Bellrock Offshore Wind Farm

Wind Farm Development Area

Volume V

Outline Lighting and Marking Plan

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Glossary of Terminology

Term	Definition
Applicant	Bellrock Offshore Wind Farm Limited, the legal entity submitting Section 36 Consent and Marine Licence application for Bellrock Wind Farm Development Area.
Automatic Identification System	A system by which vessels automatically broadcast their identity, key statistics including location, destination, length, speed, and current status, e.g. under power. Most commercial vessels and United Kingdom /European Union fishing vessels over 15 metre length are required to carry Automatic Identification System.
Bellrock Offshore Wind Farm (or the Bellrock Project)	An offshore wind farm capable of exporting around 1.8 gigawatts of renewable energy to the National Electricity Transmission System. The Wind Farm Development Area is located 120 kilometres east of Stonehaven, and will connect to the National Electricity Transmission System at the SSEN Transmission Hurlie substation, west of Stonehaven in Aberdeenshire. The Bellrock Offshore Wind Farm comprises of the following Development Areas: ▪ Wind Farm Development Area; ▪ Offshore Transmission Development Area; and ▪ Onshore Transmission Development Area.
Developer	The legal entity responsible for ensuring compliance with the Lighting and Marking Plan.
Floating offshore unit	The combined wind turbine generator and floating substructure.
Floating substructure	A floating structure which provides buoyancy and, in conjunction with the station keeping system, supports a superstructure (e.g. wind turbine generator or offshore substation), and maintaining its position within the structure's excursion limit.
Inter-array cable	Armoured cable containing electrical and fibre optic cores, which link the wind turbine generators to each other and to the subsea cable hubs and/or the offshore substations and include dynamic inter-array cable and static inter-array cable sections.
Marine Guidance Note	A system of guidance notes issued by the Maritime and Coastguard Agency which provides significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Offshore substation	An offshore platform which houses electrical equipment such as transformers, switchgear, and protection and control systems, enabling the wind farm's renewable electricity to be received via inter-array cables and exported via the offshore export cables.
Wind Farm Development Area	The boundary within which the wind farm infrastructure will be constructed, operated and maintained, and decommissioned.
Wind Farm Infrastructure	Infrastructure located within the Wind Farm Development Area including wind turbine generators; floating substructures, station keeping systems and associated scour protection; inter-array cables and associated cable protection; subsea cable hubs; and ancillary infrastructure including buoys (including activities associated with the Wind Farm

Term	Definition
	Infrastructure construction, operation and maintenance, and decommissioning).
Wind turbine generator	A wind turbine generator converts wind energy into electrical energy. The main components include rotor assembly (composed of three blades and a hub); nacelle (containing the generator, shaft and gearbox, power electronic converter and transformer); and a tower (containing lifting equipment and switchgear).

Glossary of Abbreviations

Term	Definition
AtoN	Aid to Navigation
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
cd	Candela
DDMM.mm	Degrees Decimal Minutes
DECC	Department of Energy & Climate Change
EIA Report	Environmental Impact Assessment Report
EU	European Union
Fl	Flashing
FOU	Floating offshore unit
FSS	Floating substructures
HAT	Highest Astronomical Tide
IALA	International Organization for Marine Aids to Navigation
ID	Identification
IAC	Inter-array cable
IPS	Intermediate Peripheral Structure
K	Kelvin
km	Kilometer
LMP	Lightning and Marking Plan
m	Metre
m^2	Square metre
MCA	Maritime and Coastguard Agency
mm	Milllimetre
MOD	Ministry of Defence
NLB	Northern Lighthouse Board
nm	Nautical mile
nm^2	Square nautical mile

Term	Definition
NOTAM	Notice to Airmen
NVIS	Night Vision Imaging System
OfSS	Offshore substation
OfTDA	Offshore Transmission Development Area
Radar	Radio Detection and Ranging
s	Second
s.36	Section 36 of the Electricity Act 1989
SAR	Search and Rescue
SCADA	Supervisory Control and Data Acquisition
SPS	Significant Peripheral Structure
UK	United Kingdom
UPS	Uninterruptible Power Supply
WFDA	Wind Farm Development Area
Y	Yellow

1 Introduction

1.1 Overview

1. In 2021, Crown Estate Scotland launched the ScotWind[1] leasing round which released areas of seabed in Scottish waters for new commercial scale offshore wind developments to help Scotland achieve its net-zero emissions target by 2045. In January 2022, Bellrock Offshore Wind Farm Limited (the Applicant[2]) was successfully awarded development rights for an area of seabed, to develop the Bellrock Wind Farm Development Area (WFDA), which forms part of the Bellrock Offshore Wind Farm (the Bellrock Project).

2. The Bellrock Project comprises the following three Development Areas for which separate consents and/or licences will be sought by the Applicant:

   - The Bellrock WFDA within which the Bellrock Wind Farm Infrastructure will be constructed, operated and maintained, and decommissioned.
   - The Bellrock Offshore Transmission Development Area (OfTDA) within which the Bellrock Offshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned; and
   - The Bellrock Onshore Transmission Development Area, within which the Bellrock Onshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned.

3. The Bellrock WFDA is located 120 kilometres (km) (65 nautical miles (nm) from Stonehaven (116 km (63 nm) from Peterhead)), in Aberdeenshire, Scotland, and covers an area of 280 km^2 (82 square nautical miles (nm^2)).

4. Wind Farm Infrastructure within the Bellrock WFDA will include:

   - Up to 132 wind turbine generators (WTG) with floating substructures (FSS) (together referred to as floating offshore units (FOUs));
   - Station keeping systems (SKS) for each FSS including mooring lines, anchoring systems and ancillary elements;
   - Scour protection for FSS anchoring points;

[1] The ScotWind leasing round was initiated based on the Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2020a), which identified a number of sustainable areas for future commercial-scale offshore wind development, and provided the spatial strategy to support CES's ScotWind leasing round.

[2] The term 'Applicant' and 'Developer' are used within this plan to reflect the pre-consent and post-consent development phases of the Bellrock WFDA.

- Inter-array cables (IACs) comprising static and dynamic sections of IACs linking the individual FOUs to subsea cable hub(s) or to the offshore substations (OfSSs)[3];
- Associated cable protection as required;
- Up to 18 subsea cable hubs; and
- Ancillary infrastructure including buoys.

5. This Outline Lighting and Marking Plan (LMP) sets out the aviation and navigational lighting and marking requirements for the Bellrock Wind Farm Infrastructure and up to six OfSSs located within the Bellrock WFDA[4]. This Outline LMP has been produced to support the consent applications and aims to discharge the expected conditions in the Bellrock WFDA's Section 36 (s.36) Consent[5] and Marine Licence[6] that require the submission of an LMP and its approval by the Scottish Ministers (in consultation with the Northern Lighthouse Board (NLB), Maritime and Coastguard Agency (MCA), Civil Aviation Authority (CAA), and Ministry of Defence (MOD)), prior to the commencement of construction.

6. The final LMP will include the layout for the Bellrock WFDA within **Figure A.1** (**Appendix 1**), and will include the proposed Identification (ID) marking that will be implemented (adhering to relevant MCA guidance, including a clear site identifier followed by sequential lettering and numbering based on row and position in line with Search and Rescue (SAR) requirements).

1.2 Purpose of the Lighting and Marking Plan

7. This Outline LMP will form the basis of the final LMP (the LMP), which will in turn discharge the expected conditions in the Bellrock WFDA's s.36 Consent and Marine Licence that require the submission of an LMP and its approval by the Scottish Ministers prior to the commencement of construction. The objectives of this LMP are as follows:

- To detail how the Bellrock WFDA will be lit and marked in accordance with relevant legislation and guidance; and
- To detail how the lighting and marking scheme will be managed including maintaining the availability of the scheme throughout the construction and O&M phases of the Bellrock WFDA, and emergency procedures in the event of a loss of Aid to Navigation (AtoN).

8. **Table 1.1** of the LMP will present the s.36 Consent and Marine Licence conditions relevant to the LMP, and identifies the relevant sections of the LMP which addresses specific requirements of the consent conditions.

[3] The OfSSs will be included in the Marine Licence application for the Bellrock OfTDA but are considered in this Outline LMP given they are located within the boundary of the WFDA and are therefore relevant to the WFDA LMP.

[4] As above.

[5] Submitted under the Electricity Act 1989.

[6] Submitted under the Marine and Coastal Access Act 2009 (MCAA).

Table 1.1: Section 36 Consent and Marine Licence Conditions of Relevance to the Light and Marking Plan (LMP)

Consent/Licence	Condition	Details	Relevant Section
[To be added post-consent]			

9. The LMP shall state the legislative requirements, current standards of practice and best practice measures that define the standard of construction and O&M practice. All parties, including contractors and their subcontractors, must comply with the relevant provisions of the approved LMP and are obligated to provide documentation outlining how they will guarantee both the implementation and monitoring of the LMP requirements. However, adhering to the LMP does not absolve the relevant bodies from complying with legislation and bylaws relevant to their construction and O&M activities.

1.3 Relevant Implementation Plans

10. Other consent plans that are relevant to the LMP are listed in **Table 1.2**. These documents reflect the commitments made within the Bellrock WFDA Environmental Impact Assessment (EIA) Report and any associated consent/licence conditions or requirements agreed with relevant authorities.

Table 1.2: Other Related Implementation Plans to the Light and Marking Plan

Implementation Plan	Consent/Licence Conditions	Linkage with LMP
Vessel Management and Navigational Safety Plan (VMNSP)	*[To be added post-consent]*	Details the management and coordination of Bellrock WFDA vessels to mitigate the impact on third-party users. An Outline Vessel Management and Navigational Safety Plan (**Volume V**) submitted alongside the Bellrock WFDA EIA Report.
Emergency Response Cooperation Plan	*[To be added post-consent]*	Details relevant information relating to the Bellrock WFDA and appropriate actions in the event of an emergency situation. Submitted to the Scottish Ministers for approval via the VMNSP, which will address all the recommendations of the Maritime and Coastguard Agency (MCA) in Marine Guidance Note (MGN) 654 (MCA, 2021).
Development Specification and Layout Plan	*[To be added post-consent]*	Details information relating to the final layout and the corresponding infrastructure.

1.4 Updates and Amendments to the Light and Marking Plan

11. It is acknowledged that this Outline LMP, once approved, may require updating. Factors that may influence the need for a review and/or update include:

- Significant change to the design of the Bellrock WFDA;
- Significant changes in knowledge of baseline information or environment of relevance to the contents of this plan; and
- Significant changes in legislation or best practice guidance.

2 Guidance and Consultation

2.1 Marine

12. The marine navigation lighting and marking detailed in **Section 3.1** and **Section 4.1** will be discussed during consultation with both NLB and the MCA, and will follow the following guidance documents:

- International Organization for Marine Aids to Navigation (IALA) Recommendation R0139 The Marking of Man-Made Structures (IALA, 2021);
- IALA Guideline G1162 The Marking of Offshore Man-Made Structures (IALA, 2022);
- IALA Recommendation R1001 The IALA Maritime Buoyage System (IALA, 2023);
- IALA Guideline G1185 Enhancing the Safety and Efficiency of Navigation Around Offshore Renewable Energy Installations (IALA, 2024); and
- Marine Guidance Note (MGN) 654 Safety of Navigation: Offshore Renewable Energy Installations – Guidance on UK [United Kingdom] Navigational Practice, Safety and Emergency Response and its annexes (MCA, 2021).

13. Consideration will also be made of:

- Department of Energy & Climate Change (DECC). Standard Marking Schedule for Offshore Installations (DECC, 2011)[7].

2.2 Aviation

14. The aviation lighting and marking which will be detailed in **Section 4.2** will follow the requirements set out in the following guidance documents:

- CAA Civil Aviation Policy (CAP) 393 Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016 (CAA, 2021);
- CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2026);
- CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2025);
- MGN 654 Safety of Navigation: Offshore Renewable Energy Installations – Guidance on UK Navigational Practice, Safety and Emergency Response and its annexes (MCA, 2021); and
- MOD Obstruction Lighting Guidance (MOD, 2020).

[7] DECC became part of Department for Business, Energy & Industrial Strategy in July 2016.

2.3 Consultation

15. In addition to consideration and compliance with the relevant guidance, the preparation of the LMP will also be informed by consultation undertaken with the NLB, MCA and CAA as key stakeholders of relevance to lighting and marking.

16. This Outline LMP has been prepared given that lighting and marking of the Bellrock WFDA is referenced in the MCA, NLB, Royal Yachting Association, and MOD Scoping Opinion responses and has been raised during consultation for the Navigational Risk Assessment (NRA).

3 Construction Phase

3.1 Marine

17. The marine lighting and marking to be implemented during the construction phase will be summarised in **Table 3.1** which also includes a guidance column, listing the relevant guidance/stakeholder for each lighting and marking aspect where appropriate, noting that the guidance provides the full technical specifications required by the relevant stakeholders.

18. **Figure A.2** (**Appendix 1**) will set out the positions of the construction buoyage for the Bellrock WFDA, with the associated coordinates and specifications presented in **Table 3.2**. For clarity, an ID will be provided for any buoys presented in **Figure A.2** and **Table 3.2**.

19. As required, the Applicant will seek statutory sanction from NLB prior to deployment of any AtoN and construction buoyage shall be established at least four weeks prior to commencement of construction and remain in place until the operational marking requirements have been installed, inspected and passed by NLB. See **Section 7.1** for procedures in cases of AtoN failure.

20. All construction buoyage will meet the following standard specifications:

- Radio Detection and Ranging (Radar) reflectors;
- Focal plane 3 metres (m) to 5 m above the waterline;
- Range of 5 nm; and
- Minimum 3 m diameter at the waterline.

21. All construction marine lighting on structures will be controllable remotely via the Supervisory Control and Data Acquisition (SCADA) system and with respect to any working lights (such as down lighting and access platforms) consideration will be given these being extinguished when not in use.

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Table 3.1: Construction Phase Lighting and Marking

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Temporary construction lighting	All FOUs and OfSSs	▪ IALA special mark characteristics (Flashing (Fl) Yellow (Y) 2.5 seconds (s)); ▪ 360° visibility; and ▪ Minimum 2 nm range.	**Figure A.2**	Industry standard
Construction buoyage – numbers and types	N/A	*[Details of construction buoyage required to be added post consent – expected to be combination of cardinal and special marks].*	**Figure A.2**	Standard NLB requirement
Construction buoyage removal	N/A	Construction buoyage removed once the NLB have provided written approval of the operational lighting and marking on the structures.	N/A	IALA R1001

Table 3.2: Construction Buoyage Positions and Specifications

Buoy	ID (See Figure A.2)	Location		Light and Top Mark Specifications
		Latitude (Degrees Decimal Minutes (DDMM.mm))	Longitude (DDMM.mm)	
[To be added post-consent]				

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3.2 Aviation

22. There will be no specific requirements for aviation lighting and marking implemented during the construction phase; however, the transition to operational lighting and marking (see **Section 4.2**) will be discussed with the CAA post-consent.

23. Relevant information relating to the Bellrock WFDA will be promulgated to aviation stakeholders as required under the relevant CAA guidance (see **Section 2.2**) throughout the construction and O&M phases of the Bellrock Project. This approach to aviation measures during the construction phase will be agreed with CAA post-consent.

4 Operation and Maintenance Phase

4.1 Marine

24. The marine operational lighting and making to be implemented for the FOUs and OfSSs will be summarised in **Table 4.1** and **Table 4.2**, respectively, and illustrated in **Figure A.3** (**Appendix 1**). These include a guidance column listing the relevant guidance/stakeholder for each lighting and marking aspect where appropriate, noting that this guidance will provide the full technical specifications required by the relevant stakeholders.

25. As per **Section 2.3**, NLB will be consulted on the marine lighting and marking scheme, including in relation to any requirements in potential scenarios where FOUs become off-station.

Table 4.1: Operation and Maintenance Phase Marine Lighting and Marking – Wind Turbine Generators

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Significant Peripheral Structure (SPS) lighting – where SPSs are those on the corners of the Bellrock WFDA and elsewhere on the periphery as decided by NLB.	Selected periphery structures: *[Structures to be added once final layout agreed post-consent]*	▪ Marine light marking selected periphery WTGs as required under IALA; ▪ Yellow 5 second flash (FL. Y. 5s); ▪ At least 5 nm range; ▪ 360° visibility (multiple lights per structure may be required to achieve this); ▪ All SPS should be synchronised; ▪ Located not less than 6 m above Highest Astronomical Tide (HAT) and below the arc of the rotor blades; ▪ At least IALA category 1 (> 99.8% availability); and ▪ Uninterruptible Power Supply (UPS) of a minimum of 96 hours.	**Figure A.3**	IALA O-139/G1162 and standard requirement
Intermediate Peripheral Structure (IPS) lighting – where IPSs are selected others on the periphery as decided by NLB.	Selected periphery structures: *[Structures to be added once final layout agreed post-consent, noting general NLB preference not to designate IPSs]*	▪ Structures on the periphery of the layout other than SPS which require additional lighting; ▪ Flashing yellow lights distinctly different from the SPS (typically Yellow 2.5 second flash (Fl.Y.2.5s)); ▪ At least a 2 nm range; ▪ 360° visibility (multiple lights per structure may be required to achieve this); ▪ All IPS should be synchronised; ▪ Located not less than 6m above HAT and below the arc of the rotor blades; ▪ IALA Category 2 (>99.0% availability); and ▪ UPS of a minimum of 96 hours.	**Figure A.3**	IALA O-139/G1162 and standard requirement

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Sound signals	Selected periphery structures: *[Structures to be added once final layout agreed post-consent]*	▪ Foghorns must face outward into open sea and overall sound signal coverage must be unimpeded by structures; ▪ IALA Category 3 (at least 97.0% availability) over a rolling three-year period; ▪ Each WTG fitted with a sound signal will also have a visibility meter. Sound signals will turn on when visibility is detected to be less than 2 nm; and ▪ Remote testing required.	**Figure A.3**	IALA O-139/G1162 and standard requirement
Visibility meters	Selected periphery structures: *[Structures to be added once final layout agreed post-consent]*	▪ Change in visibility will trigger all fog signals across the entire Bellrock WFDA; ▪ Signal to activate when visibility is less than 2 nm; and ▪ Visibility meters should be installed as per manufacturers requirements.	**Figure A.3**	IALA O-139/G1162 and standard requirement
Automatic Identification System	Selected periphery structures: *[Structures to be added once final layout agreed post-consent]*	▪ Availability of not less than 97.0% (IALA Category 3); and ▪ Office of Communications Licence is required for the Automatic Identification System transmission.	**Figure A.3**	Regulator requirement
ID marker boards	All WTGs	▪ IDs shown on all structures must be lit via low-level baffled (5-10 candela (cd)/square metre (m^2)) lighting; ▪ Uniformity factor better than 1:4; ▪ Colour temperature should be between 2,500 Kelvin (K) and 3,500K; ▪ 360° visibility (multiple boards will be needed to achieve this); ▪ A font which has good readability should be used for ID characters;	N/A	MGN 654

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
		▪ Black characters on yellow background; and ▪ IDs must be readable by an observer stationed 3 m above sea level at a distance of 150 m.		
WTG paint	All WTGs	▪ Traffic yellow (RAL 1023) from HAT up to between 18 m and 24 m above HAT); and ▪ Light grey (RAL 7035) upwards of between 18 m and 24 m above HAT.	N/A	IALA O-139/G1162 and standard requirement

Table 4.2: Operation and Maintenance Phase Marine Lighting and Marking – Offshore Substations (Presented for Information)

Lighting and Marking Aspect	Specifications	Relevant Guidance or Stakeholder Requirements
ID marker boards	▪ IDs shown on all structures must be lit via low-level baffled (5-10 cd/m^2) lighting; ▪ Uniformity factor better than 1:4; ▪ Colour temperature should be between 2,500 K and 3,500 K; ▪ 360° visibility (multiple boards will be needed to achieve this); ▪ A font which has good readability should be used for ID characters; ▪ Black characters on yellow background; and ▪ IDs must be readable by an observer stationed 3m above sea level at a distance of 150 m.	MGN 654
OfSS paint	▪ Traffic yellow (RAL 1023) from HAT up to at least 15 m above HAT; and ▪ Topside Light Grey (RAL 7035) or other non-reflective grey material excluding topside structures such as work cabins, cranes, ladders, and other working areas.	IALA O-139/G1162 and standard requirement

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4.2 Aviation

26. The aviation operational lighting and marking to be implemented for the FOUs and OfSSs will be summarised in **Table 4.3** and **Table 4.4** respectively, and illustrated in **Figure A.4**. These include a guidance column, which lists the guidance relevant to each aviation lighting and marking aspect where appropriate (guidance is also detailed in **Section 2.2**).

27. The process for the transition between the construction phase and O&M phase aviation lighting and marking measures will be agreed with CAA post-consent.

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Table 4.3: Operation and Maintenance Phase Aviation Lighting and Marking – Wind Turbine Generators

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Aviation warning lighting	All peripheral WTGs	▪ Red 2,000 cd light displayed at night; ▪ Dimmable to 200 cd when visibility is greater than 5 kilometres (km) in all directions at night; ▪ Off during the day; ▪ Synchronised flashing Morse 'W'; ▪ Capable of being switched off at the request of the MCA during SAR operations (alternate red light used for SAR purposes); ▪ 360° visibility; ▪ Compatibility with Night Vision Imaging System (NVIS) of infrared wavelength between 800 nm and 900 nm; and ▪ UPS of 8 hours required to maintain all aviation warning lights.	**Figure A.4**	Air Navigation Order (CAA, 2016), CAP 764 and MGN 654 SAR Annex 5
Aviation warning lighting visibility meters	Selected periphery structures: *[Structures to be added once final layout agreed post-consent]*	▪ Intensity: 2,000 cd when visibility < 5 km in any direction; and ▪ Intensity: 200 cd when visibility ≥ 5 km in all directions.	**Figure A.4**	CAA standard requirement and CAP 764
SAR lights	All WTGs	▪ Red 200 cd light; ▪ Steady when in use at MCA request, switched off otherwise; ▪ 360° visibility; ▪ Compatible with NVIS of infrared wavelength between 800 nm and 900 nm;	**Figure A.4**	MGN 654 SAR Annex 5

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
Green heli-hoist lights	All WTGs	▪ Low intensity green light; ▪ 360° visibility; ▪ Light off when WTG is not safe for heli-hoist operations; ▪ Flashing when WTG is being prepared for heli-hoist operation; ▪ Steady when WTG is ready for heli-hoist operation; ▪ Intensity: +2 to +10°: 365 cd or 115 cd; and ▪ Intensity: >10 to +90°: 122 cd or 38 cd.	N/A	CAP 437
Blade markings	All WTGs	▪ Three red marks (preferably dots) at 10, 20, and 30 m intervals from the WTG hub; ▪ Marks to be placed near the trailing edge of the blade, allowing visibility when blades are feathered and parked at Y or offset Y (one or two blades angled forward into the wind) positions, so the marks lie upwards in view of the helicopter pilot; ▪ At least 600 millimetres (mm) in diameter; and ▪ Direct consultation will be undertaken with the MCA if a variation to this requirement is needed.	N/A	MGN 654 SAR Annex 5
Blade tip marking	All WTGs	▪ From blade tip to a point on the blade corresponding to approximately 2% of the blade length when measured from tip. In line with MGN 654, the final design will be confirmed with the MCA noting lighting protection may mean the tip and part of blade leading edge cannot be painted; and ▪ Direct consultation will be undertaken with the MCA if a variation to this requirement is needed.	N/A	MGN 654 SAR Annex 5

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
ID marking	All WTGs	▪ ID numbers will be marked on the WTG nacelle roofs; and ▪ Not less than 1.5 m in height, with proportional width.	N/A	MGN 654 SAR Annex 5
Hoist area marking	Not covered within LMP, but will meet the standard in the following guidance documents, and in consultation with the appropriate authorities: ▪ CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2025); ▪ CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2026); and ▪ Consultation with Helicopter Certification Agency (MCA and CAA).			

Table 4.4: Operation and Maintenance Phase Aviation Lighting and Marking – Offshore Substations (Presented for Information)

Lighting and Marking Aspect	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
SAR lights	▪ Red 200 cd light; ▪ Steady when in use at MCA request, switched off otherwise; ▪ 360° visibility; and ▪ Compatible with NVIS of infrared wavelength between 800 nm and 900 nm.	**Figure A.4**	MGN 654 SAR Annex 5
Green heli-hoist lights	▪ Low intensity green light; ▪ 360° visibility; ▪ Light off when OfSS is not safe for heli-hoist operations; ▪ Steady when OfSS is ready for heli-hoist operation; ▪ Multifunctional SAR lights to be used as green heli-hoist lights; ▪ Intensity: +2 to +10° = 365 cd or 115 cd; and ▪ Intensity: >10 to +90° = 122 cd or 38 cd.	N/A	CAP 437

Lighting and Marking Aspect	Indicative Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirements
ID marking	▪ ID numbers will be marked on the OfSS topside; and ▪ Not less than 1.5 m in height with proportional width.	N/A	MGN 654 SAR Annex 5 and CAP 764
Hoist area marking[8]	Not covered within LMP, but should meet the standard set out in the following guidance documents, and in consultation with the appropriate authorities: ▪ CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2025); ▪ CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2026); and ▪ Consultation with Helicopter Certification Agency (MCA and CAA).		

[8] As per CAP 437, a helicopter landing area should always be provided in preference to a hoist area on substations, unless they are for “occasional use” only.

5 Cumulative Marking

28. Any need for the lighting and marking scheme to consider a cumulative scenario with the presence of other nearby developments will be discussed with NLB, MCA and CAA as part of consultation on the LMP and may be influenced by the respective construction timelines. Of particularly relevance may be the Ossian Offshore Wind Farm located approximately 4.7 nm west of the Bellrock WFDA.

6 Maintenance of Aids to Navigation

6.1 Monitoring of Aids to Navigation on Structures

29. Monitoring of AtoNs on structures for both the functionality and availability of AtoNs will be undertaken throughout the construction and O&M phases. Downtime will be monitored remotely during the O&M phase (via the SCADA system) and visually during the construction phase (via a guard vessel or similar). From this, the overall availability of AtoN will be calculated. General maintenance will be undertaken to ensure functionality of the AtoN is maintained and optimised.

6.2 Monitoring of Aids to Navigation on Buoyage

30. During construction (and O&M if applicable) of the Wind Farm Infrastructure, visual monitoring (or where feasible, remote monitoring) will alert the Applicant to failure of a buoy. Upon discovery of an extinguished AtoN on a buoy, the emergency procedures outlined in **Section 7.1** will be initiated.

6.3 Testing

31. Following the commissioning of all marine AtoNs, they will be tested at least once per annum. Sound signals will be equipped with functionality whereby they can be manually overridden in order to undertake annual testing.

6.4 Availability

32. To assist in meeting the required IALA availability standards of any given marine AtoN, remote monitoring will be used to ensure that any faults can be rectified as soon as possible.

33. The data collected through remote monitoring of AtoN will be used to calculate the overall availability of AtoN to ensure that IALA availability standards are being adhered to.

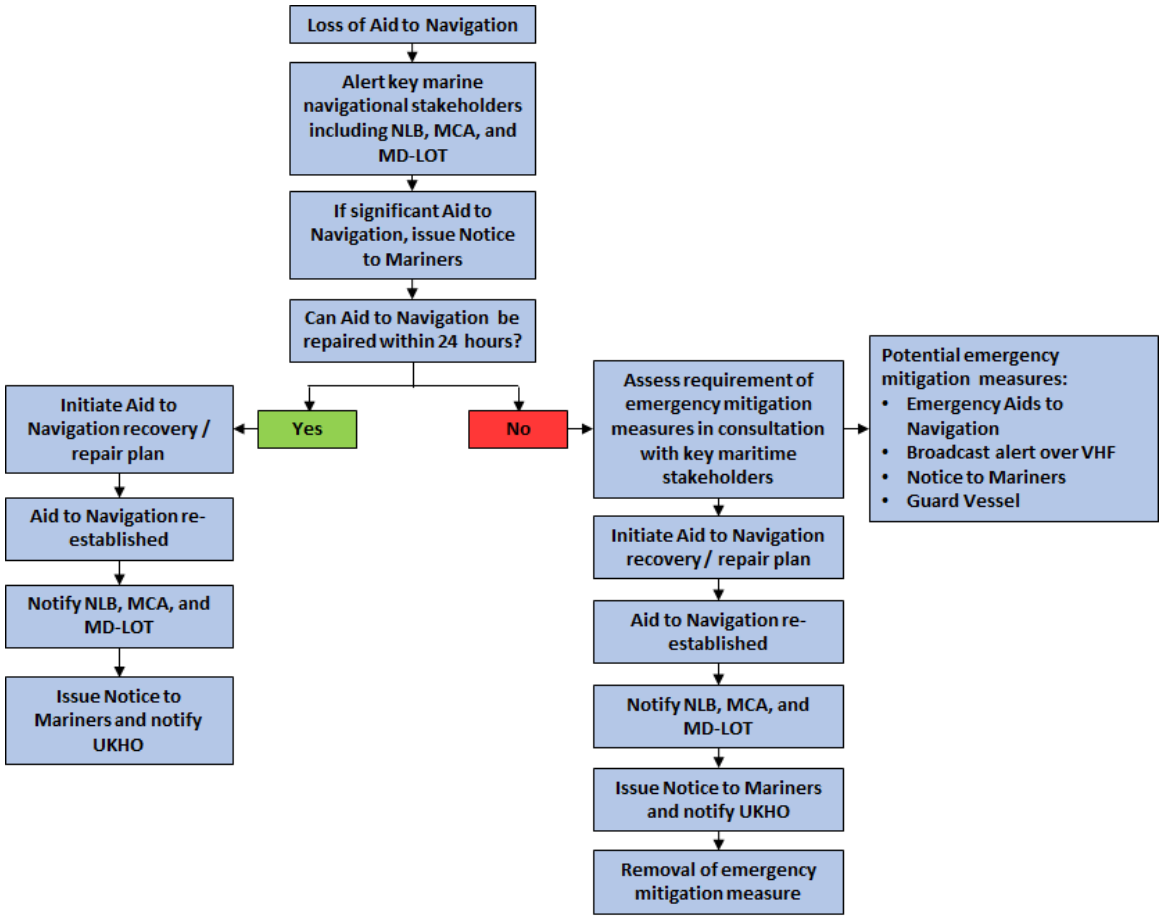
34. Availabilities will be reported to NLB via their AtoN Reporting Online Portal (https://nlbhq.nlb.org.uk/latonsonline).

7 Emergency Procedures

7.1 Loss of Aid to Navigation

35. Upon discovery of the loss of an AtoN which include marine navigational lights, fog signals, or buoys (or part thereof), the external protocol illustrated in **Plate 7.1** will be initiated.

Plate 7.1: Protocol for the Loss of an Aid to Navigation



36. A requirement of AtoN management within UK waters is to report navigational failures to NLB. This is done through the AtoN Reporting Online Portal (see **Section 6.4**). This is an online database administered by NLB in order to assist wind farm operators (as the local authority for the wind farm AtoN) to fulfil their responsibility to maintain records of AtoN availability and to provide summaries of these to NLB. This should be undertaken by the Applicant's marine coordination centre in the event of any failures or loss of availability. Additionally, the United Kingdom Hydrographic Office (UKHO) should be notified of remedial works through the Notice to Mariners process.

37. In the rare event of a significant loss of one or more AtoN, a guard vessel may be required to maintain navigational safety. **Section 7.2** provides an indicative list of trigger points that would

require the Applicant to liaise with NLB and potentially implement additional emergency mitigations which may also require informing the MCA.

7.2 Guard Vessel Trigger Points

38. It is the responsibility of the operator to maintain the AtoN and provide any backup solutions in case of an AtoN failure. This will include repair of a broken AtoN, replacement of lost AtoN, and provision of a guard vessel. **Table 7.1** will summarise the emergency mitigation measure provision agreement in place, including the party that will be responsible for the repair or replacement of AtoN (including those on structures and navigational buoys).

Table 7.1: Summary of Emergency Mitigation Measures

Emergency Mitigation Measure	Organisation Responsible for Provision	Relevant Contact Details			Service Provision
		Address	Phone	Fax	
[Details to be added post-consent]					

39. The following summarises the triggers for consultation with NLB should a key navigational aid fail. These may require further mitigation:

- Loss of key navigational light (i.e. primary SPS) for a period of greater than 72 hours;
- Failure of sound signal for greater than 120 hours;
- Loss of station of cardinal navigational mark, including significant delay (greater than 72 hours) to it being restored;
- AtoN repeatedly failing to meet IALA availability standards;
- Deployment of an emergency buoy due to an unmarked hazard within the Bellrock WFDA (the guard vessel would be required to monitor vessel awareness of the buoy and may then be demobilised); and
- Throughout significant maintenance works where an increase in navigational risk is posed (i.e. should a key SPS light have to be removed due to WTG maintenance).

40. It should be noted that the above list is not considered to be exhaustive.

7.3 Aviation Lighting

41. The Air Navigation Order 2016 states that "*in the event of the failure of any light which is required by this article to be displayed by night the person in charge must repair or replace the light as soon as reasonably practicable*."

42. It is accepted that there may be occasions when meteorological or sea conditions prohibit the safe transport of personnel for repair or maintenance tasks. Furthermore, there may be fault conditions that are wider ranging and would take longer to diagnose or repair. In such cases, international standards and recommended practices require the issue of a Notice to Airmen (NOTAM).

43. The CAA's Airspace Regulation department considers the operator of an offshore wind farm as an appropriate person for the request of a NOTAM relating to the lighting of their wind farm.

44. Should the anticipated outage be greater than 36 hours, the Applicant shall request a NOTAM to be issued by informing the CAA through Airspace Co-ordination Obstacle Management Service via the CAA customer portal (www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/obstacle-notification).

45. Upon completion of the remedial works, the Aeronautical Information Service will be notified as soon as possible to enable a cancellation to be issued. If an outage is expected to last longer than 14 days, then the CAA will also be notified directly to discuss any issues that may arise and longer-term strategies.

8 References

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Appendix A: Figures

[Figures to be added post-consent]

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