <ul style="list-style-type: none"> • Energy extraction from the tide • Reduced downstream mean velocity • Residual turbulence • Flow acceleration around the device 		Studies undertaken as part of the test site infrastructure EIA indicate that operations of individual test devices will result in insignificant loss of overall current speed for the area and thus no modification to the marine environment is predicted. The device will include a flow meter that will monitor tidal flow.	
Device presence	Seabed and habitat disturbance / loss.		Base of the device will cover an area of approximately XXXX, which is <1 % of the test site seabed area. Seabed areas at the test berth are not considered to be of conservation importance.	
	Visual and seascape impact.		Fully submerged device.	No Interaction

**The details included in the table above are by way of example only and should not be considered as an exhaustive list. Any other activity/impacts which may be important from an environmental perspective should also be included in the Impact Assessment table.*

Appendix III: Commitment Table

Issue	Commitment or action	Responsibility	Target completion date	Actual completion date	Notes
<i>*EXAMPLE</i>					
<i>Planning & Construction</i>	Public consultation and regular updates to local fishermen via EMEC.	Developer			
	Antifouling to be applied to essential areas only and not over entire structure	Developer			
	All paints to conform to BSI ???	Developer			
	Lighting & marking of device to be agreed by consultation with NLB as part of consenting process.	Developer			
<i>Installation</i>	Local contractors will be used where practically and economically possible	Developer			
	Liaison with OIC Marine Services with regard to use of local harbour facilities.	Developer			
	Installation activities will be limited where possible to daylight hours to minimise disturbance to marine mammals/birds.	Developer			
	Notice To Mariners will be issued as required and in accordance with EMEC Standard Operating Procedures.	Developer			
<i>Device Operation</i>	Emergency Response Procedure (ERP) to cover mooring line/device failure will be established in line with EMEC's ERP.	Developer			
	An Environmental Monitoring Plan approved by MS-LOT will be adhered to.	Developer			
	The noise signature of the device will be defined.	Developer			
<i>Decommissioning</i>	Detailed decommissioning plan/procedure to be submitted to EMEC.	Developer			
	Post-decommissioning seabed survey will be undertaken to establish the effects of the installation on the seabed.	Developer			
	Regular PR leading up to decommissioning.	Developer			

**The details included in the table above are by way of example only and should not be considered as an exhaustive list. Any other issues/commitments which may be important from an environmental perspective should also be included in the Commitment Register.*

Appendix IV: Ecological, Landscape & Socio-economic Issues

Impact	What should be considered/ Why it is important?
Ecological issues	
1. Ecological and tidal energy balances and flows	Consequence of energy extraction and physical presence of devices in the sea should be assessed, e.g. changes in vertical mixing, may lead to changes in currents, offshore and coastal habitats/features, and knock on effects to biological communities present (see 7).
2. Disturbance to seabed habitats	Anchoring, mooring/foundation installation operation and maintenance equipment and other seabed disturbances can lead to disturbance/destruction of seabed habitats, which may have a knock on effect on wildlife.
3. Disturbance to water masses	The scale and implications of changes to such factors as nutrients, temperature, light levels, turbidity (suspended sediments), surface waves and current patterns should be considered.
4. Shoreline disturbance	Activities that have the potential to cause change to the coastline either directly or indirectly such as erosion/deposition through changes in tidal energy flows, changes in character, etc., should be considered.
5. Disturbance of landward areas	Siting of any onshore activities/works should avoid onshore habitats and species important from a conservation perspective and minimise the loss of natural habitat and protected species.
6. Behavioural changes in wildlife	Test activities have the potential to affect the distribution of wildlife. The potential influence of activities and facilities upon wildlife, in particular those protected by European Directives and national legislation (also see issue 7) should be considered.
7. Impacts on conservation areas/protected species	Any impacts on designated conservation areas and protected species of international, national and local significance must be fully considered. For example European Protected Species, Natura Sites, other protected species such as seals, etc.
8. Contamination of water, seabed and wildlife (inc fish stocks)	Contamination may result from effluent discharge, chemical discharge/leaching/leaks, oil discharge/leaks, sewage discharge, dumping of waste etc. All potential sources, planned or accidental should be considered.
9. Wildlife entanglement, entrapment and collision	The potential for damage and entrapment of wildlife in particular marine invertebrates, fish, mammals and birds, should be addressed in relation to structure, operation, season, and location. Impacts may include entanglement or collision with any blades/rotors, jamming in joints, entrapment etc.
10. Underwater noise, light and vibration	Test devices and associated activities are likely to give rise to noise, light and other disturbances that may disturb and affect the behaviour or the well-being of marine life. Although the exact cause and effect relationships can be difficult to determine, there is keen interest in this issue with regulators and stakeholders. Any effects should be minimised.
11. Airborne noise, light and other nuisances	Airborne noise, light and other nuisances can affect wildlife (potentially offshore, coastal and onshore) and impinge upon coastal resident communities and recreational activities. Any effects should therefore be minimised.
12. Electromagnetic and electrical effects	Some organisms e.g. elasmobranchs fish (sharks, rays and skates), are particularly sensitive to electric and electromagnetic fields generated from electric cables. Consideration of this needs to be given.
13. Greenhouse gas emissions	Consideration should be given to potential greenhouse gas emissions e.g. from fuel use etc.
Landscape and visual impact issues	
14. Visual and landscape impacts	Devices visible from the coast and at sea may affect the landscape qualities of particular views. Factors (within navigational requirements) that help structures blend in with or enhance the landscape are important. This can include colour, orientation, structural design, materials etc. Consider visibility distance of lights and ensure compliance with Northern Lighthouse Board (NLB) requirements/recommendations.

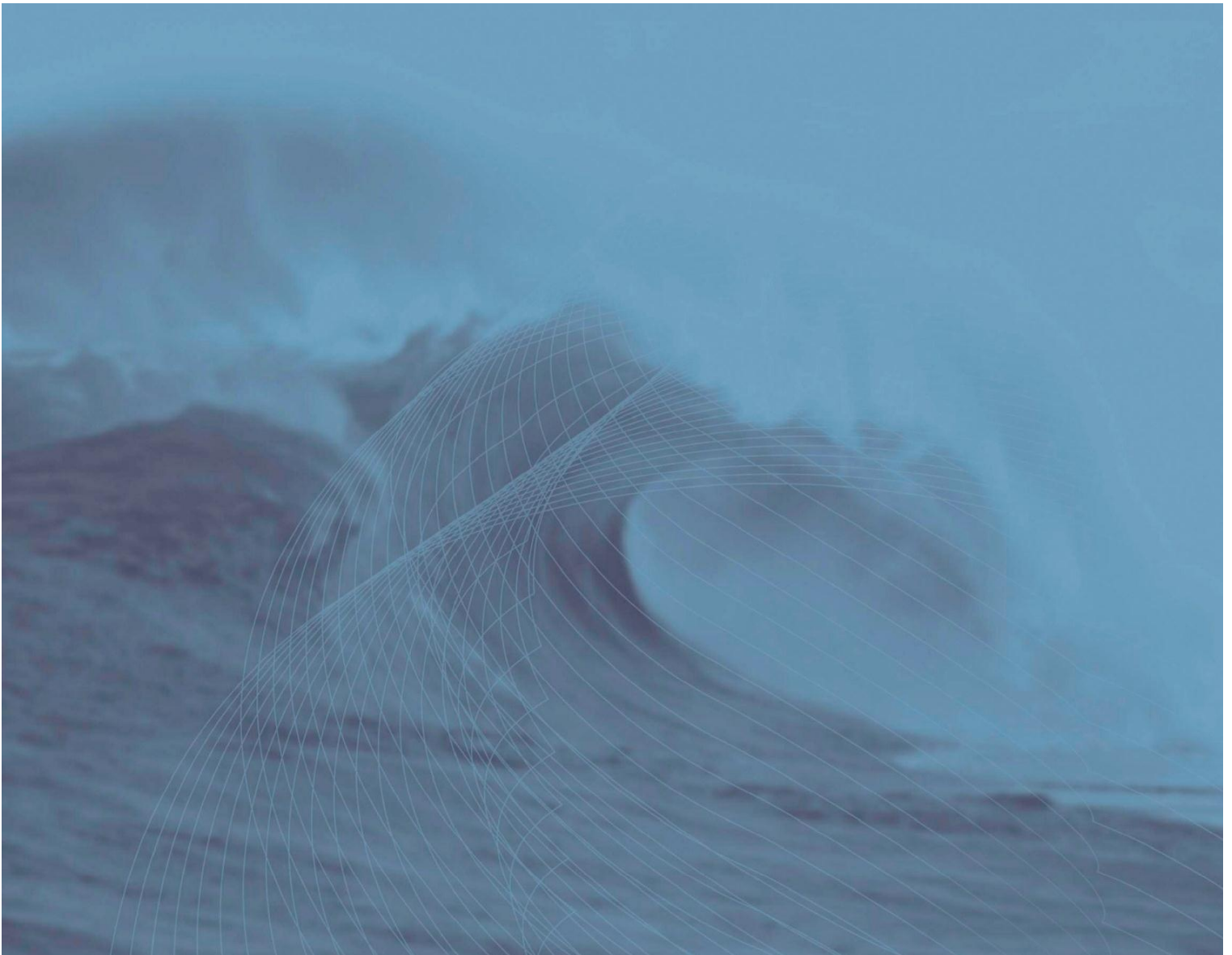
Impact	What should be considered/ Why it is important?
Socio-economic issues	
15. Local air quality issues	Any emissions of combusted or vented gases have the potential to reduce air quality. Consideration should be given to minimising any such emissions.
16. Interference with communication systems	Some device to shore communications could interfere with normal shipping communications. This aspect needs to be addressed,
17. Waste minimisation and disposal	All efforts should be made to minimise waste. Ensure suitable storage, transport and disposal for all waste streams. Some wastes will be able to follow existing waste disposal routes, others may not.
18. Navigation/sea user interference	The presence of devices and their mooring systems has the potential to interfere with vessels and other sea users e.g. fisheries. Although test berths will generally be avoided by such activities, they are not 'exclusion zones' and therefore such impacts need to be considered.
Overall management issues	
19. Suitability of the device for local environmental conditions	Ensure full consideration of local environmental conditions during design of devices and mooring systems.
20. Timing of activities regarding seasonal sensitivities for weather and wildlife	An assessment of seasonal sensitivity is an integral aspect of the environmental appraisal and timing of activities should be considered within overall mitigation and management plan. Specific seasonal 'sensitivities' are summarised in the test site environmental descriptions (provided separately).
21. Accidental spillages and releases	Spillages of materials to sea have the potential to cause damage to wildlife and livelihoods e.g. fisheries. Appropriate procedures for accidental/emergency situations should be in place to minimise the potential for accidental releases and how to deal with them effectively should an accident occur.

Appendix V: Considerations for Activities Out-with EMEC Facilities

Orkney has a wide range of resources and services available to support developer test activities and wherever possible developers are encouraged to make use of these.

If developers take advantage of the resources and services available, they are encouraged to consider potential offsite environmental effects. Examples of the issues that should be considered include those listed in the table below, however the table should not be considered to be an exhaustive list as each location will have different sensitivities.

Offsite	Issues to be considered
Construction and fabrication	<ul style="list-style-type: none"> • Location of fabrication. • Noise and other pollution (eg dust, waste water, fuel, oils, etc) • Disturbance, displacement or damage to legally protected or sensitive habitats, species or landscapes – licenses may be required in advance
Standby, support, offsite maintenance and decommissioning requirements	<ul style="list-style-type: none"> • Areas/locations required e.g. offsite mooring, harbour/pier facilities (timing and duration requirements for these facilities). • Vessel requirements e.g. number, size (GRT, draft etc) duration, timing (i.e. months) etc. • Details of any onshore facilities required additional to those provided by EMEC e.g. lay down areas (devices and supplies), workshops, crane access, slipways, offices (including requirements at decommissioning). • Requirements in event of emergency including vessel requirements, mobilisation times etc. • Noise and other pollution (eg dust, waste water, fuel, oils, etc) • Disturbance, displacement or damage to legally protected or sensitive habitats, species or landscapes - licenses may be required in advance
Personnel requirements	<ul style="list-style-type: none"> • Numbers of people, time of visit, length of stay etc.
Tow to site	<ul style="list-style-type: none"> • Draft during tow, vessel requirements (number and size), speed during tow (knots/ms^{-1}), proposed route (description), manoeuvrability (e.g. length of tow etc). • Disturbance, displacement or damage to legally protected or sensitive species or habitats - licenses may be required in advance
Temporary docking requirements	<ul style="list-style-type: none"> • Devices and associated vessels. • Areas/locations required e.g. offsite mooring, harbour/pier facilities (timing and duration requirements for these facilities). • Frequency of device off test berth including during maintenance and expected length of time at quayside. • Description of activities to take place at quayside. • Noise and other pollution (eg dust, waste water, fuel, oils, etc) • Disturbance, displacement or damage to legally protected or sensitive habitats, species or landscapes - licenses may be required in advance
Waste minimisation and disposal	<ul style="list-style-type: none"> • All efforts should be made to minimise waste. • Proposed waste disposal and oil/fuel spill procedures. • Arrangements for storing and handling non hazardous and hazardous (special) wastes eg batteries, sludges, lighting units, paints, greases, oils, lubricants, solvents, coolants, sewage, domestic, scrap, packaging etc.



FOR FURTHER DETAILS PLEASE CONTACT:

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