MORAY OFFSHORE WINDFARM (WEST) LIMITED

Lighting and Marking Plan

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05	11-10-23	Final	Fourth Submission to MD-LOT (amendment of Table 3.1 regarding OSP temporary lighting)	MD-LOT

Document Approval (Rev 03)				
Prepared by:	ECoW Review by:	Legal Review:	Approved by:	Approved by:
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Plan Overview

Purpose and Objectives of the Lighting and Marking Plan

This Lighting and Marking Plan (LMP) has been prepared to address the specific requirements of the relevant conditions attached to the Section 36 (S36) consent and Marine Licences (collectively referred to as 'offshore consent conditions') issued to Moray Offshore Windfarm (West) Limited (Moray West).

The overall objective of the LMP is to describe the lighting and marking of the Moray West Offshore Windfarm and Offshore Transmission Infrastructure (OfTI) (collectively referred to as 'the Development'). The Lighting and Marking plan relates to safe navigation of vessels and aircraft, during the construction and operational phases of the Development.

The LMP has been drafted by Anatec (Moray West's consultants) to ensure that those involved in the construction and operation of the Development, including Moray West personnel and all of the associated Contractors, are aware of and understand the lighting and marking requirements that apply at each phase of the Development. These measures are set out to inform consultation with relevant stakeholders (as described in Table 1.1), approval by the Scottish Minsters, and are based on commitments made by Moray West and the requirements of the Offshore Consent conditions.

All Moray West personnel and Contractors involved in the Development must comply, as a minimum, with this LMP. The LMP must be implemented in full, at all times, by Moray West personnel and their contractors.

Structure of the Plan

- Section 1 Introduction - provides an overview of the Development and its associated consent requirements;
- Section 2 Guidance and Consultation - describes the guidance relevant to marine and aviation lighting and marking, and consultation undertaken to date with statutory stakeholders;
- Section 3 Construction Phase - describes the proposed construction phase lighting and marking;
- Section 4 Operational Phase - describes the proposed operational phase lighting and marking; and
- Section 5 Cumulative - describes the consideration given to the cumulative approach to lighting and marking in recognition of the adjacent Moray East Offshore Windfarm.

Plan Audience

The LMP is intended to be referred to by personnel involved in the construction and operation of the Development, including Moray West personnel and Contractors. The LMP has also been prepared to inform agreement on the overarching approach to the lighting and marking of the Development with the Scottish Minsters, and has been prepared in consultation with the MCA, NLB, and CAA. Following submission to MD-LOT, consultation will be carried out by Marine Directorate Licensing Operations Team (MD-LOT) with stakeholders as described in the consents conditions listed in Table 1.1.

Compliance with the LMP will be monitored by the Moray West Development Team, Moray West's ECoW and MD-LOT.

Plan Locations

The latest version of this LMP can be obtained from Moray West's document management system, Viewpoint For Projects, and from the Marine Directorate website[1]. Copies of this Lighting and Marking Plan are also to be held in the following locations:

- Moray West's main project office in Edinburgh; and
- with the Moray West Environmental Clerk of Works (EcoW(s)).

[1] https://marine.gov.scot/ml/moray-west-offshore-windfarm

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Abbreviations and Acronyms

Acronym / Abbreviation	Description
°	Degree
AIS	Automatic Identification System
BEIS	Department for Business, Energy and Industrial Strategy
CAA	Civil Aviation Authority
CAP	Civil Aviation Policy
cd	Candela
CMS	Construction Method Statement
DDMMSS	Degrees Minutes Seconds
Fl	Flashing
HAT	Highest Astronomical Tide
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ID	Identification
K	Kelvin
LMP	Lighting and Marking Plan
m	Metre
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
mm	Millimetre
MOD	Ministry of Defence
MD-LOT	Marine Directorate Licensing Operations Team
NLB	Northern Lighthouse Board
nm	Nautical Mile
NSP	Navigational Safety Plan
OfTI	Offshore Transmission Infrastructure
OMP	Operation and Maintenance Programme
OREI	Offshore Renewable Energy Installation
OSP	Offshore Substation Platform
Q	Quick
Radar	Radio Detection and Ranging
s	Second
S36	Section 36
SPS	Significant Peripheral Structure
UPS	Uninterruptible Power Supply
VMP	Vessel Management Plan
WTG	Wind Turbine Generator
Y	Yellow

1 Introduction

1.1 Background

The Moray West Offshore Wind Farm and associated Offshore Transmission Infrastructure (OfTI) (referred to as 'the Development') is being developed by Moray Offshore Windfarm (West) Limited (known as 'Moray West'; see Appendix A for defined terms). Consent for the Development was granted on 14 June 2019 under Section 36 (S36) of the Electricity Act 1989 (as amended), Part 4 of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 from Scottish Ministers. One S36 consent was granted by Scottish Ministers for the wind farm (012/OW/MORLW – 8) and two Marine Licenses were granted by Scottish Ministers, one for the wind farm (MS-00009774) and another for the offshore transmission infrastructure (MS-00009813).

Variation of the S36 consent and Wind Farm Marine Licence (licence number: MS-00009774) were granted by the Scottish Ministers on 7 March 2022, and further variations of the Wind Farm Marine Licence (licence number: MS-00009774) and OfTI Marine Licence (licence number: MS-00009813) were granted on 11 April 2022. The revised S36 consent and associated Marine Licences are referred to collectively as 'offshore consents'.

Further details of Moray West and the Development can be found in Appendix A.

1.2 Objectives of the Plan

The Lighting and Marking Plan (LMP) intends to discharge the offshore consent conditions relevant to the LMP, specifically condition 20 of the S36 consent and associated conditions in the Marine Licences which requires the submission of an LMP detailing how the Development will be lit and marked. The relevant offshore consent conditions are detailed in Table 1.1, which includes reference to how and where the condition clauses have been addressed within the LMP.

Table 1.1 Consent conditions to be discharged by this LMP		
Condition	**Requirement**	**Where Addressed**
S36 consent Condition 20 Wind Farm Marine Licence MS-00009774 - Condition 3.2.2.17 OfTI Marine Licence MS-00009813 - Condition 3.2.2.16	The Company must, no later than six months prior to the Commencement of the Development, submit an LMP in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with SNH[2], Maritime and Coastguard Agency (MCA), Northern Lighthouse Board (NLB), Civil Aviation Authority (CAA), Ministry of Defence (MOD), RYA, Aberdeenshire Council, the Highland Council, Moray Council and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. Commencement of the Development cannot take place until such approval is granted.	This LMP will be submitted to the Scottish Ministers for approval. It is noted that Moray West consulted with NLB, MCA, and CAA on the LMP and the lighting and marking scheme therein prior to submission of the LMP (see Section 2.3).
	The LMP must provide that the Development be lit and marked in accordance with the current CAA and MOD aviation lighting policy and guidance that is in place as at the date of the Scottish Ministers approval of the LMP, or any such other documents that may supersede this guidance prior to the approval of the LMP.	The relevant MOD and CAA guidance has been applied as per Section 2.2.
	The LMP must also detail the navigational lighting requirements detailed in the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 or any other documents that may supersede this guidance prior to approval of the LMP.	The marine lighting and marking scheme complies with the latest relevant IALA guidance (R139 and G1162) as per Section 2.

[2] Scottish Natural Heritage (SNH) was renamed as NatureScot in August 2020

1.3 Linkages with other Consent Plans

Table 1.2 lists the Consent Plans with linkages to this LMP.

Table 1.2 LMP linkage with other Consent Plans

Other Consent Plans and Documents	Linkage with LMP
Construction Method Statement (CMS)	Specifies the Development's construction methods, setting out good practice construction measures and how agreed mitigation measures from the Environmental Impact Assessment (EIA) report, associated documents, consents and those stated within this LMP are implemented during construction. It is required to be consistent as is practicable with the LMP under the S36 consent and Marine Licenses.
Development Specification and Layout Plan (DSLP)	Sets out the final design and layout parameters associated with Development, including layout of the wind farm, WTG and OSP dimensions, WTG generation output, finishes for WTGs and OSPs, and length and proposed arrangements on the seabed of all cables. The layout and WTG and OSP specifications detailed in the DSLP are consistent to that used in this LMP.
Wind Farm and OfTI Operation and Maintenance Programmes (OMPs)	Sets out the procedures and good working practices for the operation and maintenance (O&M) phase of the Development, considering sensitive environmental periods. It is required to be consistent as is practicable with the LMP under the S36 consent and Marine Licenses.
Vessel Management Plan and Navigational Safety Plan (VMNSP)	Provides the management and coordination of vessels to mitigate the impact of vessels. It is required to be consistent as is practicable with the LMP under the S36 consent and Marine Licenses. Also sets out the navigational safety measures that will be in place. The S36 consent and Marine Licenses require that this includes details of temporary lighting and marking and buoyage.

1.4 Document Structure and Content

The structure of this LMP is provided in Table 1.3.

Table 1.3 LMP document structure

Section	Title	Summary of Content
1	Introduction	An overview of the Development and its associated consent requirements.
2	Guidance and Consultation	Guidance consulted relevant to marine and aviation lighting.
3	Construction Phase	Lighting and marking implemented during the construction phase.
4	Operational Phase	Lighting and marking implemented during the operational phase.
5	Cumulative	Plans for discussing lighting and marking action relating to cumulative projects.
6	References	
Appendix A	Defined Terms	Glossary of terms used in this LMP.
Appendix B	Project Background Information	Detailed information of the Development. Including the construction programme, key stakeholders and legal context associated with the Development.

2 Guidance and Consultation

2.1 Marine

The marine navigation lighting and marking detailed in Section 3 and 4.1 have been discussed during consultation with NLB and MCA, and abides by the requirements in the following guidance documents:

- International Association of Marine Aids to Navigation and Lighthouse Authorities R139 Recommendations on the Marking of Man-made Offshore Structures (IALA, 2021 (a)) and G1162 Guidance on the Marking of Man-made Offshore Structures (IALA, 2021 (b)).
- IALA R1001 – The IALA Maritime Buoyage System. Edition One. (IALA, 2017).
- MCA Marine Guidance Note (MGN) 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021).

And with consideration of:

- Department for Business, Energy and Industrial Strategy (BEIS). Standard Marking Schedule for Offshore Installations (BEIS, 2011).

2.2 Aviation

The aviation lighting and marking detailed in Section 4.2 abides by the requirements set out on the following guidance documents:

- CAA – The Air Navigation Order (ANO) (CAA, 2016 (a)) and CAP 393 (CAA, 2021 (b))
- CAA Civil Aviation Policy (CAP) 764 – Policy and Guidelines on Wind Turbines (CAA, 2016 (b)).
- CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2021 (a)).
- MCA MGN 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021).
- MOD Obstruction Lighting Guidance (MOD, 2020).

2.3 Consultation

It is noted that in addition to consideration and compliance with the relevant guidance, the preparation of this LMP has also been informed by consultation undertaken with the NLB, MCA and CAA as key stakeholders of relevance to lighting and marking. Consultation was undertaken over the course of late 2021 and early 2022 and involved the issuing of draft proposed Development layouts with associated lighting and marking proposals, which were updated following feedback received and amendments to the Development layout. Following submission to MD-LOT, consultation was carried out by MD-LOT with stakeholders as described in the consents conditions listed in Table 1.1.

3 Construction Phase

3.1 Overview

Lighting and marking to be implemented during the construction phase is summarised in Table 3.1. It is noted that there will be no 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 CAA guidance (see Section 2.2) and as set out in Section 3.2.

Table 3.1 includes a guidance column, which lists the relevant guidance / stakeholder to each lighting and marking aspect where appropriate and where the full technical specifications required by the relevant stakeholders can be located. Figure 3.1 sets out the positions of the construction buoyage, with the associated coordinates and specifications presented in Table 3.2.

All buoyage for the construction phase will meet the following IALA specifications:

- Radio Detection and Ranging (Radar) Reflectors;
- Focal Plane 3-5 metres (m) above the waterline;
- Range 5 nautical miles (nm); and
- Minimum 3m in diameter at the waterline.

3.2 Promulgation of Information - Aviation

Moray West will ensure effective promulgation of information to the appropriate aviation authorities and stakeholders throughout the construction and operational phases of the project.

As required under Article 225a of The ANO (CAA, 2016(a)), Moray West will provide the following details to the CAA[3] at least eight weeks in advance of the planned works for any temporary or permanent structures or erections associated with the Development over 100m in height:

- Description of the obstacle;
- Locations (degrees, minutes, seconds);
- Elevation above mean sea level and height above ground level to the nearest metre or foot prior to and upon completion of the works;
- Type and colour of any lighting to be fitted to it, or to be removed from it; and
- Scheduled dates of commencement and completion of the works.

If there is insufficient time to give eight weeks' notice or there is an urgent need to commence the planned works, the CAA will be notified as soon as is practicable. The CAA will also be notified in writing of the completion of the planned works and whether there has been any change to the information provided above no later than 30 days after the completion of the works.

[3] Information will be provided via the CAA Airspace Coordination and Obstacle Management Service (ACOMS) portal

There is an international civil aviation requirement for all permanent structures of 300 feet (91.4 m) or more to be charted on aeronautical charts. All such structures required for Moray West will be reported to the Defence Geographic Centre (DGC) which maintains the UK's database of tall structures (the Digital Vertical Obstruction File) at least 10 weeks prior to the start of construction of any permanent structures associated with the Development over 300 feet in height. The point of contact for the DGC is: 0208 818 2702, mail to dvof@mod.gov.uk.

In order to ensure that aviation stakeholders are aware of any temporary structures (e.g. cranes) or large construction vessels that exceed 196 feet (60 m), stakeholders shall be notified through the means of a Notice to Airmen (NOTAM). To arrange an associated NOTAM, Moray West will contact the CAA's Airspace Regulation (AROps@caa.co.uk, or via the CAA Airspace Coordination and Obstacle Management Service (ACOMS) portal); providing the same information as required by the DGC at least 14 days prior to the start of construction for any temporary structures or vessels associated with the Development over 60 m in height (noting the differing 60 m requirement).

Table 3.1 Construction Phase Lighting and Marking Summary

Lighting and Marking Aspect	Relevant Structures	Specifications	Figure Illustration	Relevant Guidance or Stakeholder Requirement
Temporary Construction Lighting (Wind Turbine Generators (WTGs) and Offshore Substation Platforms (OSPs))	All monopiles prior to Transition Piece installation	• Flashing (Fl) Yellow (Y) 2.5 seconds (s) • 360° visibility (may be either 1 x light positioned on top of monopile to be visible 360°; or more than one light affixed to the side of the monopile, as many as are required to provide 360° visibility) • At least 2nm range • Monopile temporary lights will be removed as soon as WTG or OSP Transition Piece temporary marine lights or Identification (ID) lights (as described below) are operational.	N/A	Industry Standard[4]

	All constructed WTGs and OSPs	• Flashing (Fl) Yellow (Y) 2.5 seconds (s)
		• Three configurations are under consideration noting that the final decision should be based on a risk assessment including risk to project vessels:
		  ○ For WTGs: 3 x lights on handrail - 360° visibility or for OSPs: as many lights on Transition Piece handrail as are required for 360° visibility
		  ○ 1 x light on handrail and 1 x light on ladder – 360° visibility
		  ○ 1 x light on ladder – may be less than 360° visibility
		• At least 2nm range
		• WTG temporary lights will be removed as soon as marine lights or Identification (ID) lights are operational.
			N/A	Industry Standard

[4] Temporary lighting is not a stakeholder or guidance requirement however represents an industry standard mitigation during the construction phase.

Table 3.1 Construction Phase Lighting and Marking Summary				
Lighting and Marking Aspect	**Relevant Structures**	**Specifications**	**Figure Illustration**	**Relevant Guidance or Stakeholder Requirement**
		• OSP temporary lights will be moved from the monopile to the Transition Piece once installed and then removed finally once OSP identification lights are operational.		
Construction Buoyage – Numbers and Types	N/A	• 1 x South Cardinal (with Automatic Identification System (AIS) AtoN) • 1 x West Cardinal • 5 x Special Mark • Construction buoyage will be established at least four weeks prior to the start of construction. • Construction buoyage may need to be relocated, in consultation with NLB, when vessel types (i.e., anchor spreads) are confirmed	Figure 3.1	Standard NLB Requirement IALA R1001
Construction Buoyage removal	N/A	• The approval of the operational lighting and marking on the structures by NLB will mark the removal of the construction buoyage. This will be written approval.	N/A	IALA R1001

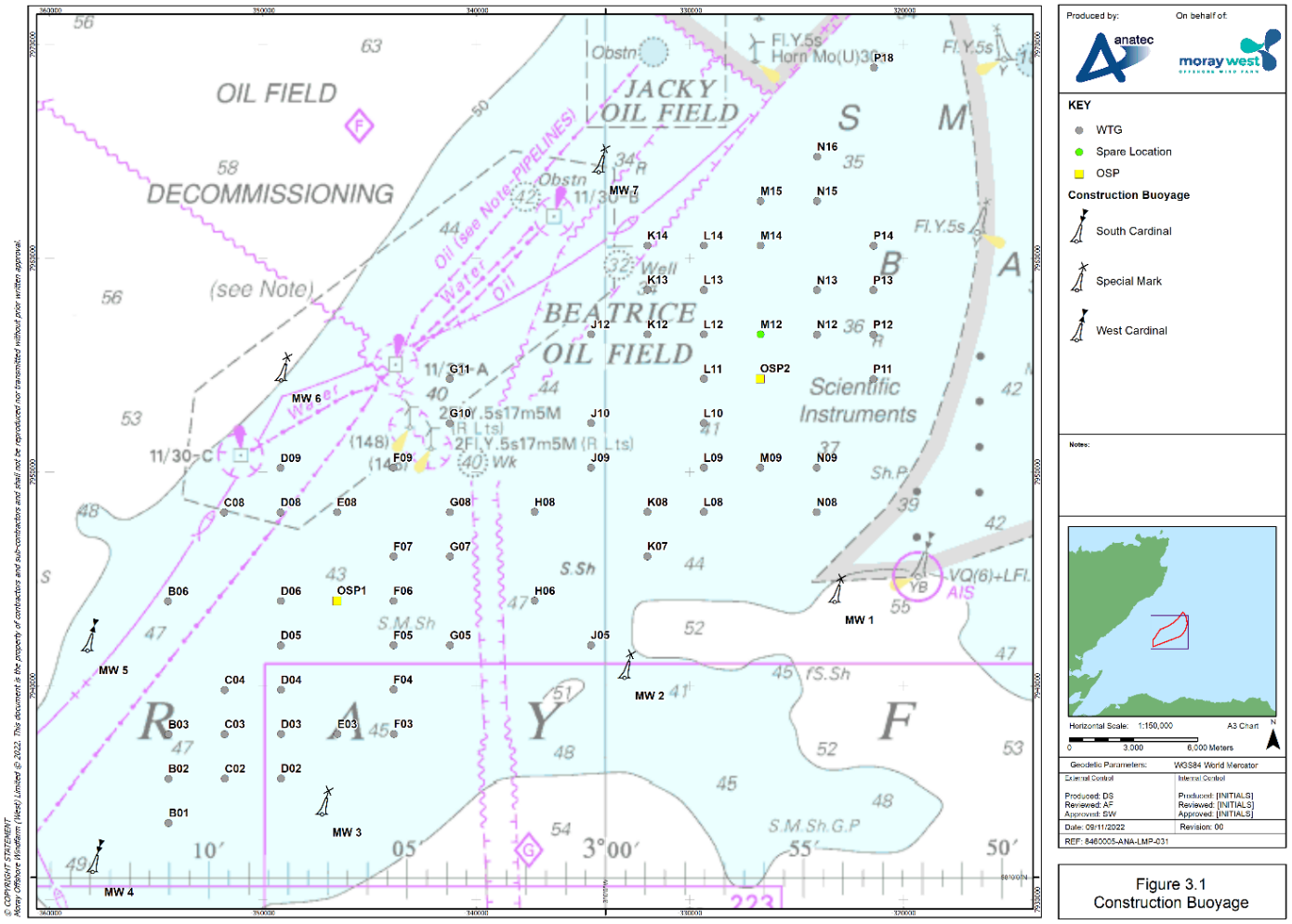

Figure 3.1 Construction Buoyage

Table 3.2 Construction Buoyage Positions and Specifications				
Buoy	**ID**	**Location**		**Light and Top Mark Specification**
		Latitude (Degrees Minutes Seconds (DDMMSS))	**Longitude (DDMMSS)**	
Special Mark	MW1	58° 03' 41" N	002° 54' 14" W	• Pillar shaped with a yellow 'x' shaped topmark • Exhibiting a Fl Y 5s light character • Category 1 Availability - 99.8%
Special Mark	MW2	58° 02' 40" N	002° 59' 01" W	• Pillar shaped with a yellow 'x' shaped topmark • Exhibiting a Fl Y 5s light character • Category 1 Availability - 99.8%
Special Mark	MW3	58° 00' 50" N	003° 07' 10" W	• Pillar shaped with a yellow 'x' shaped topmark • Exhibiting a Fl Y 5s light character • Category 1 Availability - 99.8%
South Cardinal	MW4	58° 00' 04" N	003° 12' 56" W	• Pillar shaped with a south cardinal shaped topmark • Exhibiting a V Quick (Q) (6) + L Fl 10s W light character. • Category 1 Availability - 99.8% • AIS AtoN (Category 3 Availability - 97.0%).
West Cardinal	MW5	58° 03' 02" N	003° 13' 04" W	• Pillar shaped with a west cardinal shaped topmark • Q (9) 15s or V Quick (9) 10s W light • Category 1 Availability - 99.8%
Special Mark	MW6	58° 06' 38" N	003° 08' 12" W	• Pillar shaped with a yellow 'x' shaped topmark • Exhibiting a Fl Y 5s light character • Category 1 Availability - 99.8%
Special Mark	MW7	58° 09' 30" N	003° 00' 23" W	• Pillar shaped with a yellow 'x' shaped topmark • Exhibiting a Fl Y 5s light character • Category 1 Availability - 99.8%

4 Operational Phase

4.1 Marine

Marine lighting and marking to be implemented during the operational phase is summarised in Table 4.1 for the WTGs and Table 4.2 for the OSPs. These includes a guidance column, which lists the guidance relevant to each lighting and marking aspect where appropriate (guidance is also detailed in Section 2.1).

In the event that a spare location[5] is used and the unviable position is on the periphery (meaning that a peripheral WTG shown in Figure 4.1 is not installed), consultation would be undertaken with the NLB to determine if any aspects of the marine lighting and marking plan scheme require updating.

The overarching marine lighting and marking scheme is then presented in Figure 4.1.

As per Section 2.3, NLB have been consulted on the marine lighting and marking scheme.

4.1.1 Failure of Marine Lighting

A requirement of the management of AtoN within UK waters is to report navigation failures to NLB (noting this does not include temporary lighting). This is done through an Aid to Navigation Availability Reporting database (LATONs). The system is administered by NLB in order to assist wind farm operators to fulfil their responsibility to maintain records of AtoN availability and to provide summaries of these to NLB. This should be undertaken in the event of any failure or loss of availability and should be carried out during both the construction and operational phases as per the required availability standards.

In the event of a significant loss of an AtoN such that a significant risk to navigation is considered likely to occur, consultation would be undertaken with the NLB and MCA to determine the need for any additional mitigation.

[5] Spare locations are described and identified in the Moray West Design Specification and Layout Plan (DSLP). The spare locations will only be utilised if ground conditions which represent a high risk of pile refusal are encountered during the foundation installation operations at one or more of the WTGs or OSP locations that cannot be overcome by micro-siting

Table 4.1 Operational WTGs' Marine Lighting and Marking Summary				
Lighting and Marking Aspect	**Relevant Structures**	**Specifications**	**Figure Illustration**	**Relevant Guidance**
Significant Peripheral Structure (SPS) Lighting	Selected periphery structures: B01, B06, D09, F03, G11, J05, K14, N08, P13, P18	• Located on a corner or other significant point. • Each SPS will have 360° visibility, with flashing IALA special mark characteristics (Fl.Y.5 s) and with a range of not less than 5 nm. • IALA Category 1 (> 99.8% availability). • All SPS lights shall be synchronised. • Lights on WTGs shall be located on the handrails which are approximately 16 m above Highest Astronomical Tide (HAT) (i.e., below the arc of the rotor blades). • Uninterruptible Power Supply (UPS) of 96 hours[6]. • See Section 5 for more detail on P13 .	Figure 4.1	IALA O-139 / G1162 and standard requirement
Sound signals	Selected periphery structures: B01, B06, D09, F03, G11, J05, K14, N08, P13, P18	• Foghorns on transition piece must face outward into open sea and sound signals must be unimpeded by the tower. • 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. • Remote testing required. • See Section 5 for more detail on P13.	Figure 4.1	IALA O-139 / G1162 and standard requirement

[6] Within these 96 hours either the Aid to Navigation will be made operational again, or, if this is not possible, a longer-term solution/plan shall be executed to allow mariners to be made aware of the site. UPS may be a battery supply or independent power supply to the normal power supply.

Table 4.1 Operational WTGs' Marine Lighting and Marking Summary				
Lighting and Marking Aspect	**Relevant Structures**	**Specifications**	**Figure Illustration**	**Relevant Guidance**
Visibility meters	Selected periphery structures: B01, B06, D09, F03, G11, J05, K14, N08, P13, P18	• Change in visibility will trigger all fog signals across the entire array. • Signal to activate when visibility is less than 2 nm. • Visibility meters should be installed as per manufacturers requirements. • See Section 5 of this LMP for more detail on P13	Figure 4.1	IALA O-139 / G1162 and standard requirement
AIS	Selected periphery structures: B01	• Availability of not less than 97.0% (IALA Category 3). • OFCOM Licence is required for the AIS transmission • A synthetic AIS may be used	N/A	Regulator Requirement

ID Marker Boards	All WTGs	• Lit via low-level baffled lighting which can be controlled remotely
		  ○ Uniformity factor is suggested to be better than 1:4.
		  ○ Mean luminance should be between 5 Candela (cd)/m^2 and 10 cd/m^2.
		  ○ Colour temperature should be between 2500 Kelvin (K) and 3500 K.
		• Black letters on yellow background (form of letters to be the site identifier “MW” followed by a space and then a three-digit sequence indicating the WTG row letter and number e.g. “B01” and not “B1”)
		• 360° visibility.
		• ID markings will be minimum of 350 millimetres (mm) in height.
			N/A	MGN 654

Table 4.1 Operational WTGs' Marine Lighting and Marking Summary				
Lighting and Marking Aspect	**Relevant Structures**	**Specifications**	**Figure Illustration**	**Relevant Guidance**
		• ID marking may be boards attached to handrails **or** painted directly onto structure.		
WTG Paint	All WTGs	• Traffic yellow (RAL 1023) from HAT up to and including the transition piece (located approximately 16m above HAT[7]). • Light grey (RAL 7035) upwards of the transition piece (located approximately 16 m above HAT).	N/A	IALA R139/G1162 and standard requirement

Table 4.2 Operational Phase OSPs' Marine Lighting and Marking Summary			
Lighting and Marking Aspect	**Specifications**	**Figure Illustrations**	**Relevant Guidance**

ID Marker Boards	• Lit via low-level baffled lighting which can be controlled remotely
	  ○ Uniformity factor is suggested to be better than 1:4
	  ○ Mean luminance should be between 5 Candela (cd)/m2 and 10 cd/m2
	  ○ Colour temperature should be between 2500 Kelvin (K) and 3500K
	• Black letters on yellow background (form of letters to be “MW OSP 1” and “MW OSP 2”).
	• 360° visibility.
	• ID marking may be boards attached to **or** painted directly onto structure.
		N/A	MGN 654

[7] It is noted that handrails, ladders, boat landings, and other working areas may potentially be painted (but will not be maintained given wear and tear) as part of the process.

Table 4.2 Operational Phase OSPs' Marine Lighting and Marking Summary			
Lighting and Marking Aspect	**Specifications**	**Figure Illustrations**	**Relevant Guidance**
	• Boards will be of 1 metre high with ID markings of a suitable proportional height/width. The ID marking can be split over two lines of text.		
OSP Paint	• Traffic yellow (RAL 1023) from HAT and for the entirety of the foundation structure. • Topside Light Grey (RAL 7035) or other non-reflective grey materials. Excluding topside structures such as work cabins, cranes, ladders, and other working areas.	N/A	IALA R139/G1162 and standard requirement

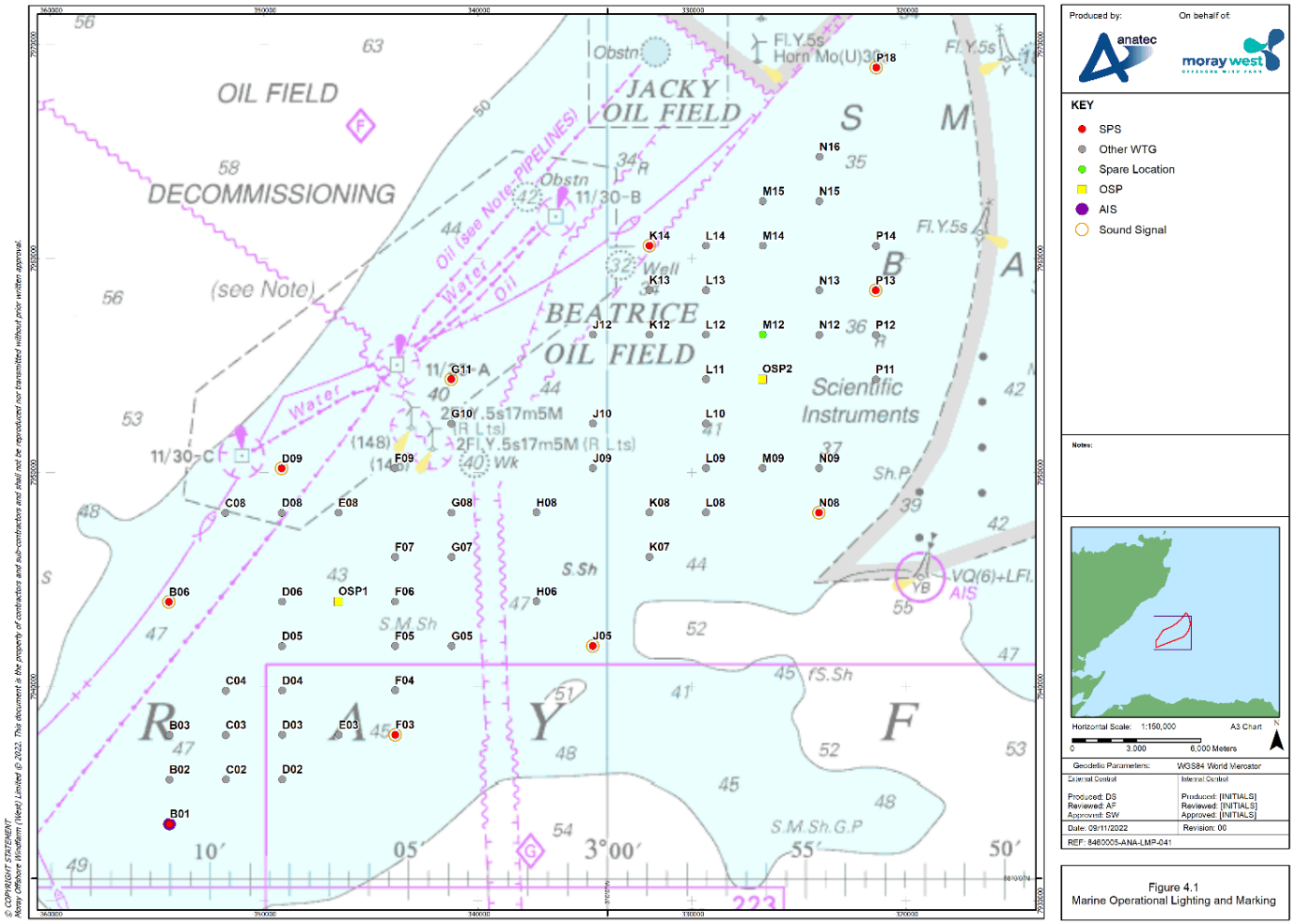

Figure 4.1 Marine Operational Lighting and Marking

4.2 Aviation

Aviation lighting and marking to be implemented during the operations phase is summarised in Table 4.3 for the WTGs and Table 4.4 for the OSPs. These includes 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).

In the event that a spare location[8] is used and the unviable position is on the periphery (meaning that a peripheral WTG shown in Figure 4.2 is not installed), consultation would be undertaken with the CAA to determine if any aspects of the aviation lighting and marking plan scheme require updating.

The overarching aviation lighting and marking scheme is presented in Figure 4.2.

4.2.1 Failure of Aviation Lighting

The ANO (CAA, 2016) 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."

It is accepted that 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).

The CAA's Directorate of Airspace Policy 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, Moray West shall request a NOTAM to be issued by informing the NOTAM section of the UK Aeronautical Information Service as soon as possible. Contact is the CAA's Airspace Regulation (AROps@caa.co.uk / 0207 453 6599).

Upon completion of the remedial works, the Aeronautical Information Service shall 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 shall also be notified directly to discuss any issues that may arise and longer-term strategies.

[8] Spare locations are described and identified in the Moray West Design Specification and Layout Plan (DSLP). The spare locations will only be utilised if ground conditions which represent a high risk of pile refusal are encountered during the foundation installation operations at one or more of the WTGs or OSP locations that cannot be overcome by micro-siting

Table 4.3 Operational Phase WTGs' Aviation Lighting and Marking Summary				
Lighting and Marking Aspect	**Relevant WTGs**	**Specifications**	**Figure Illustration**	**Relevant Guidance**
Aviation Warning Lighting (Dual purpose for warning lights and aviation lights)	All peripheral WTGs: B01, B02, B03, B06, C02, C08, D02, D09, E03, F03, F04, F09, G05, G11, H06, J05, J12, K07, K14, L08, L14, M15, N08, N09, N16, P11, P12, P13, P14, P18	• Red 2,000 cd light displayed at night[9]. • Dimmable to 200 cd when visibility is greater than 5 km at night. • Off during the day. • Synchronised flashing Morse 'W' within Moray West only. • Capable of being switched off or displaying a steady 200 Cd light at the request of the MCA during SAR operations (if switched off alternate red light required for SAR purposes). • 360° visibility. • Compatibility with Night Vision Imaging System (NVIS) of infrared wavelength between 800nm and 900 nm. • UPS of 8 hours required to maintain all aviation warning lights[10].	Figure 4.2	ANO (CAA, 2016 (a)) CAP 764 (CAA, 2016 (b)) MGN 654 SAR Annex 5 (MCA, 2021)
Aviation Warning Lighting Visibility Meters	Specific peripheral WTGs: B01, D09, J05, J12, P11, P18	• Intensity: 2,000 cd when visibility < 5 km in any direction. • Intensity: 200 cd when visibility ≥ 5 km in all directions.	N/A	CAA standard requirement CAP 764
SAR lights	All internal WTGs (i.e., any structure not fitted with an aviation warning light):	• Red 200 cd light. • Steady when in use at MCA request, switched off otherwise. • 360° visibility.	Figure 4.2	MGN 654 SAR Annex 5

[9] Definition of night / day as per ANO (CAA, 2016 (a))
[10] Within these 8 hours either the Aids to Navigation will again be made operational, or if this is not possible, a longer term solution/plan will be executed to allow aviators to be made aware of the site.

Table 4.3 Operational Phase WTGs' Aviation Lighting and Marking Summary				
Lighting and Marking Aspect	**Relevant WTGs**	**Specifications**	**Figure Illustration**	**Relevant Guidance**
	C03, C04, D03, D04, D05, D06, D08, E08, F05, F06, F07, G07, G08, G10, H08, J09, J10, K08, K12, K13, L09, L10, L11, L12, L13, M09, M14, N12, N13, N15	• Compatible with NVIS of infrared wavelength between 800 nm and 900 nm.		
Green Heli-hoist Light	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. • 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 30m intervals from the root of the blade. • 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 mm in diameter.	N/A	MGN 654 SAR Annex 5

Table 4.3 Operational Phase WTGs' Aviation Lighting and Marking Summary				
Lighting and Marking Aspect	**Relevant WTGs**	**Specifications**	**Figure Illustration**	**Relevant Guidance**
		• Direct consultation will be undertaken with the MCA if a variation to this requirement is needed.		
Blade Tip Marking	All WTGs	• From blade tip to a point on the blade corresponding to 2% of the blade length when measured from tip. • Direct consultation will be undertaken with the MCA if a variation to this requirement is needed.	N/A	MGN 654 SAR Annex 5
ID Marking	All WTGs	• ID numbers will be marked on the WTG nacelle roofs. • Not less than 1.5 m in height, with proportional width.	N/A	MGN 654 SAR Annex 5 CAP 764
Hoist Area Marking	Are not covered within the 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, 2016 (b)) • CAA CAP 437 – Standards for Offshore Helicopter Landing Areas (CAA, 2021 (a))			

Table 4.4 Operational Phase OSPs' Aviation Lighting and Marking Summary			
Lighting and Marking Aspect	**Specifications**	**Figure Illustration**	**Relevant Guidance**
SAR Lights	• Red 200 cd light. • Steady (when in use). • 360° visibility. • Compatible with NVIS.	Figure 4.2	MGN 654 SAR Annex 5
OSP ID Marking	• ID numbers will be marked on the OSP topside. • Not less than 1.0 m in height with proportional width. • Will have controllable low level lighting.	N/A	MGN 654 SAR Annex 5 CAP 764
Green heli hoist lights	• Low intensity green light. • 360° visibility. • Light off when OSP is not safe for heli-hoist operations. • Steady when OSP is ready for heli-hoist operation. • Intensity: +2 to +10°: 365 cd or 115 cd. • Intensity: >10 to +90°: 122 cd or 38 cd..	N/A	CAP 437
Hoist Area[11] Markings	Are not covered within the 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, 2016 (b)) • CAA CAP 437 - Standards for offshore Helicopter Landing Areas (CAA, 2021 (a))		

[11] 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.

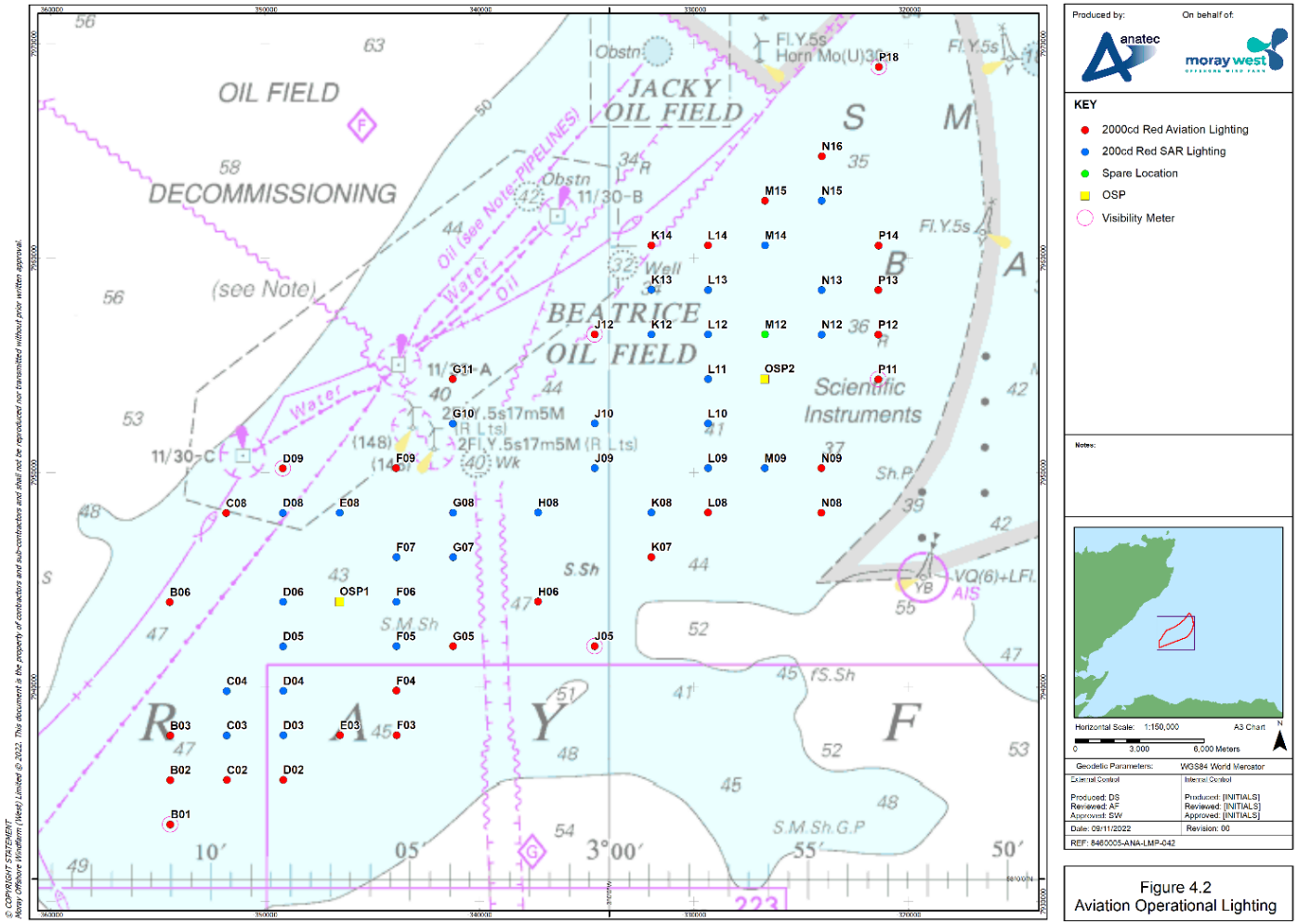

Figure 4.2
Aviation Operational Lighting

Figure 4.2 Aviation Operational Lighting

5 Cumulative

5.1 Marine

Although P13 is shown in Figure 4.1 as being fitted with SPS lighting and a sound signal, as this WTG is on the boundary with Moray East Offshore Wind Farm, following consultation with NLB and MCA it has been agreed that the operational phase marine navigation aids (i.e. SPS lights, visibility meter and sound signal) on this structure will not be used whilst Moray East Offshore Wind Farm is *in situ* because the eastern boundary of the Development is adjacent to the western boundary of Moray East Offshore Wind Farm.

Therefore it is proposed that no operational phase navigation aids (i.e. SPS lighting, visibility meter or sound signal) are installed at P13 until such time as Moray East Offshore Wind Farm is decommissioned. Specifically, it is proposed that navigation aids would be installed and be operational at P13 by the date on which the marine navigation aids on the SPS and IPS on the western boundary of the Moray East Offshore Wind Farm cease to operate. Should installation and activation of the P13 AtoN be required at a later stage, this would have to go to NLB and through the statutory sanction process.

5.2 Aviation

There are no cumulative considerations from an aviation lighting perspective. Although the Development is adjacent to the existing operational Moray East Offshore Wind Farm, due to the distance between the peripheral structures of each wind farm, the Development will be lit independently from Moray East Offshore Wind Farm, as described in Section 4.2.

6 References

- BEIS, 2011. Standard Marking Schedule for Offshore Installations.
- CAA, 2016 (a). The Air Navigation Order.
- CAA, 2016 (b). CAP 764 – Policy and Guidelines on Wind Turbines.
- CAA, 2021 (a). CAP 437 – Standards for Offshore Helicopter Landing Areas.
- CAA, 2021 (b). CAP 393 - Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016.
- IALA, 2017. The IALA Maritime Buoyage System. Edition One.
- IALA, 2021 (a). R139 Recommendations on the Marking of Man-made Offshore Structures.
- IALA, 2021 (b). G1162 Guidance on the Marking of Man-made Offshore Structures.
- MCA, 2021. Marine Guidance Note 654 and Annexes – Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response.
- MOD, 2020. Obstruction Lighting Guidance.

Appendix A – Defined Terms

Term	Description
Design Envelope	The range of design parameters used to inform the assessment of impacts.
Marine Licence for the Generating Station	Marine Licence for the Moray West Offshore Wind Farm - Licence Number: MS-00009774 - granted under the Marine and Coastal Access Act 2009, Part 4 Marine Licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the UK Marine Licensing Area granted to Moray West on 14 June 2019 and varied on 7 March 2022 and 11 April 2022.
Marine Licence for the Transmission Works	Marine Licence for the Offshore Transmission Infrastructure – Licence Number MS-00009813 – granted under the Marine and Coastal Access Act 2009, & Marine (Scotland) Act 2010, Part 4 Marine Licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the UK Marine Licensing Area (referred to as the "OfTI Marine Licence"), granted to Moray West on 14 June 2019 and varied on 11 April 2022.
Moray Offshore Windfarm (West) Limited	The legal entity submitting this Lighting and Marking Plan (LMP)
Moray West EIA Report	The Environmental Impact Assessment Report for the Moray West Offshore Wind Farm and Associated Transmission Infrastructure, submitted July 2018.
Moray West Offshore Wind Farm	The wind farm to be developed in the Moray West site (also referred as the Wind Farm).
Offshore Consents	Collective term for the two Marine Licences and the Section 36 consent
Offshore Consent Conditions	Collective term for the conditions attached to the Section 36 Consent and Marine Licences
Offshore Transmission Infrastructure (OfTI)	The offshore elements of the transmission infrastructure
OfTI Corridor	The export cable route corridor, i.e., the OfTI area excluding the Moray West site.
Section 36 Consent	Section 36 consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Moray West Offshore Wind Farm was granted on 14 June 2019 and varied on 7 March 2022.
The Development	The Moray West Offshore Wind Farm and OfTI.
The Development Site	The area outlined in Figure 1 attached to the Section 36 Consent Annex 1, Figure 1 attached to the two Marine Licences, and Figure B.1 of this LMP.
The Moray West Site	The area in which the Moray West Offshore Wind Farm will be located. Section 36 Consents and associated Marine Licence to construct and operate generating stations on the Moray West site were granted in June 2019 and varied in March 2022.

Term	Description
The Works	The construction and O&M activities undertaken for the Development.
Transmission Infrastructure (TI)	Includes both offshore and onshore electricity transmission infrastructure for the consented wind farm. A Marine Licence for the OfTI was granted in June 2019 and varied on 11 April 2022.

Appendix B - Development Background Information

B1 Development Description

Moray West Offshore Wind Farm is being developed by Moray Offshore Windfarm (West) Limited (Moray West; Company Number 10515140) which is registered at Octagon Point, 5 Cheapside, London, England, EC2V 6AA. Moray Offshore Windfarm (West) Limited is a wholly owned subsidiary of Moray West Holdings Limited which in turn is owned by Moray Offshore Renewable Power Limited, Delphis Holdings Limited, EDP Renewables Europe, S.L.U and UAB Ignitis Renewables.

The Moray West Site covers an area of approximately 225 km^2 on the Smith Bank in the Outer Moray Firth approximately 22 km from the Caithness coastline.

The Moray West Offshore Wind Farm will comprise 60 wind turbine generators (WTGs), associated substructures and seabed foundations, inter-array cables, one OSP interconnector cable and any scour protection around substructures or cable protection. The OfTI comprises up to two offshore substation platforms (OSPs) which will be located within the Moray West Site and two offshore export cable circuits which will be located within the OfTI corridor and will be used to transmit the electricity generated by the offshore wind farm to shore.

The offshore export cable circuits will come ashore at Sandend Bay, which is located on the Aberdeenshire Coast at Broad Craig, approximately 65 km south of the Moray West Site. There will be two underground circuits from landfall at Sandend Bay to Whitehillock where the onshore substation will be located. There will also be further underground cabling between Whitehillock substation and Blackhillock substation. Moray West will transfer ownership of the transmission asset to an Offshore Transmission Owner (OFTO) who will manage the transmission infrastructure.

Figure B.1 displays a map of the Moray West Site and OfTI Corridor.

The development is aiming to be fully operational in 2024/25 with an operational life of 25 years from the date of final commissioning of the Development.

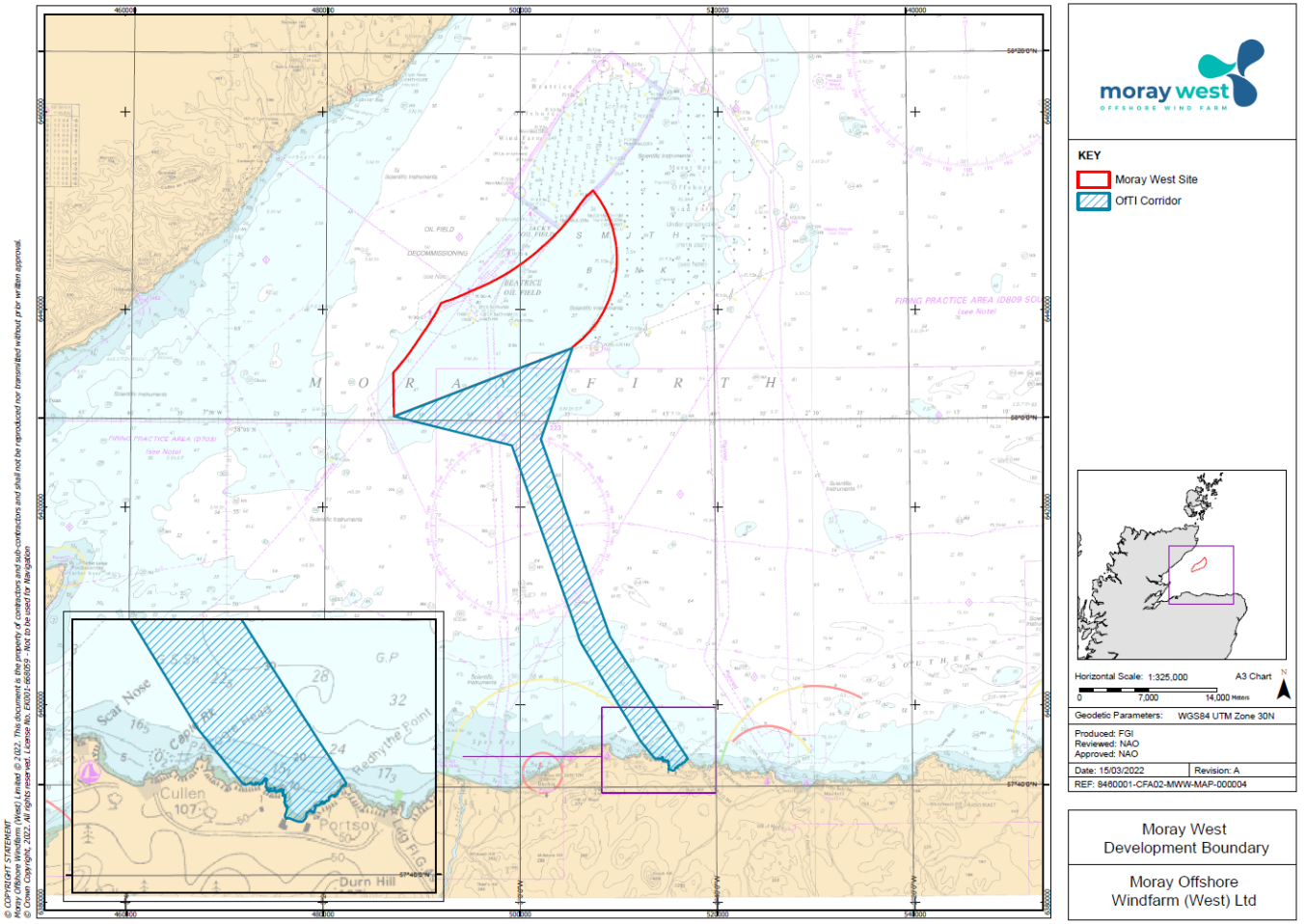

Figure B.1 Geographical location of the Moray West Site and OfTI Corridor

B2 Construction Programme Milestones

The key milestone dates associated with the construction activities of the Development are presented in Table B2.1.

Details of the programme for construction are provided in the Construction Programme (CoP).

Table B2.1 Key Milestones Dates	
Milestone	**Anticipated Programme**
First Generation	April 2024
Final Commissioning	November 2024
Wind Farm	
Commencement of Wind Farm Construction	Q3/Q4 2023 (following Scour protection installation Q2 2023)
OfTI	
Commencement of OfTI Construction	December 2022