Muir Mhòr Offshore Wind Farm

Environmental Impact Assessment Report

Volume 4, Appendix 6: Outline Aids to Navigation Management Plan

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Contents

1. Introduction 7
1.1. Project Background 7
2. Marine Aids to Navigation – Construction Phase 7
2.2. Aids to Navigation 7
2.3. Temporary Lights 8
2.4. Removal of Temporary Lights 8
3. Marine Aids to Navigation – Operation and Maintenance (O&M) Phase 8
3.1. Lighting and Sound Signals 8
3.2. Buoyage 9
4. Aviation Lighting 9
4.1. Construction Phase 9
4.2. O&M Phase – Normal Operations 9
Offshore Electrical Platforms 10
4.3. O&M Phase – Search and Rescue 10
5. Cumulative Marking of The Proposed Development 11
6. Maintenance of Aids to Navigation 11
6.2. Monitoring of Aids to Navigation on Structures 11
6.3. Monitoring of Aids to Navigation on Buoyage 12
6.4. Testing 12
6.5. Availability 12
7. Emergency Procedures 12
7.1. Loss of Aids to Navigation 12
Marine Aids to Navigation 12
7.2. Guard Vessel Trigger Points 13
7.3. Aviation Lighting 14
8. Decommissioning 14
9. References 15

Figures

Figure 2-1 Construction Buoyage 7
Figure 3-1 O&M Phase Navigational Lighting and Marking 8
Figure 4-1 Aviation Operational Lighting 10
Figure 7-1 Protocol for the Loss of an Aid to Navigation 13

Tables

Table 1-1 Consent conditions to be discharged by AtoN Management Plan _____ 7
Table 2-1 Construction Phase Buoyage Positions and Specifications _____ 8
Table 3-1 O&M Phase WTG Marine Lighting and Marking Summary _____ 8
Table 4-1 Wind Farm Aviation Lighting and Marking (Normal Operations) _____ 10
Table 4-2 WTG Operational SAR Aviation Lighting _____ 11
Table 4-3 OEP Operational SAR Aviation Lighting _____ 11
Table 7-1 Summary of Emergency Mitigation Measures _____ 14

Glossary

Term	Definition
Array Area	The area in which the generation infrastructure (including Wind Turbine Generators and associated foundations and inter-array cables), Offshore Electrical Platform(s), and an interconnector cable will be located.
Automatic Identification System (AIS)	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 (UK)/European Union (EU) fishing vessels over 15 metre (m) length are required to carry AIS.
Developer	Muir Mhòr Offshore Wind Farm Limited
Floating foundations	The floating structures on which the Wind Turbine Generators are installed.
Inter-array cables	Cables which link the Wind Turbines Generators to each other and the Offshore Electrical Platform(s).
Interconnector cable	Cable which links the Offshore Electrical Platform(s) to one another, allowing for power to be transferred between the platforms.
Landfall	The area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) where the offshore export cables are brought onshore.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Offshore Electrical Platform (OEP)	Offshore platform consisting of High Voltage Alternating Current (HVAC) equipment, details depending on the final electrical set up of the Project.
Offshore export cables	The subsea electricity cable circuits running from the Offshore Electrical Platform(s) to the landfall which will transmit the electricity generated by the offshore wind farm to the onshore export cables for transmission onwards to the onshore substation and the national electrical transmission system along with auxiliary cables such as fibre optic cables.
Project	Muir Mhòr Offshore Wind Farm – comprises the wind farm and all associated offshore and onshore components.
Proposed Development	The offshore Muir Mhòr Offshore Wind Farm project elements to which this Aids to Navigation Management Plan relates.
Wind Turbine Generator (WTG)	The wind turbines that generate electricity consisting of tubular towers and blades attached to a nacelle housing mechanical and electrical generating equipment.

Acronyms

Term	Definition
ACOMS	Airspace Coordination and Obstacle Management Service
ANO	Air Navigation Order
AtoN	Aid to Navigation
CAA	Civil Aviation Authority
DDM	Degrees Decimal Minutes
EIAR	Environmental Impact Assessment Report
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IPS	Intermediate Peripheral Structure
LMP	Lighting and Marking Plan
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
NLB	Northern Lighthouse Board
NOTAM	Notice to Airmen
NtM	Notice to Mariners
O&M	Operation and Maintenance
OEP	Offshore Electrical Platform
SAR	Search and Rescue
SCADA	Supervisory Control and Data Acquisition
SPS	Significant Peripheral Structures
UK	United Kingdom
VHF	Very High Frequency
WTG	Wind Turbine Generator

1. INTRODUCTION

1.1. PROJECT BACKGROUND

1.1.1. Muir Mhòr Offshore Wind Farm Limited (hereafter referred to as 'the Developer') is proposing to develop the Muir Mhòr Offshore Wind Farm (hereafter 'the Project'). The Project is made up of both offshore and onshore components. The subject of this offshore Environmental Impact Assessment Report (EIAR) is the offshore infrastructure of the Project seaward of Mean High-Water Springs (MHWS) which is hereafter referred to as 'the Proposed Development'.

1.1.2. The Muir Mhòr array area covers an area of approximately 200 km^2 and is located approximately 63 km east of Peterhead on the east coast of Scotland. The offshore infrastructure of the Proposed Development includes Wind Turbine Generators (WTGs) and associated floating foundations, the Offshore Electrical Platform(s) (OEP(s)) and associated foundations, the inter-array cables, interconnector cable, offshore export cables and landfall.

1.1.3. The Aids to Navigation (AtoN) Management Plan intends to discharge the offshore consent conditions relevant to the AtoN Management Plan. These will be detailed in Table 1-1 post consent, which includes reference to how and where the condition clauses have been addressed within the AtoN Management Plan.

Table 1-1 Consent conditions to be discharged by AtoN Management Plan

Condition reference	Condition text	Where addressed within AtoN Management Plan
[Consent condition details to be added post consent]		

2. MARINE AIDS TO NAVIGATION – CONSTRUCTION PHASE

2.1.1. The Navigation Directorate at the Northern Lighthouse Board (NLB) should be contacted with any issues or concerns with aids to navigation (AtoNs), including contact to sanction or remove AtoN – [appropriate email address to be added post consent].

2.2. AIDS TO NAVIGATION

2.2.1. The following Sections will summarise the content of the Lighting and Marking Plan (LMP) (outline version is submitted as Volume 3, Appendix 29 (Outline Lighting and Marking Plan).

2.2.2. The construction buoys as illustrated in Figure 2-1 and detailed in Table 2-1 will be established eight weeks prior to construction commencing. Section 2.2 as well as Table 2-1 details the lighting for partially and fully constructed structures during the construction phase.

2.2.3. The construction buoyage will meet the following standard specifications:

- [Specifications to be added post consent]

[Figure showing construction buoyage locations relative to the final array layout to be added post consent]

Figure 2-1 Construction Buoyage

Table 2-1 Construction Phase Buoyage Positions and Specifications

Buoy	ID	Location		Light and Top Mark Specifications
		Latitude (Degrees Decimal Minutes (DDMM.mm))	Longitude (DDDMM.mm)	
[Details of each buoy to be added post consent]				

2.3. TEMPORARY LIGHTS

2.3.1. All partially constructed WTGs and OEP(s) will display lighting with the following specifications:

- [Specifications to be added post consent]

2.4. REMOVAL OF TEMPORARY LIGHTS

2.4.1. The process for turning off and removal of temporary lights will be agreed with the NLB and detailed here post consent. This will include ensuring that NLB are notified before temporary lights are removed.

3. MARINE AIDS TO NAVIGATION – OPERATION AND MAINTENANCE (O&M) PHASE

3.1. LIGHTING AND SOUND SIGNALS

3.1.1. The marine lighting and marking to be implemented for WTGs during the operation and maintenance (O&M) phase is summarised in Table 3-1 and presented in Figure 3-1 and will be as per the LMP.

[Figure showing marine operational lighting and marking locations for the final array layout to be added post consent]

Figure 3-1 O&M Phase Navigational Lighting and Marking

Table 3-1 O&M Phase WTG Marine Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance
Significant Peripheral Structures (SPS) lighting	[Relevant structures to be added post consent once final array layout agreed]	[Specifications to be added post consent – details of any IPSs agreed with NLB will also be included]	International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) O-139/G1162 and standard requirement

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance
Intermediate Peripheral Structures (IPS)			IALA O-139/G1162 and standard requirement
Sound signals			IALA O-139/G1162 and standard requirement
Visibility meters			IALA O-139/G1162 and standard requirement
Automatic Identification System (AIS)			Regulator requirement
ID marker boards			Marine Guidance Note (MGN) 654
WTG paint			IALA O-139/G1162 and standard requirement
OEP paint			IALA O-139/G1162 and standard requirement

3.2. BUOYAGE

3.2.1. Should any buoyage be required to mark the Array Area during the O&M phase, this will be discussed here post consent. Buoyage requirements will be agreed in consultation NLB.

4. AVIATION LIGHTING

4.1. CONSTRUCTION PHASE

4.1.1. It is not anticipated that there will be any specific aviation lighting and marking implemented during the construction phase; however relevant information of the development will be promulgated to aviation stakeholders as required under the relevant Civil Aviation Authority (CAA) guidance.

4.2. O&M PHASE – NORMAL OPERATIONS

4.2.1. Aviation lighting to be implemented during normal operations is summarised in Table 4-1 and presented in Figure 4-1. Aviation lighting will be remotely controlled by the Supervisory Control and Data Acquisition (SCADA) system and will be visible at night and turned off during the day[1].

[1] Definition of night/day as per CAP 393 (CAA, 2021) Schedule 1 (Interpretation).

[Figure showing aviation operational lighting and marking locations for the final array layout to be added post consent]

Figure 4-1 Aviation Operational Lighting

Table 4-1 Wind Farm Aviation Lighting and Marking (Normal Operations)

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance
Aviation warning lighting (dual purpose for warning lights and Search and Rescue (SAR) lights)	[Relevant structures to be added post consent once final array layout agreed]	[Specifications to be added post consent]	Air Navigation Order 225a CAP 764 MGN 654
Aviation warning lighting visibility meters			CAA standard requirement CAP 764
Blade markings			MGN 654
Blade tip markings			MGN 654
ID markings			CAP 764 MGN 654
Hoist area markings	These are not covered within this plan but should meet the standards set out in the following guidance documents and in consultation with the appropriate authorities: • CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2016)[2]; • CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2023); and • Consultation with Helicopter Certification Agency (Maritime and Coastguard Agency (MCA) and CAA).		

OFFSHORE ELECTRICAL PLATFORMS

4.2.2. As the OEP(s) are located internally within the Array Area it is anticipated that they will not require any operational aviation warning lights. This will be confirmed in consultation with CAA.

4.3. O&M PHASE – SEARCH AND RESCUE

4.3.1. Each of the individual aviation SAR lights will be controlled and monitored by the SCADA system. The SAR lights will be turned off by default, during day and night. The SAR lights will be turned on only if required for SAR operations or at the MCA's request. The SAR lights will be dual-purpose for use as green heli-hoist lights to indicate when it is safe to conduct heli-hoist operations. SAR marine lighting and marking to be implemented during the operations phase is summarised in Table 4-2 (WTG) and Table 4-3 (OEP(s)).

[2] Noting an updated version of CAP 764 is expected to be published imminently following a consultation period earlier in 2024.

Table 4-2 WTG Operational SAR Aviation Lighting

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance
Aviation warning light (dual purpose with normal operations)	[Relevant structures to be added post consent once final array layout agreed]	[Specifications to be added post consent]	Air Navigation Order 225a
SAR lights			CAP 764 (CAA, 2016)
Green heli-hoist light			MGN 654 SAR Annex 5 (MCA, 2021)

Table 4-3 OEP Operational SAR Aviation Lighting

Lighting and Marking Aspect	Relevant Structures	Specifications	Relevant Guidance
SAR lights	All OEP(s)	[Specifications to be added post consent]	MGN 654 SAR Annex 5 (MCA, 2021)
Hoist area markings	These are not covered within this plan but should meet the standards set out in the following guidance documents and in consultation with the appropriate authorities: • CAA CAP 764 – Policy and Guidelines on Wind Turbines (CAA, 2016); • CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2023); and • Consultation with Helicopter Certification Agency (MCA and CAA).		

5. CUMULATIVE MARKING OF THE PROPOSED DEVELOPMENT

5.1.1. Cumulative overlap will be discussed with stakeholders (MCA, CAA, and NLB) to determine any changes that may be required depending on the construction schedules.

6. MAINTENANCE OF AIDS TO NAVIGATION

6.1.1. The following subsections summarise the maintenance associated with the AtoN that will be installed at the Proposed Development.

6.2. MONITORING OF AIDS TO NAVIGATION ON STRUCTURES

6.2.1. Monitoring of AtoN on structures for both the functionality and availability of AtoN shall be undertaken throughout the construction and O&M phases. Downtime shall be monitored remotely during the O&M phase (via the SCADA system) and visually[3] during the construction phase. From this the overall availability shall be calculated (see Section 6.5). Monitoring shall include general maintenance to ensure marine growth etc. does not impact functionality.

[3] Carried out weekly likely by a Guard Vessel or Crew Transfer vessel.

6.3. MONITORING OF AIDS TO NAVIGATION ON BUOYAGE

6.3.1. During construction, remote monitoring shall alert the operative to failure of a marine AtoN. Upon discovery of an extinguished AtoN, the emergency procedures outlined in Section 7 shall be initiated.

6.4. TESTING

6.4.1. Following the commissioning of all marine AtoN, all marine AtoN shall be tested at least once per annum. Sound signals shall be equipped with functionality whereby they can be manually overridden in order to carry out annual testing.

6.5. AVAILABILITY

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

6.5.2. For navigational buoyage visual confirmation shall be undertaken by on-site vessels (where possible).

6.5.3. The data collected through remote monitoring of AtoN shall be used to calculate the overall availability of AtoN to ensure that IALA availability standards are being adhered to. Availabilities will be reported to NLB via their AtoN Reporting Online Portal[4].

7. EMERGENCY PROCEDURES

7.1. LOSS OF AIDS TO NAVIGATION

MARINE AIDS TO NAVIGATION

7.1.1. Upon discovery of the loss of an AtoN which included marine navigation lights, fog signals or buoys (or part thereof), the protocol illustrated in Figure 7-1 shall be initiated.

[4] https://nlbhq.nlb.org.uk/latonsonline

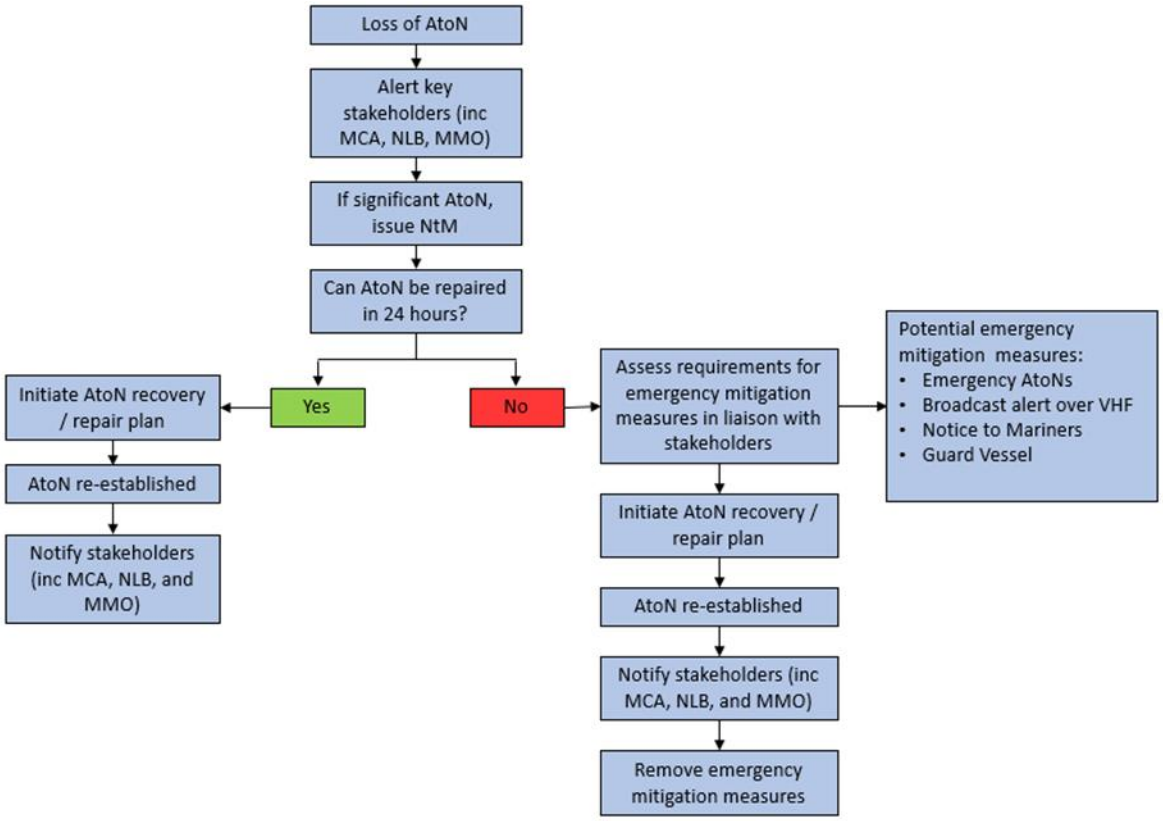

Figure 7-1 Protocol for the Loss of an Aid to Navigation

7.1.2. A requirement of AtoN management within United Kingdom (UK) waters is to report navigational failures to NLB. This is done through the NLB online reporting system (see Section 6.5). It is an online database administrated 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 marine coordination centre for the Proposed Development in the event of any failures or loss of availability.

7.1.3. It is noted, that 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 the trigger points that would require the Developer to liaise with NLB and potentially implement additional emergency mitigations which may also require informing the MCA.

7.2. GUARD VESSEL TRIGGER POINTS

7.2.1. It is the responsibility of the operator to maintain the AtoN and provide any back-up solutions in case of AtoN failure. This will include repair of a broken AtoN, replacement of lost AtoN, and provision of a guard vessel. Table 7-1 summarises the Emergency Mitigation Measures in place, which identifies the party that will be responsible for the repair or replacement of AtoN (including those on structures and navigational buoys).

7.2.2. The following list summarises trigger points which have been deemed to require consultation with NLB in which further mitigation may be required should a key navigational aid fail. These trigger points are in line with those identified for the Proposed Development in consultation with the NLB. It should be noted that the following list of trigger points is not intended to be exhaustive but is to provide broad expectations for the requirement of additional protection measures to be taken.

Table 7-1 Summary of Emergency Mitigation Measures

Emergency Mitigation Measures	Organisation Responsible for Providing the Required Mitigation Measure	Relevant Contact Details			Service Provision
		Address	Phone	Fax	
[Mitigations to be added post consent]					

7.3. AVIATION LIGHTING

7.3.1. The Air Navigation Order (ANO) states "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."

7.3.2. It is accepted there may be occasions when meteorological or sea conditions prohibit the safe transport of personnel for repair 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).

7.3.3. 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. Should the anticipated outage be greater than 36 hours, the Developer shall request a NOTAM to be issued by informing the CAA through Airspace Coordination and Obstacle Management Service (ACOMS) via the CAA customer portal[5].

7.3.4. Upon completion of the remedial works, the Aeronautical Information Service shall be notified as soon as possible to enable a cancellation to be issued.

7.3.5. If an outage is expected to last longer than 14 days, then the CAA shall also be notified directly to discuss any issues that may arise and longer-term strategies.

7.3.6. In order to expedite the dissemination of information during active aviation operations, the Developer may also establish a direct communication method with aviation operators in the area. The information provided shall be the same as the information provided in the NOTAM and where possible include a NOTAM reference.

7.3.7. The CAA requests that other obstacles are reported to the CAA even if they are below 60 metres (m), including temporary structures (e.g., cranes) or large construction vessels and meteorological masts, as this contributes to ongoing air safety initiatives for the protection of property, infrastructure and aviators. These should also be notified to the CAA using the Airspace Coordination and Obstacle Management Service (ACOMS) service that will enable the necessary NOTAM to be generated.

8. DECOMMISSIONING

8.1.1. The lighting and marking requirements throughout the decommissioning phase have not yet been finalised, i.e., what navigational lights shall be employed. However, the required lighting and marking of the Proposed Development during, and following decommissioning, shall be

[5] www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/obstacle-notification

agreed in consultation with NLB and the CAA at least six months prior to the decommissioning works including any requirements for maintaining and monitoring.

9. REFERENCES

CAA (2016). CAP 764 Policy and Guidelines on Wind Turbines. London: CAA.

CAA (2021). CAP 393 Regulations Made Under Powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016. London: CAA.

CAA (2023). CAP 437 Standards for Offshore Helicopter Landing Areas. London: CAA.

IALA (2021). IALA Recommendations O-139 on the Marking of Man-Made Offshore Structures. Edition 3.0. Saint Germain en laye, France: IALA.

IALA (2022). IALA Guideline G1162 on the marking of Offshore Man-Made Structures. Edition 1.1. Saint Germain en Laye, France: IALA.

MCA (2021). Marine Guidance Note (MGN) 654 Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response. Southampton: MCA.