Bellrock Offshore Wind Farm

Wind Farm Development Area

Environmental Impact Assessment Report – Volume II

Chapter 3: Site Selection and Consideration of Alternatives

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Glossary of Terminology

Term	Definition
Air gap	The lowest blade tip point of a wind turbine generator to sea clearance distance (see individual chapters for the relevant tidal levels).
Applicant	Bellrock Offshore Wind Farm Limited, the legal entity submitting Section 36 Consent and Marine Licence applications for Bellrock Wind Farm Development Area.
Bellrock Offshore Wind Farm (or the Bellrock Project)	An offshore wind farm capable of exporting up to 1.8 GW of renewable energy to the National Electricity Transmission System. The Wind Farm Development Area is located 120 km east of Stonehaven, and will connect to the National Electricity Transmission System at the proposed 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.
Commencement of construction	Commencement of construction to install the Wind Farm Infrastructure as authorised by the Wind Farm Development Area Section 36 Consent and Marine Licence (excluding site preparation works), being the earlier of: ▪ Intrusive pre-installation surveys; ▪ Placement on or installation in the seabed of anchors and associated scour protection, and mooring lines; ▪ Trench excavation for inter-array cables; or ▪ Trenching for, or laying of inter-array cables on or in the seabed.
Connector	Joint between a dynamic inter-array cable and a static inter-array cable.
Development Area	For consenting purposes, the area for which separate consents and/or Marine Licences will be sought by the Applicant, comprising: ▪ Wind Farm Development Area; ▪ Offshore Transmission Development Area; and ▪ Onshore Transmission Development Area.
Dynamic inter-array cable	The section of inter-array cable between the floating substructure and the seabed, which is designed to accommodate the dynamic movement of the floating substructure.
Excursion limit	The maximum horizontal movement of a floating substructure from its design coordinates.
Fixed bottom substructure	A substructure that provides support for the offshore substation or offshore reactive compensation station by transferring loads to the seabed, and provides a conduit for interconnector cables and/or offshore export cables.
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.
Integration port	A port at which wind turbine generators are integrated with floating substructures.

Term	Definition
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.
Interconnector cable	Armoured cable containing electrical and fibre optic cores which link two or more offshore substations.
Joint bay	Underground structure constructed at intervals along the onshore export cable route to join sections of onshore export cables.
Mean High Water Springs	The average over a year of the heights of two successive high waters during those periods of 24 hours (once every fortnight) when the range of the tide is greatest.
Mean Low Water Springs	The average over a year of the heights of two successive low waters during those periods of 24 hours (once every fortnight) when the range of the tide is greatest.
Mean Sea Level	The average level of the sea taking account of all tidal effects but excluding surge events.
National Electricity Transmission System	The high-voltage electricity power transmission network serving Great Britain which receives electricity from generators (such as offshore wind farms) and transmits that electricity to anywhere on the National Electricity Transmission System to satisfy demand.
Offshore export cable	Armoured cable containing electrical and fibre optic cores between the offshore substation(s) and the transition joint bay(s).
Offshore reactive compensation station	An offshore platform located along high voltage alternating current offshore export cables that accommodates reactive compensation equipment used to control reactive power flows and maintain acceptable voltage levels in the high voltage alternating current transmission system.
Offshore substation	An offshore platforms 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.
Offshore Transmission Development Area	The boundary within which the Offshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned (and includes the whole of the Wind Farm Development Area).
Offshore Transmission Infrastructure	Infrastructure located within the Offshore Transmission Development Area including fixed bottom and/or floating offshore substations, offshore reactive compensation station(s) and associated scour protection; interconnector cables and associated cable protection; and offshore export cables and associated cable protection (including activities associated with the Offshore Transmission Infrastructure construction, operation and maintenance, and decommissioning).
Onshore export cables	Electrical and fibre optic cables between the transition joint bay(s) and the onshore substation which may be laid directly within a trench or laid within cable ducts or protective covers.
Onshore substation	Onshore substation which will be fenced and house electrical equipment (such as transformers, switchgear, and protection and control systems), thereby enabling renewable electricity from the wind farm to be received via the onshore export cables and exported to the National Electricity Transmission System.

Term	Definition
Onshore Transmission Development Area	The boundary within which the Onshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned.
Onshore Transmission Infrastructure	Infrastructure located within the Onshore Transmission Development Area including transition joint bay(s); onshore export cables; onshore substation; temporary construction compounds; temporary working areas; environmental mitigation areas; drainage/irrigation infrastructure; access works; and any other associated infrastructure (including activities associated with the Onshore Transmission Infrastructure construction, operation and maintenance, and decommissioning).
Operational life	The expected operational life of the Wind Farm Infrastructure from the Commercial Operation Date to the first floating offshore unit being decommissioned.
Project design envelope	Includes all relevant technical, spatial and temporal elements of the Wind Farm Infrastructure, and the proposed methodology to be employed for construction, operations and maintenance, and decommissioning.
Safety Zone	An area of water around or adjacent to a floating offshore unit which is to be constructed, extended, operated or decommissioned, from which certain or all classes of vessels are excluded and within which activities can be regulated for the purpose of securing safety of the floating offshore unit or vessel in that vicinity, and individuals on the floating offshore unit and vessel, in line with Section 95 of the Energy Act 2004.
ScotWind	A Crown Estate Scotland leasing round for offshore wind projects in which the process enabled developers to apply for seabed rights to plan and build wind farms in Scottish waters.
Scour protection	Protective material positioned around anchors to avoid sediment being eroded as a result of the flow of water.
Site preparation works	Preparatory activities undertaken within the Wind Farm Development Area prior to the commencement of construction of the Wind Farm Infrastructure, which may comprise (and which may require separate consents): ▪ Geophysical surveys, geotechnical surveys, and non-archaeological/archaeological diver/ remotely operated vehicle surveys; ▪ Seabed preparation including sand wave levelling, slope levelling for gravity based anchors (if selected), boulder clearance, and pre-lay grapnel runs; ▪ Unexploded ordnance survey and/or clearance; ▪ Debris clearance; and ▪ Out of service cable/pipeline removal.
SSEN Transmission Hurlie substation	The onshore substation to be developed by SSEN Transmission, which will receive renewable electricity from the Bellrock Project onshore substation and allow supply of renewable electricity from the wind farm to the National Electricity Transmission System.
Static inter-array cable	The section of inter-array cable that is not designed to move.
Station keeping system	The system (including mooring lines and anchors) used to hold a floating offshore unit within its excursion limit and maintain the intended orientation of the floating offshore unit.
Subsea cable hub	A subsea device, with a gravel pad foundation, which allows the connection of multiple inter-array cables.

Term	Definition
Switchgear	Electrical equipment used to control, protect, and isolate electrical circuits and equipment.
Temporary construction compound	Area within the Onshore Transmission Development Area used temporarily to support the construction and commissioning, which may include (but not limited to) office, welfare and workshop facilities; vehicle parking; spoil, material and equipment laydown and/or storage; drainage infrastructure; wheel washing facilities; and lighting, fencing and security.
Towing	Transportation of a floating offshore unit or floating substructure between a port, and/or wet storage facility and/or the Wind Farm Development Area.
Transition joint bay	An underground structure at the landfall accessed by manhole or other means which accommodates the jointing of the offshore export cables and the onshore export cables. A fence may be installed around the access manhole for protection.
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 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
AD	Air Defence
AoS	Area of search
ATC	Air Traffic Control
CES	Crown Estate Scotland
DIO	Defence Infrastructure Organisation
DSLP	Development Specification and Layout Plan
EIA	Environmental impact assessment
FBSS	Fixed bottom substructure
FOU	Floating offshore unit
FSS	Floating substructure
GVA	Gross Value Added
GW	Gigawatt
HAT	Highest Astronomical Tide
IAC	Inter-array cable
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate - Licensing Operations Team
MD-SEDD	Marine Directorate – Science, Evidence, Data and Digital
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MOD	Ministry of Defence
MSL	Mean Sea Level
NAT	National Air Traffic Services
NESO	National Energy System Operator
NLB	Northern Lighthouse Board
O&M	Operation and maintenance
OfTDA	Offshore Transmission Development Area
OnTDA	Onshore Transmission Development Area

Term	Definition
OREI	Offshore Renewable Energy Installations
RLoS	Radar Line of Sight
RRH	Remote Radar Head
SAC	Special Areas of Conservation
SAR	Search and Rescue
SFF	Scottish Fishermen's Federation
SLVIA	Seascape and Landscape Visual Impact Assessment
SMP	Sectoral Marine Plan
SOWEC	Scottish Offshore Wind Energy Council
SPA	Special Protection Areas
SSEN	Scottish and Southern Electricity Networks
SWFPA	Scottish White Fish Producers Association
TLP	Tension leg platform
TOPA	Technical and Operational Assessment
UK	United Kingdom
UKCoS	United Kingdom Chamber of Shipping
WFDA	Wind Farm Development Area
WTG	Wind turbine generator

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3 Site Selection and Consideration of Alternatives

1 Schedule 4(2) of the Electricity Works (environmental impact assessment) (Scotland) Regulations 2017 (the 'EIA Regulations', requires an EIA Report to provide: *"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects".* Similar wording is included in Schedule 3(6) in the Marine Works (environmental impact assessment) Regulations 2007. See **Chapter 2: Policy and Legislative Context (Volume II)** for further details on the EIA Regulations.

2 As discussed in **Chapter 1: Introduction (Volume II)**, the Bellrock Project comprises the following three Development Areas for which separate consents and/or licences will be sought by the Applicant:

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

3 This Chapter of the Bellrock WFDA EIA Report provides an overview of the site selection process for the Bellrock WFDA, and the reasonable alternatives considered for the Wind Farm Infrastructure located within the Bellrock WFDA. As the three Development Areas are intrinsically linked and fundamental for the function of the Bellrock Project, the consideration of project objectives and the alternative 'do nothing' approach (where the Bellrock WFDA is not developed) is considered within this Chapter at a Bellrock Project scale. Site selection for the Bellrock OfTDA and Bellrock OnTDA is ongoing at the time of preparing this EIA Report (see **Section 3.5**) and the site selection and consideration of alternatives for these Development Areas will be presented within the OfTDA and OnTDA EIA Reports respectively, when submitted.

3.1 Consultation

4 Key consultation pertinent to this Chapter is provided in **Table 3.1** below.

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Table 3.1: Consultation Relevant to Site Selection and Alternatives

Consultee	Date/Document	Comment	How/Where Comment is Addressed
Marine Directorate - Licensing Operations Team (MD-LOT)	Bellrock WFDA Scoping Opinion (2024)	MD-LOT note that the EIA Regulations require that the EIA Report include *'a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the Developer, which are relevant to the proposed works and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects'*. The Scottish Ministers acknowledge Section 3 of the Developer's Scoping Report setting out the consideration of alternatives to date together with the planned activities that are proposed to inform the EIA Report further. The Scottish Ministers advise however that these considerations must include how decommissioning has been taken into account within the design options. The Scottish Ministers advise that this must be based on the presumption of as close to full removal as possible of all infrastructure and assets and should consider the methods and processes of doing so.	Consideration of alternatives is detailed in this Chapter, with consideration of alternatives specifically for decommissioning outlined in **Section 3.7.8.** Furthermore, details on alternative locations are discussed in **Section 3.4**, details on alternative layout are discussed in **Section 3.6**, and details on alternative technologies are discussed in **Section 3.7**.
MD-LOT	Bellrock WFDA Scoping Opinion (2024)	MD-LOT note that the Scottish Ministers advise that the EIA Report must include an up to date consideration of the reasonable alternatives studied as the parameters of the Proposed Development have been refined. This includes but is not limited to the identification of the potential wind turbine layouts within the array area. The Scottish Ministers expect this to comprise a discrete Section in the EIA Report that provides details of the reasonable alternatives studied across all aspects of the Proposed Development and the reasoning for the Selection of the chosen option(s), including a comparison of the environmental effects.	Consideration of alternatives is detailed in this Chapter, with details on alternative locations are discussed in **Section 3.4**, details on alternative layout discussed in **Section 3.6**, and details on alternative technologies discussed in **Section 3.7.** Wind turbine generator (WTG) layouts are typically considered within a Seascape and Landscape Visual Impact Assessment (SLVIA) which was scoped out from consideration in this Bellrock WFDA EIA Report. However, **Section 3.6** details how mitigation measures relevant to the Bellrock WFDA layout have been considered and adopted to reduce significant impacts to relevant receptors.
MD-LOT	Bellrock WFDA Scoping Opinion (2024)	The Scottish Ministers direct the Applicant to the SFF representation regarding design aspects of the Project, including WTG foundations, IAC, cable burial and protection and pre-construction works. The Scottish Ministers advise that these	Design aspects (floating substructure (FSS), cables, burial/protection and site preparation works) are set out in **Chapter 4: Project Description (Volume II)** and reflected in the

Consultee	**Date/Document**	**Comment**	**How/Where Comment is Addressed**
		must be fully considered by the Applicant when finalising the design parameters for the Project.	realistic worst-case parameters and effects assessed in **Chapter 11: Commercial Fisheries (Volume II)**.
MD-LOT	Bellrock WFDA Scoping Opinion (2024)	*'The Scottish Ministers highlight the representation from NATS which predicts that the Proposed Development is likely to generate false primary plots and also a reduction in the probability of Perwinnes RADAR to detect real aircraft.* *NATS has also advised that the Proposed Development will likely have unacceptable impacts to Prestwick Air Traffic Control ("ATC"), Military ATC and Aberdeen ATC. This view is supported in the representation from Aberdeen Airport with regard to aerodrome safety in the safeguarding area for Aberdeen in relation to construction and maintenance activities associated with the Proposed Development.* *The Scottish Ministers therefore recommend the Developer engage further with NATS on these points and advise that these impacts must be assessed, and appropriate mitigation proposed, in the EIA Report.'*	Impact to NATS Perwinnes is assessed in **Chapter 13: Aviation and Radar (Volume II).** Subsequent to the Scoping Opinion, the Applicant reduced the maximum blade tip height from 400 m above mean sea level (MSL) to 337 m above MSL (see **Section 3.6** and **Chapter 13: Aviation and Radar (Volume II)**). Subsequent to this design change, the Applicant has engaged NATS on the revised WTG parameters and NATS advise that their analysis shows that WTGs with a maximum blade tip height of 337 m above MSL, would be below Radar Line of Sight (RLoS) and "even when we [NATS] apply ducting corrections the detection probability would low enough that it would not draw a NATS objection".
MD-LOT	Bellrock WFDA Scoping Opinion (2024)	*'The Scottish Ministers highlight the representation from MOD DIO, which acknowledges the potential for the proposed development to impact the operation and capability of the Air Defence (AD) Radars at Remote Radio [sic] Head Buchan. The Scottish Minsters, in line with MOD DIO advice, therefore, advise that these impacts must be assessed, and appropriate mitigation proposed, in the EIA Report.'*	Impact to Remote Radar Head (RRH) Buchan is assessed in **Chapter 13: Aviation and Radar (Volume II).** Subsequent to the Scoping Opinion, the Applicant reduced the maximum blade tip height from 400 m above MSL to 337 m above MSL. This design change significantly reduces the footprint of the Bellrock WFDA that is in RLoS of RRH Buchan. See **Chapter 13: Aviation and Radar (Volume II)** for further information on secondary mitigation measures proposed. The Applicant will continue to engage with

Consultee	Date/Document	Comment	How/Where Comment is Addressed
			Defence Infrastructure Organisation (DIO) on this matter.
NatureScot	Bellrock WFDA Scoping Opinion (2024), Appendix I	NatureScot note that the project is expected to utilise an SSEN Transmission offshore substation. As stated in the Scoping Report Executive Summary (page iv) the infrastructure connecting the SSEN Transmission offshore substation to shore is to be developed by SSEN as part of the National Electricity Transmission System. The location of the SSEN Transmission offshore substation is yet to be determined, as outlined in Section 3.10.1.2. No timeline information is provided.	The Bellrock Project will no longer utilise a SSEN Transmission offshore substation but will instead connect to an onshore substation. See **Section 3.5** for details of the updated grid connection design.
Anatec and UK Chamber of Shipping (UKCoS)	Meeting Minutes from meeting with Anatec, Maritime and Coastguard Agency (MCA), Northern Lighthouse Board (NLB) and UKCoS meeting held 5 March 2025	Anatec confirmed that the final layout taken forward as a worst-case scenario for Shipping and Navigation will be the maximum number of WTGs. UKCoS confirmed that this increase in WTG density within the Bellrock WFDA does not impact their original scoping response but queried if the new minimum spacing will reduce certain aspects for Search and Rescue (SAR). Anatec responded that, when designing the revised layout, these aspects will be accounted for, and the layout will be MGN 654 compliant.	Details of the refinement of project parameters (including those related to the updated Bellrock WFDA layout) are provided in **Section 3.6** and the consideration of alternatives is presented in **Section 3.7**, with references to updated project parameters provided throughout where necessary.
Scottish Fishermen's Federation (SFF)	Email response to invitation to Bellrock virtual consultation from Nadara, 28 November 2025	SFF queried how the increase in turbine numbers and use of floating foundations will be managed to minimise loss of fishing grounds and snagging hazards.	Details of the refinement of project parameters (including those related to the updated Bellrock WFDA layout) are provided in **Section 3.6** and the consideration of alternative technologies is presented in **Section 3.7**, with references to updated project parameters provided throughout where necessary. An assessment of effects of the Bellrock WFDA on commercial fisheries receptors has been conducted based on the updated project parameters. This is provided in **Chapter 11: Commercial Fisheries (Volume II)**.

Consultee	Date/Document	Comment	How/Where Comment is Addressed
SFF/Scottish White Fish Producers Association (SWFPA)	Quarterly fishers meeting (Q1 2025) held 21/1/2025)	SFF/SWFPA queried the potential for obstacle free zones to allow continued access to Nephrops grounds within the eastern edge of the Bellrock WFDA. The Applicant noted potential challenges due to loss of design flexibility and optimising installed capacity. Stakeholders suggested that these options present a win/win and emphasised the importance of ensuring all affected fisheries are considered.	The impact assessment on Nephrops is presented in **Chapter 11: Commercial Fisheries**.
SFF	Representation on the Bellrock WFDA Scoping Report (2024)	SFF notes from section 3.4 'Wind Turbine Generator Substructure' (p35) of the Bellrock WFDA Scoping Report that depending on the water depth (which is from c.66 m to 105 m) seabed conditions, and other factors, the Bellrock Wind Farm Infrastructure will use both floating (namely, tension leg platform, semi-submersible, buoy, semi-spar and barge) and fixed foundations designs would be considered in the EIA Being concerned of the spatial footprint of floating WTGs and the potential snagging hazard that their moorings system creates to fishing vessels, SFF would propose to the Applicant to use the fixed foundation design (with lesser spatial footprint) for as much WTGs as possible, as a fixed foundation wind farm in a water depth of greater than 70 meters is planned for another offshore wind development in Scottish waters. Where use of fixed foundation WTGs is not feasible due to technical issues, in such situations, SFF's first preferred WTG floating foundation option is tension leg platform, and buoy to be the second preferred option since they have lesser spatial footprint on seabed. For the same reasons, SFF's preferred mooring system is 'tension mooring' as defined under sub-section 3.4.1.1 (p39) of the Bellrock WFDA Scoping Report. The SFF object to the use of a shared mooring system as it would deem the floating section of the array a no take zone for fishing to continue post construction.	Consultee design preferences were considered in developing the project design envelope described in **Chapter 4: Project Description (Volume II)** and also reflected in the commercial fisheries realistic worst-case parameters with implications for access/snags assessed in **Chapter 11: Commercial Fisheries (Volume II)**.
Marine Directorate - Science, Evidence, Data and Digital (MD-SEDD)	Representation on the Bellrock WFDA Scoping Report (2024)	MD-SEDD advise that they do not agree that the potential impact on additional steaming times during all phases of the project should be scoped out. Given the location of a known Nephrops fishing ground in the southeast of the WFDA, it is possible the array may interfere with important steaming routes out of Peterhead. Furthermore, MD-SEDD note that the project design has not been finalised, but if FSSs are selected (which may have mooring lines and dynamic IAC within the water column), the advisory safe distances from infrastructure could be larger leading to the whole WFDA itself acting as an obstacle for steaming, even when temporary Safety Zones for maintenance are not in effect. AIS data from 2022 has	As presented in **Chapter 11: Commercial Fisheries (Volume II)** and **Appendix 11.1 (Volume IV)** (Section 7) additional steaming is scoped in and assessed (C5/O5/D5), using multi-year AIS/VMS evidence.

Consultee	Date/Document	Comment	How/Where Comment is Addressed
		been presented within the Bellrock WFDA scoping report but this does not provide enough information to justify scoping out this impact at this stage. MD-SEDD advise looking at AIS fishing vessel tracks over at least 5 years to determine whether there will be a significant impact.	
SFF	Representation on the Bellrock WFDA Scoping Report (2024)	SFF notes from section 3.7.1 (p57) that for FSSs, due to the nature (and movement) of the structure, static IAC (on the seabed) and dynamic IAC (moving within the water column) are required, joined together by a connector to form one continuous cable. The dynamic IAC section is designed to accommodate the dynamic movement of the FSS. Dynamic IACs sections can be deployed in various configurations that may include: Free hanging; Lazy “S” wave; and Steep wave. Considering the footprint of the dynamic IACs sections, SFF’s preferred configuration is free hanging vs the other two.	Dynamic/static IAC configurations are described in **Chapter 4: Project Description (Volume II)**, and also reflected in the realistic worst-case parameters and with snagging/interference assessed in **Chapter 11: Commercial Fisheries (Volume II)**.
SFF	Representation on the Bellrock WFDA Scoping Report (2024)	SFF notes from section 3.7.2 that static sections of IAC cable may be surface laid or buried. Being concerned of fishermen’s safety, first of all, SFF would suggest to the Applicants to make all efforts to reach the required depth of cable burial and avoid using cable protection measures as much as possible since the volume of cable protection mass will disrupt the marine habitat and would create snagging hazard for fishing vessels within array area. In terms of using cable protections, SFF advise that they are opposed to using concrete mattresses and rock bags in open water since they create severe snagging hazards for bottom trawl fishing vessels and static gears. SFF’s preferred cable protection measure is rock dump/protection considering industry standard rock size (1”- 5”) with a 1:3 profile followed by an overtrawl sweep alongside a long-term monitoring programme. SFF advise that they do not object to use of sandbags in cable protection works as long as their size is not significant to create snagging hazard for fishing vessels. In terms of crossing point, as they create obstacles and snagging hazard to the fishing industry, SFF would suggest that the cable crossing should be avoided as much as possible otherwise the design of cables and pipelines crossing points should be consulted with fishing industry to ensure their impacts are mitigated.	Cable burial/protection preferences are considered within the design envelope (**Chapter 4: Project Description (Volume II)**) and reflected in realistic worst-case assumptions and with snagging/interference and disturbance pathways in **Chapter 11: Commercial Fisheries (Volume II)**.
SFF	Representation on the Bellrock WFDA	SFF notes from section 3.9.2 (p66) of the Scoping Report that pre-construction activities (i.e. site preparation works) include boulder clearance. Since the	Boulder clearance is included in the realistic worst-case and disclosure of relocated boulder

Consultee	Date/Document	Comment	How/Where Comment is Addressed
	Scoping Report (2024)	relocation of boulders from their natural positions and re-positioning them on new surface causes snagging hazard for fishing vessels, SFF would suggest avoiding the relocation of boulders as much as possible. However, where boulders relocation is unavoidable, they recommend the new locations/coordinates of the relocated boulders should be recorded and shared with fishermen. Fishermen require geographical readings to decimal of a minute format (3 decimal places sufficient) rather than going down to actual seconds and the datum should be WGS84 rather than ED50.	locations is committed as embedded mitigation in **Chapter 11: Commercial Fisheries (Volume II),** also secured through the **FMMCP (Volume V).**
DIO representing the Ministry of Defence (MOD)	Representation on the Bellrock WFDA Scoping Opinion (2024)	The DIO note that wind turbines have been shown to have detrimental effects on the operation of AD radar. These include the desensitisation of the radar in the vicinity of wind turbines, and the creation of "false" aircraft returns. The probability of the radar detecting aircraft flying over or in the locality of the turbines would be reduced, hence turbine proliferation within a specific locality can result in unacceptable degradation of the radar's operational integrity. This would reduce the RAF's ability to detect and manage aircraft in United Kingdom sovereign airspace, thereby preventing it from effectively performing its primary function of Air Defence of the United Kingdom. Within paragraph 12.4.4 (968) of Chapter 12 [of the Scoping Report] it is stated that the nearest military AD radar is located at RRH Buchan which is approximately 117.2km from the closest point of the scoping array. The MOD has undertaken an assessment based on 80 wind turbines at 400m to tip height using the Rochdale Envelope boundary co-ordinates. Turbines within the array area will be detectable to the AD Radar at RRH Buchan. The impact of the turbines on the AD radar at RRH Buchan will therefore need to be addressed through a suitable technical mitigation solution. It is the applicant's responsibility to provide a suitable technical mitigation solution to the MOD.	Impact to RRH Buchan is assessed further in **Chapter 13: Aviation and Radar (Volume II).** Subsequent to the Scoping Opinion, the Applicant reduced the maximum blade tip height from 400 m above MSL to 337 m above MSL (see **Chapter 4: Project Description (Volume II)**). This design change significantly reduces the footprint of the Bellrock WFDA that is in RLoS of RRH Buchan. See **Section 3.6** for further information on secondary mitigation measures proposed.
NATS	Representation on the Bellrock WFDA Scoping Opinion (2024). Technical and Operational Assessment (TOPA)	*'Predicted Impact on Perwinnes RADAR: Using the theory as described in Appendix A and development specific propagation profile it has been determined that the terrain screening available will not adequately attenuate the signal, and therefore this development is likely to cause false primary plots to be generated. A reduction in the RADAR's probability of detection, for real aircraft, is also anticipated.* *En-route operational assessment of RADAR impact: Where an assessment reveals a technical impact on a specific NATS' RADAR, the users of that RADAR*	Impact to NATS Perwinnes is assessed in **Chapter 13: Aviation and Radar (Volume II)**. Subsequent to the Scoping Opinion, the Applicant reduced the maximum blade tip height from 400 m above MSL 337 m above MSL (see **Section 3.7** and **Chapter 13: Aviation and Radar (Volume II)**).

Consultee	Date/Document	Comment	How/Where Comment is Addressed
		are consulted to ascertain whether the anticipated impact is acceptable to their operations or not. ▪ *Prestwick Centre ATC: Unacceptable* ▪ *Military ATC: Unacceptable* ▪ *Aberdeen ATC: Unacceptable* *En-route Consultation: The proposed development has been examined by technical and operational safeguarding teams. A technical impact is anticipated, this has been deemed to be unacceptable.'*	Subsequent to this design change, the Applicant has engaged NATS on the revised WTG parameters and NATS advise that their analysis shows that WTGs with a maximum blade tip height of 337 m above MSL, would be below RLoS and *"even when we [NATS] apply ducting corrections the detection probability would low enough that it would not draw a NATS objection".*
NATS	Email Correspondence, 6 November 2025	Subsequent to the Scoping Opinion, the Applicant reduced the maximum blade tip height from 400 m above LAT to 337 m above MSL (see **Section 3.7** and **Chapter 13: Aviation and Radar (Volume II)** and has engaged NATS on the revised WTG parameters. *In response, NATS confirms that "NATS' analysis agrees that turbines 337 m above MSL to tip would be below RLOS and even when we apply ducting corrections the detection probability would low enough that it would not draw a NATS objection.'*	Noted. Impact to NATS Perwinnes is assessed in **Chapter 13: Aviation and Radar (Volume II).**

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3.2 Objectives of the Bellrock Project

5 The site selection and consideration of alternatives process has been informed by the overarching objectives of the Bellrock Project, as set out in **Table 3.2**.

Table 3.2: Objectives of the Bellrock Project

Theme	Objective
Drive offshore wind growth in Scottish waters	1. To contribute to the delivery of a significant volume of operational offshore wind in Scottish waters in the 2030s which will generate low carbon electricity in support of the decarbonisation of the Scottish electricity supply as part of Scottish and UK climate change targets and the Scottish Government's ambition of developing up to 40 gigawatts (GW) of new offshore wind in Scottish waters by 2040.
Improve energy security	2. To improve energy security and stability in Scotland and the UK and by providing significant renewable energy generation within Scottish waters.
Optimise renewable energy within infrastructure limits	3. To optimise renewable energy generation and supply capacity at scale within the constraints of available Scottish seabed and onshore transmission infrastructure.
Unlock deep-water offshore wind potential	4. To generate renewable power on the Scottish seabed at greater depths by deploying floating wind technology at scale.
Maximising socioeconomic benefits for Scotland	5. To deliver significant socioeconomic benefits and investment within the Scottish supply chain and realise the associated economic development, skills and employment benefits for Scotland.

3.3 The 'Do Nothing' Scenario

6 The 'do nothing' scenario is a projection of the existing baseline, to show what change, if any, may occur should the Bellrock Project not be developed. The 'do nothing' scenario is an alternative which must be considered in line with the EIA Regulations and is considered in the context of the Bellrock Project objectives as set out in **Table 3.2** above. **Table 3.3** summarises the outcomes under the 'do nothing' scenario. Not proceeding with the Bellrock Project will result in the Project Objectives not being achieved, specifically the loss of up to 1.8 GW of offshore wind supply to the National Electricity Transmission System. Furthermore, if the Bellrock Project does not go ahead, a large area (280 km^2) of seabed in Scottish waters well-suited for large-scale floating offshore wind generation would remain undeveloped. As a result, the opportunity to contribute significantly to Scotland's and the UK's Net Zero and decarbonisation targets would be lost which would weaken short-term energy security. Given the critical importance of achieving climate goals, ensuring energy security, and maintaining affordability, all viable and acceptable offshore wind projects must be considered. In the context of the climate emergency, inaction is not a sustainable option.

7 Therefore, the 'do nothing' option is discounted as an alternative solution to the Bellrock Project as it would not meet any of the Bellrock Project objectives (1 – 5), as summarised in **Table 3.3.**

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Table 3.3: Consideration of the 'Do Nothing' Scenario

Objective	Basis for the Objective	Outcome in the 'Do Nothing' Scenario
1. To contribute to the delivery of a significant volume of operational offshore wind in Scottish waters in the 2030s which will generate low carbon electricity in support of the decarbonisation of the Scottish electricity supply as part of Scottish and UK climate change targets and the Scottish Government's ambition of developing up to 40 GW of new offshore wind in Scottish waters by 2040.	The Scottish Government declared a global Climate Emergency in 2019 and set a target for achieving net zero by 2045. The UK has several binding commitments to address climate change, which will require the adoption of renewable technologies as a significant proportion of its energy generation mix. Delivery of renewable power in the 2030s will enable the Bellrock Project to make a meaningful and timely contribution to the decarbonisation and security of energy supply in both Scotland and the rest of the UK, addressing important aspects of existing and emerging Scottish Government and UK Government policy.	Doing nothing would mean that Objective 1 would not be met, resulting in a missed opportunity to provide 1.8 GW of operational offshore wind in Scottish waters in the 2030s and beyond. This would undermine the UK's binding commitments to address climate change, making the UK's 2050 Net Zero target and Scotland's 2045 target harder to achieve.
2. To improve energy security and stability in Scotland and the UK and by providing significant renewable energy generation within Scottish waters.	The Bellrock Project will increase Scottish and UK renewable generated electricity. The Bellrock WFDA as part of the Project will support a secure national supply of renewable electricity to the National Electricity Transmission System and benefit Scottish and UK consumers by reducing reliance on fossil fuel and foreign imports. Once operational, the Project will significantly contribute to Scotland and the UK's energy security, system resilience and stability.	Doing nothing would fail to improve energy diversification or resilience in Scotland and the UK. Continued dependence on imported fossil fuels would leave Scotland and the UK exposed to volatile global energy markets, price instability, and geopolitical risks. This would undermine the security and independence of our energy supply.
3. To optimise renewable energy generation capacity at scale within the constraints of available Scottish seabed and capacity within the National Electricity Transmission System.	The Bellrock Project will optimise generation and export capacity by developing a floating offshore wind project within a deeper area of seabed that has not previously been considered suitable for fixed foundation development. Sites have been identified within strategic spatial planning as suitable for deeper water floating wind technologies, offering access to stronger and more consistent wind speeds than shallower sites. By situating the development further offshore, taking full advantage of designated locations and identified planning constraints, the project maximises clean, renewable energy output while minimising visual impacts on coastal communities. This strategic location balances technical feasibility with environmental and planning considerations, supporting the objective to optimise renewable energy generation and supply capacity at scale within the constraints of available Scottish seabed and onshore transmission infrastructure.	Doing nothing would leave the E1 Plan Option underdeveloped, contradicting the spatial planning intentions of the SMP (Scottish Government, 2020). This would forfeit the opportunity to optimise offshore wind generation in this designated area, which benefits from deeper waters and stronger, more consistent winds accessible by floating wind technology.

Objective	Basis for the Objective	Outcome in the 'Do Nothing' Scenario
4. To generate renewable power on the Scottish seabed at greater water depths by deploying floating wind technology at scale.	The Bellrock Project will contribute to maturing floating offshore wind technology at scale. The Bellrock Project will demonstrate technology, supply chain partnerships, and export readiness initiatives, creating pathways for global supply chain export potential from Scotland and the UK. The Bellrock Project will contribute to the rapid maturity of the GW scale floating offshore wind supply chain, which is currently in its infancy and significantly less established than fixed bottom supply chains, demonstrating Scotland as a global leader in floating wind.	Doing nothing would delay or impede the at-scale deployment and maturation of floating offshore wind technology in Scotland. This would hinder unlocking the full offshore wind potential available in deeper waters and further from shore.
5. To deliver significant socioeconomic benefits and investment within the Scottish supply chain and realise the associated economic development, skills and employment benefits for Scotland.	Maximising socioeconomic benefit and supply chain investment is a key ambition of Scottish and UK renewable energy strategies, which the Bellrock Project will support. In addition to its strategic importance, the Bellrock Project is expected to deliver significant economic value – creating jobs, stimulating local industries, and supporting the wider supply chain in manufacturing, engineering, and infrastructure. During the development and construction phase, the Bellrock Project is expected to generate £845 million GVA in Scotland, and £1,439 million GVA across the UK. During construction, peak employment is expected in 2032 with around 4,560 jobs supported in that year across the UK, of which 2,900 jobs are within Scotland. These include both direct employment by the Bellrock Project and its contractors, as well as indirect employment within the wider supply chain. Additionally, induced impacts arise from employee spending within the wider economy.	Doing nothing would reduce Scotland's opportunity to demonstrate global leadership in floating wind innovation and supply chain development, slowing the growth of a strategically important and emerging industry with significant export potential. It would substantially reduce long-term economic benefits, including jobs, skills development, and investment across Scottish and UK renewable energy supply chains, hindering the growth of the Scottish supply chain.

Notes:

[1] GVA is a measure of the value of goods and services produced in an area, industry or sector of an economy.

[2] Years of employment is a measure used to report the short-term employment that is supported by the development and construction of the Bellrock Project. As an example, a job that lasts for 18 months would support 1.5 years of employment.

3.4 Site Selection Process for the Bellrock WFDA

8 The site selection process for the Bellrock WFDA is described in **Sections 3.4.1** to **Section 3.4.4** below, and follows the stages summarised below:

- **Stage 1:** Overview of the SMP for Offshore Wind and the ScotWind Leasing Round (**Section 3.4.1**);
- **Stage 2:** Applicant's Selection of the Plan Option (**Section 3.4.2**);
- **Stage 3:** Identification of Bellrock WFDA Boundary (**Section 3.4.3**); and
- **Stage 4:** CES Award of Seabed Development Rights (**Section 3.4.4**).

3.4.1 Stage 1: Overview of the Sectoral Marine Plan for Offshore Wind and the ScotWind Leasing Round

9 In November 2017, CES announced their intention to run a seabed leasing round for commercial scale offshore wind energy projects in Scottish Waters. This leasing round became known as the 'ScotWind' leasing round.

10 From June 2018, to inform the spatial development of the ScotWind leasing round, Marine Scotland (now Marine Directorate) undertook a spatial planning exercise to identity areas of search (Marine Scotland Science, 2018) for offshore wind development. The study considered various geospatial data layers to carry out a multi-criteria analysis depicting both opportunities (such as average wind speed or existing grid connections) and constraints (such as fishing activity, shipping traffic or environmental sensitivities). These were subsequently refined through several iterations of opportunity and constraint analysis, and consultation and engagement with stakeholders and Scottish Ministers.

11 In December 2019, the draft SMP for Offshore Wind Energy (the draft SMP) was published for consultation (Marine Scotland, 2018). The draft SMP identified the 17 most sustainable areas (known as Draft Plan Options) for future development of commercial-scale offshore wind energy in Scotland.

12 In 2020, the Scottish Government published the SMP for Offshore Wind Energy (the SMP) (Scottish Government, 2020) which provided the spatial strategy to support CES's ScotWind leasing round. The SMP was informed by stakeholder engagement and a Sustainability Appraisal (comprising a Strategic Environmental Assessment, a Habitats Regulations Appraisal, and a Social and Economic Impact Assessment). Amendments were made to the boundaries of seven of the Draft Plan Options, two Draft Plan Options were not progressed and 15 sustainable areas (known as Plan Options) were identified for commercial-scale offshore wind development.

13 In January 2021, CES launched the ScotWind leasing round which released the 15 Plan Options defined within the SMP for new commercial scale offshore wind developments to help Scotland achieve its Net Zero emissions target by 2045.

3.4.2 Stage 2: Applicant's Selection of Plan Option

14 To select the Plan Option for which the Applicant would seek development rights, the Applicant undertook a desktop appraisal of the 15 Plan Options released under the ScotWind leasing process to identify (in the Applicant's view) the most viable Plan Option(s) for the development of a floating offshore wind farm. Noting each Plan Option was already identified within the SMP (Scottish Government, 2020) as being, in principle, a sustainable location for future offshore wind development, the Applicant's desktop appraisal considered the following environmental, commercial, socioeconomic, engineering, constructability and technical constraints and opportunities, allowing each Plan Option to be ranked:

- Water depth and distance to shore;
- Wind speed and metocean conditions;
- Offshore geotechnical conditions;
- Offshore environmental designations (existing and proposed) including Special Protection Areas (SPAs), Ramsar sites, Special Areas of Conservation (SAC) and Nature Conservation Marine Protected Areas;
- Ornithology;
- Benthic ecology;
- Fish and shellfish ecology;
- Marine mammals including cetaceans and seals;
- Shipping and navigation;
- Commercial fishing activity;
- Seascape and landscape;
- Archaeology and cultural heritage;
- Aviation and radar, including civil and military aspects;
- Existing infrastructure including oil and gas leases;
- Energy yield potential; and
- Emergency services, including SAR operations.

15 The consideration of constraints and opportunities was informed by the SMP (Scottish Government, 2020) and analysis was undertaken on each Plan Option using constraints mapping and a Red-Amber-Green assessment taking into consideration environmental, consenting and engineering constraints, to screen potential options and identify a short list of the most viable Plan Options for the development of a floating offshore wind farm. From the environmental and consenting perspectives, the focus was on ornithology, marine mammals and offshore

infrastructure and other users of the seabed. Whilst for engineering the criteria analysed consisted of water depths; ground conditions; grid connection availability; geohazards along the cable route; wind speeds and influence of wind speeds on installation and operations; wave conditions for design, installation and operations; and the availability of ports for manufacturing/fabrication, assembly, and operation and maintenance (O&M).

16 Plan Option E1 was subsequently selected as the preferred Plan Option for the development of the Bellrock WFDA.

3.4.3 Stage 3: Identification of Bellrock Wind Farm Development Area Boundary

17 On selection of Plan Option E1, the Applicant sought to define the boundary of the Bellrock WFDA based on the following primary considerations:

- In the absence of site-specific ornithological data, the Applicant considered that ornithological impacts would reduce in the eastern area of E1 compared to the western and central areas, due to an increased distance from sensitive coastline locations, SPAs and Ramsar sites;
- Consideration was given to minimising the impact to commercial fishers (in particular Nephrops) within the Devil's Hole, located within the eastern boundary of Plan Option E1;
- Consideration was given to minimising the impact on 'line of sight' radar from the RRH Buchan Air Defence (AD) Radar and the Perwinnes Primary Surveillance Radar, noting the impacts would reduce and potentially be removed in the eastern area of E1 compared to the western and central areas, due to an increased distance from shore;
- Consideration was given to the size of the WFDA necessary to maintain the minimum development density specified by CES (of 3 MW/km²) whilst maintaining flexibility for the number and layout of WTGs to enable the use of the latest WTGs to come onto the market in the early to mid-2030s. In addition, consideration was given to allowing flexibility for SAR, vessels and helicopters to maintain safe passage whilst enabling micro-siting for unknown constraints such as wrecks or unsuitable ground conditions; and
- Given the competitive nature of the ScotWind seabed leasing process, the Applicant considered that other developers would seek to secure seabed rights for areas in the western and central area of E1, given the proximity to shore and slightly shallower water depths in these areas. Therefore, the Applicant retained a preference to secure seabed rights for the area in the eastern area.

18 Considering the above measures to minimise the potential interactions with environmental receptors, the Applicant defined the Bellrock WFDA boundary (shown in **Figure 1.1**) on the northeastern area of Plan Option E1, and in July 2021 submitted a seabed lease application to CES seeking development rights for the Bellrock WFDA.

3.4.4 Stage 4: Crown Estate Scotland Award of Seabed Development Rights

19 In January 2022, following the evaluation of all ScotWind applications received by CES, Bellrock Offshore Wind Farm Limited (i.e. the Applicant) was awarded exclusive development rights for the Bellrock WFDA located within Plan Option E1. On entering the Option to Lease Agreement, the Applicant paid an option fee of £28 million to CES which was passed to the Scottish Government for public spending.

20 The Bellrock WFDA boundary (shown in **Figure 1.1, Appendix III** of the Bellrock WFDA EIA Report) has not been modified between the ScotWind seabed lease application, the ScotWind seabed lease award and this Bellrock WFDA EIA Report.

3.5 Change to the Bellrock Project's Grid Connection Design and Capacity

21 In July 2022, National Energy System Operator (NESO) recommended that the Bellrock Project (1.2 GW installed capacity at the time) connected to the National Electricity Transmission System via a proposed Scottish and Southern Electricity Networks Transmission (SSEN Transmission) offshore substation (NESO, 2022). This was reflected within the Bellrock WFDA Scoping Report (**Appendix 1.1 (Volume IV)**).

22 However, NESO determined in April 2025 that the Bellrock Project would instead connect onshore, to SSEN Transmission's proposed Hurlie substation, located to the west of Stonehaven, Aberdeenshire (NESO, 2025). As a result, the Bellrock Project is now required to develop additional Onshore Transmission Infrastructure (including onshore export cables and an onshore substation), and additional Offshore Transmission Infrastructure.

23 Given the additional Onshore Transmission Infrastructure and Offshore Transmission Infrastructure required as a consequence of NESO's change to the Bellrock Project's grid connection design, the Bellrock Project's development costs would increase significantly. To seek to improve the cost efficiency and competitiveness of the Bellrock Project, the Applicant has increased the export capacity of the Bellrock Project to the National Electricity Transmission System from 1.2 GW to 1.8 GW. Whilst the number of WTGs has increased, the Bellrock WFDA remains unchanged from what was presented in the Bellrock WFDA Scoping Report (refer to **Section 3.7.2.2**) and these updates have been communicated to all relevant stakeholders.

3.6 Refinement of the Bellrock WFDA Layout

24 The spatial size of the Bellrock Project has been driven by a several key factors, initially by the ScotWind seabed leasing process where the E1 Plan Option Area was formally identified within the SMP (Scottish Government, 2020).

25 Attempting to deliver the full 1.8 GW capacity within a smaller, more densely arranged area would lead to notable energy yield reductions due to increased wake effects between WTGs, which would reduce efficiency and limit the overall electrical output of the Bellrock Project. Additionally, a more compact layout could restrict the layout flexibility needed to ensure safe navigation and SAR operations.

26 The layout of offshore wind farms and positioning of WTGs is often influenced by a SLVIA. As the Bellrock WFDA is located 116 km from the nearest Scottish coastline, Scottish Ministers agreed that the SLVIA would be scoped out of this Bellrock WFDA EIA Report (**Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)**). The final WTG layout will be determined post consent and will be compliant with MCA requirements (i.e. Marine Guidance Note (MGN) 654) including SAR requirements, and also consider environmental constraints, wind resource and seabed conditions. The final WTG layout will be presented within the Development Specification and Layout Plan (DSLP) which requires the approval of the Scottish Ministers prior to the commencement of construction, in line with the Bellrock WFDA consent conditions.

27 It should be noted that where the final design and layout is agreed through the DSLP, the impacts of the final design and layout will not be materially greater than that assessed in this Bellrock WFDA EIA Report.

28 Through the EIA process and in consultation with relevant stakeholders, the Bellrock WFDA design has been refined to minimise the extent of RLoS from RRH Buchan in the northwestern area of the WFDA (see **Chapter 13: Aviation and Radar (Volume II)**). There is only a potential impact to the Buchan AD radar if WTGs are in RLoS of RRH Buchan, and it is demonstrated that such RLoS impacts have a detrimental impact on the MOD's ability to perform Defence Task 1 (i.e. surveillance activities in support of defence of the realm).

29 As discussed in **Chapter 13: Aviation and Radar (Volume II)** the WTG Type 2[1] (with an equivalent tip height of 337 m above MSL) may be detected in a small section on the northwest corner of the Bellrock WFDA (comprising an area of 3.93 km^2). RLoS modelling shows that WTGs with a tip height of 318 m above Highest Astronomical Tide (HAT) (i.e. an equivalent tip height of 320 m above MSL) and below, will not be within RLoS of RRH Buchan in this area. Should DIO demonstrate that the RLoS impact on RRH Buchan requires mitigation, the Applicant would not position WTGs with an equivalent tip height of 320 m above MSL within the RRH Buchan RLoS shown in **Figure 13.1.8** in **Appendix 13.1: Airspace Analysis and Radar Modelling (Volume IV)**. If the DIO consider that a materially larger area of the Bellrock WFDA presents RLoS impact on RRH Buchan, the Applicant will consider mitigating the impact through new AD infrastructure procured under Programme NJORD, with the cost of such Programme NJORD deployment being borne by the UK Government.

30 This secondary mitigation will be secured by an appropriate consent condition and does not change the proposed maximum number of WTGs to be installed and therefore does not change the impacts presented across the other technical chapters within this EIA Report (**Chapters 6 – 19 (Volume II)**.

[1] For full parameters refer to **Chapter 4: Project Description (Volume II)**.

3.7 Consideration of Alternative Technologies and Methodologies

31 This section summarises the key technical alternatives considered by the Applicant in progressing the Bellrock Wind Farm Infrastructure to the consent application stage. Further detail on the design considered in this Bellrock WFDA EIA Report is provided in **Chapter 4: Project Description (Volume II)**.

3.7.1 Project Design Envelope

32 The guidance prepared by MD-LOT and the Scottish Government's Energy Consents Unit on using the design envelope approach for applications under Section 36 of the Electricity Act 1989 where flexibility is required in applications (Scottish Government, 2022), has been considered when refining the project design envelope to inform the EIA.

33 As described in **Chapter 5: EIA Methodology (Volume II)**, a project design envelope approach accommodates the necessary flexibility within a consent, which is a key aspect of any large development but is particularly important for offshore wind farm projects where technology is evolving.

34 The project design envelope will provide sufficient flexibility to allow the Applicant and their supply chain to use the most up to date, efficient and economical technology and techniques in the construction, O&M, and decommissioning of the Bellrock Wind Farm Infrastructure located within the Bellrock WFDA, without affecting the surrounding environment to a greater extent than the worst-case scenarios assessed within this Bellrock WFDA EIA Report.

35 Subsequent to the submission of the Bellrock WFDA Scoping Report (**Appendix 1.1 (Volume IV)**), further refinement of the project design envelope and the WFDA layout was undertaken by the Applicant to reduce environmental impact. This design refinement reflects the Applicant's further understanding of the WFDA's baseline conditions and of the technology and equipment design likely to be available at the time of construction. These refinements are summarised below with further details presented in **Section 3.7.2** to **Section 3.7.7**.

3.7.2 Wind Turbine Generators

3.7.2.1 Wind Turbine Generator Dimensions

36 The Bellrock WTG design envelope comprises a 'WTG Type 1' which represents the smallest WTG dimensions under consideration, and a 'WTG Type 2' which represents the largest WTG dimensions under consideration. This approach provides the Applicant with flexibility of utilising any WTG dimension within this design envelope.

37 Using WTGs with smaller rotors than the WTG Type 1 proposed by the Applicant would require a greater number of WTGs to achieve the same 1.8 GW export capacity for the Bellrock Project and increase cost and the construction period. This would also increase the total swept area within the Bellrock WFDA, leading to a higher risk of bird collisions, seabed footprint and potential navigational obstructions.

38 The Bellrock WFDA Scoping Report (**Appendix 1.1 (Volume IV)**) submitted in March 2024 presented the WTG Type 1 and WTG Type 2 dimensions as envisaged at the time of scoping. After the submission of the Scoping Report, the Applicant undertook further engagement with the WTG supply chain to establish the likely dimensions (and electrical output) of WTGs which are envisaged to be available within the delivery timeframe of the Bellrock WFDA.

39 Using WTGs with smaller rotors than the WTG Type 1 was considered as failing to maximise the generation potential within the Bellrock WFDA and would limit the Bellrock Project's contribution to key objectives (**Table 3.2**).

40 Additionally, it would not make effective use of the most advanced floating WTG technology expected to be available to the Applicant. Furthermore, 'smaller' WTGs may no longer be available on the market at the time of construction of the Bellrock Project.

41 For these reasons, the use of smaller rotors or a reduced swept area (outside of the design envelope) is not considered a feasible alternative solution.

42 After the Scoping Opinion, the Applicant reduced the maximum blade tip height associated with the WTG Type 2 from 400 m above sea surface to 335 m above sea surface (which, when rounded up is the equivalent to 337 m above MSL). RLoS modelling indicates that WTGs with an equivalent maximum tip height of 337 m above MSL will not be within RLoS of Perwinnes see **Chapter 13: Aviation and Radar (Volume II)** for details) and therefore will result in no technical impact to Perwinnes Primary Surveillance Radar from the Bellrock Wind Farm Infrastructure.

43 NATS advised by email on 6 November 2025, that an equivalent maximum tip height of 337 m above MSL, would be below RLoS and the detection probability would be low enough that it would not draw a NATS objection. This design change significantly reduces the footprint of the Bellrock WFDA that is in RLoS of RRH Buchan (see **Section 3.6** for further details).

44 The WTG dimensions presented within the Scoping Report have been refined by the Applicant. **Table 3.4** below presents the WTG dimensions presented within the Scoping Report and the WTG dimensions which comprise the WTG design envelope (representing the range of WTGs expected to be available to the Applicant in the 2030s) and have been subsequently assessed for this Bellrock WFDA EIA Report.

Table 3.4: Refinement of Wind Turbine Generator Dimensions

Parameter	WTG Type 1		WTG Type 2	
	Dimension Within the Bellrock WFDA Scoping Report	Dimension Within the Bellrock WFDA EIA Report[1]	Dimension Within the Bellrock WFDA Scoping Report	Dimension Within the Bellrock WFDA EIA Report[1]
Maximum rotor diameter (m)[2]	236	236	330	300
Maximum hub height above sea surface (m)[2]	N/A	153	N/A	185

Parameter	WTG Type 1		WTG Type 2	
	Dimension Within the Bellrock WFDA Scoping Report	Dimension Within the Bellrock WFDA EIA Report[1]	Dimension Within the Bellrock WFDA Scoping Report	Dimension Within the Bellrock WFDA EIA Report[1]
Minimum hub height above sea surface (m)[2]	N/A	141	N/A	173
Maximum blade tip height above sea surface (m)[2]	N/A	271	400	335

Notes:

[1] This EIA Report and the WTG design envelope assessed are based on the WTG dimensions rather than a WTG generation capacity.

[2.] For FSS designs that move with the tide (i.e. semi-submersible platform and barge), these parameters will be maintained relative to the sea surface. For the tension leg platform (TLP) FSS design, which is restrained by tensioned moorings and does not notably move with the tide, these parameters will be within the stated project design envelope. See **Chapters 10 Offshore Ornithology, 12 Shipping and Navigation** and **13 Aviation and Radar (Volume II)** for further detail on the air gap and maximum blade tip height and corresponding reference tidal levels that apply to those specific assessments.

45 Further details on the WTG types included within this Bellrock WFDA EIA Report are presented in **Chapter 4: Project Description (Volume II)**.

3.7.2.2 Maximum Number of Wind Turbine Generators Installed

46 The Bellrock WFDA Scoping Report (**Appendix 1.1 (Volume IV)**) presented the minimum and maximum number of WTGs as envisaged at the time, reflecting a grid connection capacity of 1.2 GW. As outlined in **Section 3.5**, after the submission of the Bellrock WFDA Scoping Request, NESO imposed a change to the grid connection design and subsequently the Applicant increased the Bellrock Project's export capacity to 1.8 GW to provide an opportunity to improve the cost efficiency and competitiveness of the Bellrock Project. In addition, the Applicant has also sought to optimise the density and layout of floating offshore units (FOUs) within the WFDA, and ultimately the annual renewable energy output by the inclusion of additional FOUs within the WFDA.

47 The maximum number of WTGs proposed for the Bellrock Project is therefore 132. The specified number of WTGs is considered optimal for maximising the Bellrock Project's export capacity. Reducing this number of WTGs would reduce the Applicant's ability to deliver an efficient project and compromise the Bellrock Project's ability to meet its objectives (outlined in **Table 3.2**) and result in a significant loss of renewable energy output potential. A substantial reduction in the maximum number of WTGs is not viewed as financially viable at this stage of the project development.

48 **Table 3.6** below presents the maximum number of WTGs presented within the Scoping Report and the maximum number of WTGs which comprise the WTG design envelope for this Bellrock WFDA EIA Report.

Table 3.5: Change in the Number of Wind Turbine Generators as a Result of the Capacity Increase

Parameter	WTG Type A		WTG Type B	
	Number Included within the Bellrock WFDA Scoping Report	Number Included within the Bellrock WFDA EIA Report[1]	Number Included within the Bellrock WFDA Scoping Report	Number Included within the Bellrock WFDA EIA Report[1]
Maximum number of WTGs	80	132	42	90
Notes: [1] This Bellrock WFDA EIA Report and the design envelope presented are based on number of WTGs rather than a WTG generation capacity.				

3.7.2.3 Air Gap

49 In the UK, the minimum clearance of WTG blades above the water is 22 m above Mean High Water Springs (MHWS), in accordance with MCA requirements (MGN 654 and MGN 372) for safe navigation and to mitigate potential impacts to vessels (see **Chapter 12: Shipping and Navigation (Volume II)** for further detail).

50 An increase in the air gap can reduce seabird collision risk, as it reduces peak sensitive bird flight height densities for species such as kittiwake and gannet, and consequently reduces collision impacts. However, this increase in WTG height has implications for engineering design, feasibility of installation and operation, increased quantities of materials, and increased costs. The height of the WTGs may also affect the assessment of other receptors, such as radar.

51 The Applicant undertook preliminary ornithological collision risk modelling utilising the WTG parameters presented in **Table 3.4** and **Table 3.6**, in order to inform the decision for the optimal air gap, considering likely ornithological impact, technical constraints, development cost and development risk. Ornithological impacts were estimated for an air gap of 22 m above sea surface[2] and increasing increments.

52 In discussion with NatureScot and MD-LOT, the Applicant determined that a minimum air gap of 22 m above sea surface would provide an acceptable balance between ornithological impact (see **Chapter 10: Offshore Ornithology (Volume II)**, technical constraints and cost.

53 Increasing the minimum air gap to greater than 22 m above the sea surface would require raising of the hub height of the WTGs, which in turn would result in an increase in the overall tower height. Depending on the height increase and FSS type, this change could potentially affect the stability of the FOU and structural design of the tower. To counter these potential risks larger diameter or thicker walled towers could be required, resulting in a heavier structure. Accommodating this

[2] For all FSS designs (semi-submersible platform and barge that move with the tide and tension leg platform FSS design, which is restrained by tensioned moorings and does not notably move with the tide), the air gap will be maintained relative to the sea surface and will be minimum 22 m above all tidal levels. This project design envelope will therefore encompass the minimum 22 m air gap above MHWS required by the MCA.

additional weight and geometry could necessitate a larger FSS design, increasing costs, increasing design risk and increasing delivery risk.

54 An increase in air gap would also narrow the range of installation vessels able to tow the FOUs to the Bellrock WFDA. At the current minimum 22 m air gap, the Bellrock Project is reliant on a limited number of vessels (used globally) and an increased air gap would further limit the available pool of suitable vessels. This limitation may prevent or restrict securing an appropriate vessel within the required installation window, potentially delaying the Bellrock Project.

55 A larger air gap would also necessitate the use of a larger ring crane (a heavy construction crane), which represents a significant bottleneck in the supply chain. Moreover, the combined increase in costs associated with taller WTGs and larger FSS could render the Bellrock Project financially uncompetitive. As such, increasing the air gap beyond the proposed minimum 22 m above sea surface (which is considered by the Applicant to adequately mitigate ornithological impact) would unnecessarily impact on project viability.

3.7.3 Wind Turbine Generator Foundations

56 Fixed bottom substructure (FBSS) options comprising piled jacket, suction caisson and cable supported monopile for the WTGs were included with the design envelope at the time of submitting the Bellrock WFDA Scoping Report.

57 Subsequent to the Bellrock WFDA Scoping Report, and to reduce the project design envelope (which was a key Scoping request from MD-LOT) (**Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)**), the Applicant considered in more detail the viability of FBSS and concluded that they did not represent the most favourable foundation solution for the Bellrock WFDA from a cost and delivery risk perspective when compared to FSSs. The Applicant therefore removed FBSS from the EIA design envelope. The removal of FBSSs is considered to reduce the potential for underwater noise impacts on marine mammals and fish from foundation piling activities.

58 FSS options (i.e. TLP, semi-submersible, barge, buoy and semi-spar) for the WTGs were included within the design envelope at the time of submitting the Bellrock WFDA Scoping Request. The spar design was not considered at the scoping stage as the Applicant considers that such designs are not optimal for project water depths, and present significant restrictions on assembly and integration port options. Subsequent to the Scoping Request, the Applicant considered in more detail, the viability of these FSS design options.

59 The buoy design has been incorporated within the semi-submersible design presented within the design envelope. The semi-spar (also known as a hybrid spar) was removed from the design envelope due to associated challenges around assembly, integration and O&M activities. The complications of the suspended mass/counterweight introduced for these activities was considered significant, for example, the challenge around raising and lowering of the counterweight is unknown for a commercial scale offshore wind farm. The Applicant considered that this could potentially result in challenges regarding transport to the Bellrock WFDA, tow to shore maintenance activities and decommissioning, as lowering and raising of the suspended structure/mass is a complex marine operation to undertake. This also presents potentially challenging health and safety risks with more vessels and/or longer timeframes of towing would likely be required in comparison with the other FSS options, overall resulting in increased environmental impacts.

60 The WTG foundation options presented within the Bellrock WFDA Scoping Report have therefore been refined by the Applicant. **Table 3.6** below presents the WTG foundation options presented within the Bellrock WFDA Scoping Report and the WTG foundation options which comprise the project design envelope for this Bellrock WFDA EIA Report.

Table 3.6: Refinement of Wind Turbine Generator Foundation Options

Parameter	Foundation Option Included within the Bellrock WFDA Scoping Report	Foundation Option Included within the Bellrock WFDA EIA Report
WTG foundations	▪ FSSs: – TLP; – Semi-submersible; – Barge; – Buoy; and – Semi-spar. ▪ FBSSs: – Piled jacket; – Suction caisson; and – Cable supported monopile.	▪ FSSs: – TLP; – Semi-submersible (incorporating buoy); and – Barge.

61 Further details on the foundation types included within this Bellrock WFDA EIA Report are presented in **Chapter 4: Project Description (Volume II)**.

3.7.4 Station Keeping System – Mooring Lines

62 Mooring line options comprising catenary mooring, taut mooring, semi-taut mooring, tension mooring and shared mooring were included with the design envelope at the time of submitting the Bellrock WFDA Scoping Report.

63 Subsequent to the Bellrock WFDA Scoping Opinion (**Appendix 1.2 (Volume IV)**), the Applicant considered in more detail, the feasibility of the abovementioned mooring line options. Considering the anchor design options in the project design envelope, catenary mooring, taut mooring, semi-taut mooring, tension mooring designs remain feasible.

64 Shared mooring was removed from the project design envelope due to the environmental considerations and the Applicant's understanding of the associated technology risk, as at the time of writing, no commercially proven shared mooring line applications were identified by the Applicant.

65 Environmental considerations in removing the shared mooring option included increased risk to vessel clearance within the Bellrock WFDA due to the moorings line being positioned higher in the water column, and higher risk to entanglement of marine mammals and diving birds. In the Bellrock WFDA scoping responses (see Appendix I of the Bellrock WFDA Scoping Opinion; **Appendix 1.2 (Volume IV)**), SFF objected to shared mooring as they considered this to present the highest risk

to commercial fisheries, as SFF consider that in their opinion the Bellrock WFDA would *"effectively become a no-take zone for fishing, including after construction is complete"*.

66 The mooring line types presented within the Bellrock WFDA Scoping Report have therefore been refined by the Applicant. **Table 3.7** below presents the mooring line options presented within the Bellrock WFDA Scoping Report and the mooring line options which comprise the project design envelope for this Bellrock WFDA EIA Report.

Table 3.7: Refinement of Mooring Line Options

Parameter	Mooring Line Options Included within the Bellrock WFDA Scoping Report	Mooring Line Options Included within the Bellrock WFDA EIA Report
Mooring lines	▪ Catenary mooring; ▪ Taut mooring; ▪ Semi-taut mooring; ▪ Tension mooring; and ▪ Shared mooring.	▪ Catenary mooring; ▪ Taut mooring; ▪ Semi-taut mooring; and ▪ Tension mooring.

67 Further details on the mooring line options included within this Bellrock WFDA EIA Report are presented in **Chapter 4: Project Description (Volume II)**.

3.7.5 Anchors

68 Anchors options comprising driven pile, suction pile, drilled and grouted pile, drag embedment anchor, vertical load anchor, and suction embedded plate anchor were included with the project design envelope at the time of submitting the Bellrock WFDA Scoping Report.

69 Subsequent to the Scoping Opinion (**Appendix 1.2 (Volume IV)**), the Applicant considered in more detail, the feasibility of the abovementioned anchors considering the seabed conditions and soil characteristics established by the Applicant's geophysical and geotechnical surveys of the Bellrock WFDA.

70 The drilled and grouted pile, vertical load anchor and suction embedded plate anchor were considered not feasible due to incompatibility with the ground conditions expected at the Bellrock WFDA and more costly and complex installation procedures compared to other anchor types.

71 Torpedo piles were not considered to be feasible due to incompatibility with the ground profile within the Bellrock WFDA, which limits the self-weight penetration and hence significantly limits the capacity of a torpedo pile.

72 Gravity based anchors were not included in the Bellrock WFDA Scoping Report. Although included into the project design envelope post-scoping, gravity based anchors have not resulted in any new potential environmental impacts outside of those scoped within the Bellrock WFDA Scoping Report. This anchor option does not require piling, and the seabed footprint and anchor penetration depth is within the maximum design envelope presented at Scoping. Therefore, the Bellrock WFDA Scoping Report and subsequent Scoping Opinion (**Appendix 1.2 (Volume IV)**) both remain valid.

73 The anchor types presented within the Bellrock WFDA Scoping Report have therefore been refined by the Applicant. **Table 3.8** below presents the anchor types presented within the Bellrock WFDA Scoping Report and the anchor types which comprise the design envelope for this Bellrock WFDA EIA Report.

Table 3.8: Refinement of Anchor Options

Parameter	Anchors Included within the Bellrock WFDA Scoping Report	Anchors Included within the Bellrock WFDA EIA Report
Anchors	▪ Driven pile; ▪ Suction pile; ▪ Drag embedment anchor; ▪ Vertical loaded anchor; ▪ Suction embedded plate anchor; and ▪ Drilled and grouted pile.	▪ Driven pile; ▪ Suction pile; ▪ Drag embedment anchor; and ▪ Gravity-based anchor.

74 Further details on the anchor options included within this Bellrock WFDA EIA Report are presented in **Chapter 4: Project Description (Volume II).**

3.7.6 Inter-array Cable Installation

75 Inter-array cable (IAC) installation technique options comprising jet trenching, mechanical trenching, cable ploughing and mass flow excavator were included with the project design envelope at the time of submitting the Bellrock WFDA Scoping Report.

76 Subsequent to the Scoping Opinion (**Appendix 1.2 (Volume IV)**), the Applicant considered in more detail, the feasibility of the abovementioned IAC installation techniques from and environmental impact perspective. Mass flow excavator was eliminated from the Bellrock WFDA project design envelope due to the larger environmental impacts, notably on benthic communities, and fish and shellfish, in comparison with jet trenching, mechanical trenching and cable ploughing techniques that are considered suitable for the Bellrock WFDA.

3.7.7 Mooring Buoys

77 Mooring buoys, which may serve both as a mooring point and charging station for vessels, with the latter purpose served by a dynamic power cable, were not considered in the Bellrock WFDA Scoping Report. However, these have been included in the Bellrock WFDA project design envelope as a potential option to be used in the future. Technology is emerging to decarbonise vessels, such as battery-powered vessels and if used, offshore charging is necessary.

78 Mooring buoys are considered by the Applicant to be within the parameters of the design envelope as they would utilise the similar options as the FOUs for anchoring to the seabed, and installation activities will be the same as those presented for FOUs in the Bellrock WFDA Scoping Report (**Appendix 1.1 (Volume IV)**). Due to the minimal seabed, surface and water column footprints in comparison to the total seabed footprint from all of the Bellrock Wind Farm Infrastructure, there

would be no change in the impacts presented in the Bellrock WFDA Scoping Report. Therefore, the subsequent Scoping Opinion (**Appendix 1.2 (Volume IV)**) remains valid.

3.7.8 Decommissioning

79 As discussed in **Chapter 4: Project Description (Volume II)**, Sections 105 to 114 of the Energy Act 2004 set out statutory requirements in relation to the decommissioning of Offshore Renewable Energy Installations (OREI) and associated electrical lines. The Bellrock Wind Farm Infrastructure is being designed in compliance of these statutory requirements, and the guidance outlined in the document 'Decommissioning of Offshore Renewable Energy Installations in Scottish Waters or in the Scottish part of the Renewable Energy Zone under The Energy Act 2004: Guidance Notes for Industry (in Scotland)' (Scottish Government, 2022).

80 Decommissioning of the Wind Farm Infrastructure has been considered from the early stages of the design process and will continue throughout the detailed design phase, including during design risk assessment and technology selection processes. Environmental conditions and sensitivities will also be considered since removal of structures may result in greater environmental impacts in comparison to leaving in-situ.

81 Whilst the full details of the decommissioning plans are yet to be developed as this is dependent on technology selection and detailed design, the proposed principles for decommissioning of the Wind Farm Infrastructure are provided in **Chapter 4: Project Description (Volume II)**, and qualitative assessment of the potential impacts from decommissioning has been undertaken in all the technical impact assessment chapters. It is expected that the Bellrock Wind Farm Infrastructure will be fully removed at the end of its operational life. Exceptions to this would be where removal would create unacceptable risks to personnel or to the marine environment, be technically unfeasible or involve excessive costs (Scottish Government, 2022).

82 Prior to the commencement of construction, a Decommissioning Programme will be submitted to Scottish Ministers for approval. The Decommissioning Programme will consider good industry practice, guidance and legislation for decommissioning works along with anticipated costs and financial securities. Throughout the O&M phase, the Decommissioning Programme will be reviewed at regular intervals and decommissioning best practices and legislation will be applied at the time of the decommissioning of the Wind Farm Infrastructure. Legislation, guidance and good practice will be kept under review throughout the lifetime of the Bellrock Wind Farm Infrastructure and will be followed at the time of decommissioning.

3.8 Summary

83 During site selection and consideration of alternatives for the Bellrock WFDA and Wind Farm Infrastructure, the Applicant has sought to reduce the potential for environmental impact through refinement of the design and alternatives considered within this EIA Report.

84 As discussed in in **Section 3.7.1,** a design envelope approach has been implemented and worst case scenarios have been applied when assessing the impacts arising from the Bellrock Wind Farm Infrastructure, as presented in the technical impact assessment chapters (**Chapters 6 – 19 (Volume II)**). The final design will fall within the design parameters presented in **Chapter 4: Project**

Description (Volume II) to ensure that it is compliant with the Wind Farm Infrastructure as assessed in this EIA Report.

3.9 References

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