ForthWind Offshore Demonstration Site, Methil, Fife.

Volume 1: Environmental Impact Assessment Report

April 2022

FORTHWIND

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ACRONYMS

Abbreviation	Full Name
BEIS	Department for Business, Energy and Industrial Strategy
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AOD	Above Ordnance Datum
BEIS	Department for Business Energy and Industrial Strategy
BTO	British Trust for Ornithology
CAA	Civil Aviation Authority
CBA	Cost Benefit Analysis
CCA	Coastal Character Area
CCC	Climate Change Committee
cd	Candela
CD	Chart Datum
CE	Crown Estate
CEA	Cumulative Effects Assessment
CEC	City of Edinburgh Council
CEMP	Construction Environmental Management Plan
CES	Crown Estate Scotland
CO_2	Carbon Dioxide
COLREGs	Convention on International Regulations for Preventing Collisions at Sea
COP	Conference of the Parties

Abbreviation	Full Name
COVID-19	Coronavirus Disease 2019
CPRE	Campaign to Protect Rural England
CRM	Collision Risk Modelling
CTV	Crew Transfer Vessel
DfT	Department for Transport
EC	European Commission
EEC	European Economic Community
EGPS	Electricity Generation Policy Statement
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ELC	East Lothian Council
ELC	European Landscape Convention
EMF	Electromagnetic Field
EPS	European Protected Species
ERCoP	Emergency Response Cooperation Plan
ERP	Emergency Response Procedures
ES	Environmental Statement
EU	European Union
EUNIS	European Nature Information System
FDSFB	The Forth District Salmon Fishery Board
FEPOWDT	Fife Energy Park Offshore Demonstration Wind Turbine
FLOWW	The Fishing Liaison with Offshore Wind and Wet Renewables Group
FSA	Formal Safety Assessment
GDL	Garden and Designed Landscape
GVA	Gross Value Added
GW	Gigawatt
HAT	Highest Astronomical Tide
HB	Historic Building
HBNUM	Historic Building Number
HDD	Horizontal Directional Drill
HER	Historic Environment Record

Abbreviation	Full Name
HM	Her Majesties
HRA	Habitat Regulations Appraisal
IAMMWG	Inter-Agency Marine Mammal Working Group
ICES	International Council for the Exploration of the Sea
IEC	International Electrotechnical Commission
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organization
Impact zone	Turbine location and a precautionary 2km buffer, illustrated in Figure 6.1
IR	Index Revised
JNCC	Joint Nature Conservation Committee
km	Kilometre
kt	Knot
LB	Listed Building
LCA	Landscape Character Area
LCT	Landscape Character Type
LDT	Levenmouth Demonstration Turbine
LLA	Local Landscape Area
LOA	Length Overall
m	metre
MAIB	Marine Accident Investigation Branch
MarLIN	Marine Life Information Network
MCEU	Marine Consents and Environment Unit
MESH	Mapping European Seabed Habitats
Met Mast	Meteorological Mast
MGN	Marine Guidance Note
MHWS	Mean High Water Spring
MMO	Marine Mammal Observer
MMO	Marine Management Organisation
MMSI	Maritime Mobile Service Identity
MNCR	Marine Nature Conservation Review
MPA	Marine Protected Area

Abbreviation	Full Name
MPCP	Marine Pollution Contingency Plan
MPP	Marine Planning Partnerships
MS	Marine Scotland
MS-LOT	Marine Scotland Licensing and Operations Team
MSS	Marine Scotland Science
MW	Megawatt
n/a	Non-applicable
NCCT	National Coastal Character Types
NLB	Northern Lighthouse Board
nm	Nautical Mile
NMP	National Marine Plan
NMPi	National Marine Plan Interactive
NnG	Neart na Gaoithe
no.	Number
NOMIS	National Online Manpower Information System (Office for National Statistics; UK)
NPF3	National Planning Framework Three
NPF4	National Planning Framework Four
NRA	Navigational Risk Assessment
NRG	National Grid Reference
NSA	National Scenic Areas
ONS	Office of National Statistics
ORE	Offshore Renewable Energy
OREI	Offshore Renewable Energy Installation
OS	Ordinance Survey
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OWGP	Offshore Wind Growth Partnership
PAN	Planning Advice Note
PLL	Potential Loss of Life
PMF	Priority Marine Feature
PSA	Particle Size Analysis
Radar	Radio Detection and Ranging
RCCA	Regional Coastal Character Area

Abbreviation	Full Name
RMP	Regional Marine Plans
RNLI	Royal National Lifeboat Institution
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAR	Search and Rescue
SCANS	Small Cetaceans in the European Atlantic and North Sea
SCOS	Special Committee on Seals
SDP	Strategic Development Plan
SDP2	Strategic Development Plan Two
SEA	Strategic Environmental Assessment
SEIA	Social and Economic Impact Assessment
SES	Scottish Energy Strategy
SESplan	South-East Scotland Plan
SFF	Scottish Fishermen’s Federation
SHEP	Scottish Historic Environment Policy
SLA	Special Landscape Area
SLVIA	Seascape, Landscape and Visual Impact Assessment
SM	Scheduled Monument
SMC	Scheduled Monument Consent
SME	Small or Medium Enterprise
SME	Small or Medium Enterprise
SMEIWG	Scottish Marine Energy Industry Working Group
SMR	Scottish Marine Regions
SMRU	Sea Mammal Research Unit
SNCB	Statutory Nature Conservation Body
SNP	Scottish National Party
SOLAS	International Convention for Safety of Life at Sea
SOWEC	Scottish Offshore Wind Energy Council
SPA	Special Protected Area
SPG	Supplementary Planning Guidance

Abbreviation	Full Name
SPP	Scottish Planning Policy
SSC	Suspended Sediment Concentrations
SSSI	Site of Special Scientific Interest
STW	Scottish Territorial Waters
TA	Technical Appendix
TCE	The Crown Estate
TCE	The Crown Estate
TPH	Total Petroleum Hydrocarbon
TWh	Terawatt Hour
UK	United Kingdom

Abbreviation	Full Name
UK MPS	United Kingdom Marine Policy Statement
UKHO	United Kingdom Hydrographic Office
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UXO	Unexploded Ordnance
VHF	Very High Frequency
VMS	Vessel Management System
WTG	Wind Turbine Generator
WWT	Wildfowl and Wetlands Trust
ZTV	Zone of Theoretical Visibility
UK	United Kingdom

GLOSSARY OF TERMS

Term	Description
Airfoil	A surface, (here) a wind turbine blade, that interacts with a flow of air to provide lift and rotation
Allision	The act of striking or collision of a moving vessel against a stationary object.
Automatic Identification System (AIS)	A system by which vessels automatically broadcast their identify, key statistics including location, destination, length, speed and current status, e.g. under power. Most commercial vessels and United Kingdom (UK)/European Union (EU) fishing vessels over 15 metre (m) length are required to carry AIS.
Baseline	Refers to existing conditions as represented by latest available survey and other data which is used as a benchmark for making comparisons to assess the impact of development.
Benthic	The ecological region at the lowest level of a body of water such as an ocean, lake, or stream, including the sediment surface and some sub-surface layers
Biotope	An area of uniform environmental conditions providing a living place for a specific assemblage of plants and animals
Cable burial risk assessment	Risk assessment to determine suitable burial depths for cables, based upon effects such as anchor strike, fishing gear interaction and seabed mobility.
Circalittoral Zone	The region beyond the infralittoral, that is, below the algal zone and dominated by sessile animals such as mussels and oysters
Collision	The act or process of colliding (crashing) between two moving objects.
Construction effects	Used to describe both temporary effects that arise during the construction phases as well as permanent existence effects that arise from the physical existence of development (for example new buildings).
Crustoe community	Of a lichen or alga forming or resembling a crust.
Cultural Heritage	Cultural heritage resources include designated sites such as Scheduled Monuments, Listed Buildings, Conservation Areas, Inventoried Gardens and Designed Landscapes and World Heritage Sites, as well as non-designated archaeological remains and other archaeological sites as indicated by the Council’s Historic Environment Record

Term	Description
Cumulative effect	An additional change caused by the Proposed Development in conjunction with other similar developments or as a combined effect of a set of developments.
Cumulative Effects Assessment (CEA)	Assessment of impacts as a result of the incremental changes caused by other past, present and reasonably foreseeable human activities and natural processes together with the Proposed Development.
Decommissioning	The period during which a development and its associated processes are removed from active operation.
Design Envelope	A description of the range of possible elements that make up the Proposed Development design options under consideration. This envelope is used to define the Proposed Development for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known.
Development design mitigation	Measures implemented to avoid or reduce and where possible offset any significant adverse environmental effects that are directly incorporated into the design for the Proposed Development.
Echinoderms	Marine invertebrate of the phylum Echinodermata
Economic benefit	A positive outcome delivered by the Proposed Development to the local, national, or regional economy. For example, job creation or economic growth.
Effect	The potential to threaten human life, health, property or the environment.
Environmental Impact Assessment (EIA)	The process of evaluating the potential effects of the Proposed Development over and above the baseline.
Environmental Statement (ES)	The documentation presenting the full findings of the Environmental Impact Assessment (EIA).
Epibenthic	Organisms that live on or just above the bottom sediments in a body of water.
European Union (EU)	The political and economic union of 27 European member states.
Fife Energy Park	The Proposed Development is located within the Fife Energy Park, which is a joint venture between Scottish Enterprise and Fife Council and is home to a number of energy-related businesses and projects.
Finnock	Finnock are sea trout which have spent less than a year at sea and are making their first return to fresh water and are not included in sea trout numbers. They may also be known as whitling or herling.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks (effects) and costs (if applicable) associated with shipping activity.
Geographical scope	The assessment considers the impacts of the Proposed Development on local communities, primarily coastal communities in closest proximity to the location of the Proposed Development, and the wider regional and national economy, where appropriate.
Geographical scope	The assessment considers the impacts of the Proposed Development on local communities, primarily coastal communities in closest proximity to the location of the Proposed Development, and the wider regional and national economy, where appropriate.
Habitat	The natural home or environment of an animal, plant, or other organism.
ICES Rectangles	Areas of the sea defined by ICES (see above) that are 30 nautical miles (nm) by 30 nm. They have codes based on a grid reference e.g. '41E6'. A set of rectangles come together to form an ICES fishing area
Infralittoral Zone	The algal dominated zone, which may extend to five metres below the low water mark.
Intertidal	The area of a seashore which is covered at high tide and uncovered at low tide

Term	Description
Landings	Landing Declarations provide information on the species, weight and presentation of landed fish. Under EU legislation, Scottish vessels landing into the UK are required to submit their log sheets to the authorities within 48 hours of landing for paper logbooks or 24 hours if provided electronically. Scottish vessels landing abroad are required to dispatch copies of their landings declaration to the vessels home port within 48 hours for paper logs or 24 hours for electronic submissions.
Local Plan	The Mid Fife Local Plan
Made Ground	Made Ground is soil that has been subjected to anthropogenic intervention and can include fill material (structural or landfill), or a combination of a variety of materials from past demolition, reworking and importing
Main commercial route	Defined transit route (mean position) of commercial vessels identified within the specified routeing study area
Marine aggregate	Marine dredged sand and/or gravel.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping at sea, and to prevent or minimise pollution from shipping.
Navigational Risk Assessment (NRA)	A document which assesses the overall risk to shipping and navigation of a proposed Offshore Renewable Energy Installation (OREI) based on a Formal Safety Assessment (FSA).
Nephrops	*Nephrops norvegicus* are also known as Norway lobster, langoustine, Dublin Bay prawns or scampi. Not to be confused with other species that can also commonly be called 'prawns'.
Noise emission level	Sound power level radiated by a source.
Offshore Renewable Energy Installation (OREI)	As defined by Marine Guidance Note (MGN) 654 (MCA, 2021). For the purposes of this chapter an OREI refers to offshore WTGs and associated infrastructure such as the Meteorological Mast (Met Mast).
Project design parameter	An element of the design of the Proposed Development.
Proposed Development	This refers to offshore turbine, the metmast, the interconnecting cable between the turbine and the metmast, and the offshore cable.
Radio Detection and Ranging (Radar)	An object detection system which uses radio waves to determine the range, altitude, direction or speed of objects.
Receptor	A sufferer of an effect.
Regional Study Area	The area of the outer Firth of Forth characterised by existing benthic data to provide a wider context to the site-specific data collected in the benthic Study Area, including the Proposed Development.
Routeing study area	An eight nautical mile (nm) buffer of the two structures of the Proposed Development. This study area has been used to identify main commercial routes and provide geographical boundaries to the collision and allision risk modelling.
Scotwind leasing rounds	Refers to CES leasing round for offshore wind farms in Scottish waters.
Sessile	Fixed in one place
setting	Setting is defined as more than the immediate surroundings of a site or place and extends setting to include how a site was designed to function, how it was used to use of a place, or how it was intended to fit within a landscape or townscape, and how it was meant to be seen or to allow areas to be seen. This definition also identifies that setting can include “areas that are important to the protection of the place, site or building.

Term	Description
Significance of effect	A measure of the importance of an effect.
Stakeholder	A person or organisation with a specific interest (commercial, professional or personal) in a particular issue.
Standardised wind speed	Wind speed measured at a height representative of the turbine's hub and expressed at a standard height of 10 m using a fixed correction factor.
Subtidal	The area where the seabed is below the lowest tide.
Supplier gap	A barrier created to the production and distribution of renewable electricity from the Proposed Development, which is due to the lack of available necessary components, or the absence of workers who are adequately skilled to deliver a necessary process.
Supply chain	The sequence of products and processes involved in the production and distribution of renewable electricity from the Proposed Development.
Technical scope	The assessment considers key potential social and economic impacts, including: impacts caused to local residents and communities, arising from construction and operational activity; employment and skills training; and impacts to tourism and the tourist economy in the region
The Applicant	Forthwind Ltd
Traffic study area	An approximately 15 nautical mile (nm) wide segment of the Firth of Forth between Kinghorn and North Berwick. This study area has been used to characterise the vessel traffic baseline.
Unexploded ordnance (UXO)	Explosive weapons that did not explode when deployed and still pose a risk of detonation.
Unique vessel	An individual vessel identified on any particular calendar day using Maritime Mobile Service Identities (MMSI), irrespective of how many tracks were recorded for that vessel on that day. This prevents overcounting of vessels.
Vessel Traffic Service (VTS)	A service implemented by a competent authority designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the vessel traffic and to respond to traffic situations developing in the VTS area.
Worst case scenario	The maximum design parameters of each element of the Proposed Development for any given assessment that lies within the ranges of the Design Envelope.

ERM holds the Institute of Environmental Management and Assessment (IEMA) Quality Mark registration, in recognition of our commitment to excellence in EIA activities and our corporate pledge to take action to improve environmental practices. ERM has conducted a quality check of this EIA Report for document clarity and completeness. The quality check has been undertaken by competent EIA professionals and based upon our expertise and experience.

1. INTRODUCTION

1.1. Overview

Forthwind Ltd ("The Applicant") is proposing to develop a test facility for the demonstration of a new design of offshore wind turbine on the northern shore of the Firth of Forth at Methil, Scotland. The project, known as the Forthwind Demonstration Project (hereafter referred to as "the Proposed Development"), is located approximately 1.5 km seaward of the mean high water springs (MHWS) as shown in Figure 1.1 contained in Volume 2 of this Environmental Impact Assessment Report (EIAR). The test facility would see the introduction of a new type of wind turbine technology to Scotland.

The infrastructure for the Proposed Development will include:

- A single demonstration wind turbine, with an installed capacity of up to 20 MW. The turbine will have three blades with a maximum turbine hub height of 156 m above highest astronomical tide (HAT), a maximum rotor diameter of 255 m, including the jacket, with a maximum height to blade tip of up to 280 m above HAT. Further information regarding the Proposed Development is contained within Chapter 3: Project Description of this EIAR.
- A temporary meteorological mast (metmast) located 625 m south-west of the turbine;
- Installation of turbine foundations;
- Grid infrastructure, including the installation of a subsea cable which will connect the demonstration turbine to shore;
- A small transformer located at the landfall location; and
- Associated communications and other infrastructure.

This EIAR includes only the offshore elements associated with the Proposed Development. This EIAR assesses only the offshore works up to Mean High Water Springs (MHWS). The onshore elements associated with the Proposed Development are subject to a separate, onshore planning application and environmental impact assessment. Further details are provided in Chapter 2: EIA Methodology.

The Proposed Development will be connected to the Leven substation grid network, which falls under a separate consenting process and does not form part of this application. Grid capacity has been secured through Scottish Power Energy Networks (SPEN) and a contract for difference was secured in Allocation Round 3 in 2019.

The purpose of the test facility is to demonstrate a new model of offshore wind turbine, which will be used to generate clean electricity from a renewable source of energy, the wind. During the testing and demonstration period, various components and technical innovations within the erected turbine would be tested under differing conditions. Due to the hostile nature of the offshore wind environment, the wind turbine is required to be tested in a location where it is easily serviceable.

The final turbine detailed design will not be determined until after consent has been granted and as such, a Project Design Envelope approach has been taken to ensure flexibility within the consent and to protect any consent against potential future changes to turbine design.

1.2. The Applicant

Forthwind is a wholly owned subsidiary of Cierco Limited which is an active offshore wind turbine technology company based in Aberdour, Fife, Scotland. Cierco Limited is a technology independent renewable energy company aiming to accelerate innovative wind power solutions through step-wise demonstrations and semi-commercial projects.

Forthwind's ambition is to establish a global commercial path to market for the next generation of offshore wind turbine design and establish it as a leading offshore technology, with a significant Scottish contribution.

1.3. Proposed Development Summary

The Proposed Development represents a significant stage in enabling Forthwind to present a fundamental technology step change to the offshore wind sector. The delivery of the Proposed Development will provide evidence of significant improvements in affordability and technical efficiency, thereby enabling offshore wind to make an even greater contribution to European energy security and the global climate change challenge. In general, for offshore wind power generation to become commercially sustainable there is a need for this technology step change, where generation costs eventually must reach a reduction of up to 50% of current levels.

To facilitate this cost reduction, there must be a conceptual change in how offshore wind development is approached (both in terms of capital construction costs and longer term maintenance and operation activities). The Forthwind technology proposed for the Fife Energy Park, shown in Figure 1.1 contained in Volume 2 of this EIAR, can deliver up to 30% cost of energy reduction target compared to the state-of-the-art conventional offshore wind turbines.

1.4. Forthwind Technology

The turbine design is visually similar to a 'conventional' offshore wind turbine, although it is technically different (it is larger, has a higher generation capacity and has a different internal technical design). The technology presents new challenges for offshore installation and operation that have not been demonstrated in the offshore environment before. The turbine design consists of a three bladed upwind horizontal axis wind turbine with a rotor diameter of up to 255 m. The turbine rotor and nacelle are mounted on top of a tubular steel tower with a hub height of 156 m above HAT.

The wind turbine is anticipated to employ an active yaw control (designed to steer the wind turbine with respect to the wind direction), active blade pitch control (to regulate turbine rotor speed) and a variable speed generator with a power electronic converter system. The rotor blade airfoils are anticipated to transition along the blade span with the thicker airfoils being located inboard towards the blade root (hub) and gradually tapering to thinner cross sections out towards the blade tip.

1.5. Purpose of the Proposed Development

The purpose of the original Forthwind Offshore Wind Demonstration Project consented in December 2016, as described in its consent application and Environment Statement, was to provide a facility *"to demonstrate a new model of offshore wind turbine, which will be used to generate clean electricity from a renewable source of energy, the wind".*

The Proposed Development reasoning remains the same, in that the Proposed Development will demonstrate a new model offshore wind turbine technology, not currently available for commercial sale, just offshore Methil to validate the technical and operational abilities of the technology. The commitment to demonstrating new technology in the Proposed Development, as opposed to commercially deployed technology, is reinforced by the restrictions within the Forthwind seabed Agreement for Lease granted by the Crown Estate Scotland specifically for Technology Demonstration. The lease restricts Forthwind to only deploying offshore wind technology for demonstration purposes which is defined within the lease as:

"Demonstration Purposes means demonstrating prototype or series 0 wind turbines and/or novel foundation types and/or the demonstration of technologies and techniques (which have achieved a technology readiness level of between 5 and 9 at the time of intended demonstration as such technology readiness levels are defined in the UK Environmental Transformation Fund Strategy published by the Department for Environment, Food and Rural Affairs, and the Department for Business, Enterprise and Regulatory Reform and a copy of which technology readiness levels are included in Schedule Part 10 (Technology Readiness Levels) that have not previously been deployed commercially and that are intended to reduce the levelized cost of energy of offshore wind generation."

The Crown Estate Scotland recently evaluated the appropriateness of the proposal as a Test and Demonstration project as part of their decision to extend the Forthwind lease. The review resulted in Forthwind securing the required lease extension from the Crown Estate Scotland. In addition, any change to the nature of the technology intended to be deployed on the site cannot happen without prior approval from the Crown Estate Scotland under the terms of the lease.

Specifically, this project will enable the turbine technology to validate the following:

- Turbine and rotor performance.

- Turbine and rotor load simulation models.
- Rotor manufacturing process.
- Turbine assembly processes.
- Offshore installation processes.
- Validation of the tooling and equipment specifically designed for the turbine.
- Development of the turbine supply chain (local and international).
- Maintenance and servicing arrangements.

It is anticipated that the Proposed Development will provide a number of learning opportunities as the test programme progresses. This means that consent for a wide project design envelope is being sought to provide the ability to test differing components and technology design improvements throughout the lifetime of the Proposed Development.

1.6. Need for the Proposed Development and Significance for Scotland

Offshore wind technology has witnessed significant advances over the last four years since the original Forthwind application in July 2015; when it was considered that a wind turbine capacity between 9 to 9 MW was at the cutting edge of technology demonstration. However, by 2017, through incremental efficiencies in technology design, the average capacity of new offshore wind turbines installed was 5.9 MW (a 23% increase on 2016) and now turbine technologies providing 10 MW are commercially available on the market.

As noted in Section 1.5, the purpose of the Proposed Development is to test and demonstrate cutting edge wind turbine technology. Once certified, the turbine technology presented at the Forthwind Site will become commercially available and will be used within the offshore wind industry on both a local, and global scale. It will enable technological leap in the energy generation capabilities of OWF's. Without testing and demonstrating new technologies, the technological advances needed to meet the energy crisis, climate change crisis, and local energy demands cannot be met. Test and demonstration sites are vitally important to wind turbine technological development, as well as ensuring future energy security for Scotland.

Positive effects are predicted to arise in relation to employment, skills and training, and the development of the regional and Scottish supply chain to support the continuing development of renewables and offshore wind industry. These effects can be significantly enhanced with the future deployment of the prototype technology and the contribution it can make to the growth of the industry generally. Successful, timely deployment of the demonstration turbine will influence considerations on the establishment of future turbine component manufacturing facilities and specifically will consolidate the knowledge and expertise within the region to position it to capitalise upon future commercial and development opportunities.

The nature of the offshore wind turbine industry is that technology moves at a rapid pace. This applies severe time constraints on the window for which Test and Demonstration projects are valid. It is of intrinsic value that this application is assessed within a reasonable timeframe. The Forthwind project has, to date, been the only test and demonstration renewable energy technology project in the UK to secure a Contract for Difference[1] (allocation round 3), with a commencement date in 2024. It potentially could be a significant blow, not only to the Forthwind project but potentially the renewable industry and Scotland in general if this could not be secured. Ensuring a timely determination period will allow the technology to be installed within the commercial timelines needed, have an important impact on the local supply chain and send a signal to Europe and the world of Scotland's place as an innovative technology hub for renewable energy.

1.7. Site Consenting Background

In July 2015 Forthwind Ltd sought a Marine Licence and Section 36 (S36) from Scottish Ministers for the installation and operation of two demonstration offshore wind turbines, nominally rated at 9MW each and sited approximately 1.5km from the coast of Methil. The turbines intended to be deployed were of the 2B Energy design; a two bladed wind turbine based on a lattice tower that extended down to the seabed. The Marine Licence and Section 36 applications were approved by the Scottish government in December 2016.

[1] https://www.lowcarboncontracts.uk/cfds/forthwind

Following consent, Forthwind entered due diligence negotiations with project investors to secure project finance. The financial case was based on securing the offshore demonstration Renewable Obligation Certificates (ROC's) which required installation and export of electricity by 30 September 2018. Ultimately, due to time constraints, the Proposed Development was unable to secure the required investment to develop the Proposed Development before the ROC qualification period ended.

Forthwind Ltd are now seeking a new consent to replace the existing consent, in the same location, to reflect recent changes in both the offshore wind industry and wind turbine technology. The purpose of the original Forthwind Offshore Wind Demonstration Project will remain the same, i.e., to provide a facility "to demonstrate a new model of offshore wind turbine, which will be used to generate clean electricity from a renewable source of energy, the wind".

The Proposed Development proposed by Forthwind is broadly similar in most aspects of the previously consented design envelope. However, the turbine is different to the 2B Energy design provisioned in the original consent. The new technology is visually similar to a 'conventional' offshore wind turbine, although it is technically different (it is larger, has a higher generation capacity and has a different internal technical design).

1.8. The Environmental Impact Assessment Report

This Environmental Impact Assessment Report (EIAR) will accompany three applications for consent which relate to the installation and operation of the demonstration turbine test facility:

- An application for consent to Marine Scotland as required under Section 36 of the Electricity Act 1989 for the construction and operation of an electricity generation station with an installed capacity in excess of 1 MW in the offshore environment;
- Two applications to Marine Scotland for a Marine Licences for the placement of the turbine (including supporting structure) on the seabed seaward of the MHWS, and preparation of the sea bed for these works, as required under the Marine (Scotland) Act 2010.

A description of the legislative requirements is provided in Chapter 2: EIA Methodology of this EIAR.

This EIAR has been prepared in accordance with the relevant Environmental Impact Assessment (EIA) regulations related to these applications which are:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, as amended by the Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2019 (where applicable); and
- The Marine Works (Environmental Impact Assessment) Regulations 2017, as amended by the Marine Works (Environmental Impact Assessment) and The Marine Works and Marine Licensing (Miscellaneous Temporary Modifications) (Coronavirus) (Scotland) Regulations 2020 (where applicable).

Collectively these regulations are hereafter referred to as "the EIA Regulations". Further information on the legislative requirements is provided in Chapter 2: EIA Methodology of the EIAR.

This EIAR is designed to inform decision makers of the nature of the Proposed Development, the likely environmental effects, the measures taken to avoid likely significant environmental effects, and the measures proposed to mitigate those remaining effects.

The methodology used to define and assess the significance of the likely environmental effects is described in detail within Chapter 2: EIA Methodology of this EIAR.

The purpose of the EIAR is to:

- Explain the need for the Proposed Development and describe the physical characteristics, scale and design of the Proposed Development;
- Examine the existing environmental character of the Proposed Development site and the area with the potential to be affected by the Proposed Development;

- Predict the possible significant environmental effects of the Proposed Development;
- Describe measures which would be taken to avoid, offset or reduce adverse environmental effects;
- Report the potential residual effects of the Proposed Development through the provision of a Statement of Significance; and
- Provide the public, the consenting authority and other consultees with information on the Proposed Development, which would assist Marine Scotland in the determination of the submission for consent.

1.9. The Project Team

The EIA has been project managed and compiled by Cierco Ltd, with technical input from specialist consultants. The contributors to the EIAR are provided in Table 1.1.

Table 1.1 - The Project Team

Project Role	Organisation
EIA Co-ordination and Management	Cierco Ltd
Environmental Impact Assessment	ERM, OPEN, Anatec, Hi-Def
Project Description	Cierco Ltd
Planning Policy Framework	ERM
Seascape, Landscape and Visual Impact Assessment	OPEN
Ornithology	Hi-Def
Marine Mammals	Hi-Def
Commercial Fisheries	ERM
Archaeology & Cultural Heritage	ERM
Fish and Shellfish Ecology	Hi-Def
Noise	ERM
Shadow Flicker	ERM
Shipping and Navigation	Anatec
Socio-Economics	ERM
Benthic Ecology	ERM
Miscellaneous Issues	Cierco Ltd
Other Marine Issues	Cierco Ltd
Summary of Impacts	Cierco Ltd

1.10. The Structure of the EIAR

The EIAR comprises of the following volumes:

- EIAR, Volume 1: contains EIA text (this document) which reports the findings of the EIA;
- EIAR, Volume 2: EIA accompanying figures and visualisations;
- EIAR, Volume 3: Technical Appendices which contain detailed technical information supplementing the findings presented within Volume 1; and
- Non-Technical Summary (NTS) providing a summary of the information presented in Volume 1.

The EIAR, Volume 1, is structured as follows:

- Chapters 1 and 2 provide an overview of the Proposed Development and the EIA process;
- Chapter 3 provides a Project Description of the Proposed Development, and outlines the construction and decommissioning methodologies;
- Chapter 4 provides background relating to national, regional and local planning policy; and
- Chapters 5 – 18 cover individual technical areas, with each containing a discussion of likely significant effects, proposed mitigation measures, subsequent residual effects and an assessment of cumulative effects.

Additional documentation that will be submitted with the application to Marine Scotland includes:

- Cover Letter;

- Advert; and
- Completed Marine Licence Application forms: Marine Renewable Energy Projects in the Territorial Sea and UK Controlled Water Adjacent to Scotland and Dredging and Deposit of Solid Waste in the Territorial Sea and UK Controlled Waters Adjacent to Scotland.

These do not form part of the formal EIAR.

2. EIA METHODOLOGY

Environmental Impact Assessment (EIA) is a process aimed to ensure that permissions for developments with potentially significant environmental effects are granted only after assessment of the likely significant environmental effects has been undertaken.

This chapter of the Environmental Impact Assessment Report (EIAR) details the methodology that has been followed in undertaking the assessments of the likely significant environmental effects of the Proposed Development and details the relevant legislative framework under which this application is made.

2.1. Legislative Context of the Application

2.1.1. Section 36 Consent

To construct and operate an electricity generating station, such as a wind farm, with a capacity greater than 1 Megawatt (MW) in Scottish Territorial Waters, consent is required under Section 36 of the Electricity Act 1989 (as amended). An application for consent under Section 36 in Scottish Territorial Waters is made to the Marine Scotland Licensing Operations Team (MS-LOT) on behalf of the Scottish Ministers.

The Application is for the testing of one offshore demonstration turbine, within Scottish Territorial Waters, which will have the capacity to generate up to 20 MW of electricity. As such, this EIA is prepared in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended.

2.1.2. Marine Licence

The Marine (Scotland) Act 2010 states that a Marine Licence is required to construct, alter or improve any works, or deposit any object in or over the sea, or on or under the seabed. A Marine Licence is required for these works where the works are seaward of the MHWS. As the Proposed Development is seaward of the MHWS (as shown in Figure 1.1), a Marine Licence will therefore be required to construct the wind turbine, foundation, MetMast, export cable and communications cable, as well as any associated cable protection on the seabed and to prepare the seabed for installation of the base.

As with the Section 36 application above, the application for the Marine Licence will be made to MS-LOT. This EIAR is prepared in accordance with the Marine Works (Environmental Impact Assessment) Regulations 2007, as amended.

2.1.3. Town and Country Planning

A separate planning application for the onshore transformer and associated infrastructure will be made to Fife Council. The Proposed Development will be connected to the electricity network from the onshore transformer which will be subject to a separate application and assessment process once the details of this connection are known.

2.1.4. EIA Legislation

Requirements for EIA are defined in the EIA Directive (85/337/EEC codified by EIA Directive 2011/92/EU and then amended by EU Directive 2014/52/EU)[2]. The UK committed to implement international environmental obligations and to maintain environmental commitments and legislation already made following the departure of the UK from the EU, primarily in accordance with the EU (Withdrawal Act) 2018[3]. The UK's decision to leave the EU has no impact on the application of the EIA Regulations, as the EU Directives on EIA were required to be translated into domestic law when the UK was a full member state of the EU. The purpose of the EIA Regulations is to ensure that the potential effects of a Proposed Development on the environment are taken in consideration before consent is granted.

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[2] European Union (2014) *Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment* [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052 (Accessed 05/10/2021)
[3] UK Government (2018) European Union (Withdrawal) Act 2018 [Online] Available at: https://www.legislation.gov.uk/ukpga/2018/16/contents/enacted (Accessed 26/10/2021)

As such, the EIA Directive has continued relevance to any application in Scottish waters for a Section 36 consent, a Marine Licence or planning permission and continues to set the framework for the EIA process in Scotland. The EIA Directive was implemented into Scottish law through various statutory instruments:

- in respect to a Section 36 consent application: The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and
- in respect to a Marine Licence application: The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

The EIA Directive (85/337/EEC as amended 97/11/EC) requires that an EIA is required to be undertaken in support of an application for consent for specific types of developments. Offshore wind development falls under Annex II of the Directive which defines projects as:

"Installations for the harnessing of wind power for energy production (wind farms)".

Annex II projects require an EIA where they are likely to have significant effects on the environment by virtue of factors including their nature, size or location.

This legislation is hereafter referred to as "The EIA Regulations".

In compliance with these Regulations, when applying for Section 36 consent or a Marine Licence, an EIA Report is required to be prepared and submitted to support these applications if the development applied for is likely to have a significant effect on the environment due to factors such as its size nature or location.

An EIA is specifically required (Schedule 2 of the Marine Works EIA 2017 (Scotland) Regulations) for installations for the harnessing of wind power for energy production (wind farms) if:

- The Proposed Development involves the installation of more than two wind turbines; or
- The hub height of any wind turbine or height of any other structure exceeds 15 m.

The Proposed Development has a hub height of up to 156 m above Highest Astronomical Tide ('HAT') and therefore, an EIA is required and an EIAR has been produced to assess the Proposed Development.

2.1.5. Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013

The Marine Licensing (Pre-Application Consultation) (Scotland) Regulations 2013 lists a number of prescribed classes or descriptions of licensable marine activity associated with a renewable energy structure for which Pre-application Consultation (PAC) is required. These include:

- *"the deposit of a submarine cable within the Scottish marine area either in the sea or on or under the seabed from a vehicle, vessel, aircraft, marine structure or floating container, but only where such cable (i) exceeds 1853 metres in length; and (ii) crosses the inter-tidal boundary"*
- *"the construction of a renewable energy structure within the Scottish marine area either in or over the sea or on or under the seabed, but only where the total area in which such structure is to be located exceeds 10,000 square metres in extent".*

For the avoidance of doubt, the definition of "renewable energy structure" means a structure in the Scottish marine area constructed for the purposes of generating electricity and includes all ancillary works. For the Proposed Development this includes the cable corridors, MetMast and the turbine. The area of licensable marine activities is 9,639 m^2 and therefore the Proposed Development does not fall under the PAC Requirements. However, in keeping with the spirit of engaging with the local community, Forthwind held a public consultation event on 13th December 2021. A PAC Report summarising the event and any feedback received from the local community is included within Technical Appendix 14, contained within Volume 3 of this EIAR.

2.2. The Project Design Envelope

The 'Project Design Envelope' principal derived from planning case law (R v Rochdale MBC ex. Parte Tew and R v Rochdale MBC ex parte Milne 1999). The Rochdale case established that the description of the Proposed Development for the purposes of EIA can set out a range of parameters within which the actual project must fall. The case also established that it is acceptable for an EIAR to assess the worst case likely significant effect of the Proposed Development through implementing the Project Design Envelope approach.

The Project Design Envelope for the Proposed Development is detailed in Chapter 3: Project Description. Each technical chapter of this EIAR sets out the worst case parameters applicable to that topic and assesses the impact against the Project Design Envelope.

2.3. EIA Guidance

As discussed within Section 2.1.4, in applying for Section 36 consent and Marine Licences for the Proposed Development, an EIA Report is required. An EIA will also be undertaken in support of the planning permission application for associated onshore infrastructure (above MLWS).

In addition to the EIA Regulations described in Section 2.1.4, the following Regulations will also be considered in the production of the Offshore EIAR:

- Environmental Impact Assessment (Scotland) Regulations 2011, Scottish Government, June 2011.
- Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (The Planning Inspectorate, 2019).
- CEFAS, Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements, June 2004.
- Chartered Institute of Ecology and Environmental Management (CIEEM). Guidelines for Ecological Impact Assessment in the UK and Ireland, Terrestrial, Freshwater, Coastal and Marine, 2018.
- Conservation of Seals Act 1970.
- Convention for the Protection of the Marine Environment of the North East Atlantic 1992 (the OSPAR Convention).
- Convention on International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/77).
- Environmental impact assessment for offshore renewable energy projects (British Standards Institute (BSI), 2015).
- Environmental Impact Assessment: Guide to Procedures, January 2000.
- European Council Directive 2008/56/EC establishing a framework for Community action in the field of water policy (WFD).
- European Council Directive 2008/56/EC on the Conservation of Natural Habitats and Wild Fauna and Flora (Habitats Directive (as amended).
- European Council Regulation No 1100/2007 establishing measures for the recovery of the stock of European eel.
- European Guidance on wind energy development in accordance with European Union (EU) nature legislation (European Commission EC), 2020).
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects (Centre for Environment, Fisheries and Aquaculture Science (Cefas), 2012).
- Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019).
- Guidelines for Environmental Impact Assessment, Institute of Environmental Management and Assessment, 2004.
- Guidelines on the Environmental Impacts of Windfarms and Small Scale Hydroelectric Schemes, SNH, 2002.
- IEMA Environmental Impact Assessment Guide to Shaping Quality Development (IEMA, 2015).
- Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
- Marine Scotland Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy Applications (Marine Scotland, 2018).
- Nature Conservation (Scotland) Act 2004.
- Offshore Marine Conservation (Natural Habitats, &C.) Regulations 2007 (as amended) (Offshore Marine Regulations).

- Oslo Paris Convention (OSPAR) Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).
- Planning Advice Note (PAN) 1/2013 Environmental Impact Assessment (Scottish Government, 2017);
- Planning Advice Note (PAN) 58 'Environmental Impact Assessment,' Scottish Executive, September 1993.
- The Conservation (Natural Habitats &c.) Regulations 1994.
- the Conservation (Natural Habitats &c.) Regulations 1994 (as amended).
- The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019.
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations).
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.
- The Conservation of Habitats and Species Regulations 2017.
- The Conservation of Offshore Marine habitats and Species Regulations 2017.
- The Convention for the Protection of the Marine Environment of the North East Atlantic 1992 (the OSPAR Convention).
- The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the Bern Convention.
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended).
- The Infrastructure Planning (Decisions) Regulations 2010 (Infrastructure Planning Regulations).
- The Marine Environment (EU Exit) (Scotland) (Amendment) Regulations 2018.
- The Marine Environment (EU Exit) (Scotland) (Amendment) Regulations 2019.
- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.
- The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014.
- The Wildlife and Countryside Act (1981).
- United Nations Convention on Biological Diversity 1992 (the Rio Convention).
- Wildlife and Natural Environment (Scotland) Act 2011.

2.4. Scoping and Consultation

2.4.1. Scoping

The EIA Regulations provide an opportunity for the Applicant to seek a Scoping Opinion from Marine Scotland on the content of the EIAR should they wish to do so. The aim of the Scoping process is to identify key environmental issues at an early stage in the process, then ascertain which elements of the Proposed Development are likely to result in significant effects on the environment and to establish the extent of survey and assessment required for the EIAR.

A Scoping Report was prepared in 2021[4] (Cierco, 2021) that identified potential significant environmental effects of the Proposed Development, and proposed scope of works that would enable these to be assessed in sufficient detail The scope of works included in the Scoping Report identified the range of technical assessments proposed, the extent of desk study and field work to be carried out and the approach to assessing likely effects of the Proposed Development.

A Scoping Opinion was received from MS-LOT on 22nd December 2021[5] (Marine Scotland, 2021). Responses received within the Scoping Opinion have been incorporated into this EIAR. In addition, ongoing consultation has been undertaken with local fisheries interests and key users of the sea in the area around the Proposed Development to ensure that the design and layout can be accommodated within the existing uses of the marine area.

[4] Forthwind Offshore Wind Demonstration Project, Environmental Scoping Request - Cierco 2021

[5] Forthwind Offshore Wind Demonstration Project, Scoping Opinion - Marine Scotland 2021

Table 2.2 provides an overview of the issues raised by the consultees in response to scoping requests in 2020 . The detail of the individual responses received from consultees during the EIA, including at the scoping stage and consultation undertaken outwith this formal exercise, is set out in the relevant technical chapters.

Table 2.2 - Consultation Responses to the 2021 Scoping Request

Consultees	No Response / No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology / Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
Anstruther Harbour Marina	X														
BT (Radio Network Protection Team)		X									X				
Buckhaven Community Council	X														
Canoe Scotland															
Civil Aviation Authority (CAA)	X														
City of Edinburgh Council	X														
Chamber of Shipping	X														
Cockenzie & Port Seton Fishermen's Association	X														

Consultees	No Response / No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology / Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
Colinsburgh Community Council	X														
Communities Inshore Fisheries Alliance	X														
Community Councils	X														
Crown Estate Scotland		X													
Defence Infrastructure Organisation (MoD)		X									X				X
Dysart Sailing Club	X														
East Lothian Council	X														
East Lothian Yacht Club	X														
Edinburgh Airport	X														
Elie Community Council	X														

Consultees	No Response / No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology / Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
Elie & Earlsferry Sailing Club	X														
Fife Council		X			X	X		X							
Fife Fishermen's Mutual Association (Pittenweem) Ltd	X														
Fisheries Management Scotland	X														
Forth Ports Ltd	X														
Historic Scotland		X						X							
Inshore Fishery Group (North & East Coast Regional IFG)	X														
Inshore Fishermen's Alliance	X														
Forth Salmon Fishery Board	X														
Joint Radio Company	X														

Consultees	No Response / No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology / Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
Largo Area Community Council	X														
Largo Bay Sailing Club	X														
Leven Community Council															
Levenmouth Demonstration Turbine	X														
Maritime & Coastguard Agency		X										X			
Marine Safety Forum	X														
Marine Scotland		X	X	X	X	X		X	X	X		X			X
Marine Scotland Science		X	X		X							X			
Methil Community Council	X														
Methil Creel Fishermen	X														

Consultees	No Response / No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology / Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
NERL Safeguarding (NATS)		X													
Northern Lighthouse Board		X													
Royal Society of Protection of Birds (RSPB)		X			X										
Royal Yachting Association (RYA)		X										X			
Salmon Net Fishing Association of Scotland	X														
Scallop Association	X														
Scottish Canoe Association	X														
Scottish Creel Fishermen’s Federation	X														
Scottish Environment Protection Agency (SEPA)		X		X	X										
Scottish Fishermen’s Federation (SFF)		X													

Consultees	No Response / No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology / Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
Scottish Fisherman’s Organisation	X														
Scottish Pelagic Fishermen’s Association	X														
Scottish Surfing Federation	X														
Scottish Wildlife Trust	X														
Scottish Wild Salmon Company	X														
Sport Scotland	X														
Surfers Against Sewage	X														
NatureScot (SNH)		X			X	X									
Whale & Dolphin Conservation	X														
Visit Scotland	X														

Consultees	No Response / No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology / Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
Ports & Harbours	X														
Transport Scotland	X														
Marine Scotland Compliance	X														
Marine Scotland – Marine Planning															
Forth Ports Ltd	X														
10 m and under Association	X														

2.4.2. Public Consultation

A public exhibition was held at the Fife Renewables Innovation Centre, Ajax Way, Methil Docks, Business Park, on the Monday 13th December 2021, 11am till 7pm. The exhibition was held to introduce the Proposed Development to the local community and to invite their comments on the issues which they considered important in relation to the Proposed Development in the EIA process.

The exhibition displayed information about the Proposed Development, the Applicant, the EIA process and the project timetable. Six photomontages of the predicted views of the Proposed Development were also displayed to provide a visual representation.

Details of the exhibition were advertised in the following local newspapers:

- East Fife Mail;
- Fife Free Press;
- Glenrothes Gazette; and
- Herald & Citizen.

In addition to advertising details of the exhibition in the above newspapers, notifications were sent to the following organisations:

- The Commissioners of Northern Lighthouses;
- The Maritime and Coastguard Agency;
- The Scottish Environmental Protection Agency (SEPA); and
- NatureScot.

A record of attendees was taken at the exhibitions, with the opportunity to provide feedback given. Approximately five people attended the exhibition. Whilst none took the opportunity to provide written feedback on the Proposed Development, the response was broadly positive in wanting to see the Proposed Development proceed and recognising the need for renewable energy.

2.5. Identification of Issues

As a result of the scoping responses and on-going consultation, the following issues are addressed in the EIAR:

- Seascape, Landscape and Visual;
- Ornithology;
- Marine Mammals;
- Commercial Fisheries;
- Cultural Heritage;
- Fish & Shellfish Ecology;
- Noise;
- Shadow Flicker;
- Shipping & Navigation;
- Socio-Economics;
- Benthic Ecology;
- Miscellaneous Issues; and
- Other Marine Users.

All elements of the project and associated infrastructure during the construction, operation and decommissioning phases have been assessed in the EIAR.

2.6. Technical Environmental Assessments

Each of the technical assessments follows a systematic approach, with the principal steps as follows:

- Description of baseline conditions;
- Effect identification and magnitude
- Receptor sensitivity;
- Prediction of potential effects including any cumulative effects;
- Assessment of potential effects;
- Identification of appropriate mitigation measures; and
- Assessment of residual environmental effects.

A summary of each of these steps is provided below.

2.6.1. Baseline Description

To evaluate potential environmental effects, information relating to the existing environmental conditions was collected. This is known as the baseline. It has been used to assess the changes that may take place during the construction, operation and decommissioning of the Proposed Development.

Data was also collected from public records and other archive sources and, where appropriate, field surveys were carried out. The timing of the work and the defined Study Area, specifically relating to the subject matter in question, are also outlined within each chapter.

2.6.2. Sensitivity / Importance of Receptor

The sensitivity of the baseline conditions was defined according to the relative importance of existing environmental features within or in the vicinity of the site, or by the sensitivity of receptors which would potentially be affected by the Proposed Development.

Criteria for the determination of sensitivity (e.g. high, medium, or low) or of importance (e.g. international, national, regional or authority area) were established based on prescribed guidance, legislation, and / or statutory designation. Where no published standards exist, the assessments presented in the technical chapters describe the professional judgements (assumptions and value systems) that underpin the attribution of significance. For certain technical topics, such as ecology, widely recognised published significance criteria and associated terminology have been applied and these are presented in the technical chapters and associated appendices where relevant.

2.6.3. Magnitude of Change

The magnitude (scale) of change for each effect has been identified and predicted as a deviation from the established baseline conditions, for the construction and operational phases of the Proposed Development. The scale generally used high, medium, low and negligible criteria, and defined within each of the relevant technical chapters. This has taken due cognisance of any legislative or policy standards or guidelines, and / or the following:

- The degree to which the environment is affected, e.g. whether the quality is enhanced or impaired;
- The scale or degree of change from the existing situation;
- Whether the effect is temporary or permanent, indirect or direct, short term, medium term or long term;
- Any in-combination effects; and
- Potential cumulative effects.

In some cases, the likelihood of effect occurrence may also be relevant, and where this is a determining feature of the assessment this is clearly stated.

2.6.4. Assessment of Effects and Evaluating Significance

The potential effect that the Proposed Development may have on each environmental receptor will be influenced by a combination of the sensitivity of the environment and the predicted degree of change (the magnitude) from the baseline state. Environmental sensitivity may be categorised by a multitude of factors; for instance: status of rare or endangered species, transformation of natural landscapes, or changes to soil quality and land use. The initial assessment, consultation, and scoping stages identified these factors along with the implications of the predicted changes.

Once the sensitivity and magnitude of effect is determined, these are used assess effect significance Table 2.3 provides an example of how sensitivity and magnitude are combined to inform an assessment of significance.

Table 2.3 - Example Assessment Matrix

Sensitivity of Receptor	Magnitude of effect			
	Large	Medium	Small	Negligible
High	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

For the purpose of this EIAR the significance of ‘effect’ is generally considered in terms of:

- Negligible – no detectable change to a location, environment, species or sensitive receptor;
- Minor – a detectable change to a location, environment, species or sensitive receptor;
- Moderate – a non-fundamental change to a location, environment, species or sensitive receptor; and
- Major – a fundamental change to a location, environment, species or sensitive receptor.

A definition of what level of effect is considered to be significant in terms of the EIA Regulations is provided in each technical chapter.

The EIAR generally follows this approach. Where specific technical assessment areas adopt a variation, this is identified.. Within each assessment chapter the criteria for assessing significance of effects are made explicit.

2.6.5. Mitigation, Monitoring and Enhancement

Each chapter proposes measures to avoid, reduce or potentially remedy significant adverse effects where appropriate. These are termed mitigation measures. Where the assessment process has identified any potential significant adverse effects, mitigation measures have been proposed to reduce these effects where practicable. Such measures have included the consideration of alternatives, physical design evolutions, and management and operational measures.

Each specialist consultant has identified appropriate mitigation measures. These measures are either embedded into the overall design strategy or presented as additional measures. The Applicant has been flexible with the design within the technical and environmental constraints of the site and by doing so has been able to respond to the findings of consultation and EIA work as the project has progressed.

In some cases, where residual uncertainty has been identified, monitoring has been proposed. Enhancement may also be proposed to create or enhance positive effects such as environmental and social benefits.

2.6.6. Assessment of Residual Effects

The residual effects of the Proposed Development are those that remain, assuming successful implementation of the identified mitigation measures. Residual effects are identified in each technical assessment alongside an assessment of their significance in terms of the EIA Regulations.

2.6.7. Cumulative Effects

In accordance with the EIA Regulations, this EIAR has given consideration to ‘cumulative effects’. By definition these are effects that result from incremental changes caused by past, present or reasonably foreseeable actions together with the Proposed Development.

For the cumulative assessment, two types of effect have been considered:

- The combined effect of individual effects, for example noise, on a single receptor; and
- The combined effects of several developments that may on an individual basis be insignificant but, cumulatively, have a significant effect, such as landscape and visual effects of wind turbines.

Th extent of any cumulative assessment is defined in each technical assessment chapter. The potential landscape and visual effects, for example that relate to the intervisibility of individual wind farm development schemes will be much more wide ranging than noise effects which will be limited to receptors in the more immediate vicinity of the Proposed Development.

In relation to some of the technical chapters of this EIAR, specific guidance and policy exists advising that effects associated with existing Proposed Developments should be considered as cumulative effects.

Where no cumulative effects have been identified, this is stated.

2.6.8. Limitations of EIAR

A number of assumptions have been made during preparation of this EIAR, as set out below. Assumptions specific to certain environmental aspects are discussed in the relevant Chapters of the EIAR.

The assumptions are:

- The principal land uses within the study area remain as they are at the time of the submission of the application, except in cases where permission has already been granted for development. In these cases, it is assumed that the approved development will take place, and these have been treated as contributing to “cumulative” effects;

- Information provided by third parties, including publicly available information and databases is correct at the time of submission of the application (April 2022);
- Baseline conditions are accurate at the time of the physical surveys but, due to the dynamic nature of the environment, conditions may change during the site preparation, construction and operational phases; and
- The assessment of cumulative effects has been reliant on the availability of known information relating to existing wind farm developments at December 2021.

3. PROJECT DESCRIPTION

3.1. Introduction

This chapter provides a description of the Proposed Development Project Design Envelope, including the turbine, foundations, meteorological mast (MetMast), electricity cables, and communications cable.

This chapter contains the following elements:

- Site Description – provides a general overview of the site and its surroundings;
- Definition of the Proposed Development – describes the scope of the Proposed Development and outlines the Project Design Envelope parameters to be assessed;
- Description of the principal components of the Proposed Development – provides a description of the following elements:
    - Wind turbine;
    - MetMast;
    - Sub-structures and foundations;
    - Electricity export cable; and
    - Communications cable.
- Construction programme and installation methods;
- Operation and maintenance activities; and
- Decommissioning.

3.2. Site Description

3.2.1. Offshore Site Location

The proposed Forthwind Demonstration Project (hereafter referred to as the "Proposed Development") is located on the northern shore of the Firth of Forth at Methil, Scotland and is approximately 1.5 km from the mean high water springs (MHWS).

The Proposed Development Footprint Envelope consists of the following:

- A single turbine and sub-structure (foundation and tubular jacket if required) located at British National Grid reference (BNG) 337812, 697333. A 100 m micrositing allowance from the centre point for the turbine and associated infrastructure is required for the final selection of turbine location.
- An electricity export cable corridor, within which cable will be laid in a trench measuring approximately 1500 m in length. This will contain the cable that transmits the electricity generated by the turbine to the onshore transformer.
- A MetMast and sub-structure comprising a lattice steel tower located at (BNG) 337314, 696959. The sub-structure include foundations, a platform in the event of monopile foundation, and transition piece. A 100 m micrositing allowance from the centre point for the MetMast and associated infrastructure is required for the final selection of MetMast location.
- A communications cable approximately 625 m in length, comprising a 20 mm^2 fibre optic cable, running alongside a power cable will be located between the turbine and the MetMast.

The Project Design Envelope is the area in which the Proposed Development may be located and does not reflect the actual footprint of the Proposed Development infrastructure. The physical footprint of the Proposed Development will be within the parameters detailed in Table 3.2.

3.2.2. General Offshore Site Characteristics

The Proposed Development is located on the northern shore of the Firth of Forth at Methil, Scotland. The Firth of Forth is formed by the estuary of the River Forth, extending approximately 96 km from the tidal water limit at Stirling to the Isle of May. The Proposed Development is adjacent to the coast of Methil and Buckhaven, on the northern shore of the Forth. The coastline in this section runs in a southwest to northeast direction, and consists of a reclaimed area of land made of colliery waste. The residential areas of Methil and Buckhaven are located further back inland. Much of the coastline in this section of the Forth is characterised by intertidal rock platforms, covered by thin veneers of sand (Firth et al, 1997).

The stretch of coastline extending from Buckhaven to Methil is defended by a rock armour revetment, except for a sheet pile quay at the shorefront of the Fife Energy Park. Further west, between East Wemyss and Buckhaven, the coastline is formed by a soil and vegetation embankment. To the northeast there are the docks of Methil and a concrete seawall that extends up to Leven (Fife Council, 2011).

The mean tidal ranges in the Proposed Development area are 2.5 m for neap tides, and 5.0 m for spring tides (Admiralty Tide Tables, 2015).

Wind wave characteristics (height and period) are mostly determined by the available fetch, or the distance over which the wave generating wind is blowing. The largest fetch in the Proposed Development area is to the southeast out of the Firth of Forth and across the North Sea to mainland Europe. Wind and waves in this area reach maximum heights of 1.2 m, although heights up to 0.5 m are more likely (Fife Council, 2011; Firth et al, 1997).

Although there are two recorded wrecks within the Proposed Development site and another two within a 1km buffer, there is no evidence found for them in the geophysical data. In addition, the wrecks are recorded as arbitrary and it unlikely that these wrecks exist within the Proposed Development Site or 1 km buffer- these areas are not protected or designated sites.

The export cable corridor lies within an area of water depths ranging from 10 to 20 m at the turbine locations to the mean high water spring (MHWS) mark.

The prevailing wind at the Proposed Development site is from the southwest.

3.2.3. Onshore Site Location

The onshore elements of the Proposed Development (above MHWS) will be addressed as a separate planning application submitted to the Local Planning Authority (Fife Council). The onshore elements of the Forthwind Project are shown on Figure 3.1, contained in Volume 2 of this EIAR. The onshore elements of the Forthwind Project comprise of the following:

- An 11 kV cable connecting offshore turbine and onshore transformer;
- An Onshore transformer;
- 33 kV cable routes across the Fife Energy Park, and between substation and grid connection;
- Forthwind compound location; and
- Forthwind access routes.

Information regarding the onshore aspects of the Proposed Development are included for contextual purposes. The onshore substation and control building will be located at the Fife Energy Park site.

Fife Energy Park, acquired by Scottish Enterprise in 2005 and being developed in partnership with Fife Council, was originally the site of the Wellesley Colliery which operated from 1890 until closure in 1964. The site was largely established by the deposition of colliery spoil, gradually reclaiming land from the sea. Following the closure of the mine, the site was further developed in the 1970s as a North Sea Oil Fabrication Facility by Redpath de Groot Caledonian (RGC). RGC subsequently sold their interest to Kvaerner Oil & Gas who operated the yard until 2001 when production ceased.

The primary activities performed at the site were the production of drilling rigs for the offshore oil and gas industry, at its peak over 2000 people were employed on the site.

The vision for the Fife Energy Park is to establish a state-of-the-art industrial facility for energy in Scotland, delivering excellence in engineering, fabrication and assembly. It will incorporate a vibrant local and national supply chain and host innovation in the supporting technologies, across the energy sector.

A comprehensive programme of earthworks and site levelling has been completed which has seen formation of engineered embankments between the Fife Energy Park and neighbouring residential properties along with formation of approximately 70 acres of new development land which is the focus for attracting new companies and investment onto the site. Current users of the site include:

- Offshore Renewable Energy (ORE) Catapult Levenmouth 6MW Test turbine and associated facilities.
- Harland & Wolff group (part of InfraStrata plc) – an oil and gas decommissioning and offshore wind and marine renewables fabricator (formerly known as Burntisland Fabrication Limited).
- Professional Testing Services Ltd - heavy engineering NDT.
- Glacier Energy – Professional Testing Services.
- Hydrosphere UK Ltd.
- Ferguson Transport and Shipping; and
- Duncan Engineering - contract engineering.

3.3. The Proposed Development

This application is for the construction and operation of one offshore wind turbine with associated infrastructure including foundations, scour protection, transformers, and electricity export cables (up to Mean High Water Springs) connecting the turbines to the onshore substation. The offshore demonstration unit will be deployed on a site 1500 m offshore from the Fife Energy Park in Methil, Scotland.

The purpose of the offshore demonstration is to prove the full turbine design in an offshore environment and to obtain certification and validation of the turbine design and technology. The Proposed Development will enable Forthwind to advance in several areas; including:

- Validating the offshore installation processes and purpose-made tools;
- Demonstrating the operation of the technology and tune the systems to reach highest efficiency;
- Utilising the turbine as training platform for service personnel and procedures;
- Developing and validating the service processes and tools;
- Assessing loading, availability and performance of the turbine;
- Demonstrating and evaluating grid compliance;
- Optimising the manufacturing process, not only in assembly but also at component suppliers; and
- Providing an opportunity to test and validate optimisation ideas in operating the turbine.

3.3.1. Developing the Project Design Envelope

The Project Design Envelope has been informed by a range of technical and environmental constraints including:

- The extent of the lease area available; and
- Proximity to other marine infrastructure, particularly Forth Port’s operations in the area.

A detailed description of the Project Design Envelope parameters is provided in Section 3.4. The author of each technical assessment Chapter within this EIAR has defined and assessed a worst case scenario from the Project Design Envelope presented. This is detailed within each of the technical assessment chapters.

3.3.1.1. Micro-siting

As the exact location of the turbine, and therefore the associated infrastructure, is not yet known and will be determined by final site investigations prior to construction, it is considered appropriate to include a 100 m micrositing allowance around the centre point of turbine locations and other infrastructure as shown on Figure 1.1 contained in Volume 2 of this EIAR.

3.3.1.2. Project Alternatives

The practical alternatives to hosting the Forthwind next generation demonstration turbine at Methil, are to (a) host the turbine technology demonstration elsewhere or (b) go straight to serial production to offer the turbine on the commercial market.

On option (a) there are a distinct lack of sites within Europe that have the capacity, supply chain, accessibility or infrastructure ability to host test and demonstration sites for new offshore wind turbine technology. The option of siting it as part of a commercial offshore wind farm is difficult to justify on a commercial basis, due to access issues (commercial arrays tend to be distant from shore, leading to difficulties to access the turbine in a timely manner), and on cost and risk issues (the host site would need significant subsidy to mitigate the risk of using a technology that has not been tested in an operational environment, as opposed to using a commercially proven one). Seeking an alternative of location in the UK or Europe for a specialist test and demonstration site elsewhere may have a higher or lower environmental impact, depending on the site identified. However, from a practical point of view, there are few sites in Europe where there is a secured grid connection with a secured revenue stream (in Forthwind's case, the CfD), and available environmental baseline information to secure consent within a reasonable commercial timeframe.

However, the Methil area, with its long energy industry heritage and recent successes in the establishment of the Fife Energy Park and the ORE Catapult Levenmouth open access turbine, is a rare site that has the capability to host the Proposed Development and meet the tight construction and operational timelines required for the commercial pathway needed for a new technology. Its proximity to shore means that it is more feasible to access and learn from this early installation, make corrections, and prove concepts of operation and maintenance

There may be the potential to host the new turbine technology on a test site elsewhere but selecting an alternative site in Europe potentially puts the technology at risk of missing its commercial pathway – as it will be difficult to secure within the timeframes required. It would also lead to Scotland losing out on the commercial, supply chain, job creation and greenhouse gas reduction benefits that the Forthwind project provides.

The turbine OEM has investigated a number of locations across Europe to support their commercial pathway, but they have concluded that the Forthwind site is the most feasible to meet their technology demonstration timeline goals. The Forthwind site had already previously secured S36 consent and a marine licence for a two turbine array in the same location, indicating the suitability of the site to host a test and demonstration project.

Option (b) to move straight through from design board to commercial production on a technology leap such as this is a significant commercial risk. It is unlikely that commercial offshore wind projects will have the risk appetite to host new technologies when they can secure established and independently certified technology elsewhere. From a reputational point of view the turbine OEM needs the opportunity to learn from a demonstration turbine within a relatively safe space.

Test and demonstration sites enable technology learning in how to fabricate, install and operate this technologically advanced turbine at scale in real sea conditions – this includes how the turbines behave, their control systems and testing installation and O&M strategies. The hostile nature of the offshore environment requires the demonstration turbines to be tested in a location which is representative of the conditions the turbines will experience; but which is also easily accessible to meet the regular service and maintenance demands that a test and demonstration programme requires. The access afforded by this project will offers opportunities to test and demonstrate modular technologies that have the potential to reduce the LCOE of offshore wind, enabling it to be even more competitive in the commercial market.

3.3.1.1. Locational Alternatives in the Firth of Forth

Prior to the application, Forthwind considered a number of alternative locations within the area to host the turbine. The available area around the Methil location to locate an offshore turbine is relatively restricted due to the presence of the main Firth of Forth shipping lane further offshore the site and moving either eastwards towards Leven/lower Largo or westwards towards Kirkcaldy would encroach on Forth Ports anchorages and operations at Methil and Kirkcaldy harbours.

Forthwind undertook an internal review of seven alternative turbine sites previously identified in the April 2017 scoping opinion, prior to seeking a scoping application from Marine Scotland. While some of these sites may have offered slightly reduced environmental impact for different aspects, overall it didn't offer any significant difference.

From a practical point of view, the Methil site lease was secured from the Crown Estate in August 2014. The lease area is identified as the area bounded in blue in Figure 1.1 – Site Location Plan. There is no ability to move or amend the lease area awarded to Forthwind and the Crown Estate Scotland (CES) closed their test and demonstration lease process in September 2018, meaning there is no ability to secure the alternative locations identified in the April 2017 scoping report. Although it has since been announced by the CES of their intent to launch an Innovation and Targeted Oil and Gas (INTOG) leasing round for test and demonstration scale projects, this process is not due to launch until later in 2022.

3.4. Description of the Proposed Development Parameters

This section provides a detailed description of the Project Design Envelope parameters which combine to make up the Proposed Development.

3.4.1. Site Location

The design envelope identifies the ambition to install one turbine and one temporary meteorological mast. The turbine is located approximately 1.5km offshore Methil (at the same location identified as turbine B in Annex 1, Figure 1 of the Forthwind S36 consent). The meteorological mast is located 625 metres southwest from the proposed turbine location.

Table 3.1 – Turbine and Meteorological Mast Location Coordinates – British National Grid

	Easting	Northing
Turbine	337812	697333
Meteorological Mast	337314	696959

3.4.1. Turbine Technology

The turbine design is visually similar to a ‘conventional’ offshore wind turbine, although it is technically different (it is larger, has a higher generation capacity and has a different internal technical design). As explained in Chapter 1 - Introduction, Section 1.4, the technology presents new challenges for offshore installation and operation that have not been demonstrated in the offshore environment before. The turbine design consists of a three bladed upwind horizontal axis wind turbine with a rotor diameter of up to 255 meters. The turbine rotor and nacelle are mounted on top of a tubular steel tower with a hub height of 156 m above Highest Astronomical Tide (HAT).

The wind turbine is anticipated to employ an active yaw control (designed to steer the wind turbine with respect to the wind direction), active blade pitch control (to regulate turbine rotor speed) and a variable speed generator with a power electronic converter system. The rotor blade airfoils are anticipated to transition along the blade span with the thicker airfoils being located inboard towards the blade root (hub) and gradually tapering to thinner cross sections out towards the blade tip.

Plate 3-1 - Diagram of turbine and structural definitions

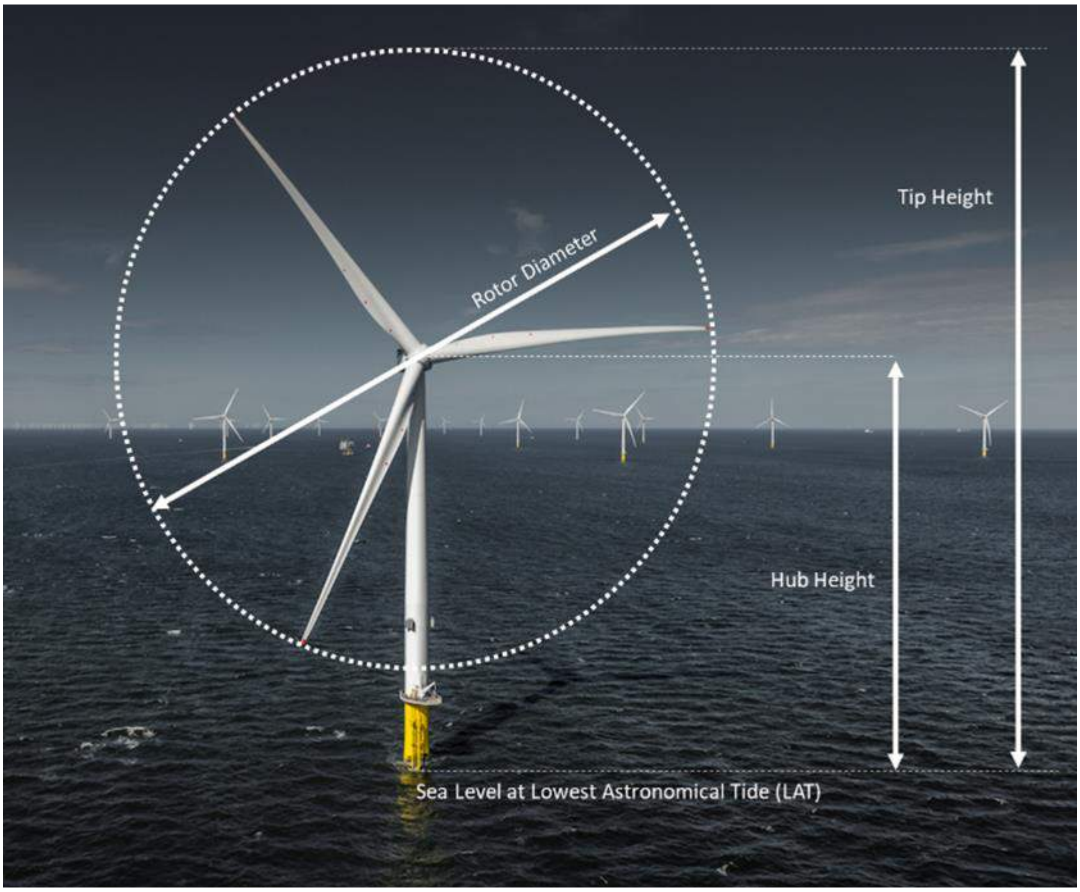


Table 3.2 - Key Data and Dimensions of the Forthwind Turbine.

Key Data and Dimensions of the Forthwind Turbine	
Number of blades	3
Orientation	Upwind
Direction of Rotation	Clockwise
Rotor Diameter	255 metres
Length of rotor	122.5 metres
Blade swept area	51,070 m^3
Hub Height	156 metres HAT
Tip Height above HAT	280 metres HAT
Blade Clearance to HAT	25 metres
Rated Capacity	Up to 20 MW
Voltage	66 kV
Converter	Full size
Structure	Tubular Steel Tower
Number of structure legs	Up to 4 legs on Steel Jacket / Transition Piece
Foundation	Pin piles (one per leg) / Monopile
Design Life	25 years
M&O Access	Boat

3.4.1. Meteorological Mast

The meteorological (or anemometry) mast will be installed 625m to the southwest of the turbine to measure the required wind speed and direction data to certify the turbine. The design and location of the mast is in line with the International Electrotechnical Commission (IEC) standard, and it is intended that the meteorological mast will be operational for a minimum of 5 years (the period required by the certification standard) and will be dismantled and removed from site at the same time as the turbine. For assessment purposes the worst-case scenario will be 25 years. Floating Light Detection and Ranging (LiDAR) technology was initially considered as an option to gather the required data; however, the LiDAR concept has not been approved for use for the appropriate Type Certification testing standards. LiDAR units comprise of a floating buoy on which meteorological instruments are mounted to obtain wind speed and directional data. These instruments use infrared light beams to measure the wind speed and direction at a determined height using the Doppler shift in the reflected signal. The decision on whether LiDAR can be used will be reviewed should floating Lidar receive approval for turbine type certification, however we are intending to proceed with a meteorological mast as a conservative assumption.

The meteorological mast is estimated to be 160m high (with respect to HAT). There will be an anemometer to measure wind speed and direction mounted on the top of the mast. Additional instrumentation may include sensors to measure wave height and direction, sea temperature and salinity, and structural response data.

Table 3.3 - Key Technical Features of the Forthwind Meteorological Mast

Key Data and Dimensions of the Forthwind Meteorological Mast	
Height	160 metres HAT
MetMast Structure (tower)	Lattice Steel Tower
Number of MetMast Structure (tower) Legs	3 legs to transition piece
Foundation	Monopile
Design Life	25 years
M&O Access	Boat

3.5. Proposed Development Footprint

The total area of seabed directly affected by the construction of the Proposed Development will be a maximum area of 10,840.1m^2. The Proposed Development footprint represents the maximum design scenario in terms of seabed disturbance and includes the trenching areas for the export and communication cables and monopile solutions to the turbine and MetMast foundations. A breakdown of the Project Design Envelope extent of the Proposed Development is provided in Table 3.4.

Table 3.4 – Calculations of the "Area of disturbance" or "Project footprint" for the Proposed Development as a result of the construction phase.

Parameter	Maximum area of direct Disturbance (m^2)
Turbine Foundation Option 2 - Monopile	1963.5
Electricity Export (Trenching)	4545
Communications Cable (trenching)	1875
Met Mast Foundation (Monopile)	1256.6
Jack up barge/vessel footprint	1,200
Total	**10,840.1**

3.5.1. Foundation Options

The turbine tower will extend from the turbine to a transition piece which will then connect to either a steel frame structure (Jacket) or tubular monopile. The transition piece will be secured to the foundations via bolts or grout. The transition piece will include a boat landing arrangement, ladders, a crane and other ancillary components as well as a flange for connection to the turbine tower.

The jacket foundation comprises of a lattice tubular steel members and welded joints, fixed to the seabed using a piled foundation. Corrosion protection will be required for all substructure elements and for areas of the structure within the splash zone, which is likely to be in the form of cathodic protection and protective coatings. Sacrificial anode cathodic protection and ICCP (Impressed Current Cathodic Protection) are the options being considered for cathodic protection.

Table 3.5 - Foundation Parameters

Foundations parameters	Detail
Turbine	- 4 Piles (one for each leg) or monopile - 2.5 – 3.5m diameter per pin pile or 10m monopile - Maximum depth of 50m per pile
Meteorological Mast	- 8m diameter monopile

3.5.1.1. Turbine Piled Foundations

A pile is a steel peg that is inserted into the seabed to secure the turbine in place. For the jacket solution, each leg of the jacket foundation in contact with the seabed requires one pile. The size of the piles used will vary depending on a number of factors including ground conditions, structural loading and hydrological regime, although it is anticipated that the pile section will not exceed 3.5m diameter and inserted to a depth of up to 50m.

3.5.1.2. Turbine Monopile Foundation

The alternate option, the monopile foundation, consists of a single steel tubular section made from several sections of rolled steel plate welded together. The size of the pile used will vary depending on a number of factors including ground conditions, structural loading and hydrological regime, although it is anticipated that the monopile will not exceed 10m in diameter and inserted to a depth of up to 50m.

3.5.1.3. Metmast Monopile Foundation

The Metmast foundation will be similar to the turbine monopile (i.e. sections of rolled steel plate welded together), however it is anticipated that the MetMast foundation will not exceed 8m in diameter and inserted to a depth of up to 50m.

3.5.2. Offshore Cables

The offshore cable and substation locations are shown in Figure 3.1. A 66 kV electricity export cable will transmit electricity from the turbine to shore (a distance of approximately 1.5 kilometres or 0.8 nautical mile). A 20 mm^2 fibre optic communications cable will run from the Metmast to the turbine (625m) and then would run alongside the power cable to link the turbine to the SCADA system, likely located in a remote control building. The power cable connection from the turbine to the MetMast is to supply power for the instrumentation. There is an intent to include redundancy in case of power loss to the MetMast, to the MetMast platform will have some backup elements (solar panels/ batteries/ etc).

The export cable landfall point will be within the zone shown on Figure 3.1, with the exact location determined after a detailed ground investigation.

3.5.3. Onshore Works and Connection

Once the cable makes landfall at Fife Energy Park it will connect to a small onshore sub-station and the electricity exported to the grid. The connection from the sub-station to the grid will be subject to a separate consenting process and is not considered in detail within this EIAR as the details of the application are not yet known.

The cable will be laid in the intertidal area within a trench, and will connect to substation and control building via an underground connection. There will be a small transition pit at the exit point from the HDD to allow access to the cable in this area. This is likely to be a small concrete box with an access hatch.

3.6. Construction and Installation Methods

The construction works required for the Proposed Development will take approximately three months, across a period of approximately six months as shown in Table 3.6. After the construction period the turbine will undergo testing and commissioning before becoming operational. The Proposed Development will be operational for 25 years from final commissioning.

An indicative schedule of activities is shown in Table 3.6 below. This shows the proposed worst-case scenario timeline for the Proposed Development. The main construction phases and likely sequence (with overlap between phases) are as follows:

Table 3.6 – Forthwind Indicative Schedule of Proposed Development Installation Activities

Offshore Turbine Installation Activity	Duration	Project week Number																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Piles																														
Piles – Scour vessel mobilisation & transit	1 week																													
Piles – Scour preparation 1st layer	1 week																													
Piles – Vessel mobilisation & transit	1 week																													
Piles – Transit to development site	1 week																													
Piles – Installation start	1 week																													
Piles – pre-commissioning	1 week																													
Piles – Position, jack-up and position pile template	1 day																													
Piles – Installation of marine buoys	1 week																													
Piles – Installation of 4 piles	1 week																													
Piles – Recover template, survey Piles, secure cranes	1 day																													

Offshore Turbine Installation Activity	Duration	Project week Number																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Piles – Piling WDT & TDT	1 week																													
Piles – Scour protection 2nd layer	2 days																													
Jacket																														
Jacket – Mobilisation of vessel	1 week																													
Jacket – Transit to development site	1 week																													
Jacket – Installation Start	N/A																													
Jacket – Pre-commissioning	1 week																													
Jacket – Transfer of Jacket from Barge to WIV	2 days																													
Jacket – Remove material inside pre-Piles	2 days																													
Jacket – installation	1 week																													
Jacket – Grouting & Grounding curing	10 days																													
Jacket – Jacket WDT & TDT	10 days																													
Turbine																														

Offshore Turbine Installation Activity	Duration	Project week Number																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Turbine Installation Vessel Mobilisation	1 week																													
Turbine – Installation and Commissioning (Summary)	3 weeks																													
Turbine – Load out	0 weeks																													
Turbine – Installation start	0 weeks																													
Turbine – Transit	0 weeks																													
Turbine – installation (Tower, Nacelle, Blades)	1 week																													
Turbine – M&E (Full Tower)	1 week																													
Turbine – WDT & TDT	1 week.																													
MetMast																														
MetMast – Installation	1 week																													
Subsea Cables																														
Subsea Cables – Installation Start	N/A																													
Subsea Cables – Mobilisation and load-out	1 week																													
Subsea Cables – Installation	1 week																													
Subsea Cables – Cable Trenching	1 week																													

Offshore Turbine Installation Activity	Duration	Project week Number																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Subsea Cables – Landing of the cable onshore	1 week																													
Subsea cables – WDT & TDT	1 week																													

The final construction methods will be determined after detailed design is completed, but will remain within the range of construction methods (and associated impacts) presented in this section (the Project Design Envelope)

Throughout the EIAR, each technical assessment section has considered the effects of construction in determining the worst case impact assessment.

3.6.1. Foundation Installation

3.6.1.1. Option 1 - Pin Pile Foundation Installation

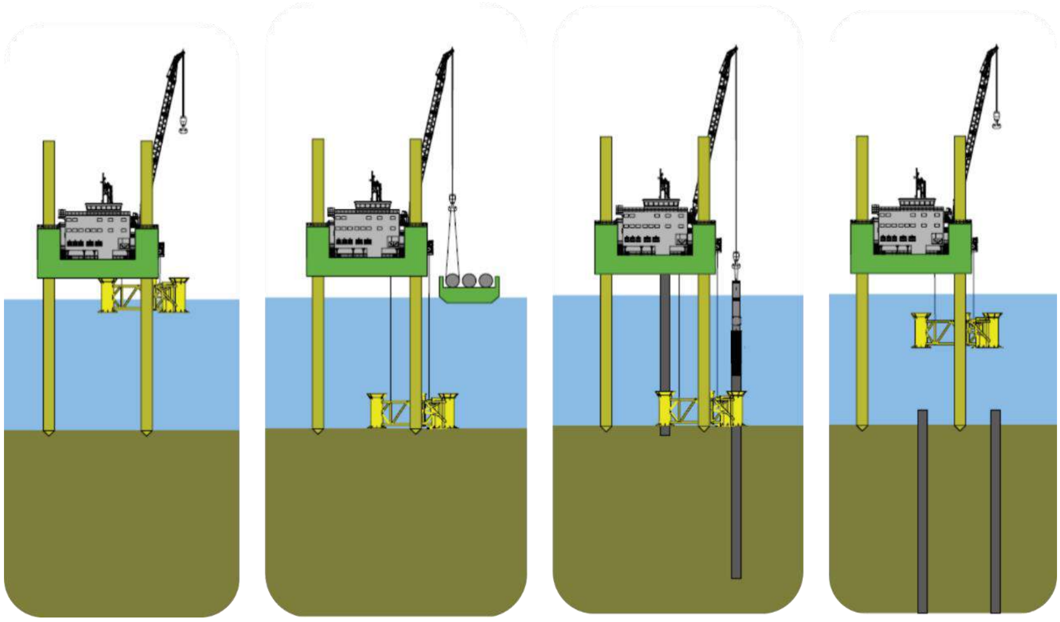
Piles will be transported to the wind farm site from their manufacturing location by vessel, and will either be taken directly to the site for installation, or taken to a suitable port or harbour facility prior to transport to the site.

The vessel which transports the piles from the manufacturing location may not necessarily be used as the installation vessel, and piles may be transferred to another installation vessel either at sea or at the port facility. Piles are likely to be transported by a cargo type barge, which typically would use a dynamic positioning system and be around 100 m in length and 30 m in width.

Plate 3-2 - The GeoSea Goliath Vessel

The installation of the piles is likely to be undertaken by a jack up barge or vessel such as the DEME Groups' GeoSea Goliath vessel (size 59.9m x 32.2m x 5m) (see Plate 3-9)), which will be mobilised to site under its own power. Once on site, the legs will be lowered and deployed. The legs of the jack-up vessel/barge will need to be on the seabed and suitable for weight bearing before operations can commence. In this position the footprint of all four legs of the jack up barge/vessel is likely to be approximately 24m^2. There is the potential that temporary grout bags will be positioned beneath one or more of the jack-up legs to ensure the barge is stable. Once the barge is stable the drilling of the piles will commence.

Plate 3-3 - Indicative Pile Installation Process



The following process would likely be followed for the installation of the foundations:

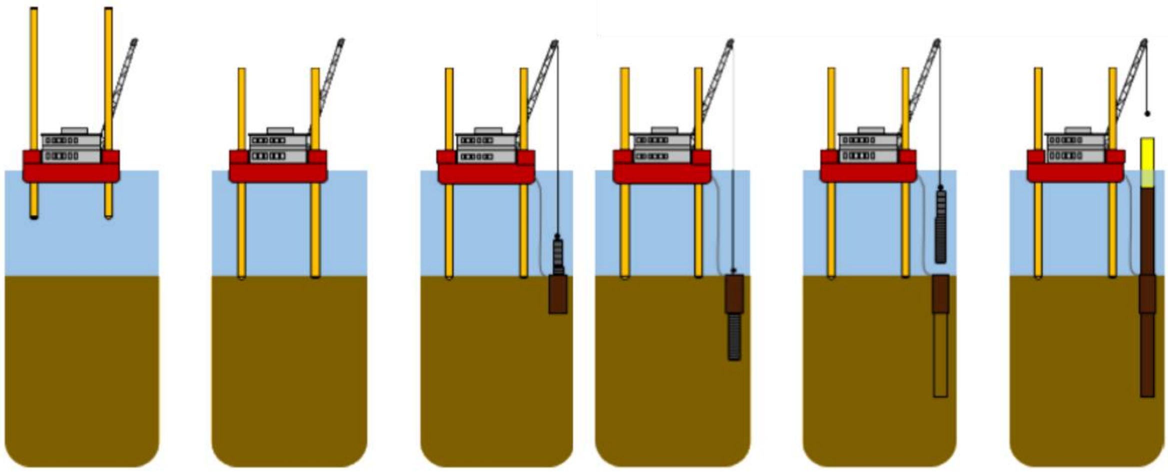
- Seabed preparation will be undertaken prior to piling operations commencing, and will include clearance of debris or levelling of the piling area;
- A piling template is placed on the seabed;
- The Piling vessel drills a pile sleeve into the seabed at the required location for the insertion of the pin pile. To note, the drill piling technique avoids the significantly greater environmental impact of using hammered mono-piles or hammered pin piles to excavate the whole pile.
- Drill fluids are used to lubricate the drill as it penetrates the seabed. The use of drill fluids will be managed and the fluid will be biodegradable and non-toxic (likely to consist of water-based mud). A pile socket will be drilled into the seabed from the jack up barge/vessel for each foundation piece, using a single drill bit. The drilling methods to be used will make use of sea water and the drilling fluid, and all drill cuttings will be left offshore.
- A steel pile is lifted into place by the lifting vessel, inserted into the pile sleeve and grouted in place.
- Cement grout, required for each pin pile following installation, will be injected through tubes in the legs of the tubular jacket substructure into the small space between each pin pile and pile sleeve. The grout used for this purpose is cement based grout and will be dispensed using a grout line from the jack up barge/vessel. There is a potential loss of grout to the sea during routine grouting operations and flushing out of the grout hoses. However, the amount of grout being pumped into the socket will be monitored from the surface and it is predicted that approximately 1m^3 of grout may be lost from each operation equating to a total maximum loss of up to 6 m^3; and
- The process is repeated up to 3 times at each location required.

Installation of the foundations is anticipated to take up to take up to 40 days. During installation, up to three support vessels will be required as guard vessels, with an additional survey vessel potentially required as part of the operations.

3.6.1.1. Option 2 - Monopile Foundation Installation

The monopile will be transported to the deployment site from the manufacturing location by vessel. The vessel which transports the monopile from the manufacturing location may not necessarily be used as the installation vessel, and piles may be transferred to another installation vessel either at sea or at a nearby port facility. The monopile is likely to be transported on the installation vessel but may be transported by a cargo type barge, which typically may be self-propelled and use a dynamic positioning system and be around 100 m in length and 30 m in width.

Monopile foundation installation will likely be carried out using a jack-up barge such as the DEME Group's GeoSea Goliath vessel (LOA 59.9m x Beam 32.2m x Draft 5m), which will be mobilised to site under its own power. Once on site, the legs will be lowered and deployed. The legs of the jack-up vessel/barge will need to be on the seabed and suitable for weight bearing before operations can commence. In this position the footprint of all four legs of the jack up barge/vessel is likely to be approximately 24m^2. There is the potential that temporary grout bags will be positioned beneath one or more of the jack-up legs to ensure the barge is stable. Once the barge is stable the drilling of the piles will commence.



The following process would likely be followed for the installation of the monopile foundation:

- Installation vessel will arrive on site.
- Jack-up legs will be lowered onto the seabed and the vessel will be lifted to provide a suitable airgap.
- Seabed preparation will be undertaken prior to piling operations and will include clearance of debris or levelling of the piling area.
- The drill string shall be assembled on the vessel.
- A pile sleeve or casing is drilled into the seabed at the required location for the insertion of the monopile to ensure stability and hole prevent collapse.
- Drill fluids are used to lubricate the drill as it penetrates the seabed. The use of drill fluids will be managed, and the fluid will be biodegradable and non-toxic, and is likely to consist of water-based mud.
- A pile socket will be drilled into the seabed from the jack up barge/vessel for each foundation piece, using a single drill bit. The drilling methods to be used will make use of sea water and the drilling fluid, and all drill cuttings will be left offshore.
- A steel pile is lifted into place by the lifting vessel, inserted into the pile sleeve and grouted in place.
- Cement grout will be injected through tubes in the casing or monopile structure into the small space between the monopile and the pile sleeve. The grout used for this purpose is cement based grout and will be dispensed using a grout line from the jack up barge/vessel. There is a potential loss of grout to the sea during routine grouting operations and flushing out of the grout hoses. However, the amount of grout being pumped into the socket will be monitored from the surface and it is predicted that approximately 2m^3 of grout may be lost from each operation.

Installing the foundation is anticipated to take up to 40 days. A support vessel may be required during installation as guard vessel, with an additional survey vessel potentially required as part of the operations.

3.6.2. Offshore Cables

An initial overview of the installation of offshore electricity cables is as follows: depending on ground conditions, the preferred installation method for the 66 kV electricity export cable and metmast cable will be to bury (to a target depth of 1.5 m). The cables may alternatively be laid on the seabed and protected by a suitable method (such as matressing or rock placement on top of the cables) where burial is not possible/effective. The following sets out the installation options that may be employed in the burial of the export cable:

- Ploughing

Ploughing involves the cutting of a trench in the seabed with the cable being laid behind. This can be undertaken by surface vessels, remote operated vehicles (ROVs) or a combination of the two.

- Jetting

Jetting uses high pressure water to displace sediment and create a trench in the seabed into which the cable is laid. The jet is attached to an ROV which is either operated in the water column as a free-swimming vessel, or 'driven' along the seabed on caterpillar type tracks.

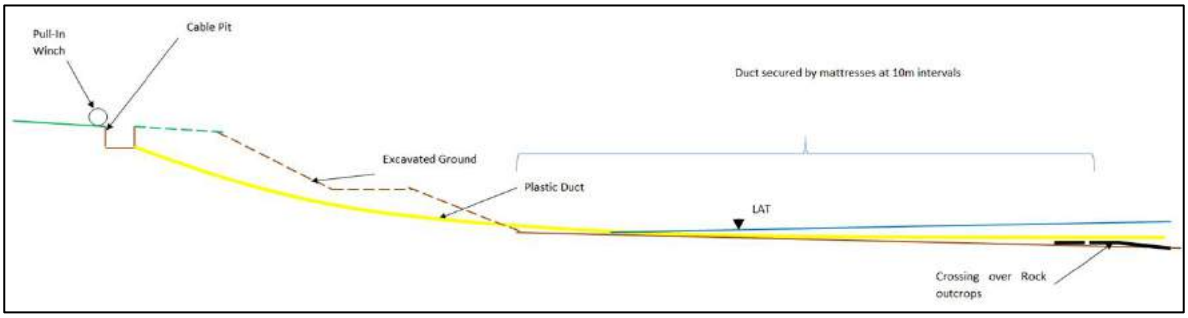
- Trenching

Trenching involves the digging of a trench by a seabed vehicle, typically on caterpillar type tracks, into which the cable is laid. The material displaced from the digging of the trench is placed to the side of the trench.

An Unexploded Ordnance (UXO) survey along the route will be undertaken and the results supplied to Marine Scotland prior to the commencement of installation activities. These surveys will be used for removing potential obstructions from the route, such as boulders and fishing debris.

A cable burial risk assessment will be provided by the cable installation contractor and submitted to Marine Scotland and consultees as part of the Construction Plan, once available.

Plate 3-4 **- Cable Landfall Cross Section**



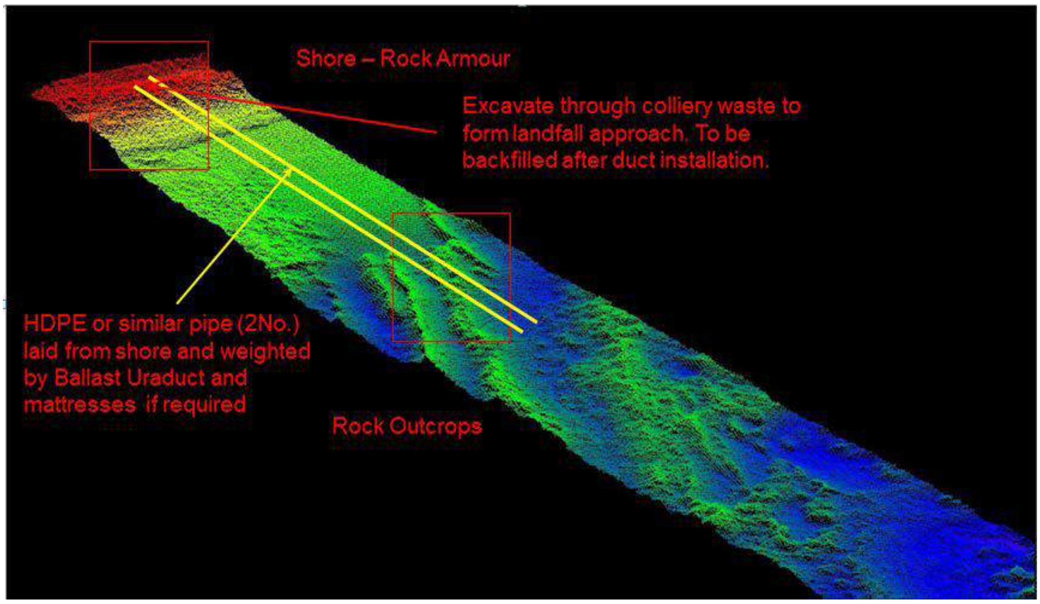
Cable Installation - Onshore Works

A pull through trench will be dug using excavators from the shallow tide limit through the beach area and the sea defence heap of rock and soils. The precise plan for this arrangement will be finalised on completion of the offshore cable route survey and location of the onshore jointing pit to ensure there is a straight run from onshore to offshore for a simple pull-in. This element of the Proposed Development forms part of the separate onshore planning application and is included within this section for context.

Cable Ducting at Landfall

The shore approach section of the cable route will use a duct to protect the electricity export cables, circa 1200m in length. The duct will be buried wherever possible and externally protected with rock bags or concrete mattress. The duct will be made from High Density Polyethylene (HDPE) material with a design life of 50 years.

Plate 3-5 - Duct Solution at Cable Landfall area



Use of concrete mattresses / rock bags

Where cables cannot be buried due to rocky outcrops and where the cables exit the trench at the turbines, it is intended to install external protection to pin and protect the cables. Profiling of these areas will be prerformed as required using loose rock / gravel to smooth the lay path and maintain the minimum bend radius of the cable. Protection will be applied in the form of 6m x 2m x 0.15m standard density concrete matresses or alternatively via bulk rock bags. A final determination on cable burying requirements and need for concrete matressing and/or additional rock bag support/protection can only be made after the cable installation is completed.

To maintain existing and future safe navigation, in areas where external cable protection methods are used, the installation contractor will ensure that the depth in the affected area does not reduce the navigable depth by more than 5% of the surrounding depth as referenced by Chart Datum.

Additional Cable Protection

Where there is a requirement to surface lay the cables over rocky outcrops, additional protection will be added to the cables in the form of Uraduct. The Uraduct is fitted externally to the cable during lay and gives increase impact and abrasion protection. This system will also be be installed at the exit of the J-Tube on the turbine structure to protect the cable, as shown in Plate 3-6, below.

Plate 3-6 - Image of a Trelleburg Uraduct

3.6.3. Overview of Cable Installation Process

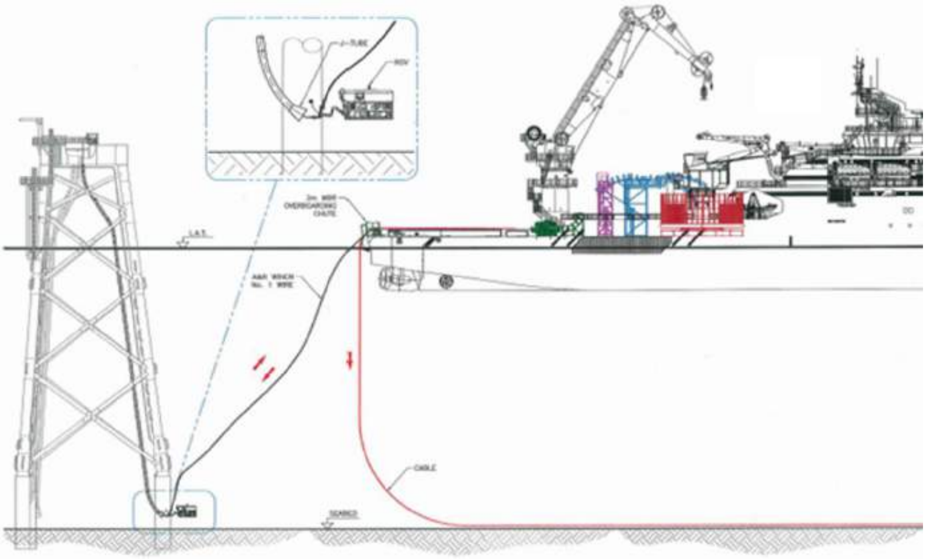
The following provides an overview to the electricity export cable installation process:

- **Pre-lay ROV route inspection** – An ROV will be deployed to inspect the cable routes out from the onshore landing point (approx. 500m offshore) to the base of each wind turbine. The surveys performed will include side scan sonar, multibeam echo-sounder, sub bottom profile and camera surveys. The purpose of the surveys is to determine that the route is clear of surface obstructions which may impede the safe surface lay of the cable out from shore to the wind turbines. Any obstructions encountered will be removed, either using the ROV with a life line recovery procedure or grappling if necessary.

- **Installation at landfall** – The cable will be supplied with suitable wire sock cable grips which will facilitate the pull-in operations to shore and for the turbine. The cable grip will be connected to messenger wires at the foreshore (secured in position by an anchor plate at the junction pit) and at each turbine for pull-in operations. After the securing of the cable end onshore, the cable is then paid out to the seabed from the cable lay vessel.

At the initial installation and shore pull stage of the operation, the vessel will set-up as close to shore as feasible, ideally during highest tide to maximise the working depth. The messenger wire (attached to a winch on the Energy Park) will be towed out to the cable lay vessel by a RIB (rigid-hulled inflatable boat) and then connected to the first end of the cable. The cable will be over-boarded over the vessel chute and pulled into the beach using floats or roller stands as required.

Plate 3-7 - Installation of the Export Cable to the Wind Turbine



A secondary vessel may also assist in supporting the cable in the shallower water depths and feeding the cable into the shore approach section. The cable will be pulled through the installed duct to the beach area and secured in the jointing pit allowing the lay vessel to move off and commence lay of the remainder of the cable to the turbine.

- **Main Cable Lay** – The cable will be laid into a pre-cut trench along the lay route. The cable will be monitored to ensure the appropriate amount of tension and slack as the topography requires. Where required the deck team will install additional protection to the cable at the predetermined locations due to the seabed profile.
- **Landing the Cable to the Wind Turbine** – A J-tube is located on one of the turbine legs to guide the cable up through the structure to the wind turbine. Before cable pulling operations begin, all necessary equipment is installed and prepared (on the turbine platform and J-tube) and the area around the entry point surveyed to ensure it is clear from debris. A messenger wire is then passed from the turbine structure through the J tube to the installation vessel. The messenger wire is attached to the main pull wire attached to the cable. The cable will then be pulled in to the switchgear and terminated and tested.

Plate 3-8 - Cable Grip arrangement for the Cable Pull

- **Post Installation Inspection and Burial –** On completion of each cable segment, it will be necessary to carry out a post lay inspection and burial (PLIB) operation along the buried cable route with the aim of determining that the cable has been buried correctly. This inspection will be most likely be carried out by a ROV, which will carry out 2 jetting passes over the route of the two cables after which a further inspection pass will be carried out.

3.6.3.1. Installation Vessels

The installation of export cables is anticipated to require the following vessel types:

- **Cable laying vessel** - will install the cables from spools located on the vessel;
- **Trenching, jetting or ploughing vessel** - will operate or deploy the trenching;
- **Service vessel** - may be required to support the installation; and
- **Workboat** may be used to transfer crew from port to the installation vessels.

It is anticipated that installation of the export cable and communications cable will take up to 15 days.

3.6.4. Wind Turbine Installation

It is anticipated that a single jack-up vessel will be used to install the turbine. Vessels of this type are in the region of 150 m in length and 50 m wide. Jack up barge/vessels typically have 4-6 feet with an area of up to 200 m^2 each, resulting in a total seabed footprint of up to 1200 m^2 per turbine during the installation process.

The installation process for the turbine is detailed below:

- Loading of wind turbine onto vessel;
- Transfer to site;
- Positioning/jacking/preparation for lifting;
- Installation of wind turbine tower;
- Installation of wind turbine nacelle;
- Installation of wind turbine blades;
- Jack down and relocate;
- Repeat at next turbine; and
- Leave site.

Installation of the turbine is likely to take up to 2 days (plus another 5 days for grouting, undertaken by a service vessel), and is anticipated to be completed within 7 days for the Proposed Development accounting for de-rigging and moving between turbine and metmast.

It is likely that guard vessels will be employed during the installation process.

3.6.5. Summary of Proposed Development Vessel Requirements

Table 3.7 below provides details of the vessel requirements for the development and the number of days each vessel is likely to be on site throughout the duration of deployment. These are approximate figures and will be subject to a number of parameters and cannot be accurately defined at this stage.

Table 3.7 - Vessel Requirement and No. of Days On Site

Activity	Vessel Type (and dimensions)	Days on site
Transport	Cargo Barge (100 x 30 m)	-
	Service Vessel (tbc)	21

Activity	Vessel Type (and dimensions)	Days on site
Cable preparation and Installation	Construction / pipe lay vessel (120 x 25 m)	15
	Workboat / Safety / Guard Vessel (15 x 7 m)	21
Foundation Installation – Piling Operations	Jack up barge / vessel (Up to 150 x 50 m)	7
Turbine	Service Vessel	21
	Jack up barge / vessel	7
	Workboat / Safety / Guard Vessel	21
Routine maintenance	Workboat	20 days / year
Decommissioning	Service Vessel	7
	Jack up Barge / vessel	7
	Workboat / Safety / Guard Vessel	7

3.6.6. Offshore HSE Management and Emergency Arrangements

This Applicant does not intend to apply for a notice declaring a safety zone around the wind turbine . The area is under VTS control and vessels arriving at the Port entrance will, in the main, will have a Pilot embarked; as such it is considered that the risks can be managed by the construction Marine Coordinator and the Port Authorities/ Pilot on a case-by-case basis.

Given the relatively low traffic levels and the duration of the construction and installation activities, in line with the conclusions of the Forthwind Navigational Safety Risk Assessment (NSRA), no restrictions on navigation will be implemented in proximity to the Proposed Development by the Applicant. It is however noted that since the Proposed Development is located within the jurisdiction of Forth Ports, it is possible that Forth Ports may implement safety zones, exclusion zones or speed restrictions.

Based on experience at other under construction offshore installations, it is anticipated that commercial vessels will choose not to navigate in close proximity to the structures and will instead maintain a safe passing distance, including avoiding passing between the wind turbine generator (WTG) and Met Mast locations. However, taking this and the existing mean positions of the main commercial routes in and out of Methil into account, no deviations from the mean positions of the routes are anticipated. Some squeezing of vessel traffic on the routes may occur to maintain safe distances from the structures and construction activities but will be limited. Subsequently the level of vessel to vessel collision risk for commercial vessels is not expected to increase substantially. This is reflected in the collision risk modelling undertaken which indicated a return period of one in 1,060 years for the base case post wind farm scenario, equating to an increase of 0.01% from the pre wind farm scenario, which is considered a negligible change.

A number of requirements and recommendations have been detailed in the Navigational Safety and Risk Assessment for more information regarding these please refer to Chapter 15 Shipping and Navigation and the NRSA itself (Technical Appendix 13a, contained within Volume 3 of this EIAR).

To ensure compliance with all relevant environmental legislation, relevant EIAR mitigation measures and other relevant environmental commitments undertaken during installation, the installation contractors will be provided with an Environmental Management Plan which must be adhered to throughout the installation process.

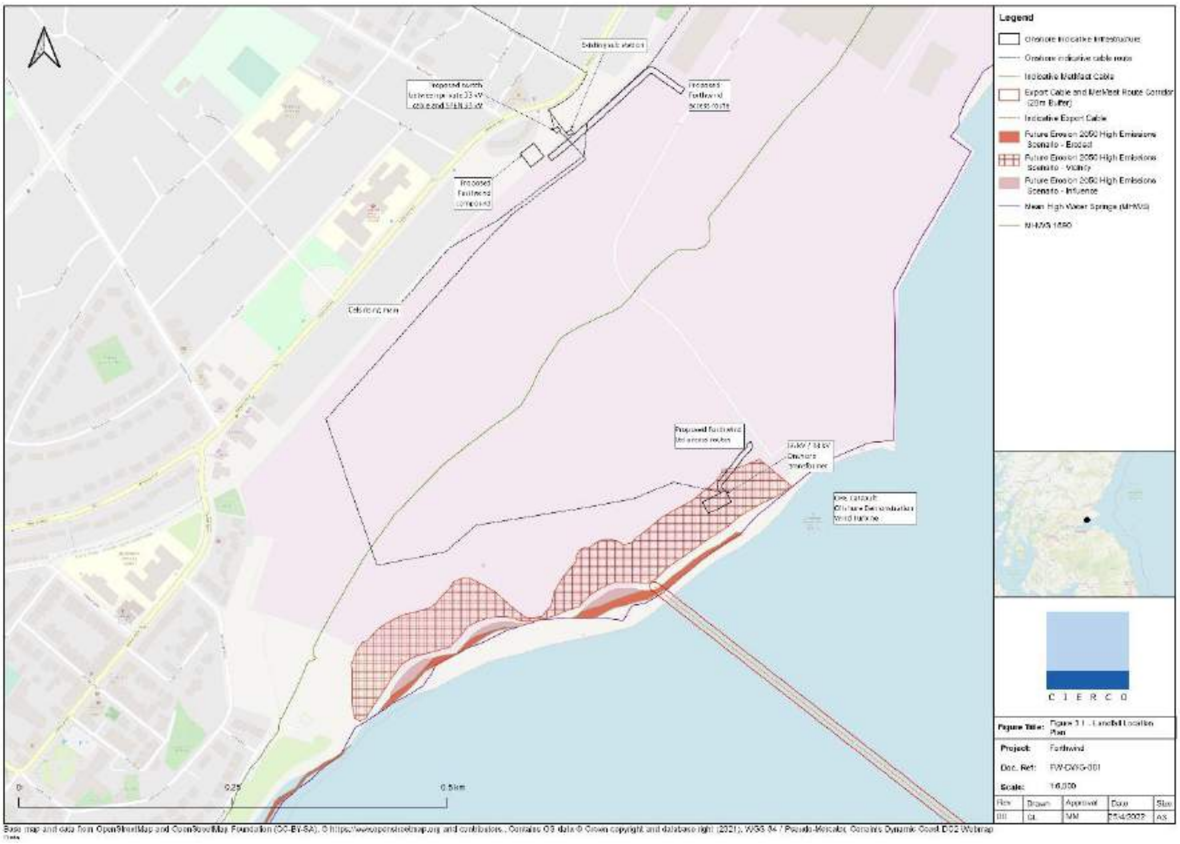
3.7. Onshore Construction Activities

This section provides information on the installation works and associated control measures that will be implemented during the construction of the Proposed Development.

The offshore electricity export cable will make landfall, via an intertidal zone trench, to an onshore junction pit located on the Fife Energy Park. From the junction pit the 66kV cable will connect to a sub-station near to the entrance of the Energy Park and from there the electricity will be exported via a dedicated cable to the grid substation at Leven.

A provisional cable route on the Fife Energy Park has been agreed with Scottish Enterprise (the owner of the Fife Energy Park) and the final detailed design and layout will be agreed with Scottish Enterprise and Fife Council. It must be noted that the onshore elements of the development will be applied as a separate onshore planning application through Fife Council.

Figure 3.1- Indicative Layout of Onshore Works



The cable route between the Fife Energy Park and the Leven substation will follow a route along public roads and the relevant permissions to access and install the required cabling will be made to Fife Council at an appropriate time prior to the installation works.

3.7.1. Offshore to Onshore Export Cable Installation

The electricity export cable may be installed using trenching, involving the digging of a trench into which the cable is laid.

The trenching option will involve removing the existing coastal defence infrastructure and digging of one open cut trench (up to 3m wide x 1.5m in depth) by an excavator (JCB or similar) from the onshore substation to the MHWS mark, through the intertidal zone and continue offshore to a point below the lowest astronomical tide (LAT).

Up to two PVC cable ducts (one for the export cable and another for a communications cable) will be installed in the trench to facilitate the installation of the cables and offer some protection. The trench will then be covered with the material excavated and the coastal defence infrastructure reinstated.

As the intertidal zone is predominantly made ground, it is anticipated that sediment depth will be sufficient to allow the trench in the intertidal zone to be entirely undertaken by an excavator. However, should the sediment depth be insufficient, rock breakers or other mechanical cutting methods may be required to achieve the required design burial depth. Excavation below LAT will be achieved using an excavator mounted on a barge or jack up platform. It is anticipated that the intertidal trench will take around 4 weeks to construct.

Once the preparatory works are complete the cable will be installed to link the onshore site compound transformer to the offshore turbine. The method of installation of the cable through the intertidal zone will be determined in detailed design but consists of two options:

Offshore to onshore - a temporary winch may be installed onshore (above MWHS) to winch the cable onshore, via the duct installed in the intertidal area, from a cable laying vessel stationed offshore.

Onshore to Offshore – the cable will be pulled onshore to offshore, via the duct installed in the intertidal area, from a cable laying vessel stationed offshore.

It is estimated that the trench will stretch out to a distance of around 150m offshore. In the deeper water beyond this point, the cable will be installed as described in Section 3.6.2.

Although the intertidal area within the cable corridor route contains a statutory nature conservation designation in the form of the Firth of Forth Site SSSI, SPA and Ramsar site, the nature of the coastal habitat in the immediate locality (a reclaimed area of land made of colliery waste of very limited ecological value), the current form of activity on the site (fabrication and construction activities) and regular disturbance of the area, along with the relatively small area of impact (3m width x 1.5m depth trench) mean that the activity is unlikely evoke any response on the nature of activity of designation. The landfall corridor lies over 300 m north east of the east end of the Geological Conservation Review (GCR) site. The area of coastline is currently managed with rock armour revetment.

3.8. Project Operation and Maintenance Approach

An initial overview of the Proposed Development Operations and Maintenance (O&M) programme is as follows: the Forthwind project Operations and Maintenance (O&M) programme, in common with O&M processes used on other offshore windfarms across the UK, is expected to be focused on providing maintenance access via a Crew Transfer Vessel (CTV) to a boat landing platform at the base of the turbine structure and Meteorological Mast. The turbine is anticipated to be accessed via a ladder. The jacket/pile will be constructed so that boats servicing the turbine can moor safely against the jacket/pile to gain access to the nacelle via the tower. O&M activities, such as servicing equipment or replacing parts or machinery, are anticipated to be hoisted up to a landing platform on the transition piece directly from the deck of a boat below.

3.8.1. Operation and Maintenance Activities of the turbine during operation

A site based engineering staff of up to six full-time maintenance and administrative staff will be required to undertake the commissioning and testing of the turbine. The engineers will require access to the turbine (daily during the commissioning period) for instrumentation, maintenance and monitoring purposes.

The turbine (blade, nacelle and tower – including the foundations) will be subject to routine maintenance that will check its structural integrity and the effectiveness of anti-corrosion measures in place. Marine growth may be removed in certain circumstances, particularly in areas such as access points or if the loading effect on the structure is considered to be excessive.

3.8.2. Maintenance of the cable during operation

Once the electricity export cables have been installed, an assessment of the potential future risk of cable exposure will be completed. Based on the outcome of the post installation cable risk assessment, visual inspections of the integrity of the subsea cables and their burial condition will be undertaken at an appropriate frequency by the Forthwind appointed O&M contractor. The subsea cables will be inspected using an underwater ROV from the J-tube of the turbine structure along the route of the cable back to the duct entry point close to shore.

In the event of cable failure or exposure, maintenance and rectification work will be undertaken to ensure that the burial condition of the cable is maintained within the cable burial risk assessment parameters. Forthwind will re-bury the cable or if this is not feasible apply additional cable protection material. Forthwind will provide notification to Marine Scotland in instances of cable failure or exposure prior to undertaking any rectification work.

3.8.3. Lubricants and Oils

The operation and design proving of the turbine will not involve discharge of material into the environment. It will require the use of lubricants like oil and grease by moving components, and chemicals like propylene glycol, dielectric fluid, ion exchange resin, electrical isolation gas and solvent as well as fire extinguishing agents, which will be stored, operated and contained according to applicable safety standards. The volume of lubricants will be around 1,200 litres, weight of chemicals around 6,500 kg. The nacelle and rotor are designed and constructed to ensure any release of lubricants or chemicals are retained within the structure; ensuring minimal risk for leakage into the environment.

In any case, a spill procedure will be developed to manage unlikely accidental unplanned discharges and all operation and maintenance staff will be trained in the procedure. Any empty lubricant containers, waste oil and other waste will be removed from the site and disposed of at a licensed waste facility in accordance with current regulations.

3.8.4. Antifouling and Corrosion protection

Over time an increase in algal growths and encrusting growths such as barnacles will occur on the turbine foundations, however there are no plans to use antifouling coatings on the structure. Corrosion protection on the steel materials will be provided by a combination of coatings and cathodic protection.

3.8.5. Decommissioning

Following the cessation of commercial operations, the Proposed Development will be decommissioned in accordance with an approved decommissioning plan. This will involve the removal of the turbines. Following a significant period of time it is possible that removal of below ground infrastructure (including the foundations) could be more environmentally damaging than leaving it in place. Provision will be made to remove this infrastructure, however the requirement to decommission will be re-evaluated at that time. The infrastructure beneath the seabed will be left in situ.

The onshore elements of the Proposed Development will be decommissioned in accordance with the approved decommissioning plan at the time. This is included in a separate planning application that will be submitted to the Local Planning Authority (Fife Council).

The processes involved in decommissioning are likely to be similar to the installation and construction activities, but of a smaller environmental impact magnitude.

Alternatively, it is possible that consent will be sought to extend the operational life of the Proposed Development, although this will require the relevant assessments and consents being undertaken and obtained prior to the end of the operational period, and in accordance with the legislation at the time.

4. PLANNING AND ENERGY POLICY

4.1. Introduction

This chapter of the EIA evaluates the effects of the proposed Forthwind demonstration project (hereafter referred to as "the Proposed development") with regards to planning and energy policy framework relevant to the Proposed Development. It establishes the general policy context surrounding the Proposed Development and highlights the key policy drivers which support the development of renewable energy in Scotland, with reference to offshore wind development in particular, highlighted throughout. This chapter contains the following sections:

- Introduction;
- Consultation;
- Energy Policy Context (International, European and Scottish);
- Marine and Terrestrial Planning;
- Legislative Requirements;
- Consents and Licencing; and
- Local Planning Framework.

4.2. Consultation

Table 4.1 details the consultation that has been undertaken in respect of the Planning and Energy Policy assessment, detailing how consultation responses have informed the assessment and have been considered within this Chapter by the Applicant.

Table 4.1 - Summary of Consultation Undertaken

Consultee	Consultation Method	Consultee Comments	Project Response
East Lothian Council	2019 Scoping Opinion	East Lothian Council advised that EIA Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA 2017) had not been referenced.	The Regulations are now referenced within this chapter, under Section 4.8.2
Fife Council	2021 Scoping Opinion	Any onshore elements to the proposal are likely to be minor in the scheme of things and would be located in the Fife Energy Park, where no difficulties are expected to arise over planning permission.	Noted
Marine Scotland	2021 Scoping Opinion	In it's Scoping Report, the Developer states that 'deemed planning' is to be sought as part of the Section 36 consent application process. However, in subsequent communication (dated 22 Sept 2021), the Developer has advised the Scottish Ministers that it no longer seeks to pursue deemed planning and will pursue relevant permission for onshore elements on the project from the Local Authority	For the onshore elements related to the Proposed Development, a separate planning application will be submitted to Fife Council.
		The Scoping Report makes a small reference to maintenance operations, whereby crew would be transferred to the structure of the turbine and some replacement of parts might take place. It should be noted that to alter or improve works in the Scottish marine	A full list of planned maintenance activities associated with the Proposed Development, which have subsequently been addressed, are

Consultee	Consultation Method	Consultee Comments	Project Response
		area is a 'licensable marine activity' and therefore would require a marine licence. Any such activity, unless clearly authorised by the marine licence for the construction of works, may require further marine licences. It is therefore advised that the Developer considers activities which may require further licences and includes such activities in the application.	presented in Chapter 3 – Project Description, Section 3.8.

4.3. Energy Policy Context

Climate change and the need to reduce carbon emissions underpins energy policy and guidance, which at international, national and regional levels has been designed to support and deliver a move to low carbon energy production. The UK has committed to meeting a legally binding target to cut greenhouse gas emissions by at least 100% from the 1990 baseline by 2050, which would result in 'Net Zero' greenhouse gas emissions[6]. Meeting this target requires major investment in new technologies, the electrification of heating, industry and transport, prioritisation of sustainable energy and cleaner power generation including the development of offshore wind capacity.

The Scottish Government intends to facilitate investment in new infrastructure projects, with particular focus on electrification[7]. Within a market-based system and with significant constraints on public expenditure, both the UK and Scottish Governments recognise the important role the private sector has to play in the delivery of renewable energy schemes[8].

In response to the growing international concern regarding the effects of climate change and the advice provided by the Climate Change Committee in its Progress reports, in April 2019 the Scottish Government declared a Climate Emergency[9]. The Scottish First Minister in her address to the SNP Party conference, announced:

"Our obligations to the next generation are the most important that we carry. A few weeks ago, I met some of the young climate change campaigners who've gone on strike from school to raise awareness of their cause. They want governments around the world to declare a climate emergency. They say that's what the science tells

[6] UK Government (2019) *The Climate Change Act 2008 (2050 Target Amendment) Order 2019* [Online] Available at: https://www.legislation.gov.uk/uksi/2019/1056/made?view=plain (Accessed 05/10/2021)

[7] For example, the Scottish Government Infrastructure Plan for Scotland 2021-22 to 2025- 26 includes specific electrification projects and has a key Theme of enabling the transition to Net Zero [Online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2021/02/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26/documents/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26/govscot%3Adocument/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26.pdf (Accessed 04/10/2021)

[8] For example, the Scottish Energy Strategy 2017 notes the need for collaboration between the public, community, and private sectors [Online) Available at: https://www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/ (Accessed 04/10/2021)

[9] Speech by Nicola Sturgeon [online] available at: https://climateemergencydeclaration.org/scotland-worlds-first-government-to-declare-a-climate-emergency/ (Accessed 04/10/2021)

us. And they are right. So today, as First Minister of Scotland, I am declaring that there is a climate emergency. And Scotland will live up to our responsibility to tackle it."

If consented, the Proposed Development would contribute to the delivery of international and national policy objectives, diversify the energy mix and facilitate the transition to low carbon energy, whilst decreasing the dependency on fossil fuels. The Proposed Development has been informed by this policy framework with key policy and legislation outlined below.

4.4. International and European Policy Context

4.4.1. COP 21 Paris Agreement

On 12th December 2015, 196 Parties to the UN Framework Convention on Climate Change ('UNFCCC') adopted the Paris Agreement, a legally-binding framework for an internationally coordinated effort to tackle climate change. The Paris Agreement's key aim is to strengthen the global response to climate change by keeping a global temperature rise this century below two degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The UK is legally bound through commitment to the Paris Agreement.

4.4.2. Committee on Climate Change Net Zero Report May 2019

In May 2019 the Committee on Climate Change ('the CCC') published *Net Zero – The UK's Contribution to Stopping Global Warming*[10]. This report responds to a request from the Governments of the UK, Wales and Scotland, asking the Committee to reassess the UK's long-term emissions targets. The report recommends a new UK target for the reduction of greenhouse gas emissions by 2050, and recommends a 2045 net-zero target for Scotland to reflect Scotland's greater relative capacity to remove emissions than the UK as a whole. The Report highlights the falling cost of key renewable technologies, which is now generally comparable or lower cost than power from fossil fuels, while bringing significant co-benefits such as reduced air pollution.

4.4.3. The Climate Change Act 2008 (2050 Target Amendment) Order 2019

On 26th June 2019, the Climate Change Act 2008 was amended to introduce a target for at least a 100% reduction in greenhouse gas emissions (compared to 1990 levels) in the UK by 2050. This 'net zero' target is likely to affect and increase future Government renewable and low carbon energy targets and create a more positive policy environment for renewable energy.

4.4.4. Committee on Climate Change Progress Report to Parliament June 2021

On the 24th June 2021 the CCC published the 2021 report to Parliament[11], assessing progress in reducing UK emissions over the past year. The report highlights that significant lessons have been learned as a result of the ongoing COVID-19 pandemic and that within testing times, the importance of activating change at Government level should continue to be a priority, particularly with COP26 on the horizon at the end of 2021. The report once again indicates that reaching net zero emissions in the UK will require all energy to be delivered to consumers in zero-carbon form, for example - renewables and nuclear, bioenergy and fossil fuels combined with carbon capture and storage.

In addition, the report states that:

"The ambition of the last year must be turned into policy and real-world delivery. The UK has begun to reinforce its new emissions targets with clear ambition for specific sectors in line with the required path (e.g. 40 GW offshore wind by 2030)".

[10] Committee On Climate Change (2019) *Net Zero – The UK's Contribution to Stopping Global Warming [Online]* Available at: https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf (Accessed 05/10/2021)
[11] Committee on Climate Change (2021) *Committee on Climate Change Progress Report to Parliament June 2021* [Online] Available at: https://www.theccc.org.uk/wp-content/uploads/2021/06/Progress-in-reducing-emissions-2021-Report-to-Parliament.pdf (Accessed 05/10/2021)

However, it is recognised that delivery and progression of climate change actions must begin to accelerate in order for the UK to meet its ongoing emissions reduction targets.

4.4.5. National Audit Office – Achieving Net Zero

Published on 2nd December 2020, the National Audit Office report to the UK Government[12] examines the main risks to achieving net zero effectively and efficiently. The report is forthright that most of the UK reductions in emissions have come about from the switch away from coal in electricity generation. Whilst reducing emissions further will require wider changes to the UK economy, further investment in renewable electricity generation will be required.

BEIS predicts that the UK will not meet its targets for emissions reduction unless action is taken to reduce the shortfall in achieving the targets set in the fourth and fifth carbon budgets. At paragraph six of the summary the report states that:

"Achieving net zero is a colossal challenge and significantly more challenging than the Government's previous target to reduce emissions by 80% by 2050."

4.4.6. British Energy Security Strategy

On 7th April 2022 the UK Government published the British Energy Security Strategy[13] in which it states an ambition to deliver up to 50 GW of offshore wind renewable energy by2030, including up to 5 GW of innovative floating wind. To facilitate this ambition, the overarching consenting process time will be cut by over half by:

- Reducing consent time from up to four years down to one year;
- Making environmental considerations at a more strategic level allowing us to speed up the process while improving the marine environment;
- Implementing a new Offshore Wind Environmental Improvement Package including an industry-funded Marine Recovery Fund and nature-based design standards to accelerate deployment whilst enhancing the marine environment; and
- Establishing a fast track consenting route for priority cases where quality standards are met.

4.4.7. The Sixth Carbon Budget: The UK's path to Net Zero

On 9th December 2020, the CCC released *The Sixth Carbon Budget*[14] which updates intermediary targets for the UK's progress to net zero.

"Our recommended pathway requires a 78% reduction in UK territorial emissions between 1990 and 2035. In effect, it brings forward the UK's previous 80% target by nearly 15 years. There is no clearer indication of the increased ambition implied by the Net Zero target than this."

These recommended targets must be considered as a factor in the determination of applications for viable wind energy projects. In establishing intermediary targets towards net zero, the context exists for Local Authorities to recognise the action that must be taken sooner rather than later. As concluded in the Sixth Carbon Budget:

"The implication of this path is clear: the utmost focus is required from government over the next ten years. If policy is not scaled up across every sector; if business is not encouraged to invest; if the people of the UK are not engaged in this challenge – the UK will not deliver Net Zero by 2050."

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[12] National Audit Office (2020) *National Audit Office – Achieving Net Zero* [Online] Available at: https://www.nao.org.uk/report/achieving-net-zero/ (Accessed 05/10/2021)
[13] UK Government (2022) *British Energy Security Strategy April 2022* [Online] Available at: https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy (Accessed 18/04/2022)
[14] Committee on Climate Change (2020) The *Sixth Carbon Budget – The UKs Path to Net Zero* [Online] Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf (Accessed 05/10/2021)

Section four of Chapter three of the report addresses electricity generation specifically. Reducing carbon emissions to net zero will require significant expansion of low carbon generation, in particular low-cost renewables and decarbonised back up generation.

Under the CCC's 'balanced pathway' approach to net zero, the annual demand for electricity will increase substantially due to increased electrification (for example the use of electric vehicles in transport) and can be expected to double from around 300 TWh today to 360 TWh in 2030, 460 TWh in 2035 and 610 TWh by 2050. Meeting this increased demand excludes potential generation from hydrogen.

The report sees renewables as forming the 'backbone of the electricity system', providing 80% of all generation by 2050. Wind, in particular offshore, will need to provide 265 TWh of generation by 2035 and 430 TWh by 2050. This will require 3 GW per year of new wind capacity, plus the repowering of existing sites, per year, in addition to a similar amount of new solar.

4.4.8. HM Government Energy White Paper – Powering our Net Zero Future December 2020

On 14th December 2020, Alok Sharma MO, then Secretary of State for BEIS announced the launch of the *Energy White Paper*[15]*.* The White Paper set out the UK Government's strategy to put attaining net zero and fighting climate change at its core, following the Prime Ministers Ten Point Plan for a Green Industrial Revolution. As part on this strategy, the target for offshore wind is raised to 40 GW, enough to power every home in the UK.

The White Paper reiterates the compelling case to urgently address climate change and avert the dangerous consequences of that will arise if global temperatures increase is not kept at well below 2% as per the Paris Agreement, if possible, not above 1.5%. The White Paper sets out the measures that need to be put in place to achieve the carbon emission targets for the UK. These entail a major shift in energy use from fossil fuels to electricity and hydrogen. Clean electricity is to become the predominant form of energy, with a consequent doubling of demand. This transition must be secured whilst retaining reliability, resilience and affordability. Delivering this will require billions of pounds of investment in clean energy infrastructure, including offshore wind farms and new nuclear plant.

The White Paper is clear that in addition to offshore wind, other low-cost renewable technologies will also need sustained growth if net zero is to be achieved. Onshore Wind (and solar) will be key building blocks in the energy mix, with the aim to deploy around 12 GW of low-cost renewable generation capacity.

4.4.9. UK Government Announcement on UK Sixth Carbon Budget 2021

On 20th April 2021 BEIS and the Prime Minister's Office jointly announced that the Sixth Carbon Budget will limit the volume of greenhouse gasses emitted over the 5-year period from 2033 to 2037, equivalent to a 78% reduction by 2035 compared with 1990 levels[16]. The UK Government is already working towards a reduction of 68% by 2030, and states that the goal of achieving 78% by 2035 constitutes the world's most ambitious climate change target.

For the first time, the Carbon Budget will incorporate the UK's share of international aviation and shipping emissions. The statement also notes that the UK continues to break records in renewable energy generation, which has more than quadrupled since 2010, with low carbon electricity accounting for over 50% of total generation.

The new target was given statutory force earlier this year as of 24th June 2021, with legislation introduced prior this through Parliament on 21st April 2021.

[15] BEIS (2020) *HM Government Energy White Paper – Powering our Net Zero Future* [Online] Available at: https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future (Accessed 05/10/2021)
[16] UK Government (2021*) 'UK enshrines new target in law to slash emissions by 78% by 2035'* [Online] Available at: https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035 (Accessed 05/10/2021)

4.4.10. Climate Change and Energy Policy Conclusion

Given the overview of relevant international policy on climate change and renewable energy and the context of the continued need for increased renewable energy generation, it is clear that projects such as the Proposed Development must be encouraged due to their environmental, social and economic benefits. If consented, the Proposed Development would contribute to meeting the CO_2 emissions reduction targets, as well as the renewable energy targets. The recently published Energy White Paper, and the subsequent Ministerial Statement by the Secretary of State accelerating the pace at which the UK carbon emissions most be reduced, are both a stark reminder of the urgency with which climate change must be addressed at UK, European and International levels.

It also highlights the economic benefits which can emerge from the transition to a low carbon economy. Given this context, it is imperative that projects which have already been assessed, in principle, as acceptable and in locations with recognised capacity to accept offshore wind development should proceed without delay. The Proposed Development is therefore fully in accord with the objectives of UK and international climate change policy.

4.5. Scottish Context

In addition to the targets and commitments identified above, the Scottish Government has set its own renewable energy targets and these are discussed further in the following sections, firstly with the legislation listed below, before specific climate change and energy policy listed throughout Section 4.6.

4.5.1. Climate Change Scotland Act 2009

The Climate Change (Scotland) Act 2009[17] ('the Climate Change Act') creates a long-term framework for the current and successive administrations in Scotland to ensure a reduction in Scottish greenhouse gas emissions by 80% by 2050 with an interim milestone of 42% by 2020.

4.5.2. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019

The Scottish Government introduced the new Climate Change (Emissions Reduction Targets) (Scotland) Bill ('the Climate Change Bill') to Parliament on 23rd May 2018, and was passed on 25th September 2019, and received Royal Assent on 31st October 2019, becoming the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019[18].

The Act amends the Climate Change (Scotland) Act 2009 and originally increased the 2050 target to 90%. In line with advice from the CCC on 2nd May 2019, the Scottish Government amended the Climate Change Bill to set a target date of 2045 for reaching net-zero emissions.

Setting a 'carbon neutral', net-zero target of 2045 is ambitious and ahead of the rest of the UK's target of 2050. The Government has set ambitious targets for reduction of carbon emissions. Projects, such as the Proposed Development, play a key role in aiding the decarbonisation of the energy sector.

4.6. Scottish Climate Change and Energy Policy

The following documents set out the Scottish Government's commitment to cut carbon emissions through the deployment of renewable energy, and sets out the national energy strategy alongside energy planning statistics.

4.6.1. Routemap for Renewable Energy in Scotland

Securing low carbon energy supplies is a key element in achieving the target of reducing emissions by 80% by 2050 with an interim milestone of 42% by 2020. In recognition of this the Scottish Government set targets which include producing 100% of the country's demand for electricity from renewable sources by 2020, first detailed

[17] Scottish Government (2009) The Climate Change (Scotland) Act 2009 [Online] Available at: https://www.legislation.gov.uk/asp/2009/12/contents (Accessed 05/10/2021)
[18] Scottish Government (2019) The Climate Change (Emissions Reductions Targets) (Scotland) Act 2019 [Online] Available at: https://www.legislation.gov.uk/asp/2019/15/contents/enacted (Accessed 05/10/2021)

within the 2020 Routemap for Renewable Energy in Scotland[19]. Although now superseded, the Development therefore draws significant support as a contributor to these and successive targets.

4.6.2. Electricity Generation Policy Statement

The Scottish Government has published an Electricity Generation Policy Statement (2013) ('the EGPS')[20] which examines the way in which Scotland generates electricity, and considers the changes which will be necessary to meet the targets which the Scottish Government has established.

The EGPS recognises that Scotland's renewables potential is such that, should the relevant technologies be developed successfully, it could deliver up to £46 billion (bn) of investment and more than enough electricity to meet domestic demand for electricity. The remainder could be exported to the rest of the UK and continental Europe to assist other countries in meeting their binding renewable electricity targets.

The EGPS set out that to achieve the 100% target, Scotland's installed generation capacity will need to almost double over the 10-year period to 2020, with wind (both onshore and offshore) expected to account for around 13 GW of capacity by 2020.

Although now to be superseded, the Proposed Development is consistent with the objectives of the EGPS, and in doing so, would provide investment to help realise these ambitions for economic growth.

4.6.3. Scottish Energy Strategy

The Scottish Energy Strategy 2017[21]: The Future of Energy in Scotland sets out the Scottish Government's vision for the future energy system in Scotland, to 2050. It articulates the priorities for an integrated system-wide approach that considers both the use and supply of energy for heat, power and transport. The Energy Strategy is designed to strengthen the development of local energy, protect and empower consumers, and support Scotland's climate change ambitions while tackling poor energy provision.

In March 2021 the Scottish Government published 'Scotland's Energy Strategy Position Statement' 22 (2021 SES) which builds on the support for offshore wind outlined in the 2017 SES. The 2021 SES notes that:

" In October 2020, we also described the importance of offshore wind to Scotland's economy when we published our Offshore Wind Policy Statement and Sectoral Marine Plan for Offshore Wind Energy in Scotland. These key documents set out how, using the powers available to us, we will grow our economy through green job creation by seeking to improve market outcomes for renewable activity."

The Position Statement also identifies the Scottish Government's key priorities for energy, which amongst others includes continued development of the Offshore Wind Policy Statement and the recently refreshed Scottish Energy Advisory Board and its Strategic Leadership Groups and supporting groups, such as the Scottish Offshore Wind Energy Council ('SOWEC') and the Scottish Marine Energy Industry Working Group ('SMEIWG').

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[19] Scottish Government (2011) *2020 Routemap for Renewable Energy in Scotland – Update* [Online] Available at: http://www.gov.scot/Resource/0048/00485407.pdf (Accessed 05/10/2021)
[20] The Scottish Government, (2013), *Electricity Generation Policy Statement – 2013* [Online]. Available at: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/EGPSMain (Accessed 05/10/2021)
[21] Scottish Government (2017) *Scottish Energy Strategy* [Online] Available at: https://www.gov.scot/energystrategy (Accessed 05/10/2021)
[22] Scottish Government – *Scotland's Energy Strategy Position Statement March 2021* [Online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2021/03/scotlands-energy-strategy-position-statement/documents/scotlands-energy-strategy-position-statement/scotlands-energy-strategy-position-statement/govscot%3Adocument/scotlands-energy-strategy-position-statement.pdf (Accessed 05/10/2021)

4.6.4. Offshore Wind Policy Statement

The offshore wind policy statement for Scotland[23] was published on 28th October 2020 by the Scottish Government. The statement sets out the government's ambitions for the future of offshore wind in Scotland and sets the context for the *Marine Scotland Sectoral Marine Plan for Offshore Wind*, which was published in parallel with this document.

The statement notes that *"Offshore wind is one of the lowest cost forms of electricity generation at scale, offering cheap, green electricity for consumers, with latest projects capable of generating power at below wholesale electricity prices"*. It is believed that by 2030, up to 30 GW of offshore wind capacity is possible in Scottish waters. The statement is clear and decisive in its support for offshore wind development in Scotland and highlights the vast amount of potential the country holds within its waters for renewable generation:

"Our 12,000 miles of coastline, 462,000 km^{2}of Scotland's Exclusive Economic Zone, attractive wind regime and extensive potential resources, allied to world class research and innovation, all combine to mean that few can rival Scotland in terms of what it is possible to achieve."

The government is confident that Scotland's 2 GW of operational and under construction offshore wind capacity (as of October 2020 when the statement was published) could grow to between 8 GW to 11 GW by 2030, based on current literature and estimated forecasts of growth trends. However, given this and the challenges that reaching net zero by 2045 presents, it is also recognised that offshore development will need to significantly increase beyond the year 2030. This furthermore emphasises the importance of developments such as the proposed, in helping achieve the national targets.

4.6.5. Offshore Wind Sector Deal

The UK offshore wind sector deal was first published in March 2019[24] by BEIS. The document is aimed at promoting the success and potential of offshore wind energy development in the UK and details specific actions to allow the sector to continue to grow over the coming decades. Some targets noted within the sector deal include; committing to increase the UK content of offshore wind to 60% by the year 2030 and increasing exports to £2.6 bn by 2030, once again.

Since the launch of the sector deal, the Scottish and UK governments have worked to deliver and build upon the commitments it sets, which so far notably includes the establishment of the Offshore Wind Growth Partnership ('OWGP'). The OWGP aims to:

"Promote closer collaboration across the supply chain, implement structured productivity improvement programmes and facilitate shared growth opportunities between developers and the supply chain.

Over the next ten years delivery will focus on direct support to supply chain companies through a combination of strategic capability assessments, advisory services and grant funding."

The Sector Deal set out targets and commitments from both the sector and Scottish and UK governments aimed at delivering benefits to the UK economy from the ongoing deployment of offshore wind. This partnership between the sector and government will help to ensure that the UK and in particular, Scotland, continues to be an innovative and forward-thinking leader in the sector across the coming decade, which will see benefits from the growth in deployment both domestically and world-wide.

[23] Scottish Government (2020) *Offshore Wind Policy Statement* [Online] Available at: https://www.gov.scot/publications/offshore-wind-policy-statement/ (Accessed 05/10/2021)
[24] BEIS (2019) *Offshore Wind Sector Deal* [Online] Available at: https://www.gov.uk/government/publications/offshore-wind-sector-deal/offshore-wind-sector-deal (Accessed 05/10/2021)

4.6.6. Low Carbon Scotland: Climate Change Plan – Third Report on Proposals and Policies 2018-2032[25]

This document was published in September 2018 and provides an overview of the Scottish Government's climate change plan 2018-2032. The document (and the summary document) contains the most up-to-date renewable electricity generation data available from BEIS.

"In 2015, Scotland had reduced its emission by 41% from the 1990 baseline, and in 2017 Scotland generated 68.1% of its electricity requirements from renewables. Scotland's success in decarbonising electricity paves the way for transformational change across all sectors of the economy and society, particularly as electricity will be increasingly important as a power source for heat and transport."[26]

The plan envisages that by 2032, Scotland will have reduced its emissions by 66% relative to the baseline, while growing the economy, increasing the wellbeing of the people of Scotland and protecting and enhancing the natural environment. Further, the plan proposes that by 2032 Scotland's electricity system will be largely decarbonised and increasingly important as a power source for heat and transport.

The Proposed Development is in keeping with the climate change plan, as it will contribute to CO_2 emissions reduction, have positive effect on the local and national economy, whilst leaving a minimal footprint on the environment.

4.6.7. A Fairer, Greener Scotland? The Government's Programme for Scotland 2021-2022[27]

In September 2021, the Scottish Government published the Government's Programme 2021-22 which sets out the actions the Government will take in the forthcoming year. The Programme reiterates the continuous support for renewable energy. Consultation will take place on a revised Energy Strategy which will set out how the energy sector will adapt to meet Scotland's emission reduction targets. The development of renewable energy presents an immense opportunity for Scotland to lead by example, ensuring that progress towards net zero is environmentally and economically beneficial.

The programme specifically refers to offshore wind as a technology which can make a key contribution to Scotland's objectives. For instance, the programme states that the Government will aim to make offshore wind central to its delivery of emissions reduction targets through further ScotWind leasing rounds over this upcoming Parliament, in addition to plans to introduce a strengthened framework to support the growth of the marine renewables and offshore wind sectors, balanced against the potential impacts on marine biodiversity. By 2030, the government also aims to furthering its ambitions for up to 11 GW of offshore wind.

If consented, the Proposed Development has the potential make a contribution to the Government's objectives for reduction of emissions, by increasing the widespread deployment of the renewables industry; encouraging offshore wind development, as well as encouraging investment in renewable energy, to achieve sustainable economic growth.

4.6.8. Reducing emissions in Scotland – 2020 Progress Report to Parliament[28]

The Climate Change Committees 9th Annual Progress Report to the Scottish Parliament advises that Scotland's greenhouse gas emissions fell by 31% from 2008 to 2018. This was primarily due to action to reduce emissions

[25] Scottish Government (2018) *Climate Change Plan: Third Report on Proposals and Policies 2018-2032* [Online] Available at: https://www.gov.scot/publications/scottish-governments-climate-change-plan-third-report-proposals-policies-2018/ (Accessed 05/10/2021)
[26] Scottish Government (2018) *Climate Change Plan: Third Report on Proposals and Policies 2018-2032: Summary Document* [Online] Available at https://www.gov.scot/publications/scottish-governments-climate-change-plan-third-report-proposals-policies-2018-9781788516488/ (Accessed 05/10/2021)
[27] Scottish Government (2021) Programme For Government – A Fairer Greener Scotland? [Online] Available at: https://www.gov.scot/publications/fairer-greener-scotland-programme-government-2021-22/documents/ (Accessed 05/10/21)
[28] Committee on Climate Change (2020) *Reducing emissions in Scotland Progress Report to Parliament* [Online] Available at: https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2020-progress-report-to-parliament/ (Accessed 05/10/2021)

in the power sector, where Scottish renewable electricity generation has tripled and fossil-fuelled generation has fallen by more than 70% in the last decade. However, greenhouse gas emissions increased by 2% in 2018, compared to a reduction of 3% in 2017.

The report identifies a number of clear priorities for the Scottish Government. Central to these are producing a new Climate Change Plan before the year end, creating the pathway to deliver Net Zero by 2045, and putting in place a UK Emissions Trading system. Amongst the more detailed recommendations is that the next National Planning Framework should be aligned closely with achieving Net Zero 2045 – providing a favourable planning framework to provide a low carbon and efficient energy system and climate resilient infrastructure.

4.6.9. Update to the Climate Change Plan 2018 – 2032 – Securing a Green Recovery on a Path to Net Zero[29]

On 16th December 2020 the Scottish Government published a draft update to the 2018 Climate Change Plan. The plan sets out the approach to delivering a green recovery, and a pathway to meeting world leading climate change targets for the period to 2032. By then, amongst other things Scotland's electricity system will be transformed, with over 100% of electricity demand being met from renewable sources. There will have been a substantial increase in renewable generation, particularly through offshore and onshore wind capacity. Whilst much of Scotland's electricity generation has decarbonised over the last decade, there is a need for increased investment in renewable energy, particularly onshore and offshore wind. The energy consenting process will be reviewed to reduce determination timescales and enable projects awarded consent to proceed more quickly. A new Energy Strategy is to be produced in 2021 and an updated Electricity Generation Policy Statement in 2022.

Planning is a key delivery mechanism for many of the policies within the Climate Change Plan update, across all sectors. By making the right choices about where and what development should take place in the future, planning can help to reduce emissions whilst improving the wellbeing of communities and the quality and resilience of places across Scotland.

4.6.10. Speech by First Minister to Scottish Renewables Annual Conference 23 March 2021

In her speech to Conference, the First Minister took the opportunity to emphasise the importance of COP26, to be held in Glasgow in October and November 2021 as a 'make or break' event for the planet. Scotland wants to demonstrate to the world that Scotland is leading by example, to help lead the world into the net zero age. She also highlights the importance of the renewable energy sector in delivering the Scottish Government's vision.

4.6.11. Scottish Climate Change and Energy Policy Conclusion

Overall, the Proposed Development draws significant support from national policy on energy and climate change. The Proposed Development has potential to contribute to decarbonising of the energy sector, whilst providing clean and secure energy supply. It has been designed in a way to minimise environmental effects whilst maintaining economic viability and would ensure further development of Scotland's clear offshore wind energy generation potential.

4.7. Marine and Terrestrial Planning

4.7.1. The Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009

The Marine (Scotland) Act 2010[30] introduced new marine planning provisions with the aim of ensuring better management of marine resources. As noted within the opening stages of the Act:

"The Marine (Scotland) Act provides a framework which will help balance competing demands on Scotland's seas. It introduces a duty to protect and enhance the marine environment and includes measures to help boost economic investment and growth in areas such as marine renewables."

[29] Scottish Government (2020) *Securing a green recovery on a path to net zero: climate change plan 2018-2032 – update* [Online] Available at: https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/ (Accessed 05/10/2021)
[30] Scottish Government (2010) *The Marine (Scotland) Act* [Online] Available at: https://www.legislation.gov.uk/asp/2010/5/contents (Accessed 05/10/2021)

There are two levels of planning provisions introduced by the Act:

- The national level, by creating Scotland's first National Marine Plan; and
- The regional level, by creating Scottish Marine Regions.

From the National Marine Plan ('NMP'), the Scottish Marine Regions ('SMR') and their Regional Marine Plans ('RMP') is the means by which marine planning and management takes place at regional levels. Under the Marine and Coastal Access Act 2009[31], the UK Marine Policy Statement ('UK MPS') (referenced below in Section 4.7.2) has been adopted by the Scottish Ministers and the NMP must be in accordance with this (unless relevant considerations indicate otherwise). Therefore, the UK MPS will be relevant in the consideration of any consent applications in the absence of adopted Scottish plans.

4.7.2. UK Marine Policy Statement (2011)

The UK MPS was published in March 2011[32], with the aim of the statement being to set out a clear policy framework for the marine planning system across the English, Welsh, Scottish and Northern Irish waters, with Scottish Ministers jointly adopting the UK MPS with their island counterparts.

The UK MPS was designed in order to facilitate and support the introduction of Marine Plans, to ensure that the marine resources within UK shores are utilised in a sustainable and economically beneficial manner. Some of the primary aims of the UK MPS include to:

- *"Promote sustainable economic development;*
- *Enable the UK's move towards a low-carbon economy, in order to mitigate the causes of climate change and ocean acidification and adapt to their effects;*
- *Ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and our heritage assets; and*
- *Contribute to the societal benefits of the marine area, including the sustainable use of marine resources to address local social and economic issues."*

Marine Plans must align with the aims of the UK MPS, unless relevant considerations dictate otherwise. Marine Plans must put into practice the policy objectives, principles and considerations (economic, environmental and social) for the marine environment and key activities that are identified in the MPS. Recent guidance was published regarding how references to any EU law in the MPS should be interpreted from 1st January 2021 following the UK's withdrawal from the EU[33].

4.7.3. Scotland's National Marine Plan (2015)

Scotland's NMP was published on 25th March 2015[34]. The NMP sets out a single statutory planning framework for all marine activity in Scottish inshore and offshore waters, including sectoral plans for offshore wind energy. The framework covers all of Scotland's seas out to 200 nautical miles and applies to existing and emerging activities as well as devolved and reserved functions.

A key objective of the NMP is the *"Sustainable development and expansion of test and demonstration facilities for offshore wind and marine renewable energy devices"* and there is a clear support for maximising the economic benefits of offshore wind and other renewable energy development (Page 78).

The NMP notes that as the global wind industry expands further offshore, Scotland is well placed to become a key hub for the design, development and deployment of the next generation of offshore wind technologies. In

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[31] UK government (2009) *The Marine and Coastal Access Act 2009* [Online] Available at: https://www.legislation.gov.uk/ukpga/2009/23/contents/enacted
[32] UK Government (2011) *The UK Marine Policy Statement* [Online] Available at: https://www.gov.uk/government/publications/uk-marine-policy-statement
[33] UK Government (2020) *UK Marine Policy Statement* – updated guidance [Online] Available at: https://www.gov.uk/government/publications/uk-marine-policy-statement (Accessed 05/10/2021)
[34] Scottish Government (2015) *Scotland's National Marine Plan* [Online] Available at: https://www.gov.scot/publications/scotlands-national-marine-plan/ (Accessed 05/10/2021)

addition to planned development sites, it is noted that Scotland is becoming a key location for demonstration and test sites. In relation to these, Marine Plan policy "Renewables 3" states:

"Marine planners and decision makers should consider proposals for sustainable development of test and demonstration for offshore wind and marine renewable energy development on a case-by-case basis where sites are identified. This preference should be taken into account by marine planners and decision makers if alternative development or use of these areas is being considered. Regional Locational Guidance should be taken into account and proposals are subject to licensing and consenting processes." (page 79)

The NMP identifies the Proposed Development as being within an area listed as a Test and Pilot Offshore Wind Site within its plan showing Options for Offshore Wind and Marine Renewable Energy and Planned developments in Scotland.

Further NMP polices of relevance include "*Renewables 4*" which states that proposals must demonstrate compliance with EIA and Habitat Regulations Appraisal ('HRA') legislative requirements. Policies "*Renewables 6*" and "*Renewables 7*" relate to provision of grid connections and infrastructure stating the need to ensure the installation of these elements aligns with relevant sectoral and marine spatial planning processes to ensure minimised impacts, as well as securing fit for purpose design.

Policies "*Renewables 8*" and "*Renewables 9*" require active early engagement by developers with the general public and interested stakeholders as well as adherence to good practice guidance for community benefit from offshore wind renewable energy development, where appropriate.

In addition, the NMP sets out a number of key considerations to be included in the emerging RMP. Under the Marine (Scotland) Act 2010, Scottish Ministers were given the power to begin creating a number of 'SMR', with the Scottish Marine Regions Order 2015[35] then coming into force on 13th May 2015. RMP will be developed by Marine Planning Partnerships ('MPP'), allowing more local ownership and decision making about specific issues within each area.

The Proposed Development lies within the Forth and Tay region, as shown on the Marine Scotland ('MS') Portal[36] and eventually a specific regional plan for the Forth and Tay area will be produced. As of the time of writing however, a precise timescale on its production is not known. As RMP will clearly take some time to develop, in the interim period, the provisions of the UK MPS and the Scottish NMP will apply.

4.7.4. Sectoral Marine Plan for Offshore Wind Energy

The initial *Sectoral Marine Plan for Offshore Wind Energy (Blue Seas Green Energy) (Marine Scotland, 2011[37])* was adopted in 2011. This originally set out a vision for the delivery of energy from offshore wind resources and contained proposals for offshore wind development at the regional level up to the year 2020 and beyond. Nine short term options to be developed by 2020 and 25 medium term areas of search for development between 2020 and 2030 were initially identified.

Following this in July 2013 MS published the *Draft Sectoral Marine Plan for Offshore Wind, Wave and Tidal energy in Scotland[38]*. This publication identified potential future options for commercial scale (with the potential to generate greater than 100 MW) offshore wind energy developments. These draft plans were never formally

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[35] Scottish Government (2015) *The Scottish Marine Regions Order 2015* [Online] Available at: https://www.legislation.gov.uk/ssi/2015/193/introduction/made (Accessed 05/10/2021)
[36] Marine Scotland (2021) *MS Maps NMPi – Limits and Boundaries – Scottish Marine Regions Order 2015 (SMRs)* [Online] Available at: https://www.gov.scot/policies/marine-planning/regional-marine-planning/ (Accessed 05/10/2021)
[37] Marine Scotland (2011) *A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters* [Online] Available at: https://tethys.pnnl.gov/sites/default/files/publications/Blue_Seas_Green_Energy.pdf (Accessed 05/10/2021)
[38] Marine Scotland (2013) Draft Sectoral Marine Plan for Offshore Wind, Wave and Tidal Energy in Scotland [Online] Available at: https://marine.gov.scot/information/draft-sectoral-marine-plans-wind-wave-and-tidal-2013 (Accessed 05/10/2021)

adopted by Scottish Ministers, but the draft options were included in the 2015 National Marine Plan and are retained on the MS Maps system for reference.

In November 2017, Crown Estate Scotland ('CES') released their intention to operate a further leasing round for commercial scale offshore wind energy projects in Scotland. To inform the spatial development of this leasing round, MS - as Planning Authority for Scotland's offshore territories - is required to undertake a planning exercise, in accordance with relevant European Commission ('EC'), UK and Scottish legislation.

The Sectoral Marine Plan for Offshore Wind energy[39] was published in October 2020. The Plan aims to identify the most sustainable options for the future development of commercial-scale offshore wind energy in Scotland. As noted within the Plan contents:

"Recent technological, policy, regulatory and market developments, such as the commitments outlined in the UK Offshore Wind Sector Deal, the development of new technologies suitable for deployment in deeper water and the aspirations established in recent climate change legislation presented the opportunity for Scottish Ministers to undertake a new strategic planning process to support further offshore wind development in Scotland's seas. This planning process provides the spatial strategy to support the current CES ScotWind leasing round, the first offshore wind leasing round to be administered in Scotland." (page 8).

The Plan aims to contribute to the achievement of Scottish and UK climate change policy objectives and targets, through the provision of a spatial strategy which seeks to maximise the benefits for Scotland, its communities and its population, whilst in the same instance minimising the potential adverse effects on other marine users, economic sectors and the environment resulting from further offshore wind development. The development of the Plan included a full Sustainability Appraisal (encompassing a Strategic Environmental Assessment ('SEA'), a HRA and a Social and Economic Impact Assessment ('SEIA')) as well as significant planning and stakeholder engagement works.

4.7.5. National Planning Framework 3 (NPF3) (2014)

On 23rd June 2014, the National Planning Framework 3 (NPF3)[40] was laid in the Scottish Parliament as required by statute alongside associated documentation. It is the Scottish Government's third NPF and is a spatial expression of the Government's Economic Strategy.

NPF3 sets the context for development planning in Scotland and a framework for spatial development of Scotland as a whole. It outlines the Scottish Government's development priorities over the next 20-30 years and identifies fourteen national developments. It focuses on supporting sustainable economic growth and the transition to a low carbon economy. Strategic and local development plans are required to take NPF3 into account and Scottish Minsters expect planning decisions to support its delivery and aims.

Within NPF3, the Scottish Government highlights its ambitions for Scotland as a whole, including, as stated in paragraphs 2.6 and 2.7:

"Our strategy aims to ensure that all parts of Scotland make best use of their assets to build a sustainable future. Planning will help to create high quality, diverse and sustainable places that promote well-being and attract investment.

Great places support vibrant, empowered communities, and attract and retain a skilled workforce. Emerging technologies for renewable energy and improved digital connectivity are changing our understanding of what constitutes a sustainable community. We must ensure that development facilitates adaptation to climate change, reduces resource consumption and lowers greenhouse gas emissions." (page 5).

Section 3 of NPF3 states:

[39] Scottish Government (2020) The Sectoral Marine Plan for Offshore Wind Energy [Online] Available at: https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/ (Accessed 05/10/2021)
[40] Scottish Government (2014) NPF3 [Online] Available at: https://www.gov.scot/publications/national-planning-framework-3/ (Accessed 05/10/2021)

"Our ambition is to achieve at least an 80% reduction in greenhouse gas emissions by 2050." (page 30).

Paragraph 3.4 highlights Scotland's wind resource and states:

"We have a significant wind resource, both onshore and offshore, and electricity generation from wind continues to rise." (page 30).

Paragraph 3.8 of NPF3 reaffirms the Scottish Government's renewable energy targets and states:

"By 2020, we aim to reduce total final energy demand by 12%. To achieve this, and maintain secure energy supplies, improved energy efficiency and further diversification of supplies will be required. We want to meet at least 30% of overall energy demand from renewables by 2020 – this includes generating the equivalent of at least 100% of gross electricity consumption from renewables, with an interim target of 50% by 2015." (page 31).

NPF3 acknowledges the longer-term potential of renewable energy and growing contributions from offshore wind. Specifically, NPF3 recognises that The Fife Energy Corridor between Methil and Longannet has potential for significant investment in energy-related business development (page 37).

National Planning Policy Framework 4 ('NPF4') is under preparation and will include all aspects of national planning policy as per the provisions of the Planning (Scotland) Act 2019, which was passed by the Scottish Parliament in June 2019. The Act includes a broad range of changes to be made across the planning system. It is anticipated that a publication draft NPF4 will be issued around Autumn 2021.

4.7.6. Scottish Planning Policy (SPP) (2014)

On 23rd June 2014, the Scottish Government published the 2014 Scottish Planning Policy ('SPP')[41]. The current SPP sets out Scottish Government policy on how nationally important land use matters should be addressed and outlines Governmental priorities for land use planning. SPP should therefore be afforded significant weight in the determination process for planning applications, however SPP acknowledges that *"it is for the decision-maker to determine the appropriate weight in each case"* (paragraph iii).

SPP sits alongside other key Scottish Government documents including NPF3 and related Planning Circulars. Paragraphs 24 to 35 reaffirm the Scottish Government's commitment to "*Sustainability".*

One of the key SPP outcomes is Outcome 2: "*A low carbon place – reducing our carbon emissions and adapting to climate change."* Paragraphs 152 to 192, under the heading *"A Low Carbon Place",* detail how the Scottish planning system will contribute towards delivering a low carbon economy, specifically through the development of electricity generation technologies which will help contribute to reducing greenhouse gas emissions.

Paragraph 154 states that *"The planning system should:*

- *Support the transformational change to a low carbon economy, consistent with national objections and targets including delivering 30% of overall energy demand from renewable sources by 2020, 11% of heat demand from renewable sources by 2020, and the equivalent of 100% of electricity demand from renewable sources by 2020.*
- *Support the development of a diverse range renewable energy generating technologies, including the expansion of renewable energy capacity.*

Overall, the SPP emphasises the merits of sustainable development and the need to deliver heat and electricity in a low carbon manner through supportive policies in Development Plans across Scotland. It is clear from the contents of the SPP that the Scottish Government is committed to the ongoing development of renewable energy projects in Scotland. The previous December 2020 update to the SPP document was removed in August 2021 following a legal challenge at the court of session, therefore the 2014 SPP version has been referenced above.

[41]Scottish Government (2014) Scottish Planning Policy [Online] Available at: https://www.gov.scot/publications/scottish-planning-policy/ (Accessed 05/10/2021)

4.8. Legislative Requirements

4.8.1. Section 36 of the Electricity Act 1989

In Scotland there is a hierarchical structure of guidance and plans covering national, region and local planning. The Government is committed to the plan led system of development management.

Any proposal to construct or operate an offshore power generation scheme with a capacity in excess of 1 MW requires Scottish Ministers' consent under Section 36 of the Electricity Act 1989[42]. A Section 36 consent is required for all elements of the 'generating station' and for the purposes of the Proposed Development, this refers to the offshore turbine, the MetMast, the interconnecting cable between the turbine and the MetMast, and the offshore cable.

Schedule 9, Section 3 (1) of the Electricity Act 1989 places on the developer a duty to:

"Have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest".

Whilst Fife Council is a Statutory Consultee and regard must be given to the local Development Plan, the final decision rests with the Scottish Ministers through the MS Directorate, specifically the Marine Scotland Licensing and Operations Team ('MS-LOT').

MS is the part of the Scottish Government charged with *"managing Scotland's seas for prosperity and environmental sustainability".* One of its key responsibilities is to 'achieve good environmental status' through its marine planning and licensing functions. The current statutory marine planning and licensing system is set out in Section 4.9.

The physical elements of the Proposed Development lie within Scottish Territorial Waters and, in respect of the onshore project elements, Fife Council. As such, in marine planning and licensing terms, the Proposed Development lies under the jurisdiction of the Scottish Ministers acting through MS-LOT. MS-LOT is therefore the decision-making body for the elements within Scottish Territorial Waters, and through The Growth and Infrastructure Act 2013 Scottish Ministers are able 'deem' planning permission for onshore elements of offshore electricity generation schemes granted consent under Section 36 of the Electricity Act. For the onshore elements related to the Proposed Development, a separate planning application will be submitted to Fife Council.

4.8.2. EIA Legislative Framework

Requirements for EIA are defined in the EIA Directive (85/337/EEC codified by EIA Directive 2011/92/EU and then amended by EU Directive 2014/52/EU)[43]. The UK committed to implement international environmental obligations and to maintain environmental commitments and legislation already made following the departure of the UK from the EU, primarily in accordance with the EU (Withdrawal Act) 2018[44]. The UK's decision to leave the EU has no impact on the application of the EIA Regulations, as the EU Directives on EIA were required to be translated into domestic law when the UK was a full member state of the EU. The purpose of the EIA Regulations is to ensure that the potential effects of a Proposed Development on the environment are taken in consideration before consent is granted.

If a Proposed Development is deemed to have potential to cause a significant effect on the environment by virtue of its scale, size and location, then an EIA is required, the results of which must be provided by the

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[42] UK Government (1989) The Electricity Act 1989 [Online] Available at: https://www.legislation.gov.uk/acts/acts1989/Ukpga_19890029_en_2.xht (Accessed 05/10/2021)

[43] European Union (2014) *Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment* [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052 (Accessed 05/10/2021)

[44] UK Government (2018) European Union (Withdrawal) Act 2018 [Online] Available at: https://www.legislation.gov.uk/ukpga/2018/16/contents/enacted (Accessed 26/10/2021)

developer to the decision maker in the form of an EIA Report ('EIAR'). The competent authority cannot grant consent for an EIA development without considering the contents of the EIAR.

The requirements of the EIA Directive are enacted through relevant UK legislation for electricity generation developments requiring consent under Schedule 36 of the Electricity Act 1989 by *the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended)*[45] and in relation to marine licensing by *The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended)*[46]. Both sets of Regulations set out the statutory process and minimum requirements for EIA, with which the EIAR for the Proposed Development has been produced in line with.

An EIA is specifically required *(Schedule 2 of the Marine Works EIA 2017 (Scotland) Regulations)* for installations for the harnessing of wind power for energy production (wind farms) if:

- The Proposed Development involves the installation of more than two wind turbines; or
- The hub height of any wind turbine or height of any other structure exceeds 15 m.

The Proposed Development has a hub height of up to 156 m above Highest Astronomical Tide ('HAT') and therefore, an EIA is required and an EIAR has been produced to assess the Proposed Development.

4.9. Consents and Licensing

4.9.1. Marine License

The Marine (Scotland) Act 2010 states that a Marine Licence is required to construct, alter or improve any works or deposit any object in or over the sea, or on or under the seabed. A Marine Licence will therefore be required to construct the offshore elements of the Proposed Development. The Marine Licence requirements under the Marine (Scotland) Act 2010 apply in Scottish Territorial Waters.

In considering a Marine Licence application insofar as it relates to Scottish Territorial Waters the Scottish Ministers must ensure the proposals are in accordance with the "*appropriate marine plans*" (as defined in the Marine (Scotland) Act 2010 i.e. any NMP or relevant RMP in effect). When making their decision, the Scottish Ministers must also consider:

- The need to protect the environment;
- The need to protect human health;
- The need to prevent interference with legitimate uses of the sea;
- The effects of any use intended to be made of the works in question when constructed;
- Any representations made by anyone with an interest in the outcome of the marine licence application; and
- Such other matters as the Scottish Ministers consider relevant.

4.9.2. Habitats and Birds Directives and Legislation

The Council Directive 92/43/EEC [47]('the Habitats Directive') was adopted in 1992. The aim of the Habitats Directive is to maintain or restore natural habitats and wild species listed on the Annexes at a favourable conservation status. This protection is granted through the designation of European Sites and European

[45] Scottish Government (2017) *The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended*) [Online] Available at: https://www.legislation.gov.uk/ssi/2017/101/made/data.htm?wrap=true

[46] Scottish Government (2017) *The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended)* [Online] Available at: https://www.gov.scot/publications/eu-exit-marine-environmental-legislation-scotland-2/pages/10/ (Accessed 05/10/2021)

[47] European Union (1992) *Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora* [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043 (Accessed 05/10/2021)

Protected Species ('EPS'). The European Directive (2009/147/EC)[48] on the conservation of wild birds ('The Birds Directive') provides a framework for the conservation and management of wild birds within Europe.

The Directive affords rare and vulnerable species listed under Annex I of the Directive, and regularly occurring migratory species, protection through the identification and designation of Special Protection Areas ('SPAs').

The Directives have been transposed into Scots Law by various regulations, those of relevance to the Proposed Development include:

- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)[49];
- The Conservation of Habitats and Species Regulations 2017[50]; and
- The Conservation of Offshore Marine Habitats and Species Regulations 2017[51].

These are hereafter referred to as the 'Habitats Regulations'. The Habitat Regulations require that where a plan or project that is not directly connected with, or necessary to the management of a Natura 2000 site, but likely to have a significant effect upon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.

MS (as the competent authority) must consider whether the Proposed Development is likely to have significant effects on the conservation objectives of the sites considered in the HRA, and, in the absence of mitigation measures, an 'Appropriate Assessment' of the implication of the Proposed Development must be undertaken by the Competent Authority before consent may be given for the Proposed Development. The EIAR will be accompanied by a separate, HRA report. The Habitats Regulations present a separate legal test to the EIA Regulations.

4.10. Local Planning Framework (Terrestrial)

The onshore elements of the Proposed Development are located within Fife Council area, and this is also the closest local authority to the offshore elements of the Proposed Development. The relevant Development Plan documents for Fife Council currently comprise:

- The South East Scotland Strategic Development Plan[52] – ('SDP') ('SESplan') (2013); and
- Fife Local Development Plan[53] ('FIFEplan') (2017)

SESplan sets out the vision for the long-term development of the south east of Scotland area. The plan covers six local authorities; City Of Edinburgh, Scottish Borders, East Lothian, Midlothian, West Lothian and Southern Fife. The first SDP for the period 2009-2032 was approved by Scottish Ministers in June 2013. Scottish Ministers rejected the draft second Strategic Development Plan ('the SESplan SDP2') in May 2019. Consequently, the status and content of the SESplan SPD2 is, at this point, considered immaterial in the determination of the Proposed Development.

The FIFEplan was adopted on 21st September 2017. The FIFEplan supersedes the previous local plans: the Fife Minerals Subject Local Plan (2011); the Dunfermline & West Fife Local Plan (2012); Mid Fife Local Plan (2012);

[48] European Union (2009) *Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds [Online]* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147 (Accessed 05/10/2021)
[49] UK government (1994) *Conservation (Natural Habitats, &c.) Regulations 1994* [Online] Available at: https://www.legislation.gov.uk/uksi/1994/2716/regulation/1/made (Accessed 05/10/2021)
[50] UK Government (2017) *The Conservation of Habitats and Species Regulations 2017* [Online] Available at: https://www.legislation.gov.uk/uksi/2017/1012/regulation/3 (Accessed 05/10/2021)
[51] UK Government (2017) *The Conservation of Offshore Marine Habitats and Species Regulations 2017* [Online] Available at: https://www.legislation.gov.uk/uksi/2017/1013/regulation/43 (Accessed 05/10/2021)
[52] SESplan (2013) *The South East Scotland Strategic Development Plan* [Online] Available at: https://www.sesplan.gov.uk/ (Accessed 05/10/2021)
[53] Fife Council (2017) *The Local Development Plan – FIFEplan* [Online] Available at: https://www.fife.gov.uk/kb/docs/articles/planning-and-building2/planning/development-plan-and-planning-guidance/local-development-plan-fifeplan (Accessed 05/10/2021)

and St Andrews & East Fife Local Plan (2012). The Proposed Development will connect onshore into a substation and control building located within the Fife Energy Park, located at Methil. It is noted within the wider FIFEplan document text, that the Fife energy corridor (within which the Fife Energy Park is located) is considered under NPF3 as a vital area of regional importance for the energy sector. The Fife Energy Park is also considered to be a key component of the National Renewables Infrastructure Plan.

4.10.1. SESplan Policies

The SESplan sets out policies for the spatial strategy of development locations and development principles. Conserving and enhancing the natural and built environment; improving quality of life in local communities; contributing to the response to climate change; and having regard to the need for high quality design, energy efficiency and the use of sustainable building materials are the overarching visions and objectives of the SESplan.

SESplan *Policy 10: Sustainable Energy Technologies* is of relevance to the Proposed Development. The Policy wording states, amongst other points, that Local Development Plans will:

"Set a framework for the encouragement of renewable energy proposals that aims to contribute towards achieving national targets for electricity and heat, taking into account relevant economic, social, environmental and transport considerations, to facilitate more decentralised patterns of energy generation and supply and to take account of the potential for developing heat networks."

4.10.2. FIFEplan (2017) Policies

Table 4.2 lists the policies contained within the FIFEplan document which are deemed most relevant to the Proposed Development. Following this table, each policy is then individually described.

Table 4.2 - FIFEplan applicable policies:

Policy	Policy Title
Policy 1	Development Principles
Policy 10	Amenity
Policy 11	Low Carbon Fife
Policy 13	Natural Environment and Access

4.10.2.1. Policy 1: Development Principles

As stated within the FIFEplan document, Policy 1: Development Principles is a *"'gateway' policy and provides the development principles against which development proposals will be determined. All development proposals must address the requirements of this policy".*

The policy text sets a number of guidelines which individual development proposals must meet in order to be considered acceptable by Fife Council. In the main, every development proposal must demonstrate that it can meet the aims of relevant FIFEplan policy and proposals, whilst also being able to satisfactorily address any potential individual and cumulative impacts resulting from said development. Developments must be appropriately sited, designed and have no adverse environmental impact.

4.10.2.2. Policy 10: Amenity

Policy 10: Amenity, aims to ensure that any new development within Fife does not have a detrimental impact upon the amenity of both existing and propose land uses. The policy is linked with ensuring that the residents of Fife are able to live a quality life within their community, without the prospect of new development creating environmental or operational issues, for example.

Development proposals will not be approved unless they can demonstrate that there will be no significant detrimental impact on amenity in relation to a number of areas, including but not limited to:

- Noise, light or odour pollution, which includes shadow flicker from wind turbines;

- Traffic Movements;
- Construction Impacts; and
- Any visual impact upon the surrounding area as a result of the new Development.

Where any potential amenity issues are identified during the development of a proposal, demonstration of appropriate mitigation methods will need to be provided and subsequently implemented by the developer in order for the proposal to be approved.

4.10.2.3. Policy 11: Low Carbon Fife

Policy 11: Low Carbon Fife, is aimed at ensure that any development taking place within Fife is able to help contribute towards nationwide emissions reduction targets, on the road towards a greener, low carbon economy. The policy states that energy resources can be *"harnessed in appropriate locations and in a manner where the environmental and cumulative impacts are within acceptable limits."*

Any low carbon technology development (including wind turbines, solar arrays or energy from waste) will be supported by Fife Council provided that it can be proven there would be no significant adverse effects or impacts which are not able to be suitably mitigated against.

When assessing proposals for renewable energy development, Fife Council will have strict regard to the principles of SPP and will assess the merits of each development against particular considerations, including, amongst others, the scale of contribution from the project towards renewable energy generation targets and the impact upon reducing greenhouse gas emissions.

4.10.2.4. Policy 13: Natural Environment and Access

Policy 13: Natural Environment and Access, is designed to ensure that the natural, environmental assets of Fife are protected, maintained and in some cases even enhanced, by any new development. The policy requires that any new development proposals should only be supported when they *"enhance natural heritage and access assets".*

This refers to a number of specific elements, including but not limited to:

- Any designated sites of international and national importance, for example Natura 2000 sites and SSSIs;
- Designated sites of local importance, for example Local Wildlife Protection Sites and Local Landscape Areas;
- Protected and Priority Habitats and Species; and
- Landscape Character and Views.

Development proposals will not be supported unless it can be proven that adverse effects can be avoided or, where it is not possible to avoid impacts upon existing assets, satisfactory mitigation methods have been agreed.

4.10.3. Low Carbon Fife Supplementary Guidance (2019)

In January 2019, Fife Council adopted the Low Carbon Fife Supplementary Guidance ('The Low Carbon SPG') document[54]. This replaced the following guidance documents:

- Wind Energy Planning Supplementary Guidance (June 2013);
- Renewable Energy in Fife: Planning Customer Guidelines; and
- Fife Air Quality Guidelines.

The Low carbon SPG is designed to provide guidance on how the principles of Policy 1: Development Principles; Policy 10: Amenity; Policy 11: Low Carbon Fife; and Policy 13: Natural Environment and Access can be implemented by developers. The document sets out how new development within Fife can contribute to Scotland's national energy targets and reduce emissions within not only the local area but across Scotland. Of

[54] Fife Council (2019) Low Carbon Fife: Supplementary Planning Guidance [Online] Available at: https://www.fife.gov.uk/__data/assets/pdf_file/0019/162316/Low-Carbon-Fife-Supplementary-Guidance-Jan-2019.pdf (Accessed 05/10/2021)

particular relevance to the Proposed Development, is the section on offshore wind energy, which states the following regarding the development of offshore wind turbines:

"Fife Council will support offshore renewable energy development, provided that it does not have a significant adverse effect on existing social and economic maritime activities in the Forth, including shipping, fishing, and leisure (sailing and diving).

In addition, the routing, scale and number of transmission lines linking offshore energy developments to the shore and the national grid must not have an adverse impact upon these activities.

Proposals will only be supported where the siting and design of the development limits damage to the living landscape, including marine habitats, sea life, birds, existing pipelines, on research activities and on the historic marine environment."

In general, the Low Carbon SPG demonstrates that Fife Council will support the development of low carbon proposals (such as renewable energy related developments) as long as it can be demonstrated that no adverse impacts upon the quality, functions and the surroundings of the development's location will be created.

5. SEASCAPE, LANDSCAPE AND VISUAL ASSESSMENT

This chapter of the Environmental Impact Assessment Report (EIAR) evaluates the effects of the proposed Forthwind demonstration project (hereafter referred to as "the Proposed Development") on the seascape, landscape and visual resource. This chapter contains the following sections:

- 5.1 Introduction;
- 5.2 Consultation;
- 5.3 Scope of Assessment;
- 5.4 Methodology and Significance Criteria;
- 5.5 Baseline Description;
- 5.6 Development Design Mitigation;
- 5.7 Potential Seascape, Landscape and Visual Effects;
- 5.8 Assessment of Residual Visual Effects;
- 5.9 Assessment of Residual Effects on Landscape and Coastal Character;
- 5.10 Cumulative Effect Assessment; and
- 5.11 Statement of Significance.

5.1. Introduction

This chapter of the EIAR presents the results of the assessment of the likely significant effects of the Proposed Development with respect to seascape, landscape and visual amenity. It should be read in conjunction with the project description provided in Chapter 3: Proposed Development Description.

The chapter describes:

- the planning policy and guidance that has informed the assessment (Section 5.4.1: Policy and Guidance);
- the outcome of consultation engagement that has been undertaken to date, including how matters relating to seascape, landscape and visual amenity within the Scoping Opinion have been addressed (Section 5.2: Consultation);
- the assessment methodology and significance criteria for the assessment for seascape, landscape and visual amenity (Section 5.4: Methodology and Significance Criteria);
- the overall baseline conditions (Section 5.5: Baseline Conditions);
- the assessment of potential seascape, landscape and visual effects (Section 5.7: Assessment of Potential Effects);
- environmental mitigation measures relevant to seascape, landscape and visual amenity and the relevant maximum design scenario (Section 5.6: Development Design Mitigation);
- cumulative assessment for seascape, landscape and visual effects (Section 0: Cumulative Effect Assessment);
- a summary of residual effects for seascape, landscape and visual amenity (Section 5.8 Summary of Effects); and
- a Statement of Significance (Section 5.11: Statement of Significance).

This seascape, landscape, and visual impact assessment (SLVIA) evaluates the effects of the construction, operation, and maintenance, and decommissioning of the offshore turbine (WTG), met mast, interconnecting cable between the WTG and the met mast, and the offshore cable (the Proposed Development) (shown in Figure 1.1 Site Location).

The SLVIA has been informed by the SLVIA undertaken as part of the Forthwind Offshore Wind Demonstration Project Environmental Statement (Forthwind Ltd, July 2015).

This chapter is supported by Appendix 5a: SLVIA Methodology and plan graphics and visual representation figures presented in Volume 2, as follows:

5.1 Site Location and 50 km SLVIA Study Area;

5.2 Landscape Character Assessment;
5.3 Landscape Designations;
5.4 Coastal Character;
5.5 Visual Receptors;
5.6 Viewpoints;
5.7 Baseline Lighting;
5.8 Blade Tip ZTV and 50 km SLVIA Study Area;
5.9 Blade Tip ZTV and 50 km SLVIA Study Area (A1);
5.10 Blade Tip ZTV and 25 km Detailed Assessment Area;
5.11 Hub Height ZTV and 50 km SLVIA Study Area;
5.12 Hub Height ZTV and 25 km Detailed Assessment Area;
5.13 Blade Tip ZTV with Coastal Character;
5.14 Blade Tip ZTV with Landscape Character Assessment;
5.15 Blade Tip ZTV with Landscape Designations;
5.16 Blade Tip ZTV with Visual receptors;
5.17 Blade Tip ZTV with Viewpoints;
5.18 Nacelle aviation lighting ZTV;
5.19 Cumulative Wind Farms;
5.20a Cumulative ZTV Inch Cape;
5.20b Cumulative ZTV Neart Na Gaoithe;
5.21 Viewpoint 1 - Buckhaven, Shore Street: viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.22 Viewpoint 2: East Wemyss, Fife Coastal Path: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage, 180° night time baseline panorama and cumulative wireline, 53.3° wireline, night time 53.5° photomontage;
5.23 Viewpoint 3: West Wemyss, Fife Coastal Path: viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.24 Viewpoint: 4 Leven, Fife Coastal Path: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.25 Viewpoint: 5 A915, Wemyss Coast: viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.26 Viewpoint: 6 Kennoway: viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.27 Viewpoint: 7 Fife Coastal Path, Lundin Links: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.28 Viewpoint: 8 Lower Largo: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.29 Viewpoint: 9 A917 near Drumeldrie: viewpoint location plan, 360° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.30 Viewpoint: 10 Largo Law Summit: viewpoint location plan, 360° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.31 Viewpoint: 11 Kirkcaldy, Esplanade: viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.32 Viewpoint: 12 Earlsferry, Links Road: viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.33 Viewpoint: 13 Elie, The Toft: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.34 Viewpoint: 14 Kinghorn, Fife Coastal Path: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.35 Viewpoint: 15 East Lomond Summit: viewpoint location plan, 360° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;
5.36 Viewpoint: 16 Benarty Hill: viewpoint location plan, 360° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;

5.37 Viewpoint: 17 Pettycur Road, Kinghorn: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;

5.38 Viewpoint 18: Gullane Beach: viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;

5.39 Viewpoint 19: Aberlady Bay footbridge: viewpoint location plan, 180° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;

5.40 Viewpoint 20: North Berwick (north of Harbour): viewpoint location plan, 270° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage, 270° night time baseline panorama and cumulative wireline, 53.3° wireline, 53.5° night time photomontage;

5.41 Viewpoint 21: North Berwick Law: viewpoint location plan, 360° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage;

5.42 Viewpoint 22: Calton Hill, Edinburgh: viewpoint location plan, 360° baseline panorama and cumulative wireline, 53.3° wireline, 53.5° photomontage, 360° night time baseline panorama and cumulative wireline, 53.3° wireline, 53.5° night time photomontage.

5.43 Viewpoint 23: Allermuir Hill: viewpoint location plan, 90° cumulative wireline.

5.44 Viewpoint 24: Arthur's Seat: viewpoint location plan, 90° cumulative wireline.

5.45 Viewpoint 25: Deuchrie Dod: viewpoint location plan, 90° cumulative wireline.

5.46 Viewpoint 26: A68 at Soutra Hill: viewpoint location plan, 90° cumulative wireline.

5.2. Consultation

Table 5.1 details the consultation that has been undertaken in respect of the SLVIA, detailing how consultation responses have informed the assessment and have been considered within this Chapter.

Table 5.1 - Summary of Consultation Undertaken

Consultee	Consultation Method	Consultee Comments	Project Response
December 2021 Scoping Opinion			
Marine Scotland	Comment within Scoping Opinion December 2021	Section 9.8 of the Scoping Reports states that options for mitigation of the identified potential effects which are predicted to arise from the Development will be considered iteratively alongside the assessment and will be discussed with the relevant stakeholders for the SLVIA. The Scoping Report states that mitigation measures will be prepared in line with the design statement for the Development.	A range of standard mitigation measures aimed at minimising potential impacts of the Proposed Development on any affected receptors. have been applied to the Proposed Development as part of the over-arching site selection and iterative design process, as stated in Section 5.6 Development Design Mitigation.
Marine Scotland	Comment within Scoping Opinion December 2021	Consultation with relevant consultees, including Fife Council and NatureScot, to define the scope of the SLVIA and the full methodology for the SLVIA should be agreed through further consultations with	Consultation with relevant consultees, including Fife Council and NatureScot, has informed the scope of the SLVIA and the full methodology for the SLVIA.

Consultee	Consultation Method	Consultee Comments	Project Response
		Fife Council and NatureScot.	
Marine Scotland	Comment within Scoping Opinion December 2021	Fife Council advised that the impact on the seascape and views from the Fife Coast will be a key factor.	The effects of the Proposed Development on the seascape is assessed in Section 5.9 Residual Effects on Landscape and Coastal Character. The effects of the Proposed Development on Views from the Fife Coast are considered in Section 5.8 Assessment of Residual Visual Effects.
Marine Scotland	Comment within Scoping Opinion December 2021	NatureScot highlighted that the proposed turbine will significantly affect the distinctive regional character of the landscapes and seascape of the Firth of Forth and that there will likely be significant cumulative issues resulting from the greater overall scale of the turbine in relation to the existing and consented turbines and with other tall structures in the area.	The potential significant effects of the Proposed Development on the landscapes and seascape of the Firth of Forth are assessed in Section 5.9. The potential significant cumulative effects of the Proposed Development are assessed in Section 0 Cumulative Effect Assessment.
Marine Scotland	Comment within Scoping Opinion December 2021	NatureScot does not agree with the proposed Zone of Theoretical Visibility (ZTV) and advised that, for a 280m turbine, an appropriate initial ZTV is at least 60km.	Following provision of a 60km ZTV, and additional consideration of the likely effects beyond 50km, (OPEN, 04 2 2022), and further discussion with NatureScot via email (March 2022), NatureScot agreed that the SLVIA Study Area does not need to be extended beyond 50 km.
Marine Scotland	Comment within Scoping Opinion December 2021	NatureScot advised that the turbine size could be modelled in appropriate increments (determined by the design process) with the outputs presented on a composite ZTV, or perhaps as individual ZTVs which should be compared against the ZTV for the consented scheme and that sensitive receptors beyond the proposed ZTV should be identified by the Developer and discussed further with relevant Local Authorities.	Further discussion with NatureScot via email (March 2022), NatureScot agreed that the SLVIA Study Area does not need to be extended beyond 50 km.

Consultee	Consultation Method	Consultee Comments	Project Response
Marine Scotland	Comment within Scoping Opinion December 2021	NatureScot advised on further viewpoints to be considered, and these should therefore also be scoped in, and gave advice in relation to lighting, baseline information on coastal character and cumulative impact assessment which should be followed.	A viewpoint on the railway line between Kirkcaldy and Glenrothes is presented in Viewpoint 5. Further discussion with NatureScot, confirmed that wireline images for the remaining four additional views are acceptable, and these 'illustrative' viewpoints are presented in Figures 5.43 to 5.46.
Marine Scotland	Comment within Scoping Opinion December 2021	NatureScot provided references for appropriate guidance to be followed and the Developer is advised to follow the advice of NatureScot in this regard.	Section 5.10.1.1 follows NatureScot guidance and recognises the distinction made between the illustration of and the assessment of lighting.
Marine Scotland	Comment within Scoping Opinion December 2021	The Scottish Ministers agree with the aspects to be scoped in in table 13 of the Scoping Report and, following advice contained in the representation of NatureScot, conclude that those matters intended by the Developer to be scoped out (beyond and outwith the 50km proposed ZTV) should not be scoped out, but should be scoped in.	Following provision of a 60km ZTV, and additional consideration of the likely effects beyond 50km, (OPEN, 04 2 2022), NatureScot agreed that matters outwith the 50km proposed ZTV can be scoped out.
Marine Scotland	Comment within Scoping Opinion December 2021	As the Scoping Report states that mitigation measures will be prepared in line with the design statement for the proposed development it will be important that such measures and statements are produced in the EIA Report and applications.	A range of standard mitigation measures aimed at minimising potential impacts of the Proposed Development on any affected receptors. have been applied to the Proposed Development as part of the over-arching site selection and iterative design process, as stated in Section 5.6 Development Design Mitigation.
Marine Scotland	Comment within Scoping Opinion December 2021	It is not apparent from the Scoping Report, whether the Developer proposes to include the meteorological mast in the assessment. The Scottish Ministers conclude that, unless the relevant stakeholders all agree not to include the mast in writing, then the	The meteorological mast has been included in the assessments included in Sections 5.8, 5.9 and 0.

Consultee	Consultation Method	Consultee Comments	Project Response
		mast should be included in the assessments.	
Marine Scotland	Comment within Scoping Opinion December 2021	All dialogue with relevant stakeholders and advisers referred to throughout the seascape, landscape and visual resources section of the Scoping Report. should have been had at the time of application to properly inform the EIA Report and applications.	Dialogue informing the EIA Report and applications with relevant stakeholders and advisers referred to throughout the seascape, landscape and visual resources section of the Scoping Report have taken place as recorded in this table.
Fife Council	Comment within Scoping Opinion December 2021	The key factor from Fife Council's point of view will be the impact on the seascape and views from the Fife Coast.	Views from the Fife Coast are considered in Section 5.8.
NatureScot	Comment within Scoping Opinion December 2021	Advised that, for a 280m turbine, an appropriate initial Zone of Theoretical Vision (ZTV) is at least 60km.	A 60km ZTV and additional consideration of the likely effects beyond 50km (OPEN, 04/02/ 2022) was provided to NatureScot for further discussion.
NatureScot	Further discussion via email March 2022	Following provision of a 60km ZTV, and additional consideration of the likely effects beyond 50km, (OPEN, 04/02/2022), NatureScot agreed that the SLVIA Study Area does not need to be extended beyond 50 km.	The SLVIA Study Area was agreed at 50 km radius from the Proposed Development.
NatureScot	Comment within Scoping Opinion December 2021	Further viewpoints should be considered, and suggested the following broad locations for additional viewpoints:" the foothills of the Lammermuirs; roads from where the proposal will be seen in 'straight-ahead' views such as the A68; an elevated viewpoint in the Pentlands; the railway line between Kirkcaldy and Glenrothes ; and Arthurs Seat.	A viewpoint on the railway line between Kirkcaldy and Glenrothes is presented in Viewpoint 5. Further discussion with NatureScot, confirmed that wireline images for the remaining four additional views are acceptable, and these 'illustrative' viewpoints are presented in Figures 5.43 to 5.46.
NatureScot	Further discussion via email March 2022	Advised that the additional viewpoints should be included in the SLVIA, initially as wireline representations, and we advise that we may	Further discussion with NatureScot, confirmed that wireline images for the remaining four additional views are acceptable, and these 'illustrative' viewpoints are presented in Figures 5.43 to 5.46.

Consultee	Consultation Method	Consultee Comments	Project Response
		request more detailed assessment in the future.	
NatureScot	Comment within Scoping Opinion December 2021	Accepted the 50km study area proposed for the night-time lighting assessment and added that a hub height ZTV would clarify where the nacelle light would theoretically be visible.	A Hub height ZTV and 50 km SLVIA Study Area is presented in Figure 5.11. A Hub Height ZTV and 25 km Detailed Assessment Area is presented in Figure 5.12.
NatureScot	Comment within Scoping Opinion December 2021	Welcomed further discussion on viewpoint selection. The assessment of night time lighting should follow guidance in Annex 2 of General Pre-application and Scoping Advice for Onshore Wind Farms which also references paras 2.11-2.13 of our Siting and Designing Wind Farms in the Landscape guidance (version 3a, 2017) and paras 174-177 of our Visual Representation of Wind Farms. Distinction to be made between the 'illustration' of lighting as advocated in our guidance and the assessment of lighting which will be wider and include twilight and night time conditions."	Chapter 5 follows NatureScot guidance and recognises the distinction made between the illustration of and the assessment of lighting.
Scottish Ministers	Comment within Scoping Opinion December 2021	The meteorological mast should be included in the assessment, unless the relevant stakeholders all agree in writing, not to include the mast.	The meteorological mast has been included in the assessments included in Sections 5.8, 5.9 and 0.
NatureScot	Comment within Scoping Opinion December 2021	Further consultation and dialogue with relevant stakeholders and advisers should have been had at the time of application to properly inform the EIA Report and applications.	Consultation and dialogue informing the SLVIA aspects of the EIA Report with relevant stakeholders and advisers referred to throughout the seascape, landscape and visual resources section of the Scoping Report have taken place as recorded in this table.
Comments on Previous 2019 Scoping Report			
NatureScot	Comment on Previous (2019) Scoping Report	NatureScot advised that a full landscape and visual impact assessment is	The new application is supported by this Seascape and Landscape Visual Impact Assessment (SLVIA).

Consultee	Consultation Method	Consultee Comments	Project Response
		required to inform and support the new application.	
NatureScot	Comment on Previous (2019) Scoping Report	NatureScot noted the intention to utilise and update the existing baseline coastal character assessment previously undertaken by the Forth & Tay offshore wind developer's group (FTOWDG) and would be happy to advise further on methods and extent of this study area.	The Forth & Tay offshore wind developer's group existing baseline coastal character assessment informs the SLVIA.
NatureScot	Comment on Previous (2019) Scoping Report	NatureScot requested that the views of all consultees are taken into account to determine the extent of local character assessment including the Zone of Theoretical Visibility ("ZTV").	The extent of the Study Area and local character assessment takes account of consultee comments.
NatureScot	Comment on Previous (2019) Scoping Report	NatureScot considered it would be helpful to explore the changes in visibility from use of larger turbines and that the increase in turbine size could be modelled and outputs presented as composite or individual ZTVs.	Visibility of the proposed single larger turbine will be presented as an individual ZTV and is modelled in Figures 5.8-5.17.
NatureScot	Comment on Previous (2019) Scoping Report	NatureScot are content with the proposed viewpoint selection as identified in Table 14 page 67/68 (referred to as Table 9.1 in the text). Baseline photography - It is unclear if the existing baseline photography for the viewpoints will be utilised, we would have no issues with this unless new photography may be necessary where views have changed substantially.	Existing baseline photography is already available from many viewpoint locations in Fife, which was undertaken in June 2016 and September 2017 as part of earlier SLVIA work on the Forthwind Project. It is assumed that the baseline viewpoint photography from these viewpoints can be used for the photomontages in the EIAR. Any material changes in the baseline views will be identified and highlighted during survey work, so that an approach to updating photography can be agreed, if necessary, on a case-by-case basis. New viewpoint photographs were undertaken in summer 2021 for several additional viewpoints and the three proposed

Consultee	Consultation Method	Consultee Comments	Project Response
			night-time viewpoints, where a photograph is not currently available.
NatureScot	Comment on Previous (2019) Scoping Report	NatureScot advised that all applications for wind turbines requiring lighting should be assessed through the normal LVIA process. NatureScot recommended that applicants only provide visualisations showing lighting from a small selection of viewpoints.	The visual effect of the Proposed Development at night is assessed in the SLVIA. Visualisations showing turbine and met mast lighting from three viewpoints is presented with the SLVIA in Figures 5.22, 5.40 and 5.42.
Scottish Ministers	Comment on Previous (2019) Scoping Report	The Scottish Ministers required the study area to be increased to 50km and also that the cumulative effects of the Forth and Tay developments are assessed. The Scottish Ministers required that the effects of the Proposed Development on seascape and landscape character of East Lothian and Edinburgh and their Firth of Forth coastlines should be scoped in.	The Study Area has been set at a 50 km radius, increased from 45 km. The cumulative effects of the Forth and Tay developments Inch Cape and Neart na Gaoithe will be included in the SLVIA. Effects on the landscape character of East Lothian and Edinburgh and their Firth of Forth coastlines is considered in the SLVIA. Local coastal character assessment of the East Lothian coastline will not be required, except for the potential for a small area of coastline at North Berwick as agreed with ELC.
HES	Comment on Previous (2019) Scoping Report	HES stated that all consented and proposed wind farm developments within the surrounding area should be included into the assessment.	The cumulative effects of the Proposed Development with consented and proposed wind farm developments are included within the SLVIA (Figure 5.19).
Fife Council	Comment on Previous (2019) Scoping Report	Fife Council consider that it is likely only to be matters of visual impact which have the potential to have the highest significance. Fife Council requested that one of the viewpoints included for the visual assessment is the public car park off Pettycur Road in Kinghorn (general grid ref. 326960 686657).	The viewpoint at the public car park off Pettycur Road in Kinghorn is included in the SLVIA on Figure 5.34.
ELC	Comment on Previous (2019) Scoping Report	ELC noted that Special Landscape Areas (SLAs) have now been designated through the East Lothian LDP 2018 and that	Fisherrow Sands SLA, Prestonpans Coast SLA and Newhailes House GDL are considered in Section 5.7.

Consultee	Consultation Method	Consultee Comments	Project Response
		Landscape Character Areas are set out in the SPG on SLAs. ELC notes that there could also be effects on the Fisherrow Sands SLA and Prestonpans Coast SLA, and that Newhailes House GDL should also be considered.	
ELC	Comment on Previous (2019) Scoping Report	ELC noted that the Proposed Development has the potential to affect coastal character when viewed from North Berwick and requests further discussion in this regard.	Further discussion with ELC will be undertaken regarding potential effects on the coastal character of North Berwick.
ELC	Comment on Previous (2019) Scoping Report	ELC stated that the assessment of Inch Cape and Neart na Gaoithe would be the worst case and agreed that Seagreen does not need to be assessed however should be noted.	The cumulative effects of Inch Cape and Neart na Gaoithe is considered in Section 0. The cumulative effects of the Proposed Development with Seagreen are scoped out of the SLVIA.
ELC	Comment on Previous (2019) Scoping Report	For roads, the overall visual assessment could consider the A6137 which is an elevated route with some views towards the area, and the A198/B1348 coastal tourist route in East Lothian.	The SLVIA considers the A6137 and the A198/B1348 coastal route in Section 5.7.
ELC	Comment on Previous (2019) Scoping Report	Golf courses, including Muirfield and the Renaissance course at Archerfield, may also have visibility and should be considered.	The effect on views from the Muirfield and Renaissance golf courses is considered in Section 5.7.
ELC	Comment on Previous (2019) Scoping Report	The Council considered that the temporary oil rig berths in the Firth of Forth should be included in the cumulative SLVIA assessment as they have similarities in that they are lit, tall, and located	Temporary oil rig berths in the Firth of Forth are considered as part of the baseline within Section 5.7.
ELC	Comment on Previous (2019) Scoping Report	ELC considered night-time views should be included in the SLVIA and mitigation explored.	Night-time views are assessed within Section 5.7 and mitigation explored in Section 5.6.

Consultee	Consultation Method	Consultee Comments	Project Response
ELC	Comment on Previous (2019) Scoping Report	Viewpoint 17 Gullane Beach - the worst case scenario would probably be from Gullane Beach, where the proposal is more likely to be seen above the skyline.	A viewpoint near the benches with views across the bay at Gullane Beach is provided in Figure 5.38.
ELC	Comment on Previous (2019) Scoping Report	Viewpoint 18 Aberlady - although the viewpoint chosen is within the settlement, it would be worth considering a point on the footbridge into Aberlady Local Nature Reserve at Luffness.	A viewpoint at Luffness footbridge into Aberlady Local Nature Reserve is provided in Figure 5.39.
ELC	Comment on Previous (2019) Scoping Report	Viewpoint 19 North Berwick - the viewpoint is on the John Muir Way, and near a popular beach, as well as the settlement of North Berwick. It is important to select a view that shows how the turbines will sit with coastal foreground and the islands of the Forth. Other spots that could be considered for this are the slipway at Victoria Road, North Berwick, or to the north of North Berwick Harbour.	A viewpoint to the north of North Berwick Harbour is provided in Figure 5.40.
ELC	Comment on Previous (2019) Scoping Report	Another potentially significant view is from the A6137 at West Garleton where there is a panoramic view over Aberlady Bay with the Methil turbine directly in the line of sight.	The A6137 is considered in Section 5.7.
ELC	Comment on Previous (2019) Scoping Report	A viewpoint from North Berwick Law could also be considered.	A viewpoint at North Berwick Law is provided in Figure 5.41.

5.3. Scope of Assessment

This section sets out the scope and methodology for the assessment for seascape, landscape, and visual amenity. This scope and methodology have been developed as the Proposed Development design has evolved and responds to feedback received to date as set out in Table 5.1.

The project-wide generic approach to assessment is set out in Chapter 2: EIA Methodology. The assessment methodology for seascape, landscape and visual amenity is consistent with that provided in in the Scoping Report (Forthwind, 2021) and no changes have been made since the scoping phase.

The methodology for the assessment of seascape, landscape and visual impacts of the Proposed Development is set out in full in Appendix 5a: SLVIA Methodology.

5.3.1. Terminology – Seascape and Coastal Character

The Marine Policy Statement (MPS) (UK Government, 2011) states *“references to seascape should be taken as meaning landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other”.*

In England, seascape characterisation includes both the sea surface and what lies below the waterline, however in Scotland, *‘the focus is on the coast and its interaction with the sea and hinterland, relationships that are quite distinctive in the Scottish context’* (NatureScot, 2018).

Given the definition in the MPS and the NatureScot coastal character assessment guidance, the assessment of seascape character effects in this SLVIA focuses on areas of onshore landscape with views of the coast or seas/marine environment, in other words the ‘coastal character’, on the premise that the most important effect of offshore wind farms is on the perception of the character of the coast.

Coastal character is the ‘*distinct, recognisable and consistent pattern of elements on the coast, land and sea that makes one part of the coast different from another’* (NatureScot, 2018) and is made up of the margin of the coastal edge, its immediate hinterland and areas of sea.

The extent of the coast is principally influenced by the dominance of the sea in terms of physical characteristics, views and experience. The landward extent of the coast can be narrow where edged by cliffs or settlement; or broad where it includes raised beaches, dunes or more open coastal pasture or machair. The major determinant in defining the landward and seaward components of the coast is the sea - the key characteristic.

5.3.2. Overview

The SLVIA assesses the effects of the Proposed Development on coastal character which is informed by the assessment of effects on viewpoints and an understanding of landscape character in coastal parts of the study area.

The following landscape receptors are assessed:

- Fife Special Local Landscape Areas (LLA);
- East Lothian Landscape Areas (SLA);
- Gardens and Designed Landscapes (GDL);
- Landscape Character Types (LCT);
- Coastal Character Areas (CCAs).

There are no National Scenic Areas (NSA), National Parks or any Wild Land Areas likely to be significantly affected by the Proposed Development. These landscape receptors are therefore excluded from the SLVIA.

The following categories of visual receptor are assessed:

- Settlements;
- Roads;
- Routes (cycle routes and footpaths including the core path network);
- Regional parks and country parks; and
- Hilltops and other viewpoints identified on maps and guides.

The SLVIA focusses on the assessment of effects on seascape, landscape and visual receptors within a 25 km radius of the Proposed Development as it is within this area that significant effects are more likely to occur. The geographical scope of the SLVIA is described in more detail in Section 5.3.3. The SLVIA also assesses the effects on 22 viewpoints which are representative of visual receptors found within the SLVIA study area. The viewpoints are also used to inform the assessment of effects on seascape and landscape receptors.

Section 5.5 of this Chapter describes the baseline seascape, landscape and visual resources assessed in the SLVIA. The existing view at each viewpoint location is described in Section 5.8 of this Chapter.

The SLVIA assesses the cumulative effects of the Proposed Development and wind turbines over 50 m in height to blade tip which are under construction or consented. In addition to the criteria described in Table 5.1 the Cumulative Environmental Assessment (CEA) considers the following types of effects on the landscape and visual resources described in Section 5.5 of this Chapter:

- In combination effects where the Proposed Development and cumulative wind turbines will be visible within the same field of view from a fixed point i.e. without the viewer moving their head;
- In succession effects where the Proposed Development will be visible with cumulative wind turbines from a fixed point only if the viewer moves their head. For example, to view wind turbines in the opposite direction to the Proposed Development; and
- Sequential effects where the Proposed Development is visible with cumulative wind turbines while moving through the landscape on a road or route. Sequential effects may be in combination and in succession, intermittent or continuous.
- The CEA focusses on the effects arising from the addition of the Proposed Development to cumulative wind turbines within the SLVIA study area.

For both landscape and visual resources the SLVIA and CEA have assessed direct effects i.e. resulting directly from the Proposed Development itself. Given the location of the wind turbine of the Proposed Development in the Firth of Forth and the location of landfall of the Export Cable and the transformer in an area of existing industrial land use indirect effects are unlikely to occur.

Effects of the Proposed Development are assessed as being adverse unless otherwise stated. The assessment of effects as adverse reflects the nature of change relative to the seascape, landscape and visual baseline.

The construction phase of the Proposed Development will not result in permanent or widespread change to the seascape, landscape and visual baseline. Any changes will be of short duration occurring over a period of 3-6 months or likely to result in very limited effects in a very localised geographic area within an area of existing industrial land use. For similar reasons the effects arising during the decommissioning phase of the Proposed Development are unlikely to be significant. The focus of the SLVIA and CEA is therefore upon the operational and long-term effects of the Proposed Development.

5.3.3. Geographical Scope

The geographical scope of the SLVIA extends to a 50 km radius from the Proposed Development as shown on Figure 5.1. This 50 km SLVIA Study Area includes the coastal regions around the Firth of Forth and much of Fife, West Lothian, the City of Edinburgh, Midlothian, and East Lothian.

The 50 km SLVIA Study Area accords with NatureScot guidance[55] that advises that a 45 km radius Zone of Theoretical Visibility (ZTV) should be prepared for wind turbine development with a tip height greater than 150 m; and takes account of comments from the Scottish Ministers shown in Table 5.1. Figures 5.8 to 5.17 show 50 km radius blade tip and hub height ZTVs for the Proposed Development.

This 50 km SLVIA Study Area is defined as the outer limit of the area where significant effects could occur, based on professional judgement, guidance, agreement through consultations with relevant stakeholders (Table 5.1), analysis of the ZTV (Figures 5.8 to 5.17), the landscape context of the Proposed Development and identification of potential impact pathways.

Seascape, landscape, and visual effects of Forthwind outside the 50 km radius SLVIA Study Area are scoped out of SLVIA as they are unlikely to be significant. The ZTV shows a very limited geographic extent of theoretical visibility at 50-60km range and draft impact assessments did not find significant effects beyond 50km, with the findings pointing to potential significant effects occurring much closer to the proposed development, even though non-significant effects are theoretically possible at longer range. The SLVIA Study Area is also informed

[55] Scottish Natural Heritage, 2014, Visual Representation of Wind Farms.

by Met Office visibility data which indicates that 'actual' visibility at distances over 50km occurs very infrequently due to weather conditions.

Analysis of the ZTV and the distribution of landscape and visual receptors likely to experience significant effects led to identification of a 'detailed assessment area' of 25 km radius (Figure 5.10) within which the SLVIA is focussed in order to identify likely significant effects.

NatureScot guidance[56] advises that the process for identifying the scope of the CEA should begin with preparation of a base map showing operational, approved and application wind turbine development within a 60 km radius to provides the 'area of search' for the CEA study area. As explained in Table 5.1, with the agreement of NatureScot, the SLVIA study area has a radius of 50 km from the Proposed Development. This SLVIA Study Area includes the Neart na Gaoithe offshore wind farm (5.19). Inch Cape offshore wind farm is located outside the SLVIA Study Area but is also considered as part of the CEA (and is shown in Figure 5.19).

5.4. Methodology and Significance Criteria

5.4.1. National Policy and Guidance

The SLVIA and CEA have taken into account the following national policies regarding seascape, landscape and visual resources within the Study Area:

- The European Landscape Convention. The UK Government is signatory to the convention which highlights the importance of all landscapes and encourages more attention to their care and planning;
- Countryside (Scotland) Act 1967. The Act requires that planning authorities further the conservation of biodiversity, natural beauty and amenity which should be reflected in development plans and development management decisions. Section 66 requires Ministers, government departments and public bodies to: "…have regard to the desirability of conserving the natural beauty and amenity of the countryside" 57. The Act also enabled the establishment of Regional Parks and Country Parks which are both primarily for the purposes of recreation and amenity near areas of large population.
- Scottish Planning Policy (SPP) (SPP) (Scotland Government, 2014) identifies the scope of local landscape designations:
  "*The purpose of areas of local landscape value should be to:*
  - *Safeguard an enhance the character and quality of a landscape which is important or particularly valued locally or regionally; or*
  - *Promote understanding and awareness of the distinctive character and special qualities of local landscapes; or*
  - *Safeguard and promote important local settings for outdoor recreation and tourism*."[58]
  - Under Development Management SPP states that *'The siting and design of development should take account of local landscape character. Development management decisions should take account of potential effects on landscapes and the natural and water environment, including cumulative effects. Developers should seek to minimise adverse impacts through careful planning and design, considering the services that the natural environment is providing and maximising the potential for enhancement' and* 'Planning permission should be refused where the nature or scale of proposed development would have an unacceptable impact on the natural environment. Direct or indirect effects on statutorily protected sites will be an important consideration, but designation does not impose an automatic prohibition on development.' (p.47)).
  - In respect of proposals for energy infrastructure developments, paragraph 196 of SPP states that considerations will vary relative to the scale of the proposal and area characteristics but are likely to include: *'landscape and visual impacts, including effects on wild land'*.
- NPF4 will be the long-term plan for Scotland. At the time of writing, it has been published for public consultation until 31 March 2022. It is expected that NPF4 will be approved by the Scottish Parliament

[56] Ibid. 3.
[57] Countryside (Scotland) Act 1967.
[58] The Scottish Government, 2014, Scottish Planning Policy.

and adopted by the Scottish Ministers during 2022. Under draft Policy 19: Green Energy, it states: 'Outwith National Parks and National Scenic Areas, and recognising the sensitivity of any other national or international designations, development proposals for new wind farms should be supported unless the impacts identified (including cumulative effects), are unacceptable. To inform this, site specific assessments including where applicable Environmental Impact Assessments (EIA) and Landscape and Visual Impact Assessments (LVIA) are required. 'As set out in Section 0 of this Chapter there are no NSAs, National Parks or Wild Land Areas within the 50 km SLVIA Study Area, therefore legislation and policy in respect of these designations/defined areas are not relevant to the Proposed Development.

The overarching vision of NatureScot's position statement on people, place and landscape[59] is: *"All Scotland's landscapes are vibrant and resilient. They realise their potential to inspire and benefit everyone. They are positively managed as a vital asset in tackling climate change. They continue to provide a strong sense of place and identity, connecting the past with the present and people with nature, and fostering wellbeing and prosperity.*

The 'Inventory of Gardens and Designed Landscapes' is compiled by Historic Scotland. It describes approximately 390 sites in Scotland which are identified by Historic Scotland as contributing to our culture and enriching the texture and pattern of our landscapes forming a unique record of social, cultural and economic change through time[60]. GDL are considered to be of national importance and while they are not afforded statutory protection, local authorities are required to make provision for the protection of the historic environment when preparing development plans and determining planning applications.

The SLVIA has taken into account local planning policies relating to the local landscape designations in the SLVIA study area with the potential to be significantly affected by the Proposed Development. The Fife Local Landscape Designation Review[61] reviews the descriptions of LCT in the Fife Landscape Character Assessment[62] and amends or augments their descriptions and boundaries from which are derived the boundaries to SLA. East Lothian SLAs are defined in the East Lothian LDP 2018 - Special Landscape Areas Supplementary Planning Guidance (SPG)[63].

The following guidance on the practice and techniques of SLVIA and the preparation of photomontages and other visualisations and SLVIA graphics has been used:

- Landscape Institute and IEMA (2013). Guidelines for Landscape and Visual Impact Assessment: Third Edition (GLVIA3);
- Landscape Institute (2019). Visual Representation of Development Proposals;
- Landscape Institute (2021). Landscape Value and Valued Landscapes. A Technical Guidance Note;
- NatureScot (2012). Guidance on Assessing the Impact of Coastal Landscape and Seascape.
- NatureScot (2017). Siting and Designing Wind farms in the Landscape, Guidance (Version 3) (herein referred to as 'NatureScot Siting and Designing');
- NatureScot (2017). Visual Representation of Wind farms, Guidance (Version 2.2) (herein referred to as 'NatureScot Visual Representation');
- NatureScot (2018). Guidance Note. Coastal Character Assessment.
- NatureScot (2021). Assessing the Cumulative Impact of Onshore Wind Energy Developments; and
- Natural England (2014). An Approach to Landscape Character Assessment.

5.4.2. Overview

This section sets out an overview of the scope and methodology for the EIAR assessment for seascape, landscape, and visual amenity. The approach for seascape, landscape and visual amenity is consistent with that provided in the Scoping Report (Forthwind Ltd, 2021) and takes account of feedback received in the Scoping

[59] NatureScot and Historic Environment Scotland, 2019, People, Place and Landscape – A Position Statement
[60] http://www.historic-scotland.gov.uk/index/heritage/gardens/gardensabout.htm [accessed 25/08/2021].
[61] Land Use Consultants, 2009, Fife Local Landscape Designation Review.
[62] NatureScot, 1998, Fife Landscape Character Assessment.
[63] East Lothian Council, 2018, East Lothian LDP - Special Landscape Areas SPG

Opinion (Marine Scotland, December 2021) and responses to the previous (2019) application, as set out in Table 5.1.

The methodology for the assessment of seascape, landscape and visual impacts of the Proposed Development is set out in full in Appendix 5.1: SLVIA Methodology. An overview is provided in the following sections.

5.4.3. Desk Study

Baseline data collection has been undertaken to obtain information over the SLVIA Study Area. The current baseline conditions presented in Section 5.5 sets out a description of the existing seascape, landscape and visual environment of the SLVIA Study Area. The data sources that have been collected and used to inform this SLVIA are summarised in Table .

Table 5.2 - Data sources used to inform the SLVIA

Source	Date	Summary
Campaign to Protect Rural England (CPRE)	2016	Interactive maps of the UK's light pollution and dark skies as part of a national mapping project (LUC/CPRE, 2016). Open Source data used to understand and illustrate baseline lighting levels. (Available at: https://www.nightblight.cpre.org.uk/)
East Lothian Council	2018	East Lothian Local Development Plan (Adopted 2018) (Available at: https://www.eastlothian.gov.uk)
East Lothian Council	2018	East Lothian Local Development Plan (Adopted 2018) Special Landscape Areas Supplementary Planning Guidance (Available at: https://www.eastlothian.gov.uk)
Fife Council	2017	Fife Local Development Plan (Adopted 2017) (Available at: https://www.fife.gov.uk)
Fife Council	2021	Local Landscape Areas (GIS Dataset) (Available at: https://data.gov.uk)
Forth and Tay Offshore Wind Developers Group (FTOWDG)	2011	Forth and Tay Offshore Wind Developers Group (FTOWDG) (2011) Regional Seascape Character Assessment: Aberdeen to Holy Island https://nngoffshorewind.com/files/offshore-environmental-statement/Appendix-21.3---Regional-Seascape-Character-Assessment.pdf
Forthwind Ltd	2015	Forthwind Offshore Wind Demonstration Project Environmental Statement
Google Earth Pro	2020	Aerial photography
Historic Environment Scotland	2021	Designations Map Search (Available at: https://historicscotland.maps.arcgis.com)
Historic Environment Scotland	2021	Inventory of Gardens and Designed Landscapes (Available at: http://portal.historicenvironment.scot)

Source	Date	Summary
Historic Environment Scotland	2021	Inventory of Gardens and Designed Landscapes (GIS dataset) (Available at: http://portal.historicenvironment.scot/downloads);
Historic Environment Scotland2021	2021	World Heritage Sites (GIS dataset) (Available at: https://portal.historicenvironment.scot/downloads)
Long Distance Walkers Association	2020	Overview map for Long Distance Paths and Walks (Available at: https://www.ldwa.org.uk)
Met Office	2010-2020	Visibility Data. Visibility bands every 1km up to 30km, then every 5km up to 50km, then every 10km up to 70km, and >70km
National Trust	2020	Any specific visitor attractions / tourist destinations (Available at: https://www.nationaltrust.org.uk/days-out)
NatureScot	2019	National Landscape Character Assessment (GIS Dataset) (Available at: https://data.gov.uk)
NatureScot	2021	Local Landscape Areas (GIS Dataset) (Available at: https://data.gov.uk)
NatureScot	2010	National Coastal Character Map (Available at: https://www.nature.scot)
NatureScot	2019	Onshore Wind Farm Proposals (Available at: https://gateway.snh.gov.uk);
Oceanwise		Marine and coastal mapping data, ferry routes.
OPEN internal dataset	2020	Public Rights of Way
Ordnance Survey	2019	1:50,000 scale mapping
Ordnance Survey	2019	1:25,000 scale mapping
Ordnance Survey Open Data	2019	OS County Region, Local Unitary Authority, Railways, Road and Settlements
Ordnance Survey	2019	OS Terrain 5 Digital Terrain Model (DTM)
Sustrans	2020	National Cycle Network (GIS dataset) (Available at: https://www.sustrans.org.uk/)

5.4.5. Site Visit / Surveys

The SLVIA has been informed by desk-based studies and field survey work undertaken within the 50 km SLVIA Study Area. The landscape, seascape and visual baseline has been informed by desk-based review of landscape and seascape character assessments and the ZTV, to identify receptors that may be affected by the Proposed Development and produce written descriptions of their key characteristics and value.

Interactions have been identified between the Proposed Development and landscape, seascape, and visual receptors, to predict potentially significant effects arising and measures are proposed to mitigate effects.

For those receptors where a detailed assessment is required, primary data acquisition has been undertaken through a series of surveys. These surveys include field survey verification of the ZTV from terrestrial LCTs, micro-siting of viewpoint locations, panoramic baseline photography and visual assessment survey from all representative viewpoints. These surveys were undertaken in August and September 2021 as described in Table 5.3. Field work over the duration of the assessment has been partly restricted due to the travel restrictions in place during the COVID-19 pandemic, including requirements for assessors to ‘stay local/at home’ during certain periods, restricted access to certain visitor locations due to closures and limited accommodation availability.

Table 5.3 - Site Surveys Undertaken

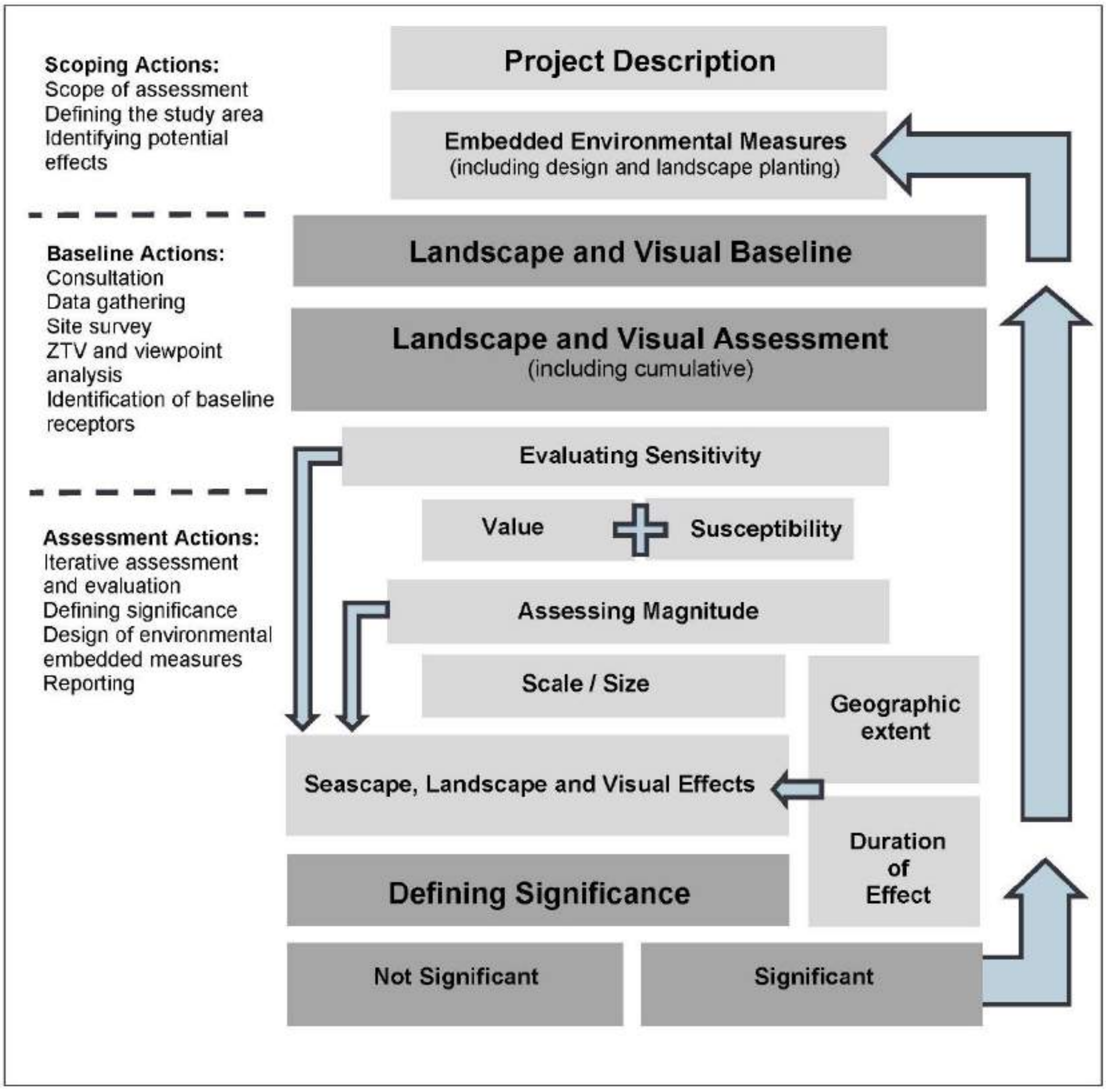
Survey date	Scope of survey	Survey status
August 2021	Seascape, landscape, and visual assessment surveys, to undertake viewpoint photography and collect baseline data on seascape character, landscape character and visual amenity associated with views of the Proposed Development and in accordance with methodology such as in GLVIA3 (Landscape Institute, 2013) and TGN 06/19 (Landscape Institute, 2019).	Surveys completed, with further surveys to be undertaken from remaining night-time viewpoints.
September 2021	Night-time viewpoint photography and further inter-related surveys within the onshore LVIA study area.	Surveys completed.

5.4.6. Assessment of Potential Effect Significance

5.4.6.1. Overview

The assessment has been undertaken in accordance with the Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3), and other best practice guidance. An overview of the SLVIA process is provided here and illustrated, diagrammatically in Table 5.4.

Table 5.4 - Overview of approach to SLVIA



The SLVIA assesses the likely effects that the construction, operation and decommissioning of the Proposed Development on the seascape, landscape, and visual resource, encompassing effects on seascape/landscape character, designated landscapes, visual effects, and cumulative effects.

An appropriate and proportionate level of assessment has been undertaken and agreed through consultation at the scoping stage. The level of assessment may be 'preliminary' (requiring desk-based data analysis) or 'detailed' (requiring site surveys and investigations in addition to desk-based analysis).

The seascape, landscape, and visual assessment unavoidably, involves a combination of quantitative and qualitative assessment and wherever possible a consensus of professional opinion has been sought through consultation, internal peer review, and the adoption of a systematic, impartial, and professional approach.

Defining impact significance

The seascape, landscape, and visual effects (and whether they are significant) is determined by an assessment of the 'sensitivity' of each receptor or group of receptors and the 'magnitude of change' that would result from the Proposed Development.

The evaluation of sensitivity takes account of the value and susceptibility of the receptor to the Proposed Development. This is combined with an assessment of the magnitude of change which takes account of the size and scale of the proposed change. By combining assessments of sensitivity and magnitude of change, a level of seascape, landscape or visual effect can be evaluated and determined. The resulting level of effect is described in terms of whether it is significant or not significant, and the geographical extent, duration and the type of effect is described as either direct or indirect; temporary or permanent (reversible); cumulative; and beneficial, neutral, or adverse.

Sensitivity

The sensitivity of seascape, landscape and visual receptors is an expression of the combination of the judgements made about the value of that receptor and its susceptibility to the specific type of change or the development proposed.

The value of a seascape, landscape or view receptor reflects the value that society attaches to that seascape, landscape, or view. There are a range of factors that are used to establish value but the presence of designations at national or local levels often reflects the level of value or importance they signify.

The susceptibility of a seascape or landscape to change reflects its ability to accommodate the changes that will result from the addition of the Proposed Development, based on its characteristics, robustness, scale, topography, openness/enclosure, perceptual qualities and the associations between the landscape/seascape receptor and the Proposed Development. The susceptibility of visual receptors (people) relates mainly to the activity of the viewer (residents, motorists, walkers etc) and the experience of the viewer - the extent to which attention or interest may be focused on the view and visual amenity, which combine to influence how susceptible viewers are to the potential effects of the Proposed Development.

An overall assessment of the sensitivity of each seascape, landscape and visual receptor has been made by combining the assessment of the value of the receptor and its susceptibility to change. In LVIA, sensitivity is specific to the Proposed Development and to the location in question. An overall level of sensitivity has been applied for each visual receptor or view – high, medium-high, medium, medium-low, or low. These levels are not defined as such, however the basis for sensitivity assessments has been made clear using evidence and professional judgement in the evaluation of each receptor, with reference to criteria that tend towards higher or lower sensitivity levels as set out in Appendix 5a: SLVIA Methodology.

Magnitude

The magnitude of change affecting seascape, landscape and visual receptors is an expression of the scale of the change that will result from the Proposed Development and is dependent on several variables regarding the size or scale of the change that will arise due to the Proposed Development. The geographic extent over which the change will be experienced is also assessed, which is distinct from the size or scale of change. Magnitude levels for the SLVIA are defined in Table 5.5

Table 5.5- Magnitude Levels for Seascape, Landscape and Visual Receptors

Magnitude	Description
High	The Proposed Development will result in a high level of alteration to the baseline characteristics of the seascape/landscape or existing view, forming the prevailing influence and/or introducing elements that are uncharacteristic in the baseline landscape/seascape or view. The addition of the Proposed Development will result in a large-scale change, loss or addition to the baseline seascape/landscape or view.
Medium-high	Intermediate rating with combination of criteria from high magnitude (described above) and medium magnitude (described below).
Medium	The Proposed Development will result in a medium level of alteration to the baseline characteristics of the seascape/landscape or existing view, forming a readily apparent influence and/or introducing elements that are potentially uncharacteristic in the baseline seascape/landscape or view. The addition of the Proposed Development will result in a medium-scale change, loss or addition to the baseline seascape/landscape or view.

Magnitude	Description
Medium-low	Intermediate rating with combination of criteria from medium magnitude (described above) and low magnitude (described below).
Low	The Proposed Development will result in a low level of alteration to the baseline characteristics of the seascape/landscape or existing view, providing a slightly apparent influence and/or introducing elements that are characteristic in the baseline seascape/landscape or view. The addition of the Proposed Development will result in a small-scale change, loss or addition to the baseline seascape/landscape or view.
Negligible	The Proposed Development will result in a negligible alteration to the baseline characteristics of the seascape/landscape or existing view, providing a barely discernible influence and/or introducing elements that are substantially characteristic in the baseline seascape/landscape or view. The addition of the Proposed Development will result in negligible change, loss or addition to the baseline seascape/landscape or view.

Significance of Effect

The significance of the effect upon seascape, landscape and visual receptors is determined by correlating the magnitude of the impact and the sensitivity of the receptor, as presented in Table 5.6.

The significance of the effect on each seascape/landscape character and visual receptor is dependent on all the factors considered in the sensitivity of the receptor and the magnitude of change resulting from the Proposed Development. Factors which influence levels of sensitivity and magnitude of change assessed in the SLVIA are set out in full in Appendix 5.1: SLVIA Methodology. Judgements on sensitivity and magnitude of change are combined to arrive at an overall assessment as to whether the Proposed Development will have an effect that is significant or not significant on each seascape/ landscape and visual receptor.

The matrix in Table 5.6Table5.6 is used as a guide to help inform the threshold of significance when combining sensitivity and magnitude to assess significance. On this basis potential impacts are assessed as of negligible, minor, moderate, and major. In those instances where there would be no effect, the magnitude has been recorded as 'Zero' and the level of effect as 'None'.

For the purposes of this assessment, any effects with a significance level of major and major/moderate have been deemed significant in EIA terms (dark shaded boxed in Table 5.6 Table5.6). 'Moderate' levels of effect have the potential, subject to the assessor's professional judgement, to be considered as significant or not significant, depending on the sensitivity and magnitude of change factors evaluated. These assessments are explained as part of the assessment, where they occur. Significance can therefore occur at a range of levels depending on the magnitude and sensitivity, however in all cases, a significant effect is considered more likely to occur where a combination of the variables results in the Proposed Development having a defining effect on the landscape/seascape character or view. Definitions are not provided for the individual categories of significance shown in the matrix and the reader should refer to the detailed definitions provided for the factors that combine to inform sensitivity and magnitude

Effects assessed as being either moderate/minor, minor, minor/negligible, or negligible level are assessed as non-significant (white shaded boxes in Table 5.6 Table5.6).

In line with the emphasis placed in GLVIA3 upon the application of professional judgement, an overly mechanistic reliance upon a matrix is avoided through the provision of clear and accessible narrative explanations of the rationale underlying the assessment made for each landscape and visual receptor.

Table5.6 - Impact Significant Matrix

		Sensitivity				
		High	**Medium-high**	**Medium**	**Medium-low**	**Low**
Magnitude	**High**	Major (**Significant**)	Major (**Significant**)	Major / moderate (**Significant**)	Moderate (**either significant or not significant**)	Moderate / minor (**Not significant**)
	Medium-high	Major (**Significant**)	Major/ moderate (**Significant**)	Moderate (**either significant or not significant**)	Moderate (**either significant or not significant**)	Moderate / minor (**Not significant**)
	Medium	Major / moderate (**Significant**)	Moderate (**either significant or not significant**)	Moderate (**either significant or not significant**)	Moderate / minor (**Not significant**)	Minor (**Not significant**)
	Medium-low	Moderate (**either significant or not significant**)	Moderate (**either significant or not significant**)	Moderate/ minor (**Not significant**)	Minor (**Not significant**)	Minor / Negligible (**Not significant**)
	Low	Moderate / minor (**Not significant**)	Moderate / minor (**Not significant**)	Minor (**Not significant**)	Minor / Negligible (**Not significant**)	Negligible (**Not significant**)
	Negligible	Minor (**Not significant**)	Minor (**Not significant**)	Minor / Negligible (**Not significant**)	Negligible (**Not significant**)	Negligible (**Not significant**)

Geographical extent

The geographic extent over which the seascape/ landscape and visual effects will be experienced is also assessed, which is distinct from the size or scale of effect. This evaluation is not combined in the assessment of the level of magnitude, but instead expresses the extent of the receptor that will experience a particular magnitude of change and therefore the geographical extents of the significant and not significant effects. The geographic extent of the effects varies depending on the specific nature of the Proposed Development and is principally assessed through analysis of the extent of perceived changes through visibility of the Proposed Development using the ZTV (Figure 5.8) and field survey verification.

Duration and reversibility

The duration and reversibility of seascape, landscape and visual effects is based on the period over which the Proposed Development is likely to exist and the extent to which it will be removed and its effects reversed at the end of that period. OPEN's methodology does not include duration and reversibility as part of magnitude of change, as there is potential that the reversibility aspect could alter or reduce potentially significant effects even though they are long-term. The duration and reversibility of the effects is instead determined separately in relation to the assessed effects.

Long-term, medium-term, and short-term seascape/ landscape effects are defined as follows:

- long-term – more than 10 years;
- medium-term – 6 to 10 years; and
- short-term – 1 to 5 years.

Duration and reversibility are not incorporated into the assessment of magnitude of change but are stated separately in relation to the assessed effects (i.e., as short/medium/long-term, and temporary/permanent) and are considered as part of drawing conclusions about significance, combining with other judgements on sensitivity and magnitude, to allow a final judgement to be made on whether each effect is significant or not significant.

Visual representations methodology

The methodology for the production of visual representations (photomontages and ZTVs) of the Proposed Development is set out in full in Appendix 5.1: SLVIA Methodology.

The visual representations presented in Figures 5.21 to Figure 5.42, have been produced in accordance with Visual Representation of Wind farms (NatureScot, 2017) and Visual Representation of Development Proposals (TGN 06/19) (Landscape Institute, 2019).

The ZTVs in Figures 5.8 to Figure 5.17 have also been produced in line with guidance in Visual Representation of Wind farms (NatureScot, 2017) and are generated using GIS software (ESRI ArcGIS Version 10.5) to model the theoretical visibility of the Proposed Development.

The following guidance on the practice and techniques of SLVIA and the preparation of photomontages and other visualisations and SLVIA graphics has been used:

- Landscape Institute and IEMA (2013). Guidelines for Landscape and Visual Impact Assessment: Third Edition (GLVIA3);
- Landscape Institute (2019). Visual Representation of Development Proposals;
- Landscape Institute (2021). Landscape Value and Valued Landscapes. A Technical Guidance Note;
- NatureScot (2012). Guidance on Assessing the Impact of Coastal Landscape and Seascape.
- NatureScot (2017). Siting and Designing Wind farms in the Landscape, Guidance (Version 3) (herein referred to as 'NatureScot Siting and Designing');
- NatureScot (2017). Visual Representation of Wind farms, Guidance (Version 2.2) (herein referred to as 'NatureScot Visual Representation');
- NatureScot (2018). Guidance Note. Coastal Character Assessment.
- NatureScot (2021). Assessing the Cumulative Impact of Onshore Wind Energy Developments; and
- Natural England (2014). An Approach to Landscape Character Assessment.

Assessment of Residual Effect Significance

The impact assessments and conclusions on significance of effect presented in Section 5.7 assume that these standard mitigation measures listed above have been successfully implemented. Where significant environmental impacts remain even after these standard measures have been factored in, then project-specific mitigation measures are detailed and the residual significance of effect presented.

Limitations of Assessment

There are some data limitations relating to seascape, landscape, and visual amenity however these do not affect the robustness of this assessment as the gaps are limited and wouldn't affect the assessments of likely significance assessed for relevant receptors.

There are limitations in the production of photomontage and wireline visualisations and ZTVs as assessment tools, and limitations in the accuracy of digital terrain model (DTM) data, which are described in Appendix 5a: SLVIA Methodology. The use of detailed terrain models (OS Terrain 5), production of visualisations to recognised standard and field survey assessment of impacts minimises these limitations.

Some data limitations have arisen due to restrictions or delay to site surveys due to COVID-19 restrictions, however limitations have been minimised through the timing of surveys when travel and access restrictions were eased.

5.5. Baseline Description

5.5.1. The Proposed Development Site

The Proposed Development site is located on the northern shore of the Firth of Forth at Methil, Scotland and is approximately 1.5 km seaward of the Fife Energy Park. The Proposed Development site consists of open water where the wind turbine will be located and an onshore area within the Fife Energy Park site where the substation and control building will be located. There is no existing development at the offshore area of the Proposed Development site while the onshore area consists of the industrial development at Fife Energy Park.

The immediate context of the wind turbine is the open water of the Firth of Forth. The Firth of Forth is 18 km wide with the opposite shore lying within the Lothians area and having a less developed character than the Fife shore at the Proposed Development site. On the Fife shore lie the settlements of Buckhaven and Methil, parts of which overlook the Proposed Development site, with the adjoining town of Leven forming a continuous area of urban development along the coastline closest to the Proposed Development site.

To the northeast and southwest of Methil the coastline consists predominantly of wide beaches and rocky shore platforms occasionally backed by low cliffs with prominent headlands occurring at Kincraig approximately 10 km to the northeast and Kinghorn approximately 15 km to the southwest. The predominant influences on the coastline are urban and industrial development to the southwestern stretch, while fewer settlements and more sandy beaches and golf links influence the north-eastern stretch.

Inland from the coast the topography rises gradually to an undulating expanse of agricultural land populated by numerous small settlements and farmsteads with a dense network of minor roads. There are notable hills such as Largo Law (290 m), 9 km to the northeast of the Proposed Development site, and East Lomond (424 m) 15.7 km to the northwest. Both these hills are connected to ridges that run east-west which is characteristic of the topography in Fife.

Operational wind energy development is part of the baseline receiving environment at and nearby the Proposed Development site. Offshore wind energy development within the outer firth is limited to the operational Levenmouth Demonstration Turbine (LDT) and Methil Docks. These are the closest WTGs to the Proposed Development and the most similar at 196 m and 195.2 m to blade tip, respectively. These are prominent within 10 km of the Proposed Development due to their location just offshore within the industrialised context of the Fife Energy Park at Methil, and the wider context of Fife's developed coast.

Onshore wind energy development has more presence within the area than offshore development and generally lies within the southwest of Fife. Earlseat Farm comprises eight WTGs and is the closest operational development to the Proposed Development, approximately 5 km to the east. Further west, WTGs lie at Middle Balbeggie, Skeddoway Farm, Noble Foods, and Wester Strathore Farm. West of Kinglassie, Westfield comprises five WTGs, 110 m to blade tip. Towards Cowdenbeath, a cluster of wind farms comprising Little Raith, Mossmorran and Goathill Quarry lie around 30 km southwest of the Proposed Development. 19 km northeast, Bonerbo comprises four 67 m to blade tip WTGs. Isolated WTGs are relatively few and widely dispersed throughout the 25 km Detailed Assessment Area, and of comparable height to Bonerbo.

5.5.2. Coastal Character Overview

The baseline description of the seascape of the SLVIA Study Area is derived from published seascape character assessments contained within the following:

- Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06);
- Forth and Tay Onshore Windfarm Developer Group (FTOWDG, 2011). Scottish Offshore Wind Farms – East Coast Regional Seascape Character Assessment: Aberdeen to Holy Island; and
- Forthwind Ltd (2015). ForthWind Offshore Wind Demonstration Project, Environmental Statement, Methil, Fife.

The assessment of seascape character effects in this SLVIA focuses on areas of onshore landscape with views of the coast or seas/marine environment, in other words the 'coastal character', on the premise that the most important effect of offshore wind farms is on the perception of the character of the coast. Coastal character is the 'distinct, recognisable and consistent pattern of elements on the coast, land and sea that makes one part of the coast different from another' (NatureScot, 2018) and is made up of the margin of the coastal edge, its immediate hinterland and areas of sea.

The coastal character of the SLVIA study area is defined at the regional level within the Regional Seascape Character Assessment Aberdeen to Holy Island (Forth and Tay Offshore Windfarm Developer Group, 2011) and at the local coastal character level by the local Coastal Character Areas (CCAs) defined in the Forthwind ES 2015, i.e. recognisable geographical areas with a consistent overall character and shown as a simple colour line along the coast (Figure 15.4). This hierarchy of published coastal character assessments is shown in Figures 5.4 and 5.13.

Due to its scale, distance from shore and extent of visibility, it is necessary to consider the effects of the Proposed Development on both coastal character and landscape character. The effect of the Proposed Development on coastal (seascape) character is considered within the boundaries of defined coastal character areas (CCAs) and the immediately adjacent landscape character type (LCT) covering its hinterland, as defined in Figure 15.3, where there is a strong visual relationship with the sea/tidal waters and coastal landscapes such as dunes or cliffs.

The effect of the Proposed Development on landscape character is considered on LCTs outside and inland of these CCAs and coastal LCTs, where there may be some intervisibility of the Proposed Development, but where the land is unlikely to have a strong visual relationship with the sea/tidal waters. These LCTs are identified in Figure 15.3. In general, they are considered unlikely to experience significant character effects as a result of the Proposed Development because it is located in the sea, and these landscapes do not have a strong visual relationship with the sea and their character is fundamentally defined by other characteristics.

Based on the published coastal character assessments, the Proposed Development is located offshore from the following seascape/coastal character areas:

- National – Developed Inner Firths (Type 5), near the boundary with Outer Firths (Type 4) within 'Area 2 – Firth of Forth';
- Regional – Kirkcaldy and Largo Bay (SA14); and
- Local – West Wemyss to Buckhaven (E) and Buckhaven/Methil/Leven (F).

The coastline near the Proposed Development is strongly influenced by urban and industrial development. At Buckhaven, the influence is from residential development and the adjacent Fife Energy Park - an engineering and research zone with easy access to the offshore energy market in the North Sea. The land is formed by industrial development and reclaimed land with a quayside, where large vessels are often moored, large oil-rig sheds, cranes, and other heavy engineering equipment. To the north of the Fife Energy Park lies Methil Docks, a bulk commodity distribution centre, with facilities to accommodate the repair, maintenance and supply of offshore drilling rigs and tankers.

The Proposed Development is located at sea and does not lie within any LCT. The nearest LCT is the Urban LCT covering the settlements of Methil, Buckhaven, Leven, East Wemyss, Windygates and Kennoway on the Fife coast. The coastal parts of the Urban LCT are strongly influenced by industrial and infrastructure development including Methil Docks and Fife Energy Park. The combined settlements are located within a broad floodplain, the setting to which is formed by Coastal Flats, Coastal Hills, Lowland Dens, Lowland River Basin and Pronounced Volcanic Hills & Craigs, and by the seascape of the Firth of Forth(Figures 5.4 and 5.13). Coastal Terraces extend from Elie and Earlsferry along the coast north to Crail.

A local level coastal character assessment is provided as part of the Baseline Description in Section 5.5. This draws on and updates the 'local seascape character units' (CCA) identified in the Forthwind Offshore Wind Demonstration Project Environment Statement, Methil, Fife (Forthwind Ltd, 2015), in light of more recent coastal character assessment guidance (NatureScot, February 2016). This covers the stretches of coastline that may experience significant effects resulting from the Proposed Development:

- Fife coast between Kinghorn and Anstruther; and
- East Lothian coast between Musselburgh and North Berwick (St Baldred's Boat).

The SLVIA considers the effects on seascape character of the Firth of Forth where the ZTV indicates theoretical visibility of the Proposed Development. The north and south banks Firth of Forth itself define the area within which seascape would potentially be affected by the Proposed Development and as such serves as the seascape study area. The effects of the Proposed Development on seascape are assessed in Section 5.7 and considers the effects on CCA as these represent the most detailed descriptions of the coastline within the ZTV.

5.5.2.1. Local Coastal Character Areas (CCAs)

This section of the SLVIA includes the CCAs defined and described for the Fife coastline within the Forthwind Offshore Wind Demonstration Project Environment Statement, Methil, Fife (Forthwind Ltd, 2015). These focus upon visual aspects of seascape character which the Proposed Development is likely to affect. CCA identified within the SLVIA partly overlap with LCT where that LCT has a coastal component. Nonetheless, the coastal character as it consists of a discrete subset of characteristics important to the overall character and quality of landscape character.

Kinghorn Rocky Cliffs

From the headland of Kinghorn Ness in the south, this CCA extends northwards to Seafield Tower and Kirkcaldy. It is characterised by a predominantly rocky coastline backed by low cliffs. A small cove forming a natural harbour at Kinghorn contains the only beach within the CCA. Settlement tends to cluster around the headland of Kinghorn Ness including the villages of Kinghorn and Pettycur.

Low cliffs limit visibility from the shore inland. Seaward views are predominantly of the open water of the Firth of Forth. Views eastwards are expansive and encompass the diverse natural and manmade features along the shore and the wide, open seascapes of the outer Firth beyond. Further northeast, Largo Law is a landmark feature within Fife. To the southeast the East Lothian coast encloses the view against a backdrop of the Lammermuir Hills.

Kirkcaldy Urban Shore

From Seafield Tower in the south, the CCA extends to Dysart Castle in the north. The coastal edge to the south consists of raised beaches dropping down in steps to a sandy beach with groynes. The landward side is characterised by urban and industrial development on gently sloping ground. The coast at Kirkcaldy is lined by a promenade, a wide boulevard and car parking. Behind the shore commercial and retail development predominates, with residential development predominating to the west.

Views are focussed either on Dysart's wooded headland to the north, or on the open water of the Firth of Forth and the East Lothian Coast, to the south. Looking north from Seafield the curve of the bay is very noticeable and is emphasised by the abrupt edge of sea defences and urban development.

Dysart

The CCA largely comprises a wooded headland fringed by beaches interspersed with fragmented rock outcrops. A small harbour lies at Dysart, around which the older part of the village is concentrated. The area has a very distinctive townscape character of crow step gables and terraces of two and three storey cottages facing out onto the Firth.

The harbour is screened by steep landform in landward views.

Dysart to West Wemyss

This stretch of coast is indented by small embayments and is predominantly rural in character, with the remains of coal mining activity at Blair. The northern part of the CCA is well wooded and landward views are limited. Looking along the coast the eye is drawn to the small headlands between each bay while the headland at West Wemyss limits views to the north.

West Wemyss to Buckhaven

The level terrace between West Wemyss and Buckhaven is backed by a raised beach with a series of narrow shingle beaches ending in the headland at Buckhaven. The village of West Wemyss occupies sloping ground and consists mainly of two storey terraced stone built cottages with pantile roofs.

Low cliffs limit landward views from the beaches such that the eye is channelled along the coast in the direction of Buckhaven. The operational LDT is a noticeable feature with Largo Law and the ridge running east from it defining the northern skyline.

Cultural heritage features an important characteristic of the CCA.

Buckhaven / Methil / Leven

This CCA is strongly influenced by urban and industrial development. At Buckhaven the influence is primarily from residential development although the adjacent Fife Energy Park has a strong influence. At Buckhaven the beach is shingle and backed by riprap behind which is a level terrace which rises through the residential areas of Buckhaven.

The Fife Energy Park is an area of industrial development and reclaimed land with an abrupt seaward boundary with the shingle beach having been removed and replaced with a quayside against which barges and other vessels are often moored. Within the Fife Energy Park are large industrial sheds, cranes, and other heavy engineering equipment.

To the north of the Fife Energy Park lies Methil Docks and the site of the dismantled power station which was a prominent feature along the coast at the mouth of the River Leven. The coastline around the power station site is heavily modified by concrete coastal defences. On the east side of the River Leven are broad sandy beaches backed by a level terrace of parks and amenity grassland. The terrace opens out onto a coastal plain on which the residential areas of Leven are located and from which there are views into the Firth and to Largo Law which is notable landmark feature.

Leven Links

Forming the western part of Largo Bay, this section of coast is characterised by broad sandy beaches backed by golf course links. The character of the CCA is open, expansive, and undeveloped with views to Buckhaven and Kincraig Point.

Lower Largo Rocky Shore

The complex and indented edge of this CCA is characterised by rocky shore platforms interspersed with short stretches of sandy beaches backed by a low, sloping cliff occupied by residential development. Gardens descend the cliff to end at a stone-built sea wall. In the eastern section of the CCA the rocky shore platform ends in a narrow band of sandy beach toward the landward side.

East Largo Bay and Links

This CCA comprises a broad sheltered sandy beach backed by heath and rough pasture. The headland of Ruddons Point, jutting into Largo Bay and enclosing the western part of Shell Bay, terminates the CCA in the east. The absence of development and coastal defences lends the CCA a remote and wild character.

Rocky Headlands

This coastline of small bays is enclosed by the headlands of Ruddons Point and Sauchar Point near Elie, to the west and east, respectively. The linear village of Elie lies along the coast of, and looks southward over, a larger bay with a natural harbour formed by adjacent headlands and rocky outcrops.

There are expansive views west to the Kirkcaldy, east along the East Neuk coast and south across the Firth of Forth to East Lothian.

East Neuk Coast

This CCA extends from Sauchar Point in the west to Crail in the east. The shoreline consists primarily of rocky shore platforms with narrow bands of sandy beach gathered against low cliffs that mark an abrupt transition between the seaward and landward areas. The small, compact villages of St Monance, Pittenweem, Anstruther Wester, Anstruther Easter and Crail have a long history of association with the herring industry in the Firth of Forth until the early 1950s when fish stocks collapsed.

5.5.3. Landscape Character Overview

The landscape baseline has been defined by the Scottish Landscape Character Types Map and Descriptions (NatureScot, 2019), which define Landscape Character Types (LCT) that are of an appropriate scale and sufficient detail to allow assessment of the effects of the Proposed Development.

5.5.3.1. Landscape Character Types

This section provides a summary description of the baseline LCTs within a 25 km Detailed Assessment Area, which includes parts of Fife, East Lothian, City of Edinburgh and Perth & Kinross. Where the LCT has strong coastal characteristics the relevant CCA is cross-referenced. As the Proposed Development is located at sea and does not lie within any LCT, the baseline description and assessment begin with the nearest LCT to the Proposed Development, which consists of the urban coastline of Methil and Buckhaven.

LCTs in Fife

Urban LCT (0)

The LCT is not described in the Fife Landscape Character Assessment, although it is identified in the NatureScot GIS dataset of LCTs and is therefore considered in the SLVIA.

The Urban LCT coincides with the settlements of Methil, Buckhaven, Leven, Windygates and Kennoway and the northernmost wind turbine of the Proposed Development is located approximately 1.5 km to the southeast.

The coastal parts of the Urban LCT are strongly influenced by industrial and infrastructure development including Methil Docks and fabrication yard and the decommissioned and dismantled Methil Power Station. The operational LDT wind turbine adds to the industrial scale of development in the southern part of the Urban LCT.

Inland from the coastal strip there are areas of residential, commercial, and light industrial development with Methil and Leven separated by the River Leven. The combined settlements are located within a broad floodplain the setting to which is formed by Coastal Hills, Lowland River Basins, Lowland Dens and by the Firth of Forth.

Other notable areas of Urban LCT lying within the 25 km of the Detailed Assessment Area are Kirkcaldy, Glenrothes, East Wemyss and Lower Largo.

Coastal Hills – Fife LCT (192)

The Coastal Hills LCT is located approximately 1.7 km northwest of the Proposed Development and extends from the western part of Buckhaven to Dysart.

The Coastal Hills LCT is described as having a “close association with the coast, either through views of the sea, the Firths or the estuaries or indirect coastal experiences of sounds, smell etc.” The open undulating fields and the absence of hedges or presence of low hedges means there are extensive views out to sea with landward views enclosed by nearby hills.

Lowland River Basin LCT (190)

The Lowland River Basin LCT is located approximately 3.5 km to the northwest of the Proposed Development and extends from an area of mine workings in the south near Kirkcaldy to Muirhead approximately 2.7 km north of Glenrothes.

The landscape of the Lowland River Basin LCT is low-lying and consists of a wide valley or basin of medium to large scale with a regular pattern of arable fields. The intensive agricultural land use gives rise to an ordered or organised landscape of geometric patterns and linear features with a range of different architectural styles.

Earlseat Windfarm is in the southern part of the Lowland River Basin LCT and exerts a strong influence on the LCT.

Lowland Dens LCT (188)

The Lowland Dens LCT extends from the north of Methil as far east as Kilconquhar 15 km to the east and as far north as New Gilston approximately 13 km to the northeast of the Proposed Development.

The Lowland Dens LCT consists of narrow, deep, gorge-like valleys or Dens that dissect the Coastal Hills and Coastal Terraces LCT. The units of Lowland Dens LCT contain fast flowing burns which often have steeply sloping semi-natural woodland occurring on their banks. The Dens are confined and sheltered places where development is largely absent and landscape pattern is irregular and strongly influenced by landform.

Coastal Flats – Fife LCT (196)

There is one unit of Coastal Flats LCT within 15 km of the Proposed Development. It is located on the east side of Largo Bay approximately 9 km east of the Proposed Development and immediately west of Kincraig Point.

The Coastal Flats LCT consists of flat, low-lying open and large-scale landscapes occurring at sea level. The landscape has an exposed character with open views across the Firth of Forth. Land use is predominantly arable or grazing with a caravan park and commercial forestry in the southeast part of the unit of Coastal Flats LCT at Kincraig Point. Ruddons Point is a notable landform that forms the eastern limits of Largo Bay and encloses the much smaller Shell Bay on its western side. The Fife Coastal Path crosses the Coastal Flats LCT.

Pronounced Volcanic Hills and Craigs LCT (185)

There are five units of this LCT lying wholly or partly within a 15 km radius of the Proposed Development:

- Clatto / Hill of Tarvit (6.3 km to the north of the Proposed Development). This large unit extends from Kennoway in the south to Cupar in the north and from Muirhead north of Glenrothes, in the west to Peat Inn and Drumcarrow Hill in the east. It contains rounded hills such as Hill of Tarvit and Cults Hill;
- Largo Law (9 km to the northeast of the Proposed Development). This small unit is centred upon the upper slopes of the dome shaped hill of Largo Law that forms a prominent feature on the skyline in views across the Firth of Forth;
- Kincraig Point (9.5 km to the east of the Proposed Development). This small unit is centred upon the headland of Kincraig Point that encloses the east side of Shell Bay and is crossed by the Fife Coastal Path;
- Glassmount (11.5 km to the southwest of the Proposed Development). This large unit lies to the west of Kirkcaldy and extends as far west as the M9 motorway approximately 26 km to the southwest of the Proposed Development. It consists of an undulating plateau that slopes steeply down to a narrow coastal shelf at Burntisland and Kinghorn; and
- Kinglassie (11.5 km to the west of the Proposed Development). This unit lies to the west of Glenrothes and immediately to the north of Kinglassie. It includes the Goatmilk Hills in the east. The landscape is modified by the opencast coal workings to the west of Kinglassie.

Lowland Hills and Valleys LCT (186)

There is one unit of this LCT within the 25 km Detailed Assessment Area from which there will be visibility of the Proposed Development as indicated by the ZTV (see Figure 5.14). The unit lies between Kirkcaldy and Thornton and extends as far west as Dunfermline. The closest part of the Lowland Hills and Valleys LCT to the Proposed Development is near Dysart approximately 6 km to the southwest of the Proposed Development.

The Lowland Hills and Valleys LCT is described as having a variety and subtlety of landform with extensive areas of plantations, shelter planting, roadside planting and policies linked to estates. The unit is strongly influenced by infrastructure such as the A92 dual carriageway, the rail junction at Thornton and a network of pylons and power lines in the east.

Hill Slopes LCT (183)

There is one unit of this LCT located approximately 10 km to the northwest of the Proposed Development immediately to the north of Glenrothes.

The LCT is described as consisting of highly conspicuous slopes and skylines often defining the edge of other landscape types and with extensive, panoramic, and elevated views across substantial distances and many other landscape types. The unit forms the lower slopes to East Lomond (424 m) which is a conical hill at the east end of the Lomond Hills and a prominent landmark feature in views from locations in Fife and East Lothian.

Foothills - Fife LCT (184)

There is one unit of this LCT located approximately 13 km to the northwest of the Proposed Development adjoining Glenrothes to the northwest.

The Uplands LCT is described as open, large scale rolling hills of upland pasture with peaks, knolls, and ridges. The landscape is vast in scale, exposed and open with extensive, panoramic, and elevated views across substantial distances and many other landscape types.

Coastal Terraces LCT (193)

This linear LCT occurs on the east side of Largo Bay extending as far as Crail approximately 27 km to the east northeast of the Proposed Development. The nearest part of the LCT to the Proposed Development is at Lower Largo approximately 7.5 km northeast of the Proposed Development.

The Coastal Terraces LCT is described as mostly flat or gently sloping landform of medium to large scale with extensive views of the coast and seaward to the Firth of Forth. The unit of LCT to the east of Lower Largo is largely undeveloped with land use consisting primarily of agriculture with the main coastal road of the A917 passing through the Coastal Terraces LCT and connecting the villages of the East Neuk including Elie, St. Monans, Pittenweem, Anstruther Easter, Anstruther Wester and Crail.

LCTs in East Lothian

Coastal Terrace - Lothians LCT (278)

The Coastal Terrace – Lothians LCT occurs in East Lothian, extending from Dunbar in the east to the edge of Port Seton in the west. The area is virtually flat immediately inland of the coast, consisting of raised beach deposits. Crags and rocky outcrops form much of the northern coastal edge and enclose numerous sandy coves backed by dunes, and several rocky islands just offshore in the Firth are included in this Landscape Character Type. The estuaries of the Tyne and Peffer Burn are along this coastline. The key characteristics include is diverse coastal scenery and habitats, comprised of crags and rocky outcrops interspersed with wide sandy beaches, estuaries and quiet coves backed by dunes; and the distinctively shaped prominent rocky islands, including Bass Rock, Craigleith and Fidra, close to the coast providing local focus to sea views. There are also numerous designed landscapes with policy woodlands and built elements forming important landscape features, including coastal villages, towns and settlement expansion. There are extensive views across the sea and inland to the Lammermuir Hills.

Settled Coastal Farmland LCT (279)

The Settled Coastal Farmland Landscape Character Type is located primarily in East Lothian, extending from the eastern margins of Edinburgh in the west to the eastern side of Port Seton in the east. The coastline consists of low rocky platforms, small rocky headlands and sandy beaches, with a well settled coastal fringe, and prime agricultural land inland. It is defined by the Tranent Ridge and valley of the River Esk to the south. Its key characteristics include the coastline of low rocky platforms, small rocky headlands and sandy beaches; and the almost continuously settled coastal strip giving the area an overall dominant urban/industrial character. There are also prominent main road and rail transport corridors, as well as a dense network of minor roads. Views across the coastal plain are often curtailed by development, especially in the westernmost part of this LCT and vertical structures create visual clutter.

5.5.4. Landscape Planning Designations Overview

The SLVIA Study Area includes areas designated for their landscape value as defined in Figure 5.3. While the SLVIA Study Area does not include any NSAs, National Parks or Wild Land Areas, there are landscape designations of local importance with potential to be affected by the Proposed Development.

There are also a number of GDLs within the SLVIA study area, which are of national importance and while they are not afforded statutory protection, local authorities are required to make provision for the protection of the historic environment when preparing development plans and determining planning applications. The SLVIA deals with the potential effects of the Proposed Development upon views to and from GDL and considers the contribution they make to landscape character and the effects of the Proposed Development on this aspect. Chapter 12: Cultural Heritage of this EIAR describes the assessment of effects on the cultural heritage assets of GDL. The Proposed Development has the potential only to result in effects on views to and from and on the setting of GDL, therefore the SLVIA has focussed upon those GDL lying within a 10 km radius of the Proposed Development. Newhailes House, 24.8 km from the Proposed Development, has been included following consultation with East Lothian Council (see Table 5.1)

This section provides a summary description of the baseline conditions of areas designated for their landscape value, focusing on those within the 25 km Detailed Assessment Area.

Landscape Designations within Fife

Cullaloe Hills and Coast LLA

12.4 km to the southwest of the Proposed Development, this large area (6,038 ha) covers the area between Rosyth, Kirkcaldy, the coastline and the A92. The coastal boundary skirts the settlements of Dalgety Bay, Aberdour, Burntisland and Kinghorn. From Dalgety Bay, the remaining boundary runs along the B981 to include the grounds of Fordell Castle; follows a minor road to the B925 to run south of chemical works south of Cowdenbeath; and turns north at Auchtertool to follow line defined by linear woods to Kirkcaldy. The boundary largely follows that of Kirkcaldy to the coast.

The area is characterised by the upland topography of the Cullaloe Hills, which reach 219 m in height. Mixed woodland and forestry plantation covers the hills. Quarry workings lie on their northern slopes and two follies (Cullaloe Temple and Cullaloe Tower) are located within the woodland. Tree cover within the area is relatively high with small water bodies and several lochs also present. Due to the topography both elements tend to be sporadic and are dispersed over the whole area. The A921 runs along the coast, largely in parallel with a rail line. The A909 runs across the area to Cowdenbeath from Burntisland.

East Neuk LLA

This area comprises: a coastal area broadly defined by Lower Largo, Kilconquhar and Elie and Earlsferry, extending along the coastline to St Monans; an area centred on Balcaskie House and its estate; and two areas of coastline between Pittenweem and Anstruther, and Anstruther and Crail. At its nearest point, the LLA lies 7.4 km northeast of the Proposed Development.

Around Elie and Earlsferry, the largest area (982 ha) comprises unenclosed grassland to the west and farmland to the east. An extensive woodland is central to the area with further woodland surrounding Elie House adjoining the eastern boundary. A loch abuts Kilconquhar to the south. To the west, a caravan park extends from the coast to St Ford Links and the larger woodland. Elie House and Elie golf courses lie on the coast west of the settlement. From the north, the A917 to Elie traverses the area.

To the east, the next area (805 ha) extends to the coastline between St Monans and Pittenweem with the B942 and minor roads connecting to the A917 defining the remaining boundaries. Balcaskie is central to the area with Grangemuir House on the eastern boundary. The two houses are enclosed by woodland, heavily so at Balcaskie, with the remaining area consisting of largely open farmland. Between Pittenweem and Anstruther and Anstruther and Crail, the two small areas of coastline (23 and 225 ha, respectively) extend to the A917 and comprise open farmland settled by a few farmsteads.

Largo Law LLA

Located 6.7 km northeast of the Proposed Development, the primary characteristic of this 2,855 ha area is the 290 m high hill of Largo Law. The 202 m high Flagstaff Hill lies just to the east. From Pirrwindy at its north-west, the area is defined by a minor road adjoining the B941 at Largoward, to the north; extends to take in the Clachreid Ha' Wood and Kilbrackmont Knock, to the east; is defined by the B941 and A917, to the south; and Boghall Burn to Pirrwindy from Lower Largo, to the west. Primarily farmland with moorland on the hills, the area largely unwooded to the west with increasing tree cover in blocks and group to the east.

Lomond Hills LLA

Lying 11.2 km northwest of the Proposed Development, this area of 5,770 ha is defined by the A91 and A912 roads, to the north and east, respectively; the northern edge of Glenrothes, and the western council area boundary, to the south and west respectively. The small settlements of Gateside and Strathmiglo abut the northern boundary with Falkland lying on the eastern boundary. The hills of West and East Lomond, Fife's most prominent landmarks, characterise the area. Moorland covers the hills with a large area of forestry covering the northern slopes. Patches of woodland are dispersed throughout the surrounding farmland, often adjoining reservoirs, several of which lie to the southwest. The area broadly coincides with the Lomond Hills Regional Park, the first in Scotland and established in 1986.

Wemyss Coast LLA

3.8 km to the west of the Proposed Development, this area comprises 691 ha of hinterland between Kirkcaldy to East Wemyss and extending between the coastline and Standing Stane Road. The area does not cover Coaltown of Weymss, in the centre of the area, and West Wemyss to its south, on the coast. The area is largely agricultural with several farmsteads and a high level of tree cover. Blair Den, Chapel and Crow Park Woods line the coast to East Wemyss. Cowdenlaws Strip, Forester's Moor, Forester's Strip and Standingstone Park Plantation provide woodland screening along Standing Stane Road. Abutting East Wemyss to the north, Wemyss Den provides tree cover on the eastern boundary. Running loosely parallel to but offset from the coast, the A955 is the only major road within the area.

Landscape Designations within East Lothian

Fisherrow Sands SLA

This area 23.2 km south of the Proposed Development is centred on the estuary and mudflats of the River Esk, the largest river in East Lothian. It covers the area between the end of the bird scrapes at Levenhall Links at the Ash Lagoons and the boundary with the City of Edinburgh Council area, encompassing Fisherrow Harbour. An apparently natural area, it forms a buffer between urban development and the sea. Due in part to its proximity to main population centres, the area is well used for outdoor recreation with Levenhall Links and the River Esk being particularly important for outdoor recreation.

Prestonpans Coast SLA

Located 21.9 km to the south of the Proposed Development, this area comprises the setting of Prestonpans and includes its narrow, rocky foreshore; mature woodlands within the Royal Musselburgh Golf Course and at Drummohr House to its west; and open spaces at Morrison's Haven and Preston Links to the west and east of Prestonpans, respectively. A historic area, it has strong links to the sea as well as mining and salt panning and the more recent power station to the east. Views east and west along the coastline and north to Fife, across the Firth of Forth, are high in scenic value. Recreational value derives from proximity to Prestonpans with features including the John Muir Way, Prestongrange Mining Museum, Royal Musselburgh Golf Course and open links at Morrison's Haven, Green Hills at Preston Links, and a camp site at Drummohr.

North Berwick to Seton Sands Coast SLA

The heart of East Lothian's recreational coast, this area 16.0 km to the southeast of the Proposed Development, includes attractive, popular beaches; world class golf courses, the expansive Aberlady Bay nature reserve and several Gardens and Designed Landscapes. Its coastline is divers with low rocky headlands, estuaries, sandy beaches, and rare mobile sand dunes. The islands of Fidra, Lamb and Craigleith form part of the iconic seascape. Running along the coast from the east side of Port Seton, the SLA is backed by mixed deciduous native wooded valleys and wooded Gardens and Designed Landscapes. The coastline is complemented by traditional towns, villages, and historic settlements with highly scenic views from and of the area. The coast has high recreation value derived from the sea, beaches and links golf courses which include Muirfield at Gullane and the Renaissance course at Dirleton.

Tantallon Coast SLA

This area 17.2 km southeast of the Proposed Development, is the least developed and most wild and remote area of mainland coast in East Lothian. Its rugged and diverse coastline is highly scenic with rocky cliffs and headlands at North Berwick and Tantallon, and small sandy coves giving way to expansive windswept beach at Peffers and Ravensheugh Sands. The cliff edge is backed by a wide strip of agricultural fields that are bounded by the A198 North Berwick to Whitekirk road inland. Medieval castles, secluded hamlets and harbours contrast with the landform and the sea. The open and expansive coastal setting provides clear views out to the sea and the islands of the Firth of Forth with the iconic presence of Bass Rock within the seascape. Views are panoramic and strongly influenced by the dramatic effects of changing light and weather conditions at sea.

North Berwick Law SLA

This area covers the hill of North Berwick Law and some of the farmland and boggy ground in which it is set. The 257 ha area immediately to the south of North Berwick, lies 21.4 km to the southeast of the Proposed Development. The hill is one of the largest and most prominent volcanic intrusions into fertile arable land in East Lothian. The distinctive conical hill rises dramatically from the surrounding gently rolling farmland and is recognisable from across East Lothian and as far as from Edinburgh, Fife, and the Forth Bridges. The area is high in scenic value due to the prominence and contrast of the Law in comparison to its setting. Views from the top of the Law, marked by whale bones, are panoramic and look over the Firth of Forth to Fife; across farmland to Bass Rock and Tantallon Castle; down the East Lothian and Berwickshire coast; towards the Garleton Hills and the Lammermuir Hills beyond; and up the Forth Estuary to Edinburgh and the Pentlands. North Berwick Law is a Marilyn, one of the Relative Hills of Britain and the John Muir Way runs to its west.

Gardens and Designed Landscapes (GDL)

This section provides a summary description of the baseline conditions of GDL within the 25 km Detailed Assessment Area.

Balbirnie GDL

Adjoining the eastern built-up edge of Glenrothes and north of Markinch, the 140 ha is bounded by Stobb Cross Road to the east and the north; the B9130 to the south; and the A92 for much of the western boundary. The Balbirnie Back Burn flows through the park from the northwest to the east. Balbirnie House is central to the designed landscape, which contains grassland, wetland, and woodland shelterbelts around the perimeter. In combination with landform these restrict internal views to the former policies and screen the elements of the designed landscape from external views. The inventory attributes some scenic interest to Balbirnie arising from its expansive mixed woodland shelterbelt which contrasts with the adjacent suburbs of Glenrothes to the south, east, and west in views from various locations within the Lomond Hills.

Balcarres GDL

Balcarres is in the East Neuk of Fife, 5 km north of Elie and 4km inland from the Forth shore. One of a series of designed landscapes on the Methil-Elie coastal terrace, it is bounded to north and east by the steep-sided, wooded Den Burn; the B942 Colinsburgh road to the south; to the west, minor roads and shelterbelts abutting the Charleton House policies. The parkland, policies, and category A listed house with spectacular formal gardens are highly visible from nearby roads, make skilful use of the surrounding topography and define a distinctive local landscape character. The inventory considers the parklands, woodlands, policy plantings and Craig Tower to have an outstanding scenic interest.

Charleton House GDL

Located in the East Neuk, 4.5km east of Lower Largo, Charleton House is one of a series of designed landscapes on the Methil-Elie coastal terrace, which is cut by a series of lowland dens. The estate adjoins Balcarres on the southern slopes of Flagstaff Hill, part of the volcanic Pronounced Hills and Crags at Largo Law and Largoward. Shelter belts and woodlands define the estate's boundaries except the south boundary, which is defined by the B942. The area is characterised by gently undulating arable farmland, with beech shelter belts and policy planting and the combined Charleton and Balcarres policies define a distinctive local landscape character. There are views into the parkland from Colinsburgh Road, with views outwards and southwards from the terraced gardens and South Park to the Firth of Forth. Charleton House is an early to mid-18th century formal landscape which is considered to have a high level of scenic interest.

Dysart House and Ravenscraig Park GDL

Dysart House and Ravenscraig Park lies within a suburb of Kirkcaldy adjacent to the A955 Dysart Road and extends across a clifftop above Dysart Harbour. The public park opened in 1929 and includes a remarkably intact 18th century core at a 16th century Christian pilgrimage site. Dysart House's elevated position to the north of the harbour allows views over the Firth of Forth, which are screened by mature trees in the lower garden levels from the top terrace. The formal garden is entirely walled and bounded by Shore Road and Rectory Lane to the south and north, respectively. To the west Hot Pot Wynd, which leads to the harbour, separates the park from the house. Views south from Ravenscraig Park are panoramic and look over the Firth of Forth. Ravenscraig Park has some scenic interest as the wooded garden of the Carmelite monastery provides an important area of woodland and strategic open space in an otherwise urban setting.

Lahill GDL

5km east of Lower Largo, in the East Neuk, Lahill adjoins Charleton House north of the A917 Lower Largo-Elie road. One of a series of designed landscapes on the Methil-Elie coastal terrace, the designed landscape lies on the southern slopes of Lahill Craig, the highest point of Newburn parish at 239 m above sea level. The designed landscape has changed very little since 1854 and its boundaries remain unchanged.

The mid-19th century villa and gardenesque landscape is relatively rare and modest in scale. Views limited to the inner parkland and haughland contrast with long-distance panoramic views from the south garden terraces over the Firth of Forth to the East Lothian coastline. From within the policies, views north are dominated by Largo Law. Views from the drive take in the length of the designed landscape and Lahill House during the final stages of the hill-approach.

The gardenesque parkland planting and improvement field system is of some level of scenic interest.

Leslie House GDL

Located at the eastern end of Leslie High Street within a suburb of Glenrothes, Leslie House sits above the River Leven on the south side of the A911. The designed landscape occupies a sheltered valley formed by the River Leven with long-distance axial views along the East and West avenues, and south over the terraced gardens to the tree-clad south bank of the River Leven.

While the underlying structure of the gardens and some of the major features of the policies along the river have survived as Glenrothes has expanded, the ornamental policy boundaries have contracted. Extensive parks to the north, alongside policy woodlands south of the River Leven, survived until the early 1960s, when the south parks were developed for housing. A public park, 'Riverside Park', was also laid out within a major part of the designed landscape south-east of the house.

The 17th century formal garden and designed landscape is rare and well documented, with some modifications from the 18th–20th centuries. The surviving wooded policies provide important amenity to the town of Glenrothes and have outstanding scenic value and interest.

Newhailes House GDL

The designed landscape is located approximately 24.8 km south of the Proposed Development and just west of the Fisherrow Sands SLA.

Although enclosed on its south-west and south sides, Newhailes House stands centrally on a slightly elevated plateau above Musselburgh with extensive views out to the north-east and the Firth of Forth. North Berwick Law is a focal point in these views while there are also views north to the Firth of Forth from the Terrace Walk in the park.

The landscape of the GDL is described as making an outstanding contribution to the surrounding landscape and there are panoramic views from Newhailes House to the Firth of Forth, the Lothians, the Bass Rock, the Lammermuir Hills and the Edinburgh hills.

The Inventory attributes a high scenic value to the GDL due to its function as an important green buffer between suburban areas on the outskirts of Edinburgh.

Raith Park & Beveridge Park GDL

Raith Park adjoins the west of Kirkcaldy and is bounded by the A910 Kirkcaldy-Glenrothes and B925 Kirkcaldy-Auchtertool roads to the north and south, respectively.

The landscape is highly distinctive with the policies ranged over the easternmost point of the Cullaloe Hills. The pronounced hills with recognisable peaks and steep slopes, give long-distance views over the lower coastal areas fringing the Forth and, to the north-west, to the Lomond Hills. Raith House is situated on a ridge midway between, and linking, Cormie Hill and Castle Hill. The Dronachy Burn forms a deep, narrow glen. It rises in Auchtertool and flows into Raith Lake, artificially formed at the foot of Sunnybrae and Castle Hill.

To the north-west, principal views were originally gained of the Lomond Hills, now obscured by heavy tree cover. Extensive views to the Firth of Forth, North Berwick Law and Arthurs Seat are obtained from Raith House. A panoramic view of Raith House set in its designed landscape is obtained from the ridge to the south, at Balwearie, over Boglily Braes.

A late 18th - early 19th century picturesque park that overlays an earlier formal landscape, the site is attributed high scenic interest as the policies define the rural landscape on the fringes of Kirkcaldy and form important features in long-distance views from adjacent hills

Wemyss Castle GDL

The site has a long history of gardening, with the current structure resulting from the overlaying of an 18th - 19th century landscape over an earlier formal landscape from the 15th century associated with West Wemyss Castle and Chapel tower-house.

Wemyss Castle Park extends across coastal hills directly north-west of West Wemyss; the policies lie south of the A955 Kirkcaldy-Methil road, stretching between East Wemyss and West Wemyss. Coaltown of Wemyss lies on its north-west boundary. The extent of the designed landscape remains unchanged.

The Wemyss Castle designed landscape is of outstanding scenic interest due to its picturesque character and vital coastal link between the settlements of East and West Wemyss.

Regional Parks

Regional Parks are large areas of attractive countryside which lie close to Scotland's larger towns and cities and are popular for outdoor recreation. The parks have been created to provide co-ordinated management for recreation alongside other land uses such as farming and forestry.

There are two Regional Parks lying within the 25 km Detailed Assessment Area: The Lomond Hills Regional Park (LHRP) and the Pentland Hills Regional Park. The Lomond Hills Regional Park is centred on the Lomond Hills and covers an area of approximately 6,645 ha. The two most noticeable hills are West Lomond (522 m) and East Lomond (424 m) which are prominent landmarks within Fife and from East Lothian. The south-eastern edge of the Park lies approximately 11 km northwest of the Proposed Development.

The Pentland Hills Regional Park lies approximately 31 km southwest of the Proposed Development and the ZTV (Figure 5.15) indicates fragmented and partial theoretical visibility of it from the park. Given the long distance between the Park and the Proposed Development, and the fact that it would be indirectly affected, it is not considered further in the SLVIA. The Lomond Hills Regional Parks is assessed in Section 5.7.

Lomond Hills Regional Park

Formerly Fife Regional Park, Lomond Hills Regional Park (LHRP) covers approximately 65 km^2 of mostly privately owned land, with a lesser area in public ownership and belonging to Fife Council and Scottish Water.

LHRP comprises two separate areas: a western area including Lochore Meadows Country Park and its surrounding countryside, incorporating parts of Benarty Hill; and an eastern area including most of the Lomond Hills, parts of the River Leven Valley and Balbirnie Park. Lochore Meadows provides the administrative base and main area for intensive recreational activities with a Visitors Centre, Outdoor Education Centre, and workshops. The Pitcairn Centre is the base for the Ranger Service and Estate Team in the east of the Regional Park.

LHRP includes two prominent peaks, West Lomond, and East Lomond (or Falkland Hill), just under 5 km apart above a long 10 km north and west-facing escarpment. The source of the River Eden, one of the two primary rivers in Fife, lies on the slopes of West Lomond. Maspie Burn and the Arraty Burn run down the northern slopes of the Lomond Hills from the plateau between the two hills in impressive gorges.

Steep gradients and poor soil mean that land uses on the hills are predominantly sheep grazing, commercial forestry, and water catchment: there are six reservoirs in the Lomond Hills. Proximity to major settlements and good accessibility makes the hills are very popular with walkers. Both can easily be climbed from Craigmead Car Park, between the two and lying at approximately at a height of approximately 300 m AOD; Bunnet Stane; the village of Falkland and the East Lomond car park. Both summits afford long, uninterrupted, and panoramic views from the Highlands to the Borders, with the sea in the east.

Easy access means the Lomonds are also popular for paragliding and mountain biking on wooded tracks on the northern slopes of East Lomond. The annual Falkland Hill Race is held between the fountain in the centre of Falkland village and the summit of East Lomond.

5.5.5. Visual Baseline – views and visual amenity

The visual baseline focuses on and describes the area in which the Proposed Development may be visible, as defined by its Zone of Theoretical Visibility (ZTV); the different groups of people who may view it; the viewpoints where they will be affected; and the nature of views at those points.

Zone of Theoretical Visibility (ZTV)

The ZTV (Figure 5.8) shows that the Proposed Development will not be visible from areas shown in 'white' in the mapping with no ZTV colouring, where the terrain prevents views of the Proposed Development. Notably, these areas where the Proposed Development will not be visible include:

- The seascape and coastline north of Fife Ness extending outside the SLVIA Study Area, including St Andrews Bay, and the Firth of Tay;
- The seascape of the inner firth, west of Kinghorn on the north shore, and west of Queensferry on the south shore, including the bridges across the Forth;
- Much of the East Neuk coastline, east of Sauchar Point, and the Lothian coast, east of North Berwick, where the orientation and indentation of the coastline combine to restrict visibility;
- The larger part of northeast Fife including the settlements of Ladybank, Cupar and St Andrews, due to low hills lying between 10-20 km from the Proposed Development;

- The northwest of Fife into Perth and Kinross, and including the settlements of Perth and Auchterarder, due to the screening effects of the Lomond Hills; and
- Southwestern Fife and Clackmannanshire, including Dunfermline, Clackmannan and Tillicoutry.

The ZTV (Figure 5.8) shows that the main areas of theoretical visibility of the Proposed Development will be from the open seas within the 50 km SLVIA Study Area; the outer firth of the Firth of Forth and much of the adjoining coastline on both shores of the firth; much of eastern Fife within 20 km of the Proposed Development; and, less consistently, much of the Lothians within 40 km of the Proposed Development. Notable areas where the Proposed Development will be visible include:

- the Fife coastline between Pettycur and Sauchar Point, which lies within 20 km of the Proposed Development, and includes the settlements of Kirkcaldy, Dysart, West and East Wemyss, Buckhaven, Methil, Leven, Lundin Links, Lower Largo, and Elie and Earlsferry;
- the Lothian coastline between South Queensferry and St Baldred's Boat, which lies between 15-30 km from the Proposed Development, and includes Edinburgh, Musselburgh, Prestonpans, Cockenzie and Port Seton, and North Berwick;
- the coastal areas of east Fife between Kinghorn and Crail in the East Neuk, which generally extends to around 5 km inland but extends nearly 20 km inland towards the Lomond Hills in the northwest to include Glenrothes; and
- the more inland areas within the Lothians over 30 km from the Proposed Development, between Livingston and Dunbar where the Pentland, Moorfoot and Lammermuir Hills interrupt its theoretical visibility.

Visual Receptors

The principal visual receptors in the SLVIA Study Area are focused along the closest sections of the Fife and East Lothian coastlines, including people within settlements, driving on roads, visitors to tourist facilities or historic environment assets, and people engaged in recreational activity such as on walking and cycle routes where the sea is a strong influence in the baseline view.

Broadly, the principal visual receptors are identified as follows:

- **Coastal settlements.** The larger settlements within the ZTV generally lie on the coastline, where the focus of views is typically 'coast across sea to land' or 'land to sea'. The principal coastal settlements with capacity for views of the Proposed Development (with approximate distance to the wind turbine) are: Anstruther (16.8 km); Buckhaven (1.4 km); Crail (25 km); Dysart (7.0 km); East Wemyss (3.3km); Elie and Earlsferry (10.1 km); Glenrothes (7.7 km); Kennoway (5.1 km); Kirkcaldy (7.0 km); Leven (1.4 km); Lower Largo (5.6 km); Lundin Links (5.6 km); Methil (1.4 km); Pittenweem (16.8 km); St. Monans (14.8 km); West Wemyss (5.6 km); and Windygates (4.3 km).
- **Roads**. The ZTV covers part of the road network and includes major and minor roads that the Proposed Development has the potential to affect: the A92, A911, A912, A914, A915, A916, A917, A921, and A955. Following comments from ELC on the previous (2019) Scoping Report, the A6137 and the A198/B1348 coastal route have been included within the assessment.
- **Long distance paths.** The principal long-distance paths with potential views of the Proposed Development are: The Fife Coastal Path, which follows the coast between Kincardine and Newburgh and has potential visibility of the Proposed Development from the stretch of the path between Kinghorn and Anstruther West; and the John Muir Way which runs west to east from Helensburgh on the Firth of Clyde, to Dunbar on the Firth of Forth, passing through many of East Lothian's coastal settlements with potential visibility of the Proposed Development between South Queensferry and North Berwick.
- **Long distance cycle routes.** Sustrans National Cycle Routes (NCR) which pass through the ZTV are NCR 1, which connects Dover with Shetland via the east coast of England and Scotland; NCR 76, which links Berwick-upon-Tweed to Edinburgh, Stirling, and St Andrews; and NCR 766, which joins Kirkcaldy to Milldeans Wood north of Glenrothes and links NCRs 1 and 76.

- **Golf Courses.** In response to comment within the 2019 Scoping Opinion, effects on views experienced from two golf courses, Muirfield and Renaissance, are assessed within the SLVIA. Both have theoretical visibility of the Proposed Development, as indicated by the ZTV (Figure 5.9); views across the Firth of Forth and have potential to be affected by the Proposed Development**.**
- **Country Parks.** Country Parks are non-statutory designated areas of land close to towns and cities that are managed to provide open air recreation and convenient opportunities to enjoy the countryside for people. Of the three Country Parks in Fife: Craigtoun, Lochore Meadows and Townhil, only Loch Ore Meadows has the potential to be affected by the Proposed Development, as indicated by the ZTV (Figure 5.10). There is one Country Park in East Lothian: John Muir Country Park, which has no potential visibility of the Proposed Development and is not considered further.

Lochore Meadows Country Park

Lochore Meadows Country Park lies 3.2 km north of Lochgelly. Based around Loch Ore, the 485 ha park includes wildflower meadows, park land, ancient woodlands, a beach, an adventure playground for children and several trails, many of which are wheelchair and mobility scooter accessible. At the Park Centre facilities include free car parking, accessible toilet and baby changing facilities and mobility scooters for hire.

Popular as a place for picnics and barbecues, the park provides for leisure activities such as birdwatching and cycling, in addition to organised activities of golf, fishing, orienteering, water sports and mountain biking. It is a major centre for outdoor and leisure in Fife.

Muirfield Golf Course

Muirfield is one of the oldest clubs in golf and its world famous course is used in rotation for The Open Championship. Muirfield is also the home of The Honourable Company of Edinburgh Golfers, being sited at its current location in East Lothian in 1891. The course has changed little since 1936.

The course adjoins the West Links and dunes of the coastline to the north. To the east, woodland separates the course from the Renaissance golf course. To the south, the course abuts open farmland and urban development in Gullane. The dunes and scrub of Gullane Bents are separated from the course by woodland screening. A large wood, Jamies Neuk, lies on the coastline to the northwest.

Renaissance Golf Course at Archerfield

The 300 acre Renaissance course is located near the historic village of Dirleton and 4.8 km from North Berwick on the golfing coastline of the Firth of Forth. Renaissance is the only portion of the 404 ha Archerfield Estate remaining on the windswept dune landscape along this coastline.

The woodland of Broad Wood bounds much of the course's perimeter, with further woods to the west at West Strip, and south at Halfmoon Plantation. Further woods abut the northern boundary, separating the course from the coast. To the northeast, residential development at Muirfield View adjoins the course. Further afield, the sandy shores of the Firth of Forth lie to the north. To the east are the Archerfield Links, with the world-renowned North Berwick West Links beyond. Adjoining to the west is the world famous Muirfield golf course.

5.6. Development Design Mitigation

Within the design process, subject to the parameters of the seabed lease available, other environmental sensitivities and economic and technical constraints, efforts have been made to increase the distance of the turbine from the shore to reduce its potential effects on the closest receptors.

A range of standard mitigation measures have already been applied to the Proposed Development as part of the over-arching site selection and iterative design process. These have been introduced in order to minimise potential impacts of the Proposed Development on any affected receptors.

Standard mitigation measures which the Proposed Development has already implemented, or is committed to in the future, in order to minimise potential impacts on seascape, landscape and visual receptors are listed below.

- Maximum blade tip height is 280m from HAT and maximum rotor diameter of 255m.
- The colour of the WTG tower and blades will be RAL 7035 (light grey) from 15 m above water line which provides standard mitigation as a recessive colour in the seascape/sky backdrop.
- The Proposed Development will comply with legal requirements with regards to shipping, navigation and aviation marking and lighting.
- A lighting scheme for the aviation lighting of structures (turbine and met mast) above 60m in height will be agreed with the relevant authorities. Aviation warning lights will have reduced intensity at and below the horizontal and allow a further reduction in lighting intensity from 2,000 candela to 200 candela will be applied when the visibility in all directions from every wind turbine is more than 5km.

5.7. Potential Seascape, Landscape and Visual Effects

A detailed description of the Proposed Development is contained in Chapter 3: Project Description of this EIAR. The components of the Proposed Development most likely to affect landscape and visual resources and the stages of the development life cycle at which such effects are likely to occur are identified in Table 5.7.

Table 5.7 – Potential Effects on Seascape, Landscape and Visual Resources

Development stage	Development component / activity	Potential effect
Construction	Erection of wind turbine tower, nacelle, and rotor and meteorological mast. Laying of export cable and landfall of the export cable. Construction of the transformer and ancillary buildings.	Short term and reversible effects of vessels and cranes in the Firth of Forth. Short term and reversible effects of cable trenching at the landfall of the Export Cable. Short term and reversible effects of construction plant and materials at the sub-station and control building location within Fife Energy Park.
Operation	Presence of the operational wind turbine and meteorological mast in the Firth of Forth.	Long term and reversible effects on aesthetic and perceptual aspects of landscape resources. Long term and reversible effects on visual resources.
Decommissioning	Dismantling of the wind turbine and meteorological mast.	Short term and reversible effects of vessels and cranes in the Firth of Forth. Short term and reversible effects of construction plant and materials at the sub-station and control building

A number of potential activities or impacts have been scoped out from further assessment, resulting from a conclusion of no likely significant effect as set out in Table 5.8. These conclusions have been made based on the knowledge of the baseline environment, the nature of planned works and the wealth of evidence on the potential for impact from such projects more widely.

Table 5.8 – Activities or Impacts Scoped Out of the Assessment

Phase	Activity or impact	Justification for scoping out
Construction and decommissioning	Construction and decommissioning phase seascape, landscape and visual impacts of the Proposed Development	The 50 km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond

Phase	Activity or impact	Justification for scoping out
	outside the 50km radius SLVIA study area (Figure 5.1).	50km due to the limited changes to views arising from the Proposed Development at distances of over 50 km.
	Impacts of the construction and decommissioning of the Proposed Development on physical aspects of landscape character.	Due to the location of the Proposed Development offshore, it will only impact on the perception of character and qualities – which is considered as an indirect effect in LVIA. No physical attributes that define landscape character or special qualities of designated landscapes will be changed as a result of the Proposed Development.
	Impact of the Proposed Development lighting on seascape and landscape character at night during construction and decommissioning.	The matter of visible aviation lighting assessment is assessed as wholly a visual matter as it is considered that the proposed aviation lighting will not have significant effects on the perception of landscape or seascape character, which is not readily perceived at night in darkness. No attributes of seascape or landscape character will be changed as a result of the lighting of the Proposed Development.
Operation and maintenance	Operation and maintenance phase seascape, landscape and visual impacts of the Proposed Development outside the 50 km radius SLVIA Study Area (Figure 5.1).	The 50km radius SLVIA study area is defined to an outer limit within which significant effects could occur. Significant effects will not occur beyond 50km due to the limited changes to views arising from the Proposed Development at distances of over 50 km.
	Operation and maintenance phase seascape, landscape and visual impacts of the Proposed Development on receptors located outside the ZTV (Figure 5.8).	The Proposed Development will have no impacts on receptors located outside the ZTV i.e. those which have no views/visibility of the Proposed Development. All seascape, landscape and visual receptors located outside the ZTV (Figure 5.8) are scoped out and not assessed any further.
	The seascape, landscape and visual effects of the operation of the offshore cable route.	Cable is located below the sea surface so would not be visible as part of the seascape or views once operational and would therefore have no operational effect on seascape, landscape and visual receptors.
	Impact of the array area lighting on seascape and landscape character at night during operation and maintenance.	The matter of visible aviation lighting assessment is assessed as wholly a visual matter as it is considered that the proposed aviation lighting will not have significant effects on the perception of landscape or seascape character, which is not readily perceived at night in

Phase	Activity or impact	Justification for scoping out
		darkness. No attributes of seascape or landscape character will be changed as a result of the lighting of the Proposed Development.

5.7.1. Construction and Decommissioning Effects

The construction and decommissioning of the Proposed Development does not require the creation of a new quayside or access roads. The Export Cable will be installed within a High Density Polyethylene (HDPE) duct placed in trenching dug using excavators from the onshore site, through the sea defence rock and soils, the beach area and the shallow tide limit to the offshore cable section. As such effects will be short term, very localised within the Fife Energy Park site and reversible.

During the installation and decommissioning of the wind turbine and meteorological mast, some related vessel movement may be required. In this part of the Firth of Forth. it is not uncommon for there to be short periods of increased vessel activity, due to the present land uses at the Fife Energy Park site which exports fabricated structures for use in the oil and gas and renewables sectors. Large vessel movements are common in the Firth of Forth due to the presence of oil refineries at Mossmorran and Grangemouth and other ports such as Rosyth that receive commercial shipping. On completion of construction related vessel activities will cease.

The installation and decommissioning of the wind turbine will involve the presence of a large crane on a jack up barge or heavy lift vessel at the wind turbine location for a short duration. The wind turbine will also be visible as a partly assembled structure for a short duration. On completion of construction and decommissioning the crane vessel will be demobilise back to its home port.

The increased vessel activities and the presence of a tall crane in this part of the Firth of Forth will result in changes to seascape character and visual amenity. However, such changes will be of very short duration with only very minor residual effects associated with landfall of the Export Cable extending into the operational stage.

The construction and decommissioning effects of the Proposed Development are therefore assessed as not significant.

5.7.2. Operational Effects

The remaining sections of the SLVIA (Sections 5.9 and 0) describe the effects of the operation and maintenance of the Proposed Development on seascape, landscape and visual resources. For the avoidance of doubt, and to avoid repetition in the assessment of receptors, unless stated otherwise all effects are adverse, long term and reversible.

5.8. Assessment of Residual Visual Effects

5.8.1. Viewpoints

The operational effects of the Proposed Development on views from representative viewpoints has been assessed as follows and is summarised in Table 5.9.

Viewpoint 1 Shore Street, Buckhaven (Figure 5.21)

The viewpoint is located on the shoreline at Buckhaven and is representative of the views seen by residents. Due to the uninterrupted view of the Proposed Development (approximately 1.9 km away), receptor sensitivity at this location is medium-high. reflecting their high susceptibility to change and the medium value of the view. The viewpoint is not formally recognised, and no facilities are provided for appreciation of the view. The view is not afforded protection in planning policy but the viewpoint lies on the boundary of the locally designated Wemyss Coast LLA, whose special qualities are protected by planning policy. Residents have clear, direct views of the Firth of Forth that are liable to be influenced by development directly ahead of their properties, in the Firth of Forth. The expanse of the firth and its backdrop of the East Lothian coast appear largely natural but for several prominent rigs near the shore. In combination with the LDT on the shoreline to the north, these reduce receptor susceptibility to the Proposed Development.

Views tend to focus on the open water of the Firth of Forth and the East Lothian coastline. Rigs within the Forth are prominent and relatively near to the viewpoint. Shipping movements are common in this part of the Firth of Forth and emphasise the industrial / commercial character of the Inner Firth. Within this context, the Proposed Development will be prominent, resulting from the uninterrupted view, the short distance to the Proposed Development, and its scale. The entire WTG will be visible and will appear of similar scale to the LDT and seemingly larger than the rigs that will frame it. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as high. Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and high magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major), direct, long-term and reversible.

Viewpoint 2 Fife Coastal Path, East Wemyss (Figure 5.22)

The viewpoint is located 3.6 km from the Proposed Development, close to the shoreline at East Wemyss and is representative of users of the Fife Coastal Path, whose sensitivity to the Proposed Development is medium-high, reflecting their medium-high susceptibility to change and the medium value of the view. The viewpoint is not formally recognised, and no facilities are provided for appreciation of the view. The view is not afforded protection in planning policy and the viewpoint lies outwith any designated area. Walkers on the Coastal Path have clear views of the Firth of Forth and the Fife coastline that are liable to be influenced by development in the Firth of Forth. While the coastline at this viewpoint is relatively less developed, settlement is clearly visible along with prominent structures that reduce receptor susceptibility, including a wind turbine, just offshore; and several rigs in the firth, that contrast strongly with the sea horizon.

The LDT is prominent in the middle distance with the east Fife coast beyond but much of the view is of the Firth of Forth. The entire Proposed Development will be visible relatively near to the viewpoint and will appear slightly larger than but otherwise like the LDT with which it will be associated. A detailed view of the evenly spaced rigs in the Forth is seen further offshore. The Proposed Development will be perceived as extending wind farm infrastructure and will maintain the character of the industrialised seascape. While this moderates the impact of Proposed Development, it will comprise a notable new feature in the view. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as high.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and high magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major), direct, long-term and reversible.

Viewpoint 3 Fife Coastal Path, West Wemyss (Figure 5.23)

The viewpoint is located 5.8 km from the Proposed Development on the Fife Coastal Path where it emerges from West Wemyss. The uninterrupted view is representative of those seen by users of the path, whose sensitivity to the Proposed Development is medium-high, reflecting their high susceptibility to change and the medium value of the view. The viewpoint is not formally recognised, and no facilities are provided for appreciation of the view. The view is not afforded protection in planning policy but the viewpoint lies on the boundary of the locally designated Wemyss Coast LLA, whose special qualities are protected by planning policy. Walkers on the Coastal Path have clear views of the Firth of Forth and the Fife coastline that are liable to be influenced by development in the Firth of Forth. At this viewpoint the developed coastline includes coastal defences, backed by settlement; and prominent structures within the firth that reduce receptor susceptibility, including wind turbines, just offshore; and several rigs in the firth, that lie quite close to shore.

The view is predominantly of the Forth and enclosed by the developed coastline and low hills of east Fife which define the skyline beyond. The LDT pierces the skyline with Largo Law rising to a similar extent. Further within the Forth several rigs are clearly visible on the horizon. Appearing taller than the similar LDT due to its location, the Proposed Development will be a notable addition between the coast and the rigs offshore. The Proposed will occupy a small proportion of the field of view and will extend the influence of wind energy development into the Firth of Forth, altering the balance of elements within the view, if not its character. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium-high.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and medium-high magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major/moderate), direct, long-term and reversible.

Viewpoint 4 Fife Coastal Path, Leven (Figure 5.24)

The viewpoint is located on the esplanade in the eastern part of Leven, 3.5 km away from the Proposed Development. The view is representative of the uninterrupted views of the Firth of Forth seen by users of the Fife Coastal Path, the esplanade, and local beaches. The sensitivity of these receptors to the Proposed Development is medium-high, reflecting their high susceptibility to change and the medium value of the view. While the seafront viewpoint is not formally recognised, the seafront is a popular recreational destination with numerous benches oriented for appreciation of the view. The view is not afforded protection in planning policy and the viewpoint lies outside any designated area. Recreational receptors have clear views of the Firth of Forth and the Fife coastline that are liable to be influenced by development in the Firth of Forth. The highly developed coastline at this viewpoint includes the esplanade, backed by settlement; and prominent structures that do much to reduce receptor susceptibility: nearby wind turbines, just offshore; and several rigs in the firth, that lie quite close to shore.

The view looks over the Firth of Forth from a heavily modified shoreline of engineered features such as the sea wall and the esplanade with vertical features including the LDT and cranes within Fife Energy Park nearby. While the Proposed Development is largely consistent with the existing character of the view, it will extend wind energy development into the Firth of Forth. The entire WTG will be visible at relatively short range and it will appear much the same as the LDT in terms of form and scale. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as high.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and high magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major), direct, long-term and reversible.

Viewpoint 5 A915, Wemyss Coast (Figure 5.25)

The viewpoint is located inland from the sea on the side of Standing Stane Road, just north of the Standingstone Park Planation and 4.8 km west of the Proposed Development. The viewpoint is representative of road users, whose sensitivity to the Proposed Development is medium-low, reflecting their medium-low susceptibility to change and the medium value of the view. The viewpoint is not a formally recognised viewpoint and no facilities are provided for appreciating the view, which is not afforded protection in planning policy. The viewpoint lies on the boundary of the locally designated Wemyss Coast LLA whose special qualities are protected by planning policy. Motorists are less liable to be influenced by development off the Fife coastline due to the transient and peripheral nature of their views towards the Firth of Forth; and the strongly developed nature of the coast, that is noticeable by the presence of onshore windfarm development and a prominent wind turbine off the coast nearby; coastal settlement glimpsed between woodland; and cranes at Methil docks.

The Proposed Development will rise above woodland enclosing the view. To the north cranes within Fife Energy Park and the LDT, which will appear similar in from and scale to the Proposed Development, will also appear above the trees. Much of the rotors of both WTGs will be visible and they will be associated. Little development is visible and the simple, rural landscape will readily accommodate the additional WTG. Looking away from the Proposed Development, other turbines within Earlseat Wind Farm are visible near the viewpoint and it will appear congruent with these. While the Proposed Development will be a noticeable addition to the view, it will extend the established presence of wind energy infrastructure. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium-low.

Based on the combination of the medium-low sensitivity of the receptors at the viewpoint and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Viewpoint 6 Kennoway (Figure 5.26)

This viewpoint, 5.1 km away from the Proposed Development, is located on Castle Terrace on the southern edge of Kennoway. The view is representative of south facing properties at the southern edge of Kennoway and as such, receptor sensitivity is medium, reflecting their medium susceptibility to change and the medium value of the view. The viewpoint is not a formally recognised viewpoint and no facilities are provided for appreciating the view, which is not afforded protection in planning policy. The viewpoint lies outside any locally designated area protected by planning policy. Residents are liable to be influenced by development off the Fife coastline, but their susceptibility is reduced by the set back position and the character of the intervening coast which includes settlement; industrial activity at Methil; onshore windfarm development; a prominent wind turbine on the shoreline; and within the firth, rigs and shipping activity.

Views from this location look out across agricultural land that lies between Kennoway and Methil. Large sheds in the left of the view and urban development in the midground in the direction of the Proposed Development are important visual influences. The LDT is a noticeable feature in views and the Methil Docks wind turbine is visible in the left of the view. The immediate setting is urban fringe rather than rural in character. The Firth of Forth is visible as a narrow band above the intervening development and the nearby Fife coastline is not discernible. At this location the Proposed Development will appear similar in scale to the LDT, seen to the south. A similar proportion of the Proposed Development as the LDT will be visible. As rigs in the Forth and large sheds nearby also have an industrialising influence, the Proposed Development is in keeping with the existing context. The Proposed Development will be seen relatively near to the viewpoint and while the influence of the LDT and the urban fringe nature of the scene moderates its impact, this proximity to the viewpoint is such that there is a readily observable change. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium.

Based on the combination of the medium sensitivity of the receptors at the viewpoint and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (moderate), direct, long-term and reversible.

Viewpoint 7 Fife Coastal Path, Lundin Links (Figure 5.27)

6 km from the Proposed Development, the viewpoint is located at an elevated location overlooking Largo Bay near Lundin Links Golf Club on the Fife Coastal Path and is representative of users of the path. Receptor sensitivity to the Proposed Development is medium-high, reflecting their high susceptibility to change and the medium value of the view. The viewpoint has views along the Fife coast and looks past the Wemyss Coast LLA to coastline within the Cullaloe Hills and Coast LLA. No facilities are provided for appreciating the view, which is not afforded protection in planning policy and the viewpoint lies outside any locally designated area protected by planning policy. Users of the Coastal Path are liable to be influenced by development off the Fife coastline, but their susceptibility is reduced by the character of the strongly developed coast which includes settlement with industrial activity at Methil, including onshore windfarm development; notable wind turbines on the shoreline; and within the firth, rigs and shipping activity.

Lundin Links Golf Course occupies the foreground with the sweeping curve of Largo Bay and development along the shore at Leven, Methil, Fife Energy Park and Methil Docks. The LDT just offshore and the westernmost rig within the Forth will frame the Proposed Development. Almost the entire WTG will be visible between the rigs and the LDT, whose combined influence along with that of the industrialising elements on the Methil coastline, will moderate the impact of the Proposed Development. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major/moderate), direct, long-term and reversible.

Viewpoint 8 Lower Largo (Figure 5.28)

Located on the shoreline 6.9 km northeast of the Proposed Development, the viewpoint is representative of users of the Fife Coastal Path and residents of Lower Largo, whose sensitivity to the Proposed Development is medium-high, reflecting their high susceptibility to change and the medium value of the view. The view looks west along the Fife coast, past the Wemyss Coast LLA to coastline within the Cullaloe Hills and Coast LLA. The view is not afforded protection in planning policy and the viewpoint lies outside and to the south of the Largo Law LLA. The view is typical of views from the settled coastline. Residents with sea views and users of the Coastal Path are liable to be influenced by development off the Fife coastline but their direction of travel, perpendicular to the view over the firth; and the settled coastline, with Methil, associated industrial activity, offshore wind turbines, onshore windfarms and rigs in the firth, reduces their susceptibility.

The expansive and far-ranging view takes in the entire Largo Bay, the Firth of Forth and the Lothian coast. The Proposed Development will be a new, isolated feature within the Forth with rigs and the developed coastline at Methil to either side. It will be seen in its entirety, at moderate range and will appear slightly taller than the existing LDT. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major/moderate), direct, long-term and reversible.

Viewpoint 9 A917 near Drumeldrie (Figure 5.29)

The viewpoint is located on the A917 approximately 8.8 km to the east of the Proposed Development. The viewpoint is representative of motorists using the A road whose sensitivity to the Proposed Development is medium-low, reflecting their medium-low susceptibility to change and the medium value of the view. The A917 has views west along the Fife coast and looks past the Wemyss Coast LLA to coastline within the Cullaloe Hills and Coast LLA. The view is not afforded protection in planning policy but the viewpoint lies within the Largo Law LLA, whose special qualities are protected by planning policy. The peripheral view of the firth and the Fife coastline is typical of many roads within Fife that run broadly parallel to the coastline. Motorists are less liable to be influenced by development off the Fife coastline due to the transient and peripheral nature of their views towards the Firth of Forth. The strongly developed coast, characterised by settlement onshore windfarm development; offshore wind turbines; shipping activity in the firth; and most prominently, rigs near the shore, all serve to reduce susceptibility.

With low lying farmland, the flat expanse of the Firth of Forth behind and the enclosing coastlines beyond, the view is quite expansive with a horizontal emphasis. While rigs in the Forth are notable, the LDT is just visible with development behind, beyond nearby buildings. The Proposed Development will lie further out in the Forth and will be clearly visible in its entirety midway between the rigs and the coastline. Apparently taller but less bulky than the rigs and contrasting with the western Fife coastline, the Proposed Development will be a noticeable addition to the scene that does not alter its overall balance of elements or character. The Proposed Development will be an observable addition occupying a small part of the view that is in keeping with the components of the view. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium.

Based on the combination of the medium-low sensitivity of the receptors at the viewpoint and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Viewpoint 10 Largo Law Summit (Figure 5.30)

Largo Law, 9 km away from the Proposed Development, is a prominent landscape feature in this part of Fife and the view is representative of those seen by hill walkers on the hill. Receptor sensitivity to the Proposed Development is medium-high, reflecting their medium-high susceptibility to change and the medium-high value of the view. The viewpoint has views west along the Fife coast, and looks past the Wemyss Coast LLA to coastline within the Cullaloe Hills and Coast LLA. No facilities are provided for appreciating the view, which is not afforded protection in planning policy but the viewpoint lies within the Largo Law LLA, whose special qualities are protected by planning policy. The elevated, panoramic view is relatively uncommon within this part of the Fife coast. Walkers are liable to be influenced by development off the Fife coastline, however, receptor susceptibility is reduced by the strongly developed coast in the view which includes settlement with industrial activity at Methil; onshore windfarm development; offshore wind turbines; shipping activity in the firth; and most prominently, rigs sufficiently inshore to be seen in detail.

The viewpoint is elevated at a height of 290 m AOD with uninterrupted 360° views taking in Largo Bay and the Firth of Forth, Methil, Leven, and the Lothian coastline. Looking away from the Proposed Development views take in the agricultural plateau of northeast Fife and the East Neuk coast. The elevated viewpoint and expansiveness of views from this location means the Proposed Development will be seen in its entirety within the Forth. It will appear noticeably taller than the LDT to which it is similar in form. As the Proposed Development lies offshore, its impact will be moderated by rigs clearly visible nearby and by the wide expanse of view that remains unaffected. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium-low.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), direct, long-term and reversible.

Viewpoint 11 Kirkcaldy, Esplanade (Figure 5.31)

The viewpoint is located on Kirkcaldy esplanade, 12.1 km southwest of the Proposed Development and is representative of residents, users of the Fife Coastal Path, esplanade and the beach, whose sensitivity to the Proposed Development is medium-high, reflecting their high susceptibility to change and the medium value of the view. The viewpoint has views along the Fife coast and looks past the Wemyss Coast LLA to coastline within the East Neuk LLA. No facilities are provided for appreciating the view, which is not afforded protection in planning policy. The view is broadly typical of views from this section of coast and its south easterly aspect. While receptors are liable to be influenced by development off the Fife coastline, the developed coast in the view includes urban development in Kirkcaldy, industrial activity at Methil; onshore windfarm development; and within the firth, notable offshore wind turbines, rigs and shipping activity that reduces receptor susceptibility.

The view is channelled along the wooded coastline, with West Wemyss and Buckhaven marking corners of the landform. Largo Law slopes down to the East Neuk of Fife in the background. The LDT is clearly visible just off the coast near Buckhaven with the Proposed Development lying midway between it and the first of several rigs in the open waters of the Forth. The Proposed Development will appear like the LDT and will be seen in its entirety, with the rotor largely rising above distant landform behind. While it will appear taller than the existing LDT and rigs, the Proposed Development will generally maintain the character of the view. The Proposed Development will be a notable addition to the view from Kirkcaldy Esplanade. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium-low.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), direct, long-term and reversible.

Viewpoint 12 Links Road, Earlsferry (Figure 5.32)

The viewpoint is located 10.5 km east of the Proposed Development on the western edge of the settlement of Earlsferry with residential development backing the viewpoint. The viewpoint is representative of residents on this settlement edge whose sensitivity to the Proposed Development is medium-high, reflecting their high susceptibility to change and the medium value of the view. The viewpoint has views along the Fife coast and looks past the Wemyss Coast LLA to coastline within the Cullaloe Hills and Coast LLA. No facilities are provided for appreciating the view, which is not afforded protection in planning policy but the viewpoint lies within the East Neuk LLA, whose special qualities are protected by planning policy. The view is broadly typical of views from this section of coast and its southerly aspect. While residents are liable to be influenced by development off the

Fife coastline, the strongly developed coast in the view includes settlement with industrial activity at Methil; onshore windfarm development; and within the firth, notable offshore wind turbines, rigs and shipping activity that reduces receptor susceptibility

The view encompasses rigs within the Forth, the settled coastline of western Fife, the developed coast along Methil and Buckhaven and the LDT just offshore at Methil. The LDT and rigs pierce the skyline, moderating the impact of the Proposed Development. While this will appear as the tallest of these features, it will be consistent with the highly modified and developed vista. Although it will be a noticeable addition to the view from Links Road, the Proposed Development will not dominate the scene. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium-low.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), direct, long-term and reversible.

Viewpoint 13 The Toft, Elie (Figure 5.33)

The viewpoint is located on the shoreline 11.8 km from the Proposed Development and is representative of residents of Elie and users of the Fife Coastal Path and the beach, whose sensitivity to the Proposed Development is high, reflecting their high susceptibility to change and the high value of the view. The viewpoint has views along the Fife coast and looks past the Wemyss Coast LLA to coastline within the Cullaloe Hills and Coast LLA. Benches, seating areas at local businesses and car parking are provided for appreciating the view, which is not afforded protection in planning policy but the viewpoint lies within the East Neuk LLA, whose special qualities are protected by planning policy. While the southerly aspect of this stretch of coast makes the view relatively typical of those from the Coastal Path, the view of a wide bay beyond a sandy beach is uncommon. Walkers on the Coastal Path are liable to be influenced by development off the Fife coastline. Coastline within the panoramic view is developed with settlement; and within the firth, notable offshore wind turbines and shipping activity that reduces receptor susceptibility.

The sandy bay between Earlsferry and Elie is enclosed by settlement within the two villages, which extends to the shoreline. The expanse of the outer firth dominates views from this location. The Proposed Development will be a discordant feature behind properties in the backdrop to Earlsferry. A ridgeline mast inland and the rigs within the open firth are features similar in character. Movement from the rotor will be clearly seen within an expansive context which is predominantly residential and small scale towards the Proposed Development. At the Toft, Elie, the Proposed Development has limited precedent within the scene, introducing wind energy development to the view in which it is not currently a feature. The Proposed Development is however, viewed at some distance, reducing its scale, and is located outwith the main focus of the view to the sea. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium-low.

Based on the combination of the high sensitivity of the receptors at the viewpoint and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), direct, long-term and reversible.

Viewpoint 14 Fife Coastal Path, Kinghorn (Figure 5.24)

The viewpoint is located on the Fife Coastal Path at Kiln Rocks, north of Kinghorn and 14.1 km southwest of the Proposed Development. The view is representative of those seen by users of the Fife Coastal Path, whose sensitivity to the Proposed Development is medium-high, reflecting their high susceptibility to change and the medium value of the view. The viewpoint has views along the Fife coast, and looks past the Wemyss Coast LLA to coastline within the East Neuk LLA. No facilities are provided for appreciating the view, which is not afforded protection in planning policy but the viewpoint lies within the Cullaloe Hills and Coast LLA, whose special qualities are protected by planning policy. The north easterly aspect of this stretch of coast makes the view relatively untypical of those from the Coastal Path. Walkers on the Coastal Path have clear views along the Fife coastline of the Firth of Forth that are liable to be influenced by development off the Fife coastline. Coastline within the panoramic view is developed with settlement; and within the firth, notable offshore wind turbines and shipping activity that reduces receptor susceptibility.

From a near natural stretch of coastline, the view looks takes in the Forth and the wooded coast south of West Weymss to the eastern shoreline of Largo Bay. The LDT is discernible against Methil's developed coastline immediately behind and shipping within the firth is a notable feature. While the entire Proposed Development will be visible, it will represent a lesser element in the view and will have little influence on the composition or character of the scene. From the Fife Coastal Path at Kinghorn, the Proposed Development will be a discernible addition to the view that does not change its focus. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as medium-low.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), direct, long-term and reversible.

Viewpoint 15 East Lomond Summit (Figure 5.35)

The viewpoint is representative of hillwalkers located on the 424 m AOD high summit of East Lomond and lies approximately 16.1 km northwest of the Proposed Development. Receptor sensitivity to the Proposed Development is medium-high, reflecting their medium-high susceptibility to change and the high value of the view. The elevated viewpoint has views across the Firth of Forth and looking towards the East Lothian coastline. No facilities are provided for appreciating the view, which is not afforded protection in planning policy but the viewpoint lies within the Lomond Hills LLA, whose special qualities are protected by planning policy. The elevated viewpoint is relatively uncommon within Fife but the view is largely typical of views from similar highpoints. Walkers on the hill have clear views over the Fife coastline of the Firth of Forth that are liable to be influenced by development off the Fife coastline. The panoramic view includes settlement and onshore wind farms nearby; industry on the coastline; rigs and offshore wind turbines just offshore in the firth; and notable shipping activity in the firth, that reduces receptor susceptibility.

The view is elevated and there are uninterrupted 360° views from the viewpoint consisting of Largo Law, the Firth of Forth, Glenrothes and the Lothian coastline. Views in the opposite direction to the Proposed Development consist of the agricultural plateau of northeast Fife, the Ochil Hills, and the hills of the south central Highlands. The LDT is discernible and Earlseat windfarm is a noticeable feature to the right of the LDT. Three wind turbines at Drum Farm each approximately 33 m to blade tip are visible in the mid ground to the right of the masts on the lower hill. The Proposed Development will appear as a small element within the panoramic view and will be associated with developed coastline at Methil and Leven rather than the open waters of the Firth of Forth. While it will extend the visual presence of wind energy development, the Proposed Development will not alter the balance of elements or the character of the view. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Viewpoint 16 Benarty Hill (Figure 5.36)

Located at the trig point of Benarty Hill lying at 356 m AOD and approximately 22.1 km west of the Proposed Development, the viewpoint is representative of hillwalkers, whose sensitivity to the Proposed Development is medium, reflecting their medium susceptibility to change and the medium-high value of the view. The elevated viewpoint has views across the Firth of Forth and looking towards coastline within the East Neuk LLA. No facilities are provided for appreciating the view, which is not afforded protection in planning policy but the viewpoint lies within the Loch Ore and Benarty LLA, whose special qualities are protected by planning policy. The elevated viewpoint is relatively uncommon within Fife but the view is typical of views from similar highpoints. Walkers on the hill have clear views of the Firth of Forth and the Fife coastline that are liable to be influenced by development off the Fife coastline. The panoramic view includes settlement and onshore wind farms nearby;

industry on the coastline; rigs and offshore wind turbines just offshore in the firth; and notable shipping activity in the firth, that reduces receptor susceptibility.

The far ranging and expansive view takes in a settled and reasonably well wooded agricultural landscape interspersed with development and industry, particularly on the coast. The Proposed Development will be visually absorbed into and behind onshore windfarm development which is prominent within the view. Distance further moderates its impact. While the Proposed Development will extend the visual presence of wind energy development from Benarty Hill, it will represent a very small element within the expansive view. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the medium sensitivity of the receptors at the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

Viewpoint 17 Pettycur Road, Kinghorn (Figure 5.37)

The viewpoint is located 15.2 km southwest of the Proposed Development on the Fife Coastal Path at Kinghorn. The viewpoint is representative of users of the Coastal Path whose sensitivity to the Proposed Development is medium, reflecting their medium susceptibility to change and the medium value of the view. At this section of the Coastal Path, the viewpoint has views across the Firth of Forth looking towards coastline within the East Neuk LLA that encloses and provides the backdrop to the Forth. No facilities are provided for appreciating the view, which is not afforded protection in planning policy and the viewpoint lies south of, and outside, the Cullaloe Hills and Coast LLA. The view is Iargely typical of this section of coast. Walkers on the Coastal Path have clear views of the Firth of Forth and the Fife coastline that are liable to be influenced by development off the Fife coastline. The developed nature of the Fife coastline, which includes rigs just offshore in the firth, industry, onshore wind farms and offshore wind turbines; and the level of shipping activity in the firth, reduces receptor susceptibility.

The viewpoint over looks Kinghorn Harbour to the northwest Fife coastline. The LDT is just discernible against Largo Law, with rigs and ships visible within the Firth of Forth. The Proposed Development will be clearly discernible against and piercing the undulating skyline of the Fife hills. Although this will appear taller than the industrialising features of the LDT, rigs and shipping, distance and the limited extent of the rotor above the skyline will moderate its impact. The Proposed Development will be noticeable but lesser element from Pettycur Road, Kinghorn that is in keeping with the character of the view. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the medium sensitivity of the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

Viewpoint 18 Gullane Beach (Figure 5.38)

The viewpoint is located 17.3 km southeast of the Proposed Development on the south coast of the Firth of Forth, at Gullane and is representative of visitors to Gullane Bents. Receptor sensitivity to the Proposed Development is high, reflecting their high susceptibility to change and the high value of the view. The viewpoint at the popular beach has views across the Firth of Forth to the Fife coast that may be appreciated from the shoreline. Benches are provided for appreciating the view, which is not afforded protection in planning policy. The viewpoint lies within the Port Seton to North Berwick Coast SLA, whose special qualities are protected in planning policy, and takes in the Fife coastline, towards the Cullaloe Hills and Coast, and Wemyss Coast LLAs. Enclosure by the opposite coast focusses attention on the Forth and its backdrop of the Fife coastline. Visitors to the beach have clear views of the Firth of Forth and the Fife coastline that are liable to be influenced by development in the Firth of Forth and off the opposing coastline. The developed nature of the Fife coastline, which includes industry, onshore wind farms and offshore wind turbines; and the level of shipping activity in the firth reduces receptor susceptibility.

The view looks out over grassland and amenity grassland which is fringed with scrub and woodland on the seaward side. The views of the Firth of Forth are expansive with and development is not a prominent feature of the view. East and West Lomond are visible in the left of the view with Largo Law visible in the right of the view. The Proposed Development will be a discernible element occupying a small proportion of the view. The WTG will be seen against and associated more with the developed coastline at Methil and Leven rather than the open waters of the Firth of Forth. The composition of the view and its character will remain largely unaffected by the Proposed Development. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the high sensitivity of the receptors at the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Viewpoint 19 A198, Aberlady Bay (Figure 5.39)

The viewpoint is located 19.2 km from the Proposed Development, just off the A198 at Aberlady Bay which is a Local Nature Reserve. The view is representative of visitors to the nature reserve, whose sensitivity to the Proposed Development is medium-high, reflecting their medium-high susceptibility to change and the medium-value of the view; and motorists on the A198, whose sensitivity is medium, reflecting their low susceptibility to change and the high value of the view. The viewpoint is a relatively natural and undeveloped location where views across the Firth of Forth to the Fife coast may be appreciated from the shoreline. The views of bridge at Aberlady Bay are well known locally and much photographed. There are no particular facilities provided for appreciating the view, although there is car parking nearby, and the view is not afforded protection in planning policy. The viewpoint lies within the Port Seton to North Berwick Coast SLA, whose special qualities are protected in planning policy, and takes in the Fife coastline, towards the Cullaloe Hills and Coast, and Wemyss Coast LLAs. While the northerly aspect of the coast focusses attention on the Forth, much of the visual appeal lies in the quality of the LNR. Shipping activity in the firth and development along the Fife coast detracts a little from this quality. Visitors to the LNR have views of the Firth of Forth and the Fife coastline that may be liable to be influenced by development in the Firth of Forth and off the opposing coastline. This is limited by the distant, partial view of the Fife coastline beyond the northern shore of Peffer Burn. Motorists on the A198 are less liable to the influence of development in the firth due to transient nature of their views, which are generally peripheral to their direction of travel.

As the Proposed Development will be screened by landform and vegetation, a negligible magnitude of change will be observed. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as negligible. Based on the combination of the medium-high sensitivity of visitors to the nature reserve and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible for visitors to the nature reserve.

Viewpoint 20 North Berwick, north of Harbour (Figure 5.40)

The viewpoint is located 21.1 km from the Proposed Development, on the north side of the harbour at North Berwick and is representative of visitors to the harbour. Receptor sensitivity to the Proposed Development is assessed as high, reflecting the high value of the view and the high susceptibility to change of receptors experiencing the view. The viewpoint is a location where unimpeded views of the sea and the setting of North Berwick may be appreciated from the shoreline. There is seating provided for appreciating the view and the harbourside is a popular location for taking in the view, which is not afforded protection in planning policy. The viewpoint lies within the Port Seton to North Berwick Coast SLA and the view also takes in the Isle of May, East Neuk and East Coast LLAs covering the island and the Fife coastline beyond. The expansive view from the harbourside is typical of this coastline, whose northerly aspect focusses attention on the islands in the Forth, and the East Lothian coast. There is much visual interest and texture within the panoramic view with shipping activity in the firth and development along both of its shores detracting from its overall quality. The viewpoint is representative of the view experienced by visitors to the harbourside, who have protracted views of the Firth of Forth and the Fife coastline. Viewers are more liable to be influenced by development in the Firth of Forth and off the opposing coastline within the direct view from the harbourside, with the Forth, its islands and the opposing coast drawing much of their attention. The developed Fife coastline provides much visual interest and texture to the large scale view encompassing the sea horizon, such that viewers experience a moderate level of visual amenity at this location.

Looking over North Berwick bay and the Firth of Forth, rocks and islands in the foreground attract the eye. The LDT is discernible off the Methil coast, against the backdrop of Fife's hills. The Proposed Development will be viewed adjacent to the existing LDT such that they are likely to be perceived as a two-turbine cluster, concentrating development in part of the view already affected by a wind turbine influence. Due to its greater height, slightly closer proximity and its location directly in front of East Lomond hill, the Proposed Development will appear more prominent than the LDT. The encircling coastline and inshore islands in the intervening seascape provide the main interest in the view and the Proposed Development will not be a competing focus in views, nor will it substantially change its composition or character. The view from the north of North Berwick harbour is focussed upon the inshore waters and will largely remain unchanged. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the high sensitivity of the receptors at the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Viewpoint 21 North Berwick Law (Figure 5.41)

Adjoining the southern edge of North Berwick, the law is an iconic landmark feature and a visitor attraction. The viewpoint is located 22.1 km southeast of the Proposed Development on the summit of North Berwick Law, near to the whale's jawbone and is representative of walkers on the law, whose sensitivity to the Proposed Development is high, reflecting their high susceptibility to change and the high value of the view. The viewpoint is a location where views of the sea and the setting of North Berwick may be appreciated from the elevated viewpoint. There are no facilities provided for appreciating the view, although a whalebone arch provides a framing device for visitors to the summit. The view is not afforded protection in planning policy, but is representative of the excellent coastal views that are a special quality of the locally designated North Berwick Law SLA, which are afforded protection by planning policy. The views takes in the Tantallon Coast, and Port Seton to North Berwick Coast SLAs, covering the East Lothian coastline immediately below the law; and the Isle of May and East Neuk LLAs covering the island and the Fife coastline beyond. Looking south east, the landscape includes Leuchie, Tyninghame, and Broxmouth Park GDLs. The expansive view from elevation is not typical of this coastline, due to the flat topography and low number of high points such as the law with similar views. The islands in the Forth, Isle of May and distant East Lothian coast adds particular interest. Shipping activity in the firth and development along both of its shores detracts from the quality of the view. The viewpoint is representative of the view experienced by visitors to the summit of the law, who have protracted views of the panorama of sea and outer firth coastlines. The viewpoint affords a direct view out to sea from an elevated point, in which viewers are more liable to be influenced by development in the sea. The Forth, its islands and the opposing coast are the primary focus, with the nearby town and harbour, and surrounding landscape offering much visual interest and texture to a large scale view including the sea horizon. Viewers experience a moderate level of visual amenity at this location.

The Proposed Development will be viewed adjacent to the existing LDT such that they are likely to be perceived as a two-turbine cluster, concentrating development in part of the view already affected by a wind turbine influence. In the view across North Berwick and the Firth of Forth, the islands of Fidra, Lamb and Craigleith are clearly visible near off the shore. The Proposed Development will be discernible alongside the LDT against the developed Fife coast. The moving rotors will be the most noticeable component of the Proposed Development. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the high sensitivity of the receptors at the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Viewpoint 22 Calton Hill, Edinburgh (Figure 5.42)

Calton Hill is an important landmark feature in Edinburgh's city centre and a popular visitor attraction. The viewpoint lies 25.8 km from the Proposed Development, and is representative of elevated views from Edinburgh. Receptor sensitivity is medium-high, reflecting their medium susceptibility to change and the high value of the view. Views across the firth and the setting of Edinburgh may be appreciated from the elevated viewpoint, but no facilities are provided for appreciating the view, which is neither a recognised key view nor afforded protection in planning policy. The viewpoint lies within the Old and New Towns of Edinburgh World Heritage Site, which is protected by planning policy. The view takes in the Edinburgh coastline, which is not locally designated; and the Fife coastline, including the Cullaloe Hill and Coast, and Wemyss Coast LLAs. The view from elevation is uncommon along this coastline, which has a low number of similar high points. The islands in the Forth and distant East Lothian coast add particular interest, with shipping activity in the firth and development along both shores detracting from the quality of the view. The viewpoint is representative of the view experienced by visitors to the summit of the hill, who have protracted, panoramic views over Edinburgh and the Firth of Forth to the Fife coast and the Fife hills. Viewers are more liable to be influenced by development in the firth within this direct view from an elevated point. The Forth, its islands and the opposing coast fill much of the view, with interest and texture derived from the surrounding townscape within a large-scale view that includes the sea horizon. Viewers experience a moderate level of visual amenity at this location and the sensitivity to change is moderated by the extent of built development in the intervening foreground.

The view looks over the eastern part of Edinburgh's New Town and Leith to the Firth of Forth and the island of Inchkeith. The developed coastline of Fife, below a skyline defined by low hills rising to the Lomond hills and Largo Law encloses the view. The LDT is barely discernible to the right of Inchkeith. The Proposed Development will be discernible within a highly developed context, near the LDT. The Proposed Development will be viewed adjacent to the existing LDT such that they are likely to be perceived as a two-turbine cluster, concentrating development in part of the view already affected by a wind turbine influence. The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the medium-high sensitivity of the receptors at the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Summary of Operational Effects on Viewpoints

A summary of the operational effects of the Proposed Development on views from representative viewpoints is provided in Table 5.9.

Table 5.9 - Summary of Operational Effects on Viewpoints

Viewpoint	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
1. Shore Street, Buckhaven	Medium-high	High	Major **Significant**
2. Fife Coastal Path, East Wemyss	Medium-high	High	Major **Significant**
3. Fife Coastal Path, West Wemyss	Medium-high	Medium-high	Major/moderate **Significant**
4. Fife Coastal Path, Leven	Medium-high	High	Major **Significant**
5. A915, Wemyss Coast	Medium-low	Medium-low	Moderate/minor Not Significant
6. Kennoway	Medium	Medium	Moderate **Significant**

Viewpoint	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
7. Fife Coastal Path, Lundin Links	Medium-high	Medium	Major/moderate **Significant**
8. Lower Largo	Medium-high	Medium	Major/moderate **Significant**
9. A917 near Drumeldrie	Medium-low	Medium	Moderate/minor Not Significant
10. Largo Law Summit	Medium-high	Medium-low	Moderate Not Significant
11. Kirkcaldy, Esplanade	Medium-high	Medium-low	Moderate Not significant
12. Links Road, Earlsferry	Medium-high	Medium-low	Moderate Not Significant
13. The Toft, Elie	High	Medium-low	Moderate Not Significant
14. Fife Coastal Path, Kinghorn	Medium-high	Medium-low	Moderate Not Significant
15. East Lomond Summit	Medium-high	Low	Moderate/minor Not Significant
16. Benarty Hill	Medium	Low	Minor Not Significant
17. Pettycur Road, Kinghorn	Medium	Low	Minor Not Significant
East Lothian			
18. Gullane Beach	High	Low	Moderate/minor Not Significant
19. Aberlady Bay footbridge	High	Negligible	Minor and Not Significant
20. North Berwick (north of Harbour)	High	Low	Moderate/minor Not Significant
21. North Berwick Law	High	Low	Moderate/minor Not Significant
City of Edinburgh			
22. Calton Hill, Edinburgh	Medium-high	Low	Moderate/minor Not Significant

5.8.2. Illustrative Viewpoints

Following consultation with NatureScot, views from four additional ‘illustrative’ viewpoints are presented as wireline images only in Figures 5.23 to 5.26, Volume 2. These views are not assessed as part of the SLVIA but have been included to illustrate the likely wider visibility of the Proposed Development from four viewpoints requested by NatureScot.

5.8.3. Assessment of night-time visual effects

5.8.3.1. Introduction

The Proposed Development will have impacts on visual receptors/views at night during the operation and maintenance phase. This section provides an assessment of the visual effects arising from the visible lighting requirements (aviation and marine navigational) of the Proposed Development.

Civil Aviation Authority (CAA) guidance requires that 'en-route obstacles' at or above 150 m above ground level are lit with visible lighting to assist their detection by aircraft. As such, there is potential that parts of the

Proposed Development may be visible at night. The effect of the Proposed Development at night would result primarily from visible medium intensity (2,000 candela) red coloured aviation light fittings located on the nacelle of the proposed wind turbine and meteorological mast.

The methodology for the assessment of the night-time visual effects is set out in Appendix 5a and the visual assessment of WTG lighting is supported by the Nacelle Aviation Lighting ZTV (Figure 15.18) and night-time photomontage visualisations from three viewpoints in Fife, Edinburgh and East Lothian, showing medium-intensity nacelle mounted aviation lighting and platform level marine navigational lighting:

- Viewpoint 2 Fife Coastal Path, East Wemyss (Figure 5.22g/j/k);
- Viewpoint 20 North Berwick, north of Harbour (Figure 5.40i/j/l/m); and
- Viewpoint 22 Calton Hill, Edinburgh (Figure 5.42 i/j/n).

Night-time photographs were taken in low light conditions, after the end of civil twilight, when 'night' has been reached and when other artificial lighting, such as streetlights, car headlamps and lights on buildings are on, to show how the aviation lighting would look compared to the existing baseline at such times.

Although aviation lighting manufacturers must meet the minimum requirements, their products may vary in relation to recommended limits set out in ICAO standards, which makes it difficult producing accurate visualisations as the lighting characteristics of different light fittings, of the same intensity, may vary outside the minimum requirements stipulated by ICAO. The night-time photomontages shown in these figures have been produced to show 2,000 cd lighting, to inform the assessment of worst-case effects assessed and are likely to over-represent the visibility of aviation warning lighting experienced in reality, as they are likely to operate at reduced intensity (200 cd) in clear visibility conditions. The night-time photomontages have been produced to with reference to the intensity of the operational LDT aviation lighting visible in the baseline views.

5.8.3.2. Regulations and Guidance

In the UK, the International Civil Aviation Organization (ICAO) requirements for lighting wind turbines are implemented through CAA publication CAP 764: Policy and Guidelines on Wind Turbines (CAA, 2016), and CAP 393: Air Navigation Order 2016 (CAA, 2016).

The proposed wind turbine would require lighting under Article 223 of the Air Navigation Order (CAA, 2016). This requires that wind turbine generators in UK territorial waters of 60 m or more above sea level HAT), are *'fitted with one medium intensity steady red light positioned as close as reasonably practicable to the top of the fixed structure'* and that *'the periphery of the group need to be fitted with a light'*. For the purpose of the assessment, medium intensity aviation lighting is assumed to be 2,000 candela fitted at nacelle level of the proposed wind turbine.

For 2,000 candela medium intensity steady or fixed red lights, ICAO indicates a requirement for no lighting to be switched on until 'Night' has been reached, as measured at 50 cd/m2 or darker. CAA have confirmed that UK policy broadly aligns with the International standards, including insofar as the point at which lights must be switched on at 'Night' rather than 'Twilight'.

Article 223 of Air Navigation Order (CAA, 2016) also requires that *'the angle of the plane of the beam of peak intensity emitted by the light must be elevated to between 3-4° degrees above the horizontal plane'*, but that 20-45% of the peak intensity is to be visible at the horizontal plane and not more than 10% of the peak intensity is visible at 1.5 degrees or more below the horizontal plane. This focusses the 2,000cd lighting in the horizontal plane between 3-4° above horizontal and allows for a reduced intensity of the light at and below the horizontal plane.

Article 223 of Air Navigation Order (CAA, 2016) also allows for 2,000 cd aviation lights to be dimmed to *'not less than 10% of the minimum peak intensity'* if '*visibility in all directions from every wind turbine generator in a group is more than 5km'*. Visibility conditions are measured using a visibility sensor, to allow the aviation lights to dimmed automatically to respond to prevailing meteorological conditions. 2,000 cd lights will therefore only be experienced in visibility of <5 km; and their intensity would be dimmed to 200 cd in visibility of >5 km.

6GLVIA3 (Landscape Institute, 2013) recommends that *'the visual effects assessment will need to include qualitative assessments of the effects of the predicted light levels on night-time visibility'* and that '*reference should be made to appropriate guidance, such as that provided by the Institution of Lighting Professionals (ILP, 2011)'.*

Guidance produced by the Institute of Lighting Professionals (ILP, 2011) is useful in setting out some key terminology that is used in this visual assessment of WTG lighting:

- *'Obtrusive Light - whether it keeps you awake through a bedroom window or impedes your view of the night sky, is a form of pollution, which may also be a nuisance in law and which can be substantially reduced without detriment to the lighting task;*
- *Skyglow – the brightening of the night sky;*
- *Glare – the uncomfortable brightness of a light source when viewed against a darker background; and*
- *Light Intrusion – the spilling of light beyond the boundary of the property or area being lit, are all forms of obtrusive light which may cause nuisance to others'.*

5.8.3.3. Assessment Methodology

The assessment of night-time visual effects is based on the description of proposed wind turbine lighting set out in the ICAO/CAA regulations and standards described above.

The effect of the visible lights will be dependent on a range of factors, including the intensity of lights used, the clarity of atmospheric visibility and the degree of negative/ positive vertical angle of view from the light to the receptor. In compliance with EIA Regulations, the likely significant effects of a 'worst-case' scenario for wind turbine lighting are assessed and illustrated in this visual assessment.

A worst-case approach is applied to the assessment that considers the potential effects of medium-intensity 2,000 cd lights in clear visibility. It should be noted however, that medium intensity lights are only likely to be operated at their maximum 2,000 cd during periods of poor visibility. A further assessment of the likely residual effects is therefore made factoring in embedded mitigation, i.e. that the 2,000cd aviation lights will be dimmed to 10% of their value (200 cd) if meteorological conditions permit (when visibility is greater than 5 km).

The study area for the visual assessment of wind turbine lighting is shown in Figure 5.7 and is coincident with the 50 km SLVIA Study Area, however is particularly focused on the closest areas of the Fife coastline and East Lothian Coastline, within 25 km.

The assessment of the lighting of the Proposed Development is intended to determine the likely significant effects on the visual resource i.e. it is an assessment of the visual effects of aviation lighting on views experienced by people at night. The assessment of Proposed Development wind turbine lighting does not consider effects of aviation lighting on landscape or coastal character.

ICAO indicates a requirement for no lighting to be switched on until 'Night' has been reached, as measured at 50 cd/m2 or darker. It does not require 2,000 candela medium intensity to be on during 'twilight', when coastal and landscape character may be discerned. The aviation and marine navigational lights may be seen for a short time during the twilight period when some recognition of landscape features/ profiles/ shapes and patterns may be possible. It is considered however, that level of recognition does not amount to an ability to appreciate in any detail landscape character differences and subtleties, nor does it provide sufficient natural light conditions to undertake a landscape character assessment.

The proposed aviation lighting will not have significant effects on the perception of landscape or coastal character, which is not readily perceived at night in darkness, particularly in rural areas. The matter of visible aviation and marine navigation lighting assessment is wholly a visual concern and the assessment presented focusses on that premise.

5.8.3.4. Baseline conditions

The baseline lighting conditions across the 25 km Detailed Assessment Area vary considerably and OPEN is not aware of a single data source that serves to provide a detailed or quantitative evidence base. The assessment of night-time effects is not based on quantitative measurement of light levels but relies on the professional judgement of Chartered Landscape Architects.

To provide some context to the assessment, Figure 5.7 illustrates information relating to light pollution in the 50 km SLVIA Study Area information provided by Campaign to Protect Rural England (CPRE), who have produced interactive maps of the UK's light pollution and dark skies as part of a national mapping project. This is based upon data from the National Geophysical Data Center, part of the National Center for Environmental Information (NCEI) in the USA. Land Use Consultants (LUC) has processed this satellite data to prepare a map showing the areas of relative light pollution across Scotland (LUC/CPRE, 2016). This Open Source data has been used to help understand and illustrate the existing baseline lighting levels of the 50 km SLVIA Study Area.

Each pixel in the mapping shows the level of radiance (night lights) shining up into the night sky, which have been categorised into colour bands to distinguish between different light levels, from colour band 1 (darkest) to 9 (brightest). The map clearly identifies the main concentrations of night-time lights, creating light pollution that spills up into the sky.

As shown on Figure 5.7, the primary source of light pollution within the 50 km SLVIA Study Area is settlement, with secondary sources being transport infrastructure and industry. Edinburgh forms the largest and brightest area, with smaller but equally bright areas at Livingston and Grangemouth further west. Edinburgh Airport, the bridges across the Forth and Rosyth Shipyard are notable bright spots. Within Fife, Kirkcaldy, Glenrothes and the settlements of Methil and Leven are relatively bright at night along the nearest section of the coastline to the Proposed Development. The closest sections of the Fife coastline are not dark at night due to the extensive baseline lighting of urban and industrial areas along the nearest coastline at night, which is evident in views along the Fife coast (Viewpoint 2, Figure 5.27g/j) and in the backdrop to views across the Firth of Forth from East Lothian (Viewpoint 20, Figure 5.40i/j/l) and Edinburgh (Viewpoint 22, Figure 5.42i/j/n). Areas of the Fife coast with lower levels of night lighting occur to the north-east of Lower Largo, around Largo Bay and along the coastline of the East Neuk. Across the firth, the coastline between Edinburgh and Longniddry has high levels of lighting at night, with the rural sections of coast between Aberlady, Gullane and North Berwick having lower levels of night lighting and darker skies, albeit with the backdrop of urban lighting evident in views across the Firth of Forth to Fife at night.

Experience on the ground established that there are further sources of light within the Forth that are prominent within the darker areas towards the outer firth: shipping, nautical navigation lights and rigs punctuate the night sky to the east while to the west, there is typical skyglow from the urban coast. Red aviation lighting on the existing LDT and nearby communications mast are notably visible at night in views locally from both the Fife coast (Viewpoint 2, Figure 5.27g/j), and are visible at greater distance in views across the Firth of Forth from East Lothian (Viewpoint 20, Figure 5.40i/j/l) and Edinburgh (Viewpoint 22, Figure 5.42i/j/n), however they form very minor distant red point features of light amongst the urban lighting and are characteristic in the wider panorama with numerous red lights visible on communications masts, cranes and the Queensferry Crossing.

5.8.3.5. Nacelle aviation light ZTV

The nacelle aviation light ZTV shown in Figure 5.18 defines the geographical area where visual effects on visual amenity and views due to aviation lighting within the Proposed Development will theoretically occur. This nacelle aviation light ZTV is based on the hub height ZTV, given the location of the aviation light on the hub/nacelle of the WTG. The base mapping has been darkened to give an indication of those areas that will not be affected by visibility of the aviation lighting. The nacelle aviation light ZTV shows potential visibility from much of the Firth of Forth and the open sea. To the north from Fife visibility will be focused within 10 km of the Proposed Development, including the Fife coast between Kinghorn and Chapel Ness, but also extends in visibility splays to 20-30 km to the west and east of the Proposed Development, from areas of higher ground. South of the Firth of Forth, the ZTV is more intermittent but extends to coastal areas and higher ground in Edinburgh and along the settled East Lothian coast to Longniddry, and the rural coastlines to North Berwick/Tantallon, with intermittent visibility at longer distances over 30 km from the higher ground of the Lammermuirs and Moorfoot Hills in the southern portion of the SLVIA Study area.

5.8.3.6. Night-time Viewpoint Assessment

Viewpoint 2 Fife Coastal Path, East Wemyss (Figure 5.22g/h/j/k)

Development provides a prominent source of light within the relatively dark scene: at Buckhaven on the coast, where there is some skyglow; and at coastal settlements strung along the Lothian coastline. Aviation lighting to the LDT and the nearby mast are notable. Intermittent, bright lights within the Forth are also evident. A rig within the Forth is the dominant light source within the view towards the Proposed Development site. Within the wider panorama, lighting within Edinburgh and the resulting skyglow is bright and expansive across this part of the panorama. The predicted view of the Proposed Development at night is shown in Figure 5.22k. The Proposed Development will introduce an additional light source to the scene, consisting of the red aviation lighting at the turbine nacelle and meteorological mast, as well as the visible marine navigational lighting at platform level. The intensity of this lighting is expected to be similar to that of the LDT and the resulting addition of these new point sources of light to the view will be apparent, but of a low magnitude of change to the level and incidence of baseline lighting evident in the view, such that the effect of the Proposed Development lighting on the view at night is assessed as not significant.

Viewpoint 20 North Berwick, north of Harbour (Figure 5.40h/i/j/l/m)

The dark expanse of the North Berwick bay and the Firth of Forth is punctuated by light from shipping, nautical navigation lights and rigs in the Firth of Forth, together with extensive areas of urban lighting from Fife's coastal settlements in the backdrop to the firth. The aviation light on the LDT is discernible off the Methil coast, to the fore of the dark backdrop of the Lomond Hills, but within a coastal baseline context that is extensively lit at night.

The Proposed Development will introduce an additional light source similar to the LDT when introduced to the scene, consisting of the red aviation lighting at the turbine nacelle and meteorological mast adding two further red lights in the distance at 21 km from the viewpoint to the fore of the Lomond Hills backdrop, with limited overall effect on the number of light sources or levels of brightness. The Proposed Development will be readily absorbed into the baseline context at night and as such, the magnitude of change to the view from North Berwick at night will be negligible and the effect not significant (minor).

Viewpoint 22 Calton Hill, Edinburgh (Figure 5.4i/j/k/l/n/o)

The panoramic foreground of the view from Calton Hill is extensively lit at night by urban lighting within the City of Edinburgh, with lights from within and outside buildings, street lighting and floodlighting of stadiums and industrial areas creating a foreground scene scattered with white/yellow lighting. Occasional red aviation lights are visible on cranes and communications masts within the city and its hills. Beyond the brightly lit urban with multiple light sources, a notable dark area punctuated by sparse lights denotes the seascape of the Firth of Forth. Lights within settlements along the Fife coast are plainly visible in the distance forming the backdrop to the Firth of Forth. Lighting of the Queensferry Crossing forms a landmark to the north-west, as does the red aviation lighting of the tall communications masts on the Fife skyline and occasional mooed oil rigs in the Firth. The aviation lights of the LDT and its nearby mast are discernible. The Proposed Development will introduce an additional light source similar to the LDT when introduced to the scene, consisting of the red aviation lighting at the turbine nacelle and meteorological mast adding two further red lights in the distance at over 25 km from the viewpoint. The Proposed Development will be readily absorbed into the baseline context at night and as such, the magnitude of change to the view from Calton Hill at night will be negligible and the effect not significant (minor).

5.8.4. Visual Receptors - Preliminary Assessment

A preliminary assessment of the effects of the Proposed Development on views and visual receptors is presented in Table 5.10 and Table 5.11. A detailed assessment follows in Section 5.8.5 for each visual receptor that is identified in the preliminary assessment as requiring detailed assessment. Visual receptors that may be affected by the Proposed Development are shown on Figure 5.16.

Table 5.10 – Primary Visual receptors with potential for significant effects included in the detailed assessment

Primary Visual Receptors	Preliminary Assessment
Anstruther (Wester and Easter) Buckhaven Crail Dysart East Wemyss Elie and Earlsferry Glenrothes Kennoway Kirkcaldy Leven Lower Largo Lundin Links Methil Pittenweem St. Monans West Wemyss Windygates	Coastal settlements or settlements near the coast which have a strong relationship with the coast, that partially or wholly enter the ZTV such that they have potential for significant effects. Potential for significant effect requiring detailed assessment.
A92 A911 A912 A914 A915 A916 A917 A921 A955 A6137 A198/B1348 Fife Coastal Path John Muir Way NCR 1 NCR 766 NCR 76	Roads and routes with a larger proportion or notable section(s) that enter the ZTV such that they have potential for significant effects. Potential for significant effect requiring detailed assessment.
Lomond Hills Regional Park Lochore Meadows Country Park	Regional and country parks with a larger proportion or area that wholly or partially enters the ZTV such that they have potential for significant effects. Potential for significant effect requiring detailed assessment.

Table 5.11 – Primary Visual receptors with no potential for significant effects excluded in the detailed assessment

Primary Visual Receptors	Preliminary Assessment
Settlements:	
Coaltown of Wemyss	The small village lies within the ZTV but is inward looking and set back from the coast with little relationship with the coast where the Proposed Development will be located. No potential for significant effects and excluded from detailed assessment.

Primary Visual Receptors	Preliminary Assessment
Kinglassie	14 km inland from the coast, the small village lies west of Glenrothes and within the ZTV. The village has little visibility of the coast where the Proposed Development will be located, due to intervening urban form. No potential for significant effects and excluded from detailed assessment.
Roads and routes:	
Fife Coastal Route	The 137 km route between Kincardine Bridge and the Tay Road Bridge, generally following the coast. While the ZTV includes 46 km of the route within 20 km of the Proposed Development, visibility of it will be restricted by the high level of urban form and screening roadside vegetation along the route. No potential for significant effects and excluded from detailed assessment.
Heart 200	The ZTV includes approximately 8 km of the 100 km route west of Kinross and over 25 km from the Proposed Development. No potential for significant effects and excluded from detailed assessment.
Borders Historic Route	Running exclusively along the A7 from Edinburgh to the border near Canonbie, the 153 km route lies over 30 km from the Proposed Development with visibility of it limited by distance. No potential for significant effects and excluded from detailed assessment.
Forth Valley Tourist Route	The 63 km route runs along the south side of the Firth of Forth between Edinburgh and Stirling, A stretch of less than 1.5 km lies within the ZTV while the entire route lies over 30 km from the Proposed Development with visibility of it limited by distance. No potential for significant effects and excluded from detailed assessment.
Settlements: Aberlady; Auchtermuchty; Ballingry, Lochore and Crosshill; Balmullo; Bathgate; Birkhill and Muirhead; Bonnyrigg, Dalkeith and Gorebridge; Broxburn; Cardenden and Auchterderran; Cockenzie; Cowdenbeath, Lochgelly and Lumphinnans; Crook of Devon; Danderhall; Dechmont; Dirleton; Dunbar; Dundee; Dunfermline; East Calder; East Linton; Edinburgh; Elphinstone; Falkirk; Gauldry; Gifford; Gullane; Kelty; Kinghorn; Kingseat (Fife); Kinross; Kirkliston; Kirknewton; Linlithgow; Livingston; Loanhead and Bilston; Longniddry; Macmerry; Newbridge and Ratho Station; North Berwick; Pathhead; Pencaitland; Penicuik; Prestonpans;	Limited and/or restricted or distant visibility of the Proposed Development such that there is no potential for significant effects. No potential for significant effects and excluded from detailed assessment.

Primary Visual Receptors	Preliminary Assessment
Ratho; Rosewell; Roslin; Seafield; South Queensferry; Strathmiglo; Tranent; Wellbank; Whitecraig; Winchburgh.	
A roads: A1; A7; A8; A9; A68; A70; A71; A85; A88; A89; A90; A91; A92; A93; A94; A198; A199; A700; A701; A702; A703, A705; A706; A720; A766; A768; A772; A977; A779; A800; A801; A803; A823; A824; A876; A899; A900; A901; A902; A903; A904; A905; A907; A908; A909; A910; A911; A912; A913; A914; A915; A916; A917; A918; A919; A921; A922; A923; A928; A929; A930; A955; A972; A977; A984; A985; A989; A991; A993; A994; A1087; A1107; A1140; A6106; A7066; A6093; A6094; A6095; A6106; A6124; A9000. Motorways: A823(M); M8; M9; M90; M876. **NCN**: 75; 76; 196; 754; 775; 777.	Roads and routes with a smaller proportion or short section(s) that enter the ZTV such that they have no potential for significant effects. No potential for significant effects and excluded from detailed assessment.
Settlements: Aberdour; Abernethy; Airth; Alloa; Almondbank; Alva; Arbroath; Auchterarder; Bankfoot; Blackford; Blairgowrie; Blairhall; Bo'ness; Bridge of Earn; Bridgend; Burntisland; Burrelton; Cairneyhill; Carnoustie; Ceres; Clackmannan; Coupar Angus; Crossford (Fife); Cupar; Dalgety Bay; Dollar; Dunning; Errol; Falkland; Forgandenny; Freuchie; Glenfarg; Haddington; High Valleyfield; Inchture; Kincardine; Kingskettle and Kettlebridge; Kinnesswood; Ladybank; Leuchars and Guardbridge; Liff; Limekilns and Charlestown; Longforgan; Luncarty; Methven; Milnathort; Murthly; Newburgh (Fife);Newport-on-Tay and Wormit; Newtyle; North Queensferry; Oakley, Carnock and Comrie; Ormiston; Perth; Saline; Scone; Springfield; St Andrews;St Madoes and Glencarse; Stanley; Strathkinness; Tayport; Tillicoultry; Torphichen; Townhill; West Barns; Whitecross. **Roads and routes:** Angus Coastal Route; Deeside Tourist Route.	No potential for significant effects and excluded from detailed assessment as no theoretical visibility of the Proposed Development. No potential for significant effects and excluded from detailed assessment.

5.8.5. Visual Receptors - Detailed Assessment

5.8.5.1. Settlements

The settlements in this section are included in the assessment due to a short distance to the Proposed Development, and / or because they have a coastal location or setting that is influenced by seaward views.

Settlements consist of residential areas, public spaces such as parks, esplanades, pavements, and roads. Within settlements there are different outlooks. Views to the surrounding area from some areas of settlements may be restricted by landform or by buildings and vegetation within and at the edge of the settlement. Views within settlements are influenced by buildings, infrastructure, utilities, and traffic to a varying degree with some parts of settlements having little or no outward facing views. The sensitivity of settlements will vary depending on the degree to which these factors affect the existing view. Settlements are normally considered to be of high sensitivity when undertaking SLVIA as they contain residential receptors. Current guidance advises that

Residents at home are likely to be most susceptible to change and that properties within an area of a settlement can be aggregated to identify effects on a community as a whole [64].

The assessment of effects on settlements described in this SLVIA is therefore not an assessment of effects on individual residential properties.

Anstruther

Located 16.8 km northeast of the Proposed Development, Anstruther is a small coastal resort town comprising two settlements, Anstruther Easter and Anstruther Wester, divided by the Dreel Burn. It is the largest community on the section of coastline known as the East Neuk. Sensitivity pf Anstruther's residents to the Proposed Development is high.

The town is distant from the Proposed Development with limited coverage by the ZTV. Built form within the village and at Pittenweem restricts visibility of the Proposed Development to the area around Queens Gardens and Milton Crescent on the western boundary. The view of the Proposed Development will be limited by intervening landform to its uppermost parts.

For residents of Anstruther, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as negligible. Based on the combination of the high sensitivity of Anstruther's residents and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor) direct, long-term and reversible.

Buckhaven

Buckhaven is located approximately 1.5 km northwest of the Proposed Development. The southwest of the town looks directly onto the Firth of Forth and the Proposed Development site. Sensitivity to the Proposed Development for residents of Buckhaven, is high.

The entire settlement lies within the ZTV (Figure 5.16) with actual visibility of the Proposed Development limited by the screening effect of intervening buildings and vegetation within the settlement. The following streets are most likely to have views of the Proposed Development: West High Street; Wellsley Road; Shore Street; Randolph Street (southwest end); West Wynd; East High Street; Lawson Lane; Anderson Lane; Lady Wynd; Rising Sun Road; and College Street. Viewpoint 1 (Figure 5.21) provides a representative viewpoint from Buckhaven (Shore Street).

Where visible and particularly from the southern part of the settlement nearer the coast, the magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as high. Based on the combination of the high sensitivity of the viewpoint and high magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major), direct, long-term and reversible.

Excluding those areas with views along streets aligned toward the Proposed Development or from tall buildings overlooking intervening buildings, residents of the settlement north of Wellsley Road will observe little change due to the Proposed Development.

For residents north of Wellsley Road, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of Buckhaven's residents and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate) direct, long-term and reversible.

[64] Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition.

Crail

Located 25 km northeast of the Proposed Development, the historic fishing village of Crail comprises a miniature harbour, sheltered by cliffs and surrounded by fishing cottages. For residents of Crail, sensitivity to the Proposed Development is high.

Built form within the village and rising topography to the north restricts visibility of the Proposed Development to the area around Carr Crescent and West Braes Crescent on the western boundary. Intervening landform will limit the view of the Proposed Development to its uppermost parts and a smaller proportion of the WTG may be seen from the rear of residential properties, away from the main aspect of the village (which is out to sea), however the ZTV indicates that the majority of the settlement will have no visibility of the Proposed Development.

For residents of Crail, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as negligible. Based on the combination of the high sensitivity of Crail's residents and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

Dysart

The village of Dysart is located approximately 7 km to the southwest of the Proposed Development. The majority of the settlement is elevated above the sea at an altitude of 25 m AOD or greater. The sensitivity of Dysart's residents to the Proposed Development is high.

The principal orientation of the settlement is east or southeast although some roads and houses are aligned in the direction of the Proposed Development. There will be few glimpses of the Proposed Development from the settlement due to this principal orientation and screening by intervening buildings, although there are clear views in the direction of the Proposed Development from the lower lying areas at the harbour.

For residents of Dysart, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of residents and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor), direct, long-term and reversible.

East Wemyss

The village of East Wemyss is located approximately 2.7 km west of the Proposed Development. The principal orientation of the settlement is east or southeast with parts of the settlement strongly associated with the Firth of Forth with clear views out to sea. Given these factors the sensitivity of the settlement to the Proposed Development is considered to be high.

The Proposed Development will be a noticeable new feature occupying a moderate proportion of the view looking to the Firth of Forth from parts of the settlement around Back Dykes, Main Street and the coastal edges of East Wemyss. In the north of East Wemyss there will be views of the Proposed Development from those parts of the settlement with outward facing views such as the settlement edge to the west of the A955 at High Road. Viewpoint 2 (Figure 5.22) provides a representative viewpoint from East Wemyss, at the coastal edge. For these parts of East Wemyss with visibility of the Proposed Development, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium. Based on the combination of the high sensitivity of residents and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major / moderate), direct, long-term and reversible.

From other parts of the settlement such as to the west of High Road and to the north of Main Avenue, the Proposed Development will be a less noticeable feature in views. In these areas, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of residents and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor), direct, long-term and reversible.

Elie and Earlsferry

The small coastal settlements of Elie and Earlsferry adjoins Chapel Ness on the coastline of the East Neuk of Fife and lies approximately 10 km east northeast of the Proposed Development. For residents of Elie and Earlsferry, sensitivity to the Proposed Development is high.

Curling around a sandy bay oriented south southwest, much of the conjoined settlement lies within the ZTV apart from those on the eastern flanks of the enclosing headlands. Visibility of the Proposed Development is restricted by this aspect and built form within the settlement. As such, the Proposed Development will only be visible from the settlement edges: to the north, along Links Road west of Ferry Road and Chapel Green Road, where it will clearly visible beyond Earlsferry Links and Largo Bay; and to the south, along the shoreline and on the western end of South Street, where the Proposed Development will be visible above the west end of the village. Detracting elements including rigs in the Forth and masts on land provide an industrialising influence on views from the settlement. The Proposed Development is oblique to the main focus of the view out to sea from dwellings at Elie sea front, occurring in the inland backdrop behind the settlement. Viewpoint 13 (Figure 5.33) provides a representative viewpoint from Elie at the Toft.

For residents of Elie and Earlsferry with visibility of the Proposed Development, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium-low. Based on the combination of the high sensitivity of residents and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), direct, long-term and reversible.

For residents of remaining parts of Elie and Earlsferry, including Earlsferry sea frontage where eastern flanks of enclosing headlands and landforms screen views, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of residents and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

Glenrothes

Located approximately 9 km east of the Proposed Development, the town of Glenrothes is the third largest settlement in Fife. Nearly complete coverage by the ZTV (Figure 5.16) indicates potential to be affected by the Proposed Development that is likely to be reduced by the intervening landscape. Sensitivity to the Proposed Development for residents of Glenrothes, is high.

Actual visibility of the Proposed Development is constrained by urban form within the town; built form along the coast at Methil, Buckhaven and East Wemyss; and tree cover in the hinterland, including Wemyss Wood and Moss Wood, and bordering the town. Infrequent high spots within the town may have greater visibility of the Proposed Development, whose impact will be moderated by distance and its developed coastal context.

For residents of Glenrothes, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as negligible. Based on the combination of the high sensitivity of Glenrothes' residents and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

Kennoway

The village of Kennoway is located approximately 5 km to the north of the Proposed Development and lies above 50 m AOD at the east end of a low ridge. The sensitivity of Kennoway's residents to the Proposed Development is high. The village looks out over an area of farmland and a large area of warehouses and industrial land of the north of the A915. Residential areas of Leven and Methil are visible beyond the farmland and beyond this the Firth of Forth is visible. The operational LDT is visible from the southern part of Kennoway.

The Proposed Development will potentially be visible from the southern part of Kennoway in conjunction with the operational LDT. It will primarily be visible from the southern part of the settlement. Viewpoint 6 (Figure 5.26) indicates that the Proposed Development will be a lesser element in the view that will be partially screened by existing vegetation and buildings in the middle ground. While the Proposed Development will be noticeable it will not become the dominant focal point.

For residents of Kennoway, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium-low. Based on the combination of the high sensitivity and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate) direct, long-term and reversible

Kirkcaldy

Kirkcaldy is located approximately 9 km to the southwest of the Proposed Development. The sensitivity of Kirkcaldy's residents to the Proposed Development is high. The Proposed Development has limited potential to affect the settlement due to the distance to it, and the screening effects of existing buildings. The Proposed Development has the potential to affect the esplanade area of Kirkcaldy where there are open views out to sea.

Apart from the area to the east of Hayfield and south of Smeaton, much of the settlement lies within the ZTV (Figure 5.16). Buildings and vegetation within the settlement limits visibility of the Proposed Development to glimpses of turbine blades and occasional distant views of the WTG. From the vicinity of the esplanade, the Proposed Development will be more noticeable. Viewpoint 11 (Figure 5.31) provides a representative viewpoint from Kirkcaldy, at the coastal edge.

For Kirkcaldy's residents near the esplanade, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium-low. Based on the combination of the high sensitivity and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate) direct, long-term and reversible.

Away from the esplanade, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as negligible. Based on the combination of the high sensitivity and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor) direct, long-term and reversible.

Leven

Leven is located approximately 3 km to the north of the Proposed Development with the predominant orientation of the settlement being to the southeast. Sensitivity to the Proposed Development Leven's residents is high.

The Proposed Development has the potential to affect views of the Firth of Forth from the esplanade area while in other parts of the settlement the potential to affect visual amenity is limited due to the screening effects of intervening buildings and vegetation. The majority of Leven is located on gently sloping ground that falls from north to south. Screening by buildings and vegetation restricts views of the Proposed Development to more elevated parts such as the residential area to the north of Scoonie Brae and west of Cupar Road; and to glimpses through gaps in vegetation from residential areas west of the B933 between the River Leven and the A915. Uninterrupted views of the Proposed Development from the esplanade area means it will be an unmissable new feature from this area. Viewpoint 4 (Figure 5.24) provides a representative viewpoint from Leven, at the coastal edge.

Limited views from the settlement and the presence of the LDT means Leven will receive a low magnitude of change, minor in effect and not significant.

For Leven's residents near the esplanade, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium. Based on the combination of the high sensitivity and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major / moderate) direct, long-term and reversible.

For Leven's residents away from the esplanade, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor) direct, long-term and reversible.

Lower Largo

Lower Largo is located approximately 6.8 km to the northeast of the Proposed Development and looks southward onto Largo Bay and the Firth of Forth. For residents of Lower Largo sensitivity to the Proposed Development is high.

Most of Lower Largo is set back from the shoreline and while some elevated residential areas have views towards the Proposed Development site, others are restricted by built form and vegetation. The potential for the Proposed Development to affect Lower Largo is limited to areas along the Largo Bay shoreline. Along the Largo Bay shoreline, the Proposed Development will comprise an addition to the operational LDT, extending wind energy development towards the rigs within the Forth. Viewpoint 8 (Figure 5.28) provides a representative viewpoint from Lower Largo, at the coastal edge.

For residents of shoreline properties, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium. Based on the combination of the high sensitivity of the viewpoint and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major / moderate) direct, long-term and reversible

For much of the settlement, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor) direct, long-term and reversible.

Lundin links

The village is located on the west side of Hatton Burn immediately to the west of Lower Largo. Sensitivity to the Proposed Development for residents of Lundin Links is high.

There is limited potential for the Proposed Development to affect Lundin Links apart from areas with a more open outlook such as Links Road or Golf Road in the south of the village. The Proposed Development will increase the level of wind energy development within the area that will have relatively little influence due to the developed coast at Methil and the operational LDT. Viewpoint 7 (Figure 5.27) provides a representative viewpoint from Lundin Links.

For residents of Lundin Links the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor) direct, long-term and reversible.

Methil

Methil is located approximately 1.8 km to the north of the Proposed Development. The sensitivity of Methil's residents to the Proposed Development is high.

The Proposed Development has greater potential to affect residential areas in the south and east of the settlement, at Crossroads and east of the B931, with areas in the west and north less likely to be affected. Visual amenity in the south and east of Methil is affected by the docks and harbour area and by the industrial areas to the south of the docks including Fife Energy Park and the operational wind turbines at Methil Docks and the LDT.

The shoreline of Methil has been completely altered by industrial development at Fife Energy Park, Methil Docks, and the dismantled Power Station. Residential areas are set back from the shoreline and any views of the Firth of Forth tend to be of the more distant open waters of the central channel than nearby coastal areas. The operational LDT is a noticeable feature in views from the south and east of Methil where the Proposed Development will be a noticeable new feature. Views of the Proposed Development for much of this part of the settlement will be glimpsed, intermittent or partial and limited to its upper parts. Views from the west and north of Methil will be restricted by buildings and vegetation.

For the residents of the south and east of Methil, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium-low. Based on the combination of the high sensitivity of the viewpoint and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate) direct, long-term and reversible.

For the residents of the west and north of Methil, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor) direct, long-term and reversible.

Pittenweem

Pittenweem is a small and secluded fishing village enclosing a small working harbour, approximately 17 km northeast of the Proposed Development. For residents of Pittenweem sensitivity to the Proposed Development is high.

Built form within the village limits visibility of the Proposed Development to the west and southwest boundary. Shoreline properties address the Forth while properties on Sandycraig Road back onto the Proposed Development. The blades of the Proposed Development will be visible directly behind the village of St Monans. The Proposed Development will be peripheral to the focus of views across the open waters of the Firth of Forth and the Lothian coastline.

For the residents of Pittenweem, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as negligible. Based on the combination of the high sensitivity and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor) direct, long-term and reversible.

St. Monans

The small village of St. Monans lies approximately 15 km northeast of the Proposed Development. For residents of St Monans sensitivity to the Proposed Development is high.

Built form within the village limits visibility of the Proposed Development to the western edge. Shoreline properties address the Forth while properties on Inverie Street back onto the Proposed Development where its uppermost parts will be visible directly behind undulating landform along the coast. A small proportion of the Proposed Development will be visible and peripheral to the main view across the Firth of Forth to the Lothian coastline.

For the residents of St Monans, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as negligible. Based on the combination of the high sensitivity of St Monans' residents and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor) direct, long-term and reversible.

West Wemyss

West Wemyss is a small linear village located approximately 4.6 km southwest of the Proposed Development. The sensitivity of residents of West Wemyss to the Proposed Development is high.

The principal orientation of the village is south or southeast, with some small areas in the east of the village where it is towards the Proposed Development. The shoreline is easily accessible and considered an important resource to the village.

The Proposed Development will primarily be visible from the shoreline and from the car park and church grounds in the east of the village. It will be seen in conjunction with the LDT, distinct from Largo Law and forming a lesser feature in the area. Viewpoint 3 (Figure 5.23) provides a representative viewpoint from West Wemyss, at the coastal edge.

For the residents of West Wemyss along the shoreline, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium. Based on the combination of the high sensitivity of St Monans' residents and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major / moderate) direct, long-term and reversible.

For the residents of West Wemyss away from the shoreline, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of St Monans' residents and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor) direct, long-term and reversible.

Windygates

Windygates is located approximately 4 km northwest of the Proposed Development. The sensitivity of residents of Windygates to the Proposed Development is high.

The village consists primarily of late 20th century housing with a small core of older buildings. It is oriented predominantly south or southeast and looks out onto Methil with limited views of the Firth of Forth. Intervening buildings, vegetation, and landform restricts potential visibility of the Proposed Development.

For the residents of Windygates, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of St Monans' residents and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor) direct, long-term and reversible.

Table 5.12 - Summary of Operational Effects on Settlements

Settlement	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
Anstruther (Wester and Easter)	High	Negligible	Minor Not significant
Buckhaven	High	High in a limited area particularly from the southern part of the settlement nearer the coast Low for much of the settlement where views of the proposed development are partial or screened	Major and **Significant** in a limited area particularly from the southern part of the settlement nearer the coast Moderate and not significant for much of the settlement where views of the proposed development are partial or screened
Crail	High	Negligible	Negligible Not significant
Dysart	High	Low	Moderate / minor Not significant

Settlement	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
East Wemyss	High	Medium from areas including coastal edges of East Wemyss, Back Dykes, Main Street. Low from other areas west of High Road and north of Main Avenue.	Major / moderate and Significant from areas including coastal edges of East Wemyss, Back Dykes, Main Street. Moderate / minor and Not significant from other areas west of High Road and north of Main Avenue.
Elie and Earlsferry	High	Medium – low from settlement edges to north along Links Road, along Elie sea front, and western end of South Street. Low from remaining parts of settlement including Earlsferry sea frontage where eastern flanks of enclosing headlands and landforms screen views.	Moderate and Not Significant from settlement edges to north along Links Road, along southern sea front, and western end of South Street. Minor and Not significant from remaining parts of settlement including Earlsferry sea frontage where eastern flanks of enclosing headlands and landforms screen views.
Glenrothes	High	Negligible	Minor Not significant
Kennoway	High	Medium-low	Moderate Not significant
Kirkcaldy	High	Medium-low at the esplanade and sea frontage Negligible for much of the settlement	Moderate and Not Significant at the esplanade and sea frontage. Minor and Not Significant for much of the settlement.
Leven	High	Medium near the esplanade and sea frontage Low for much of the settlement	Major / moderate and **Significant** at the esplanade and sea frontage. Moderate and Not Significant for much of the settlement.
Lower Largo	High	Medium along the shoreline Low	Major / moderate and **Significant** along the shoreline and sea frontage Minor and Not significant for much of the settlement set further back.
Lundin Links	High	Low	Moderate / minor Not significant
Methil	High	Medium in the south and east Low in the north and west	Moderate and Not Significant on the south and east of the settlement.

Settlement	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
			Moderate / minor and Not Significant on the north and west of the settlement.
Pittenweem	High	Negligible	Minor Not significant
St. Monans	High	Negligible	Minor Not significant
West Wemyss	High	Medium along the shoreline frontage of the settlement. Low for much of the settlement set further back.	Major / moderate and **Significant** along the shoreline frontage of the settlement Moderate / minor and Not Significant for much of the settlement set further back.
Windygates	High	Low	Moderate / minor Not significant

5.8.5.2. Roads and Routes

A92

The A92 links the M90 with Kirkcaldy and Glenrothes and passes 7.5 km to the west of the Proposed Development at its closest point. Sensitivity to the Proposed Development for users of the A92 is low.

The ZTV (Figure 5.16) indicates theoretical visibility of the Proposed Development between Kirkcaldy and Glenrothes. Views of the Proposed Development will be limited by vegetation growing at the roadside and in the intervening landscape to glimpses or intermittent views.

For road users on the A92, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A92 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

A911

Linking Glenrothes and Kinross with Methil, the A911 passes 4 km to the northwest of the Proposed Development at its closest point and sensitivity of users of the A911 to the Proposed Development is low.

The ZTV (Figure 5.16) includes the area between Glenrothes and Methil and the Proposed Development will be seen at an oblique angle to the road. Views of the Proposed Development will primarily be limited by roadside vegetation growing to glimpses or intermittent views.

For road users on the A911, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A911 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

A912

At its closest point near Muirhead, the A912 lies 12 km northwest of the Proposed Development and runs northwest to Perth. Sensitivity of users of the A912 is low.

Its orientation means that only southbound road users will see the Proposed Development, from two stretches of road: leaving Strathmiglo where visibility of the Proposed Development is limited by distance and landform; where it is limited by roadside vegetation.

For road users on the A912, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A912 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

A914

Meeting the A912 at the New Inn Roundabout in Muirhead, the A914 runs north-east forming a detour of the A92 between Muirhead, north of Glenrothes and Newport, and south of the Tay Road Bridge. Sensitivity of road users on the A914 is low.

The area around the New Inn Roundabout lies within the ZTV (Figure 5.16). Northbound road users will not view the Proposed Development behind them. For southbound road users, visibility from this area is limited by extensive tree cover at Lochmui and Cowdens Woods. The Proposed Development will largely be screened from the limited stretch of the A914 within the ZTV.

For road users on the A914, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A914 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

A915

The A915 links Kirkcaldy with Methil, Lower Largo and St Andrews in northeast Fife. The road runs parallel to the coast between Kirkcaldy and Lower Largo, passing within 3.5 km of the Proposed Development. At Lower Largo the road heads in a north-easterly through elevated, undulating terrain to St Andrews. The sensitivity of visual receptors on the A915 is medium.

The ZTV is consistent between Kirkcaldy and Lower Largo, with no visibility of the Proposed Development approximately 3 km northeast of Lower Largo, where Largo Law screens it from the road passing over high ground to the east. Between Kirkcaldy and Methil, the Proposed Development lies at an angle to the road and intervening vegetation will screen views of the Proposed Development, although blade tips may be visible. Between Methil and Lower Largo only westbound travellers are likely to experience views of the Proposed Development. Views will be restricted by vegetation at the side of the road and within the golf courses immediately to the south of the road. There will be glimpses or intermittent views of the Proposed Development.

For road users on the A915, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium-low. Based on the combination of the medium sensitivity of users of the A915 and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

A916

The north to south aligned A916 links Kennoway and Windygates with Cupar to the north and passes within 4 km of the Proposed Development. Sensitivity of road users on the A916 is low.

The ZTV includes the area between Windygates and Montrave. While northbound travellers will not see the Proposed Development behind them, it will be visible for southbound travellers along the stretch of road between Letham Feus Holiday Park and Bonnybank, to the north of Kennoway. From this section of road views of the Proposed Development are uninterrupted, particularly where elevated. The visual impact of the Proposed Development, approximately 7.3 km away, will be moderated by distance and the short duration of these views.

For road users on the A916, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A916 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

A917

The A917 follows the coastline from Lower Largo to St Andrews and passes within 8 km of the Proposed Development at its closest point. Sensitivity of road users on the A917 is medium.

Eastbound travellers will not view the Proposed Development behind them while undulating terrain varies the visibility of the Proposed Development for westbound travellers. Distance from the Proposed Development and the transience of the views limits the potential level of effects for visual receptors.

For road users on the A917, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium-low. Based on the combination of the medium sensitivity of users of the A917 and medium-low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

A921

The A921 follows the coastline between Kinghorn and Kirkcaldy joining the A92 just south of Thornton and passes within 7.6 km of the Proposed Development at its closest point. Sensitivity of road users on the A921 is low.

Southbound travellers will not see the Proposed Development which will always be behind them. From some stretches of the road south of Kirkcaldy and from the esplanade area, northbound travellers will have uninterrupted views of the Proposed Development that are distant and short in duration.

For road users on the A921, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A921 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

A955

The A955 runs parallel to the coast between Kirkcaldy and Methil, passing through the villages of Coaltown of Wemyss and East Wemyss. The road passes within 2.1 km to the north of the Proposed Development at its closest point. Sensitivity of road users on the A955 is medium.

The Proposed Development will always be behind southbound travellers, who will not see it. Approaching Buckhaven and to its northwest, before the junction with the B930, northbound travellers will have uninterrupted views of the Proposed Development from some stretches of the road.

For road users approaching Buckhaven on the A955, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium. Based on the combination of the medium sensitivity of users of the A955 and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), direct, long-term and reversible.

From other stretches of A955 from West Wemyss to Leven, visibility of the Proposed Development will be limited due by the screening effects of vegetation, while between Buckhaven and Leven the A955 passes through urban areas where the Proposed Development may be noticeable when glimpsed between buildings, but will be largely screened by the intervening townscape.

For road users on the A955 to the west of West Weymss and between Buckhaven and Leven on the A955, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the medium sensitivity of users of the A955 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

A6137

The 8 km A6137 generally runs southeast to Haddington. Initially level at Aberlady, the road climbs increasingly steeply to a shoulder of the Garleton Hills, before falling into the valley of the River Tyne. Sensitivity of road users on the A6137 is low.

Southbound travellers will not see the Proposed Development behind them. North of the ECML the combination of flat topography and various landscape elements such as buildings and woodland limit visibility of the Proposed Development. South of the rail line, where the road rises through more open farmland to the Garleton Hills, the Proposed Development will lie directly in front of road users. Distance to the Proposed Development and its context of developed coastline limits the impact of the Proposed Development.

Northbound users of the A6137 will observe a low magnitude of change, of minor effect that is not significant.

For users of the A6137, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A921 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

A198/B1348

The B1348 runs eastwards along the southern edge of the Firth of Forth, from Levenhall Roundabout in Musselburgh to meet the A198 at Longniddry Bents. Along the route, the coast of the Firth of Forth is intermittently visible between dense residential development. From the Bents, the A198 loosely follows the coast through the settlements of Aberlady, Gullane and North Berwick to end a mile south of Tyninghame. Sensitivity of users of the A198/B1348 to the Proposed Development is low.

Much of the largely northwest facing coastline lies within the ZTV and road users will not view the Proposed Development directly but at various angles. Areas between Aberlady and Dirleton, and west of North Berwick lie out with the ZTV. Distance to the Proposed Development and built form along the coast, limits its visibility west of Longniddry. Landform and land cover to the east limits visibility of the Proposed Development to short stretches at Gosford and Aberlady bays. While noticeable from these areas, the Proposed Development will be seen near to the LDT against the Methil coast and its impact moderated by distance.

For users of the A198/B1348, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of users of the A198/B1348 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), direct, long-term and reversible.

5.8.5.3. Long distance recreational routes

Fife Coastal Path

The Fife Coastal Path passes within 1.7 km of the Proposed Development at Buckhaven, extending along the Fife coast with the most relevant section being between Kinghorn in the south-west and Elie Ness in the north-east. Users of the path are likely to be focussed upon the landscape and views of the coast and sea. Sensitivity of users of the Fife Coastal Path to the Proposed Development is assessed as high.

The ZTV shown in Figure 5.16 indicates that the Proposed Development will be visible from a section of the Fife Coastal Path between Kinghorn and Elie Ness. There are several representative viewpoints (Viewpoints 2, 3, 4, 7, 8, 11, 12, 13 and 14) located on or near the route of the Fife Coastal Path included in the SLVIA that indicate the predicted views of the Proposed Development that will be experienced by users of the route.

Approaching from the west, there will be sustained views of the Proposed Development from the Fife Coastal Path between Kinghorn and Kirkcaldy. The Proposed Development will be visible as a lesser element in the large scale panoramic views along this stretch of the route, resulting in a medium-low magnitude of change and not significant (moderate) effect on the stretch of the route between Kinghorn and Kirkcaldy (Viewpoint 14, Figure 5.34).

Between Kirkcaldy and West Wemyss the Proposed Development will be a more noticeable element in views from the route which passes along stretches of coast with an undeveloped and more natural character than the preceding section. At West Wemyss the Proposed Development will be seen to the right of Largo Law and in association with the LDT (Viewpoint 3, Figure 5.23). Uninterrupted views of the Proposed Development will continue as walkers approach East Wemyss where the Proposed Development will occupy a small proportion of the field of view and will be seen in the context of the LDT and other activity at Fife Energy Park (Viewpoint 2, Figure 5.22). For users of the Fife Coastal Path between Kirkcaldy and West Wemyss; and between West Wemyss and East Wemyss, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as medium-high. Based on the combination of the high sensitivity of users of the Fife Coastal Path and medium-high magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major), direct, long-term and reversible.

Between East Wemyss and Buckhaven the Proposed Development will occupy a large proportion of the field of view. It will be visible to the side of the direction of travel until Buckhaven is reached where, for a short stretch of the route, the Proposed Development will align with the direction of travel and will become the focal point of views (Viewpoint 2, Figure 5.22). The route heads northeast through residential parts of Buckhaven adjacent to Fife Energy Park. For users of the Fife Coastal Path between East Wemyss and Buckhaven, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as high. Based on the combination of the high sensitivity of users of the Fife Coastal Path and high magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major), direct, long-term and reversible.

Between Buckhaven and Leven visibility of the Proposed Development will be intermittent and partial where the route of the Fife Coastal Path passes through the urban areas of Buckhaven and Methil, due to the screening effect of intervening buildings. While the Proposed Development will be visible intermittently to walkers along the route, it will not be the focal point of views and occurs in the context of urban and industrial development and the existing LDT. For users of the Fife Coastal Path between Leven and Buckhaven, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of users of the Fife Coastal Path and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), direct, long-term and reversible.

Between Leven and Lundin Links the Proposed Development will be a more noticeable feature in views where the route of the Fife Coastal Path follows the esplanade in Leven and the edges of the links, although it will be seen in the context of the Methil Docks wind turbine and the LDT and other activities at Fife Energy Park, such as that shown in Viewpoint 7 (Figure 5.27). West of Lundin Links the route follows the shoreline and there will be uninterrupted views of the Proposed Development until Leven is reached. In the east of Leven, the Proposed Development will be seen in the context of the Methil Docks wind turbine and the LDT and other activities at Fife Energy Park (Viewpoint 4, Figure 5.24) and its association with the developed coastline will be more apparent than if approaching from the west. Between Lundin Links and Leven, the magnitude of change will be medium due to the sustained and open views in the direction of travel, the significance of effect major / moderate and **significant**.

From Lower Largo to Kincraig Point the Proposed Development will continue to be a notable feature in views where the route of the Fife Coastal Path follows the shoreline of Largo Bay and the magnitude of change will be continue to be medium, and the effect major/moderate and significant on walkers, particularly those travelling in a westerly direction who will experience sustained and uninterrupted views of the Proposed Development primarily between Kincraig Point and Lower Largo.

The magnitude of change to views experienced by walkers on the Fife Coastal Path is assessed as reducing to medium-low and the effect moderate and not significant from Chapel Ness through Earlsferry eastwards to Elie and Elie Ness, where the route passes through Earlsferry and Elie, and there are generally limited views of the Proposed Development due to the intervening buildings of the settlement and the enclosing landforms of the headlands to the west of the settlement.

There will be very limited theoretical visibility of the Proposed Development from the Fife Coastal Path between Fife Ness and Elie Ness. For users of the Fife Coastal Path between Elie Ness and Fife Ness, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low to negligible. Based on the combination of the high sensitivity of users of the Fife Coastal Path and low to negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

John Muir Way

For recreational receptors using the way, appreciation of the landscape and views is integral to their experience and their sensitivity to the Proposed Development is high.

The ZTV (Figure 5.16) includes the southern coastline of the Firth of Forth within a 30 km radius of the Proposed Development, between South Queensferry and St Baldred's Boat. The ZTV indicates that constant, uninterrupted views of the Proposed Development are likely from much of this section of the route. Apart from the eastern extent beyond Eyebroughy which generally faces north, this section of coastline ranges from northeast to northwest facing.

Towards South Queensferry, the way lies over 25 km from the Proposed Development and the Forth bridges are the primary features within view. Between South Queensferry and Joppa on the eastern fringe of Edinburgh, the way either lies beyond 25 km of the Proposed Development and its potential effects are limited by distance; or the urban form of Edinburgh screens the Proposed Development as the way passes through the city.

From Joppa the way passes Newhailes, Fisherrow Sands and Musselburgh Lagoons to Prestonpans and Cockenzie and Port Seton. From here the route edges the sandy beaches of Seton Sands and Gosford Bay before cutting inland to Aberlady Bay. The primary focus will remain on the expansive firth and as the aspect of this section of coastline is north-westerly, the Proposed Development will be a peripheral and distant feature within the developed coast at Methil.

East of Aberlady Bay, the route runs inland to the villages of Gullane and Dirleton where it skirts the boundary of the Archerfield Golf Course to the back of the beach at Yellowcraigs. The route then heads to North Berwick, largely running behind dunes backing the shore. Visibility of the Proposed Development is limited by topography, tree cover and built form, particularly within North Berwick and only westbound users may glimpse it from this section.

At North Berwick, the route turns inland to pass the Law, turning at East Linton to Dunbar. Much of this section lies out with the ZTV and as it is mostly inland, the Proposed Development will barely be perceptible from the section of the route.

While the Proposed Development is visible from South Queensferry to Aberlady Bay, its impact is moderated by distance, the character of the coastline seen behind and, in the east, the angle of view. Along the North Berwick coastline, the Proposed Development is only briefly and intermittently visible for westbound walkers.

While the Proposed Development may be more apparent approaching Aberlady Bay (going eastbound) and leaving North Berwick (going Westbound), the short duration of these views, the intervening distance and peripheral location of the Proposed Development within the view means that the visual effects within these sections will largely remain the same as in other sections of the route.

For users of the John Muir Way, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of users of the John Muir Way and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate / minor), direct, long-term and reversible.

NCR 1

Cyclists on NCR 1 place a high value on views of the land and seascape. The sensitivity of cyclists on NCR 1 to the Proposed Development is high.

The ZTV shown in Figure 5.16 indicates there will be limited visibility of the Proposed Development from the route at approximately 9.5 km where the route passes through woodland to the north of Star. The ZTV also indicates theoretical visibility from a short stretch of the route to the north of Auchtermuchty at approximately 20 km. A negligible magnitude of change will occur that is negligible and not significant in effect.

For cyclists on NCR1, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of cyclists on NCR1 and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

NCR 766

Cyclists on NCR 766 place a high value on views of the land and seascape. The sensitivity of cyclists on NCR 766 to the Proposed Development is high.

The ZTV shown in Figure 5.16 indicates the Proposed Development will be visible from much of the route. It is likely that the Proposed Development will be more noticeable to southbound users of the route as opposed to northbound users who will view it at an angle. Views of the Proposed Development from the route will be limited by the screening effects of urban and industrial development and vegetation. Distance from the Proposed Development and the urban and industrial character of the landscape through which the route passes, moderates the level of effect.

For cyclists on NCR766, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of cyclists on NCR766 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate-minor), direct, long-term and reversible.

NCR 76

Cyclists on NCR 76 place a high value on views of the land and seascape. The sensitivity of cyclists on NCR 76 to the Proposed Development is high.

The ZTV shown in Figure 5.16 indicates limited theoretical visibility at approximately 11.5 km to the southwest of the Proposed Development. The route crosses an elevated area of land from which there are long distance views of the Firth of Forth, Largo Law and the East Lothian coastline. The Proposed Development will be visible as a lesser element in views and will be seen in the context of the developed coastline at Methil and Leven (Viewpoint 4, Figure 5.24). The Proposed Development will occupy a small proportion of the field of view and will have a limited influence on users of the route.

For cyclists on NCR76, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of cyclists on NCR76 and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate-minor), direct, long-term and reversible.

Table 5.13 - Summary of Operational Effects on Roads & Routes

Road or Route	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
A92	Low	Low	Negligible Not significant
A911	Low	Low	Negligible Not significant
A912	Low	Low	Negligible Not significant
A914	Low	Low	Negligible

Road or Route	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
			Not significant
A915	Medium	Medium-low	Moderate/minor Not significant
A916	Low	Low	Negligible Not significant
A917	Medium	Medium-low	Moderate/minor Not significant
A921	Low	Low	Negligible Not significant
A955	Medium	Medium approaching Buckhaven from south (to the west of Buckhaven) Low west of West Wemyss and between Buckhaven and Leven	Moderate/minor and Not Significant approaching Buckhaven from south (to the west of Buckhaven) Minor and Not Significant west of West Wemyss and between Buckhaven and Leven
A6137	Low	Low	Negligible Not significant
A198/B1348	Low	Low	Negligible Not significant
Fife Coastal Path	High	Medium-low between Kinghorn and Kirkcaldy. Medium-high between Kirkcaldy and West Wemyss. High between East Wemyss and Buckhaven. Low between Buckhaven and Leven. Medium between Leven, Lundin Links, Lower Largo and Kincraig Point. Medium-low from Chapel Ness through Earlsferry eastwards to Elie and Elie Ness. Negligible between Elie Ness and Fife Ness.	Major and **Significant** between Kirkcaldy, West Wemyss and Buckhaven. Major/moderate and **Significant** between Leven, Lundin Links, Lower Largo and Kincraig Point. Moderate and Not Significant between Kinghorn and Kirkcaldy; and from Chapel Ness through Earlsferry eastwards to Elie and Elie Ness. Moderate/minor and Not Significant between Buckhaven and Leven. Minor and Not Significant between Elie Ness and Fife Ness.
John Muir Way	High	Low	Moderate / minor Not significant
NCR 1	High	Negligible	Minor Not significant
NCR 766	High	Low	Moderate / minor Not significant
NCR 76	High	Low	Moderate / minor Not significant

5.8.5.4. Other recreational receptors

Lomond Hills Regional Park

The sensitivity of park users to the Proposed Development is high as it is an area designated for outdoor recreation and enjoyment of the landscape and views are part of the experience of visiting the park. The potential for the Proposed Development to affect views from the park is limited due to its distance from the designated area.

The ZTV shown in Figure 5.15 indicates the Proposed Development is theoretically visible from the southern part of the park and more elevated parts in the west. Viewpoint 15 (Figure 5.35) is considered representative of the magnitude of change to the park and indicates that the Proposed Development will be a very small visible element. The Proposed Development will be seen in the context of the developed coast at Methil and Leven and in association with the LDT. As such, it will not be seen in the open waters of the Firth of Forth nor become the focal point in views. Other views from the park which are important to its enjoyment such as views to the Ochils and the south central Highlands will be unaffected by the Proposed Development.

The magnitude of change to the park will therefore be low. Due to the very limited effect on views from the park in the direction of the Proposed Development the significance of effect on the park will be minor and not significant.

Lochore Meadows Country Park

The sensitivity of park users to the Proposed Development is high as it is an area designated for outdoor recreation indicating that enjoyment of the landscape and views will be part of the experience of visiting the park.

The Proposed Development will not be visible from Lochore Meadows Country Park due to the screening effects of vegetation within the park and in the surrounding landscape; intervening settlements and the low lying topography of the landscape which further limits visibility. The magnitude of change will be low, with a minor effect that is not significant.

Table 5.14 - Summary of Operational Effects on Country and Regional Parks

Country / Regional Park	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
Lomond Hills Regional Park	High	Low	Minor Not significant
Lochore Meadows Country Park	High	Negligible	Negligible Not significant

Muirfield Golf Course

Home of The Honourable Company of Edinburgh Golfers since 1891, Muirfield is a privately owned golf links in Gullane, East Lothian. The club is world famous and one of the oldest golf courses. Overlooking the Firth of Forth it remains relatively unchanged since 1936. Enjoyment of the landscape and views is part of the golfing experience however, the attention of receptors is engaged in playing golf, therefore receptor sensitivity to the Proposed Development is moderated and assessed as medium-high.

While the landform of the area is generally low-lying and its coastal location means it lies within the ZTV (Figure 5.16), the potential for effects arising from the Proposed Development is limited as distance, the backdrop of Methil’s developed coast, and the presence of the operational LDT will moderate the visual impact of the Proposed Development. Woodland along the coast restricts visibility to the eastern half of the course.

As the Proposed Development comprises a larger turbine than the existing LDT, it will be a new but not discordant feature off the Methil coast. The visual character of the Fife coastline from Muirfield will largely remain the same as at baseline.

The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

Renaissance Golf Course at Archerfield

The 300 acre Renaissance Club golf course is located next to the historic village of Dirleton. It is part of the golfing coastline of the Firth of Forth and abuts the world famous Muirfield golf course to the west with Archerfield Links to the east and North Berwick West Links slightly further east. Historically part of the 1000 acre Archerfield Estate, the club is the only remaining portion of the estate on the natural windswept dunes of the coastline. Enjoyment of the landscape and views is part of the golfing experience however, the attention of receptors is engaged in playing golf, therefore receptor sensitivity to the Proposed Development is moderated and assessed as medium-high.

The sensitivity to the Proposed Development of golfers at the Renaissance Golf Course at Archerfield is low. The ZTV (Figure 5.16) extends over the western part of the course and the larger proportion of the course lies out with the ZTV. Woods along the northern boundary and within the north of the course encloses the course such that the Fife coast is largely screened.

The magnitude of change to the view resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the high sensitivity of the viewpoint and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), direct, long-term and reversible.

Table 5.15 - Summary of Potential Effects on Golf Courses

Country / Regional Park	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
Muirfield	Medium-high	Low	Moderate/minor Not significant
Renaissance	Medium-high	Low	Moderate/minor Not significant

5.9. Assessment of Residual Effects on Landscape and Coastal Character

5.9.1. Preliminary Assessment – Coastal Character Areas

A preliminary assessment of the effects of the Proposed Development on coastal character areas (CCAs) is presented in Table 5.16 and Table 5.17, with reference to the ZTV in Figure 5.14. A detailed assessment follows in Section 5.9.3 for each CCA that is identified in the preliminary assessment as requiring detailed assessment.

Table 5.16 - Preliminary assessment of coastal character receptors with potential for significant effects and included in the detailed assessment

Seascape Receptor	Preliminary Assessment
Local Coastal Character Area (CCA) A. Kinghorn Rocky Cliffs; B. Kirkcaldy Urban Shore;	CCAs partially or wholly entering the ZTV and within the 25 km Detailed Assessment Area.

Seascape Receptor	Preliminary Assessment
C. Dysart; D. Dysart to West Wemyss; E. West Wemyss to Buckhaven; F. Buckhaven/Methil/Leven; G. Leven Links; H. Lower Largo Rocky Shore; I. West Largo Bay & Links; J. Rocky Headland; and K. East Neuk Coast. **Regional Coastal Character Area (CCA)** SA16 Edinburgh To Gullane; and SA17 Eyebroughy To Torness Point.	Potential for significant effect requiring detailed assessment in Section 5.7.

Table 5.17 – Preliminary assessment of coastal character receptors with no potential for significant effects and excluded from detailed assessment

Seascape Receptor	Preliminary Assessment
National Coastal Character Area (CCA) Type 2. Rocky Coastline / Open Sea Views Type 3. Deposition Coastline, Open Views **Regional Coastal Character Area (CCA)** SA8. Arbroath to SA9. Dundee SA10. Inner Firth of Tay SA11. St. Andrews Bay SA12. St. Andrews to Fife Ness SA18. Torness Point to St. Abbs	Excluded from detailed assessment due to limited / restricted or distant visibility of the Proposed Development. No potential for significant effects - scoped out of further assessment

5.9.2. Preliminary Assessment – Landscape Character Types (LCTs)

A preliminary assessment of the effects of the Proposed Development on LCTs is presented in Table 5.18 and Table 5.19. A detailed assessment follows in Section 5.9.3 for each LCT that is identified in the preliminary assessment as requiring detailed assessment. The preliminary assessment, presented below, has been undertaken with reference to the ZTV in Figure 5.14.

Table 5.18 - Preliminary assessment of LCT with potential for significant effects and included in the detailed assessment

Landscape Character Type (LCT)	Preliminary Assessment
Fife 0 Urban; 192. Coastal Hills- Fife; 190. Lowland River Basin; 188. Lowland Dens; 196. Coastal Flats - Fife; 185. Pronounced Volcanic Hills and Craigs; 186. Lowland Hills and Valleys; 183. Hill Slopes 184. Foothills – Fife; and 193. Coastal Terraces - Fife. **East Lothian** 18. Northern Coast; and 19. Musselburgh/Prestonpans Coast.	LCT along the coast or with a strong relationship with the coast, partially or wholly entering the ZTV. Potential for significant effect requiring detailed assessment in Section 5.9.

Table 5.19 - Preliminary assessment of LCT with no potential for significant effects and excluded from detailed assessment

Landscape Character Type (LCT)	Preliminary Assessment
Dundee City and Fife LCT	
191. Lowland Loch Basins - Fife	Limited effects due to the high level of boundary woodland south of Kilconquhar Loch. Visibility from other areas of the LCT are limited by distance. No potential for significant effects - scoped out of further assessment.
390. Lowland Basins	Potential for significant effects is limited by the small proportion of the LCT with potential visibility of the Proposed Development and the intervening distance and landscape.
East Lothian Landscape Character	
270. Lowland River Valleys - Lothians	No potential for significant effects due to the enclosed and wooded nature of the valley; the high level of boundary woodland and trees in the surrounding countryside; and urban development along the coast. No potential for significant effects - scoped out of further assessment.
275. Lowland Farmed Plain - Lothians	No potential for significant effects due to boundary woodland and trees in the surrounding countryside; and urban development along the coast to the north. No potential for significant effects - scoped out of further assessment.
Perth and Kinross Landscape Character	
182. Upland Hills	Limited potential for significant effects due to the limited influence of the coast on the character LCT. No potential for significant effects - scoped out of further assessment.
383. Rugged Lowland Hills	Limited potential for significant effects due to the limited influence of the coast on the character LCT and the smaller area with potential visibility of the Proposed Development.

Landscape Character Type (LCT)	Preliminary Assessment
	No potential for significant effects - scoped out of further assessment.
Angus Landscape Character 387. Dipslope Farmland	Excluded from detailed assessment due to limited / restricted or distant visibility of the Proposed Development.
City of Edinburgh Landscape Character 0. Urban **Dundee City and Fife LCT** 182. Upland Hills; and 187. Lowland Open Sloping Farmland. **Clackmannanshire Landscape Character** 149. Lowland Hills - Central; and 152. Lowland River Valleys - Central. **East Lothian Landscape Character** 266. Plateau Moorland - Lothians; 269. Upland Fringes - Lothians; 270. Lowland River Valleys – Lothians; 272. Lowland Hills and Ridges – Lothians; and 277. Coastal Margins – Lothians. **Falkirk Landscape Character** 151. Lowland Plateaux - Central; 152. Lowland River Valleys - Central; and 0. Urban. **Midlothian Landscape Character** 0. Urban; 267. Plateau Grassland – Lothians; 268. Upland Hills – Lothians;and 275. Lowland Farmed Plain – Lothians. **Perth and Kinross Landscape Character** 382. Lowland Hill Ranges; 384. Broad Valley Lowlands - Tayside; and 385. Firth Lowlands. **West Lothian Landscape Character** 268. Upland Hills - Lothians; 269. Upland Fringes - Lothians; 272. Lowland Hills and Ridges - Lothians; 273. Lowland Plateaux - Lothians; 274. Lowland Plain;	No potential for significant effects - scoped out of further assessment.

Landscape Character Type (LCT)	Preliminary Assessment
271. Lowland River Corridors - Lothians; 276. Lowland Hill Fringes - Lothians; and 280. Coastal Farmland - Lothians. **Scottish Borders Landscape Character** 90. Dissected Plateau Moorland; 91. Plateau Grassland – Borders; 92. Plateau Outliers; 99. Rolling Farmland - Borders; 104. Upland Fringe Rough Grassland; 110. Coastal Farmland – Borders; 114. Pastoral Upland Valley; and 117. Pastoral Upland Fringe Valley.	
Angus Landscape Character 0. Urban; 382. Lowland Hill Ranges; 384. Broad Valley Lowlands - Tayside; 386. Low Moorland Hills; and 388. Beaches Dunes and Links - Tayside. **Clackmannanshire Landscape Character** 153. Carselands; and 154. Lowland Valley Fringes. **Dundee City and Fife LCT** 0. Urban; 195. Coastal Braes; 189. Lowland Valley – Fife; 384. Broad Valley Lowlands – Tayside; 385. Firth Lowlands; 194. Coastal Cliffs; 387. Dipslope Farmland; 390. Lowland Basins; and 383. Rugged Lowland Hills. **Falkirk Landscape Character** 152. Lowland River Valleys - Central; 155. Coastal Farmland - Central; and 0. Urban. **Midlothian Landscape Character** 266. Plateau Moorland – Lothians; 269. Upland Fringes – Lothians; 270. Lowland River Valleys - Lothians; and 272. Lowland Hills and Ridges – Lothians.	Excluded from detailed assessment as no theoretical visibility of the Proposed Development.

Landscape Character Type (LCT)	Preliminary Assessment
Perth and Kinross Landscape Character 379. Foothills - Tayside; 380. Lowland Hills – Tayside; and 381. Lowland River Corridors - Tayside. **Scottish Borders Landscape Character** 100. Plateau Farmland - Borders; 115. Upland Valley with Mixed Farmland; and 119. Wooded Upland Fringe Valley.	

5.9.3. Detailed Assessment – Landscape and Coastal Character

This section describes the effects of the Proposed Development on LCTs and CCAs partially or wholly within the ZTV and within the 25 km Detailed Assessment Area. As mentioned in Section 5.4, where an LCT has a coastal component and therefore an associated CCA the assessment of effects on the CCA is described under the LCT heading. Figure 5.10 indicates the geographical area within which significant effects on landscape character are predicted to occur.

As mentioned in Section 5.4 and described in Section 5.5, several units of a LCT may occur within the 25 km Detailed Assessment Area. Where this is the case the effects on each unit of the LCT are assessed.

5.9.3.1. Landscape and Coastal Character in Fife

Urban LCT (0)

The sensitivity of the LCT to the Proposed Development is low. The LCT has an extensively modified character due to the influence of existing urbanisation and industrial development at the coast. The Proposed Development site forms part of the seaward setting of the LCT and has the potential to influence the character of the coastal areas of Leven, Methil and Buckhaven.

Figure 5.10 indicates theoretical visibility from the majority of the LCT. Actual visibility of the Proposed Development will be restricted by buildings and vegetation within the urban area such that views of the Proposed Development will be glimpsed or partial. The Proposed Development will be a more noticeable feature in views from the southern edge of the LCT, where it is strongly influenced by industrial and commercial development and the operational LDT is a notable visible feature. The Proposed Development will be associated with the operational LDT and less so with the shipping and oil related activities in the Firth of Forth. Due to the short separation distance, the Proposed Development will influence the character of the southern part of the LCT and its setting. The magnitude of change to the Urban LCT resulting from the operation and maintenance of the Proposed Development is assessed as medium.

Based on the combination of the low sensitivity of the receptor and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), indirect, long-term and reversible.

The associated **Buckhaven / Methil / Leven (F) CCA** is strongly influenced by urban and industrial development. Views along the shoreline and out to the Firth of Forth are influenced by the LDT and the Methil Docks WTG. Shipping activities in the Firth add to the experience of a backdrop of commercial and industrial activity. The sensitivity of the CCA to the Proposed Development is low.

The Proposed Development will be a new focal point in views from this urban CCA, which will not interrupt views along the coastline although it will be a new feature to which the eye is drawn and will extend the existing influence of wind turbines on the coastal character. This influence is not a new influence and does not constitute a material change in character, given the influence of the existing wind turbines at Methil docks, but forms an extension of wind turbine influence at a larger scale off this CCA in the nearshore waters of the Firth of Forth, which results in localised effects on this closest and industrialised coastline. The magnitude of change to the Buckhaven / Methil / Leven CCA resulting from the operation and maintenance of the Proposed Development is assessed as medium.

Based on the combination of the low sensitivity of the receptor and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), indirect, long-term and reversible.

Coastal Hills LCT (192)

Due to the close association with the coast, the importance of sea views to the character of LCT and the potential for the Proposed Development to affect such views, the sensitivity of the LCT to the Proposed Development is considered to be high.

The majority of the Coastal Hills LCT has theoretical visibility of the Proposed Development, as shown in Figure 5.14. Effects arising from the Proposed Development will primarily be visual and limited to effects on aesthetic and perceptual qualities of the LCT. While views from the shoreline or narrow coastal strip wherein the Fife Coastal Path lies, views of the sea from inland areas of the LCT will be less affected due the intervening distance and the nature of the landscape characteristics set-back from the coast. The magnitude of change to the Coastal Hills LCT will range from medium along the coastal edges of the LCT, where effects on the perceived character are assessed as major / moderate and **significant**, dropping to low magnitude from areas set-back from the coast where intervening vegetation and settlements reduce visibility of the Proposed Development and the potential changes in the seascape, where moderate / minor and not significant effects occur on the perceived character of the coastal hills inland from the coast.

The **Dysart to West Wemyss (D)** and the **West Wemyss to Buckhaven (E) CCAs** are associated with the Coastal Hills LCT. The West Wemyss to Buckhaven (E) CCA is also considered to be of high sensitivity to the Proposed Development due to its value and close association with the seascape, such that it is highly susceptible to change occurring in the nearshore waters. There are open views along the coast in the direction of the Proposed Development from the CCA, including views along the coast to Largo Law. The Dysart to West Wemyss (D) CCA is considered to have a medium sensitivity to change due to the orientation of the coast and its wooded hinterland which restrict views.

Although the key, historic aspects of the Dysart CCA are unlikely to be affected by the Proposed Development, the Proposed Development has potential to affect views from the coastline within the Dysart to West Wemyss CCA. Visibility from the landward part is likely to be limited by vegetation and settlements. The Proposed Development will be a noticeable feature in views from the Dysart to West Wemyss and the West Wemyss to Buckhaven CCAs, however occupies a small proportion of the field of view away from Largo Law, which will remain an important landmark and visual focus. The magnitude of change to the Dysart to West Wemyss (D) and West Wemyss to Buckhaven (E) CCAs resulting from the operation and maintenance of the Proposed Development is assessed as medium.

Based on the combination of the medium sensitivity of the Dysart to West Wemyss (D) and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate), indirect, long-term and reversible.

As views tend to be channelled along the coast within the West Wemyss to Buckhaven CCA, the Proposed Development will appear to have a greater influence in this area. Based on the combination of the high sensitivity of the West Wemyss to Buckhaven (E) CCA and medium magnitude of change, the significance of effect arising from the Proposed Development is assessed as **significant** (major/moderate), indirect, long-term and reversible. The Proposed Development extends an existing coastal wind turbine influence, which is not a new influence or step change in character, given the influence of the existing wind turbines, but forms an extension of influence at larger scale and into the nearshore water of the Firth of Forth, resulting in localised significant effect on this closest and less industrialised parts of the Fife coast.

Lowland River Basin LCT (190)

The intensively modified nature of the landscape, and the limitation of effects arising from the Proposed Development to its aesthetic and perceptual qualities means that sensitivity of the Lowland River Basin LCT to the Proposed Development is low.

Much of the LCT will have theoretical visibility of the Proposed Development as shown in Figure 5.14. To the south of the River Ore the LCT is intensively modified by coal workings, afforestation at Earlseat Windfarm and electricity transmission lines that run parallel to the A915. Agricultural land use is more of an influence north of the River Ore and the River Leven. The Proposed Development would exert more of an influence on aesthetic and perceptual aspects in the south of the LCT than in the northern part. However, the southern part is less sensitive. The magnitude of change to the Lowland River Basin LCT resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the low sensitivity of the receptor and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), indirect, long-term and reversible.

No CCA is associated with this inland LCT.

Lowland Dens LCT (188)

The nearest unit of Lowland Dens LCT lies approximately 3.5 km to the north of the Proposed Development. The landscape has a predominantly inward looking aspect and as such, the Proposed Development has limited potential to affect its small scale character, however it has a very distinctive characteristics of the Fife landscape. The sensitivity of the Lowland Dens to the Proposed Development is medium.

Apart the northeast of the LCT, which will be unaffected due to the screening effects of Largo Law, much of the LCT has theoretical visibility of the Proposed Development, as shown by the ZTV in Figure 5.14. Key characteristics of the LCT will remain largely unaffected. Panoramic and large scale vistas, generally from a few elevated locations, include large areas of the Firth of Forth.

The Proposed Development will be seen in the context of the rigs within the Firth of Forth, the operational LDT and the urban areas of Methil / Leven / Buckhaven. As such, the Proposed Development represents a small but noticeable new element in keeping with the existing landscape character. The magnitude of change to the Lowland Dens LCT resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the medium sensitivity of the receptor and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), indirect, long-term and reversible.

The **Leven Links (G) CCA** forms the western part of Largo Bay and is associated with the Lowland Dens LCT. As the Proposed Development has the potential to affect the character of the coastline of Largo Bay by interrupting views along it, the sensitivity of the CCA to the Proposed Development is high.

The Proposed Development will be a noticeable feature associated with the LDT and the developed coastline at Methil and Leven, seen against the backdrop of the Kinghorn Rocky Cliffs (A) CCA and the developed Inner Firth. Given the short distance between the Leven Links (G) CCA and the Proposed Development and the open character of views from the broad beaches, the magnitude of change will be medium with a moderate / major effect that is **significant**. The Proposed Development extends an existing coastal wind turbine influence, which is not a new influence or step change in character, given the influence of the existing wind turbines, but it is the extension of influence at larger scale and into the nearshore water of the Firth of Forth, that results in these localised significant effects on the closest and less industrialised parts of the Fife coast.

Coastal Flats LCT (196)

As the Proposed Development has the potential to affect seaward views across Largo Bay, the sensitivity of the Coastal Flats LCT to the Proposed Development is medium.

The entire LCT has theoretical visibility of the Proposed Development, as shown in Figure 5.14. Sloping landform with few intervening features to screen the Proposed Development from view means it will be clearly visible from the LCT. The Proposed Development will be seen in association with the operational LDT in the context of the developed coastline. As such, it will not exert a strong influence on the Coastal Flats LCT. The magnitude of change to the Coastal Flats LCT resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the medium sensitivity of the receptor and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (moderate/minor), indirect, long-term and reversible.

The **West Largo Bay and Links (I) CCA** is associated with the Coastal Flats LCT. There are open, seaward views from the shoreline and landward parts of the CCA. Views follow the sweeping line of Largo Bay towards the LDT and the urban areas of Leven and Methil. The sensitivity to the Proposed Development of the East Largo Bay and Links CCA is medium. The Proposed Development will be a noticeable new feature but will not become a dominant focal point in views which encompass the wider Firth of Forth and the coastline of East Lothian. The magnitude of change to the East Largo Bay and Links CCA will be medium-low, and the effect will be moderate / minor and not significant.

Pronounced Volcanic Hills and Craigs LCT (185)

Five distinct units of this LCT may potentially be affected by the Proposed Development: Clatto / Hill of Tarvit, Largo Law, Kincraig Point, Glassmount and Kinglassie.

- **Clatto / Hill of Tarvit:** As the character of the unit is less influenced by the seaward views from southern parts of the unit and more by the rolling, hilly interior, its sensitivity to the Proposed Development is low. The ZTV (Figure 5.14) covers the southern part of this unit, where seaward views give wider context to the LCT by providing glimpses to the Firth of Forth and the developed coastline where the LDT is visible. While the Proposed Development will be visible in seaward views, such views are of limited contribution to the character of the LCT which is influenced more by the undulating hills and dissected agricultural plateau. The magnitude of change to the Clatto / Hill of Tarvit unit will be negligible, with a negligible effect that is not significant.
- **Largo Law**: As views across Largo Bay and the Firth of Forth are important to its setting, the sensitivity of the unit to the Proposed Development is medium. The ZTV (Figure 5.14) covers a small area of the upper slopes of Largo Law and panoramic views from the unit take in northeast Fife, the East Neuk of Fife, Largo Bay, the Firth of Forth and the East Lothian coast including North Berwick Law and the Bass Rock. Within these views the Proposed Development will represent a lesser element that is seen along with the operational LDT and in the context of the developed coastline at Methil. The Proposed Development will have a limited influence on the character of the LCT and the magnitude of change will be low, with a minor and not significant effect.
- **Kincraig Point**: As views across Largo Bay are important to its setting, sensitivity of the unit to the Proposed Development is medium. The ZTV (Figure 5.14) covers the western part of this small unit. The Proposed Development will be seen within the context of the developed coastline at Methil as a new, lesser feature that is similar in nature to the operational LDT. Distance from the unit lessens the influence the Proposed Development on the Kincraig unit such that the magnitude of change is low, with a moderate / minor and not significant effect. The **Rocky Headland (J) CCA** forms the eastern part of Shell Bay and is associated with the Kincraig unit. The Proposed Development may potentially affect the character of the bay by interrupting views along the coastline and as such, sensitivity to the

Proposed Development medium. Seen against the developed coastline at Methil and Leven, the Proposed Development will be perceived as a lesser element similar in nature to, but larger than the existing LDT. Despite its larger scale, the Proposed Development will not become a focus within views from the CCA nor will it interrupt views along the coastline. The resulting magnitude of change will be medium-low with a moderate / minor and not significant effect.

- **Glassmount**: As it does not have the potential to affect the plateau landform and views are orientated predominantly in a southerly direction, sensitivity of the unit to the Proposed Development is low. The ZTV (Figure 5.14) indicates fragmented theoretical visibility from the eastern parts of this unit. The Proposed Development will be glimpsed in the context of the developed coastline at Kirkcaldy and Methil; associated with the operational LDT; and perceived as a lesser element in this context. The resulting magnitude of change will be negligible, with a low significance of effect that is not significant.
- **Kinglassie:** The unit is strongly influenced by urban development at Glenrothes and by opencast coal workings, such that sensitivity to the Proposed Development is low. The ZTV (Figure 5.14) is fragmented across much of the eastern parts of this unit and the Proposed Development will be visible from the unit and the broad coastal plain forming its immediate setting as a lesser element. The Proposed Development will not influence the landscape character of the unit and the magnitude of change will be negligible, with a negligible and not significant effect.

Lowland Hills and Valleys LCT (186)

Potential effects of the Proposed Development are limited to visual effects on the aesthetic and perceptual qualities of the landscape character. In combination with the influence of existing infrastructure and development across the large area of this LCT, this means that sensitivity of the Lowland Hills and Valleys LCT to the Proposed Development is low.

The ZTV (Figure 5.14) indicates theoretical visibility predominantly from eastern parts with fragmented visibility in the west. Intervening vegetation within the low lying and level eastern parts of the LCT means that there are no views of the sea from this area. The Proposed Development will be visible from small hills in the west, however given the intervening distance from the Proposed Development, the magnitude of change resulting from the operation and maintenance of the Proposed Development is assessed as negligible.

Based on the combination of the low sensitivity of the receptor and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), indirect, long-term and reversible.

Hill Slopes LCT (183)

As the Proposed Development will only have potential effects on aesthetic and perceptual aspects of the LCT the sensitivity of the Hill Slopes LCT to the Proposed Development is low.

The ZTV shown in Figure 5.14 indicates theoretical visibility from the larger part of the LCT north of Glenrothes. The southern part of the LCT contains urban development within the northern suburbs of Glenrothes in addition to areas of woodland. The slopes of the LCT predominantly face east or northeast and such that the Proposed Development will appear as a lesser element within and peripheral to the main orientation of views. The magnitude of change to the Hill Slopes LCT resulting from the operation and maintenance of the Proposed Development is assessed as negligible.

Based on the combination of the low sensitivity of the receptor and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), indirect, long-term and reversible.

Foothills - Fife LCT (184)

The Proposed Development has limited potential to affect aesthetic and perceptual aspects of the LCT due to the separating distance. The sensitivity of the Foothills - Fife LCT to the Proposed Development is low.

As indicated by the ZTV (Figure 5.14), a large proportion of the LCT has theoretical visibility of the Proposed Development. The character of the LCT is predominantly influenced by the conical peaks of East and West Lomond and the intervening moorlands and wide open spaces that lie between them. Views out to the surrounding landscape are important to the character of the LCT and such views encompass the Firth of Forth, the Lothians, the southeast Highlands, and the Angus hills to the north. The Proposed Development will appear as a small additional element in 360° panoramic vistas from the LCT and in combination with the separating distance. The magnitude of change to the Foothills - Fife LCT resulting from the operation and maintenance of the Proposed Development is assessed as negligible.

Based on the combination of the low sensitivity of the receptor and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), indirect, long-term and reversible.

Coastal Terraces - Fife LCT (193)

Due to the importance of seaward views from the LCT and the open character of the landscape, sensitivity to the Proposed Development of the western part of the Coastal Terraces LCT (between Kilconquhar and Lower Largo) is medium.

To the east of Kilconquhar, the southeast orientation of the coast and views, and the long distance to the Proposed Development from these parts of the LCT, means sensitivity to the Proposed Development is low.

A large proportion of the Coastal Terraces has theoretical visibility of the Proposed Development, as indicated by Figure 5.14. Seaward views and views to the East Lothian coast contribute to the sense of openness of the western terraces, while more undulating topography in the eastern terraces limits views towards the Proposed Development. Visibility of the Proposed Development is likely to be limited to glimpses of its blade tips. The magnitude of change to the Coastal Terraces LCT resulting from the operation and maintenance of the Proposed Development is assessed as negligible.

Based on the combination of the low sensitivity of the receptor and negligible magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (negligible), indirect, long-term and reversible.

The **Lower Largo Rocky Shore (H) CCA** is associated with the western part of the Coastal Terraces LCT. There are views to the west towards the urban areas of Leven and Methil and eastward to the less developed coastline and headlands at Kincraig Point. The sensitivity of the Lower Largo Rocky Shore CCA is medium.

Views from the CCA encompass the urban and industrial coastline of Leven, Methil and Buckhaven with wider views across the Firth of Forth to the Lothians and eastward to Kincraig Point and the Outer Firth. Views westward along Largo Bay are important to the character of the CCA and the Proposed Development will be a noticeable new feature in such views, although it will not become a dominant focal point. As the Proposed Development will increase the amount of wind energy development visible, the magnitude of change will be medium, the effect moderate and not significant.

Landscape and Coastal Character in East Lothian

Coastal Terrace - Lothians LCT (278)

The LCT lies approximately 16 km southeast of the Proposed Development at its closest point, the island of Eyebroughty. The ZTV incudes much of the area between St Baldred’s Boat and Cockenzie and Port Seton. Although the Coastal Terrace LCT is distinctive and highly valued, its separation from the Proposed Development and the developed character of the Fife coast reduces the susceptibility of the LCT such that its sensitivity to the Proposed Development is assessed as medium.

Long seaward views and funneled views along the coast to the open sea are widespread within the flat LCT. East of Eyebroughy, the north facing coastline is less focussed on the Fife Coastline. To the west, the coastline looks directly to Fife with shipping activity in the Forth quite notable. Within this context, the Proposed Development will be a new element that is similar to the LDT and in keeping with the industrial development behind within Methil. While perceptible, the effects of the Proposed Development on the Coastal Terrace LCT will be limited to visual effects on its setting. The magnitude of change to the Coastal Terrace LCT resulting from the operation and maintenance of the Proposed Development is assessed as low.

Based on the combination of the medium sensitivity of the receptor and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), indirect, long-term and reversible.

The regional CCA, **SA 17 Eyebroughy To Torness Point**, forms the coastal edges of the Coastal Terrace LCT (278) of East Lothian between the small island of Eyebroughy, west of North Berwick, and St Baldred's Boat that comprises a smaller proportion of SA 17 lies within the ZTV (Figure 5.13). The large scale coastline and the relatively low lying and open hinterland have long seaward and coastal views focussed more on the open North Sea. The sensitivity of the CCA to the Proposed Development is assessed as medium.

The Proposed Development will be perceptible within the concentration of industrial development along the Fife coastline, and peripheral to expansive seaward views. As the predominant views across the Forth and the Isle of May have Fife Ness and the East Neuk as a backdrop, the likely magnitude of effect arising from the Proposed Development will be low, moderate/minor in effect and not significant.

Settled Coastal Farmland LCT (279)

The predominantly developed coastal strip of the LCT lies approximately 23 km south of the Proposed Development, at its nearest point adjoining Fisherrow Sands. From this built-up area coastal views across the Firth of Forth to Fife beyond, and along the coast are occasional and the sensitivity of the LCT to the Proposed Development is low.

The Proposed Development will be perceptible as a new element off the Methil coast. It will extend wind energy infrastructure within the view and will be similar to the LDT, albeit larger. Distance from the Proposed Development, and the existing character of the Methil coast are such that the magnitude of change to the Musselburgh/Prestonpans Coast LCT resulting from the operation and maintenance of the Proposed Development is assessed as low. Based on the combination of the low sensitivity of the receptor and low magnitude of change, the significance of effect arising from the Proposed Development is assessed as not significant (minor), indirect, long-term and reversible.

The regional CCA, **SA16 Edinburgh to Gullane**, forms the coastal edges of the Settled Coastal Farmland LCT (279) This section of coastline extends between Leith Docks and the small island of Eyebroughy, including the developed shoreline between Portobello and Cockenzie and Port Seton, and the less developed East Lothian coast around Gullane. While the entire section lies within the ZTV (Figure 5.13), much of the coastline lies over 20 km away from the Proposed Development with a northerly aspect. A smaller proportion of the coast faces northwest and closer to the Proposed Development. The sensitivity of SA16 Edinburgh To Gullane is medium.

While the Proposed Development is perceptible from the developed western coastline, the separating distance and well-developed Methil coastline do much to reduce its visual impact. Further east, the less developed coastline loosely faces northwest and includes villages set back from the coast (Longniddry, Aberlady, and Gullane). As this coastline approaches Eyebroughy, the Proposed Development will appear larger but the combination of distance, the character of the coastline appearing immediately behind, the existing LDT, and the level of shipping activity, rigs, and other artificial structures within the Forth, means it will a new but largely characteristic element within the seascape.

Although the larger scale of the Proposed Development with regard to the LDT may be discernible, they will appear largely similar. The overall magnitude of impact will be low, moderate/minor in effect and not significant.

Summary of effects on landscape and coastal character

Table 5.20 - Summary of Potential Effects on Landscape Character Types

Landscape Planning Designation	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
Fife			
Urban LCT (0)	Low	Medium	Minor Not significant
Coastal Hills LCT (192)	High	Medium along the shoreline. Low at inland locations.	Major / moderate and **Significant** along the shoreline. Moderate and Not Significant from inland locations.
Lowland River Basin LCT (190)	Low	Low	Minor Not significant
Lowland Dens LCT (188)	Medium	Low	Moderate/minor Not significant
Coastal Flats LCT (196)	Medium	Low	Moderate/minor Not significant
Pronounced Volcanic Hills and Craigs LCT (185)	Low to medium varying across landscape units	Negligible to low varying across landscape units	Negligible to moderate/minor varying across landscape units Not significant
Lowland Hills and Valleys LCT (186)	Low	Negligible	Negligible Not significant
Hill Slopes LCT (183)	Low	Negligible	Negligible Not significant
Foothills -Fife LCT (184)	Low	Negligible	Negligible Not significant
Coastal Terraces LCT (193)	Medium in the west Low in the east	Low in the west Negligible in the east	Minor in the west and negligible in the east Not significant
East Lothian			
Northern Coast LCT (18)	Medium	Low	Moderate/minor Not significant
Musselburgh / Prestonpans Coast LCT (19)	Low	Low	Minor Not significant

Table 5.21 - Summary of Potential Effects on CCAs

Landscape Planning Designation	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
Fife			
C. Dysart CCA	Low	Medium-low	Moderate / minor Not significant
D. Dysart to West Wemyss CCA	Medium	Medium	Moderate Not Significant
E. West Wemyss to Buckhaven CCA	High	Medium	Major / moderate **Significant**
F. Buckhaven / Methil / Leven CCA	Low	Medium	Moderate / minor Not significant
G. Leven Links CCA	High	Medium	Moderate / major **Significant**
H. Lower Largo Rocky Shore CCA	Medium	Medium	Moderate / minor Not significant
I. West Largo Bay and Links CCA	Medium	Medium-low	Moderate / minor Not significant
J. Rocky Headland CCA	Medium	Medium-low	Moderate / minor Not significant
East Lothian			
SA16 Edinburgh to Gullane	Medium	Low	Moderate/minor Not significant
SA 17 Eyebroughy to Torness Point	Medium	Low	Moderate/minor Not significant

5.9.4. Preliminary Assessment - Landscape Designations

A preliminary assessment of the effects of the Proposed Development on landscape designations is presented in Table 5.22 and Table 5.23. A detailed assessment follows in Section 5.9.5 for each landscape designation that is identified in the preliminary assessment as requiring detailed assessment. The preliminary assessment, presented below, has been undertaken with reference to the ZTV in Figure 5.15.

The landscape designations that are scoped in to the SLVIA are identified in Figures 5.3 and 5.15 and in the preliminary assessment as those that those that have an associated seascape setting that may have potential to be significantly affected by the Proposed Development and includes Local Landscape Areas (LLA) in Fife, Special Landscape Areas (SLA) in East Lothian and Gardens and Designed Landscapes (GDL).

Table 5.22 - Landscape Designations with potential for significant effects included in the detailed assessment

Landscape Designation	Preliminary Assessment
Fife Cullaloe Hills and Coast LLA; East Neuk LLA; Largo Law LLA; Lomond Hills LLA; and Wemyss Coast LLA. **East Lothian** Fisherrow Sands SLA; North Berwick Law SLA. North Berwick to Seton Sands Coast SLA; Prestonpans Coast SLA; Tantallon Coast SLA; and **Gardens and Designed Landscapes (GDL)** Balbirnie GDL; Balcarres GDL; Charleton House GDL; Dysart House and Ravenscraig Park GDL; Lahill GDL; Leslie House GDL; Newhailes House GDL; Raith Park & Beveridge Park GDL; and Wemyss Castle GDL.	Designated areas along the coast or with a strong relationship with the coast, and partially or wholly entering the ZTV. Potential for significant effect requiring detailed assessment.

Table 5.23 - Landscape Designations with no potential for significant effects and excluded from detailed assessment

Landscape Designation	Preliminary Assessment
Antonine Wall WHS	A very limited extent of the WHS enters the ZTV beyond the 50 km Study Area. No potential for significant effects - scoped out of further assessment.
Edinburgh Old and New Towns WHS	Distance from the Proposed Development and its highly developed and industrial context means there is no potential for significant effects. No potential for significant effects - scoped out of further assessment.
Forth Bridge WHS	A small proportion of the area, approaching Queensferry enters the ZTV and combined with the transitional nature of receptors, there is no potential for significant effects. No potential for significant effects - scoped out of further assessment.
Balcaskie GDL	Potential visibility of the Proposed Development, 14.5 km to the east, is restricted by boundary woodland to a small proportion of the GDL in the north with limited potential for significant effects on its character. No potential for significant effects - scoped out of further assessment.

Landscape Designation	Preliminary Assessment
Gosford House GDL	Woodland to the boundary screens the Proposed Development 19 km to the north from the GDL on the East Lothian coastline. No potential for significant effects - scoped out of further assessment.
Grey Walls (High Walls) GDL	Potential visibility of the Proposed Development, 18 km to the northwest, is limited to a small proportion of the GDL with limited potential for significant effects on its character. No potential for significant effects - scoped out of further assessment.
Kellie Castle GDL	Woodland to the western boundary screens the Proposed Development 16 km to the west southwest from the walled garden. Visibility of the Proposed Development is likely to be limited to farmland to the north that represents a smaller proportion of the GDL. No potential for significant effects - scoped out of further assessment.
Seton House (Palace) GDL	Tree cover within the GDL and distance to the Proposed Development, 24 km to the north, limits visibility of the Proposed Development. No potential for significant effects - scoped out of further assessment.
SLAs: Braids, Liberton, Mortonhall; Calton Hill; Cammo; Castle Rock; Corstorphine Hill; Craigie Hill; Craiglockhart; Craigmillar Castle; Dundas; Edmonstone House; Gogar; Holyrood, Duddingston and Prestonfield; Inverleith; Lower Almond; Pentlands; Princes Street Gardens; Ratho Hills; Southern Forth Coast; The Drum; Upper Almond; Water of Leith – West; Water of Leith, New Town. **GDL:** Balgone House; Blair Adam; Carberry Tower; Cockenzie House GDL; Dalkeith House (Palace); Dalmeny; Dirleton Castle; Duddingston House; Falkland Palace; Hill of Tarvit (Wemyss Hall); Kinross House; Luffness; Lauriston Castle; Lennoxlove (Lethington); Leuchie; Mavisbank; Melville House; Melville Castle; Newbattle Abbey; Pinkie House; Roslin Glen and Hawthornden Castle; Tyninghame; Winton Castle.	Excluded due to limited / restricted or distant visibility of the Proposed Development. No potential for significant effects - scoped out of further assessment.
SLA: Balgone & Whitekirk Outcrops; Belhaven Bay; Biel & Bielton; Bolton; Clerkington & Tyne; Danskine to Whitcastle; Doonhill to Chesters; Dunbar to Barns Ness Coast; Elphinston Ridge; Garden County Farmland; Halls to Bransley Hill; Humbie Head & Waters; Kingston; Lammer Law, Hopes to Yester; Lammermuir Moorland; Linplum; Monynut to Blackcastle; Morham; Ormiston View & Fountainhall; River Esk; Samuelson; Thorntonloch to Dunglass Coast; Traprain;	No potential for significant effects and excluded from detailed assessment as no theoretical visibility of the Proposed Development.

Landscape Designation	Preliminary Assessment
Whiteadder; Whittingeham to Woodhall; Winton Walks. **GDL:** Castle Campbell; Balgay Park; Park; Park;Cleish Castle; Dupplin Castle; Cambo; Dunimarle Castle; House of Falkland; Meikleour; Prestonfield House (Priestfield); Rossie Priory; Scone Palace; Methven Castle; Megginch Castle; Naughton; Earlshall; Gleneagles Hotel And Golf Courses; House of The Binns; Broxmouth Park; Castle; Biel; Craigiehall; Royal Botanic Garden, Edinburgh; The New Town Gardens; Millburn Tower; Stevenson House; Cammo; Newliston; Palace of Holyroodhouse; Dean Cemetery; Whittingehame; St Mary's Pleasance (Haddington Garden); Dunglass; Dunmore Park; Tulliallan; The Pineapple; Valleyfield; Pittencrieff Park; The Murrel; Culross Abbey House; Aberdour Castle; Pilmuir; The Drum; Hatton House; Saltoun Hall; Yester House; Prestonhall; Oxenfoord Castle; Arniston; Harburn House; Penicuik; Newhall; Thirlestane Castle; Inchyra; The Guynd; Craigtoun; Battleby; Balmanno; Fingask Castle; Murthly Castle; Keillour Castle; Glendoick; Kinfauns Castle; Glamis Castle; Drumkilbo; Stobhall; Invermay; Craigmillar Castle; Camperdown House; Portmore; Cowden Japanese-Style Garden; St Andrews Links; Hopetoun House; St Andrews Botanic Garden; Branklyn; Malleny.	

5.9.5. Detailed Assessment – Landscape Designations

5.9.5.1. Landscape Designations in Fife

Cullaloe Hills and Coast LLA

Due to the intervening distance (11 km) and the fact that only aesthetic and perceptual aspects of the LLA will potentially be affected, the sensitivity of the LLA to the Proposed Development is low.

The designation statement identifies coastal views from the LLA as an important quality. There is a strong sense of naturalness to the shoreline and the rolling farmland and policy landscapes along the coast between Kinghorn and Burntisland provide a high quality setting to the Cullaloe Hills and Coast LLA.

The ZTV includes the eastern part of the SLA and viewpoints 11, 14 and 17 (Figures 5.31, 5.34 and 5.37) indicate that the Proposed Development will be a noticeable but not intrusive new feature. Alteration to aesthetic and perceptual attributes of the SLA will be limited and occur primarily in areas along the shoreline.

Given the distance to the Proposed Development and the very limited effects on qualities of the SLA, the magnitude of change to the perceived character of the LLA will be low and the effect minor, and not significant.

East Neuk LLA

Open sea views from inland areas, the shoreline and coastal villages are a recognised and important quality of the LLA. While the Proposed Development may potentially affect such views, due to its location 7.5 km away towards the Methil coastline, rather than in the open water directly opposite the LLA, the sensitivity of East Neuk LLA to the Proposed Development is medium.

The majority of the East Neuk LLA on the east side of Largo Bay and at St Monans lies within the ZTV (Figure 5.15). There is limited theoretical visibility from the LLA between Anstruther Easter and Crail. Viewpoint 13 (Figure 5.33) indicates that the Proposed Development will be visible as a lesser feature in views from Kincraig Point within the LLA. Due to the very limited effect on aesthetic and perceptual qualities important to the designated landscape, the magnitude of change to the perceived character of the East Neuk LLA will be low, the effect moderate / minor and not significant.

Largo Law LLA

Views from Largo Law which encompass the Firth of Forth, the East Lothian coastline and the Lammermuir Hills beyond, are the key aspect that the Proposed Development could potentially affect. Distance from the designated area will limit potential effects to aesthetic and perceptual aspects upon the setting of the LLA such that the sensitivity to the Proposed Development is medium.

The ZTV in Figure 5.15 indicates that predominantly southern parts of the LLA will be affected by visibility of the Proposed Development which will be a noticeable new addition to views from the Largo Law LLA. As it will be similar in form to the operational LDT, the Proposed Development will appear as a lesser element within the large scale vistas from the LLA of modified coastal plains, and recreational and urban land uses near to it, as shown on Viewpoint 10 (Figure 5.30). Looking towards the distinctive landform of Largo Law from the southwest, the Proposed Development will be more strongly associated with the adjacent developed coastline and the LDT than the distant hill.

A very limited effect on aesthetic and perceptual qualities important to the designated landscape will occur and the perceived character of the LLA will undergo a low magnitude of change, of moderate / minor effect that is not significant.

Lomond Hills LLA

Potential effects on aesthetic and perceptual aspects of the LLA are severely limited by its distance from the Proposed Development, 11 km at its closest point. The distinctive conical landform of the two main hills, East and West Lomond are notable features in views from the surrounding low lying landscape and particularly from the A91 and A92. The sensitivity of the Lomond Hills LLA to the Proposed Development is low.

The ZTV shown in Figure 5.15 includes the southern part of the Lomond Hills LLA and more elevated parts in the west. Viewpoint 15 (Figure 5.35), approximately 15.7 km from the Proposed Development, is considered representative of the LLA and indicates that the Proposed Development would be barely discernible from the summit of East Lomond.

The magnitude of change to the perceived character of the Lomond Hills LLA will be low due to the very limited effect on the setting of the designated landscape. The effect of the Proposed Development on the perceived character of the LLA will be minor and not significant.

Wemyss Coast LLA

The LLA is strongly influenced by the Firth of Forth as described in the designation statement. Reflecting the potential the Proposed Development has to affect the setting of the Wemyss Coast LLA, sensitivity is high.

While the entire LLA lies within the ZTV, woodland covering a large proportion of the western part and the steep slopes at the coastal edge will limit visibility of the Proposed Development to the shoreline and eastern and elevated parts of West Wemyss. Viewpoint 2 (Figure 5.22) indicates that the Proposed Development will be similar to the operational LDT albeit larger in scale.

From inland areas the undulating topography and prevalence of hedges, trees and woodland will limit views of the Proposed Development to its blades and blade tips.

The perceived character of the Wemyss Coast LLA will undergo a medium magnitude of change on shoreline parts of the LLA between west Wemyss and East Wemyss, that is major / moderate in effect and **significant**. A low magnitude of change across the majority of the area inland will be not significant.

Landscape Designations in East Lothian

Fisherrow Sands SLA

Potential effects on the SLA will be restricted to visual effects on its character and are limited by distance. Sensitivity of the Fisherrow Sands SLA to the Proposed Development is low.

The entire SLA is covered by the ZTV (Figure 5.15) such that open, large scale views to Fife that are a key characteristic of the SLA, are readily available from the designated area. The Proposed Development will be seen some 23 km to the north, against the developed coast of Methil and the existing LDT.

As the Proposed Development will be in keeping with the character of the Methil coastline, and similar in nature albeit larger in scale then the LDT, the magnitude of change to the perceived character of the SLA will be low, the effect minor and not significant.

North Berwick Law to Seton Sands SLA

The scenic quality of the seascape and the widespread quality and number of views from the relatively natural area are recognised as key characteristics that are susceptible to changes due to the Proposed Development. The separating distance and varying aspect of the coastline reduces the susceptibility of much of the area. Sensitivity of North Berwick Law to Seton Sands SLA to the Proposed Development is medium.

Views from the sandy beaches of Seton Sands, Broad Sands and Yellowcraigs; and within Gosford, Aberlady, Gullane bays, will have uninterrupted views of the entire Proposed Development. It will appear near to the operational LDT against development, some of it industrial, at Methil. While the SLA is valued in part for its a lack of artificial elements and its natural groundcover, sand dunes and mud flats, the existing setting is influenced by development along the Fife coast, shipping, rigs and the LDT.

Within this context the Proposed Development, at least 16 km away, will be a peripheral and distant feature that appears intermittently due to the varying aspect of the coastline. The magnitude of change to the perceived character of the LLA arising from operation of the Proposed Development will be low, minor in effect and not significant.

North Berwick Law SLA

North Berwick Law SLA consists of the conical eponymous hill that rises to a height of 187 m immediately to the south of North Berwick. A noticeable feature in the landscape of East Lothian and also visible from the north shore of the Firth of Forth, potential effects on the SLA arising from the Proposed Development will be visual and as such its sensitivity is low.

Figure 5.15 indicates theoretical visibility of the Proposed Development from most of the SLA. While the Proposed Development will be visible it will be seen as a lesser feature against the backdrop of the developed coastline at Methil and in the context of the operational LDT.

The magnitude of change resulting from the Proposed Development to the perceived character of the LLA will be negligible, the effect negligible and not significant.

Prestonpans Coast SLA

The entire SLA lies within the ZTV (Figure 5.15) and views across the Firth of Forth to Fife are high in scenic value and a key characteristic of the SLA. Susceptibility of the SLA to the Proposed Development is reduced as anticipated effects will be restricted to visual effects on its character, limited by distance. Sensitivity of the Prestonpans Coast SLA to the Proposed Development is medium.

While views from the narrow, rocky foreshore may take in the Proposed Development some 22 km to the north, mature woodlands such as within the Royal Musselburgh Golf Course and at Drummohr House limits the availability of seaward views away from the coast. As the Proposed Development will be seen in a wider context of industrialising development, including the similar LDT, the magnitude of change to the perceived character of the LLA will be low with a minor effect that is not significant.

Tantallon Coast SLA

Potential effects on the SLA arising from for the Proposed Development will be restricted to visual effects on its character and are limited by the orientation of the coastline and distance. Sensitivity of the Tantallon Coast SLA to the Proposed Development is low.

Much of the SLA lies within the ZTV (Figure 5.15) and views across the Firth of Forth to Fife make a strong contribution to its character, with Bass Rock providing a key characteristic of the area.

The open and expansive coastal setting of this, the most wild and remote area of mainland coast in East Lothian provides clear views out to the seascape of the Firth of Forth and its islands including Bass Rock. Many viewpoints within the area have panoramic seaward views. The SLA lies 17.2 km from the Proposed Development and the orientation of the coast northwards places the emphasis on views to the north, Bass Rock and the East Neuk.

The Proposed Development will be seen as a lesser element in the wider context of the firth and will not be a focal point in most views from the area. As such, the magnitude of change to the perceived character of the LLA will be low, with minor effect and not significant.

Gardens and Designed Landscapes (GDLs)

Balbirnie House GDL

Much of the Balbirnie House GDL 9.4 km from the Proposed Development, lies within the ZTV. The grounds of the GDL are well wooded particularly on the eastern side and urban development and roads enclose the southeast and south boundary of the GDL such that susceptibility to the Proposed Development is negligible and sensitivity to the Proposed Development is low.

Views of the Proposed Development are unlikely from within the GDL due to the screening effects of vegetation. Where views are obtained, they would be glimpsed, partial views of the blades of the proposed WTG and the magnitude of change to the perceived character of the GDL will be low, negligible in effect and not significant.

Balcarres GDL

Located 11 km northeast of the Proposed Development within Largo Law LLA, the GDL is described as making an outstanding contribution to the surrounding landscape and there are panoramic views from Balcarres House to the Firth of Forth, the Lothians, Bass Rock, the Lammermuir Hills and the Edinburgh hills. While the Proposed Development has the potential to affect views of the Firth of Forth and the Edinburgh Hills, the distance to the GDL means susceptibility is negligible and sensitivity to the Proposed Development is low.

A large proportion of the GDL including Balcarres House lies within the ZTV. Due to the well vegetated grounds the Proposed Development will only be glimpsed through gaps and from elevated locations such as the upper floors of Balcarres House.

While views encompassing the Firth of Forth and Edinburgh are important to the character of Balcarres, the restricted visibility means the magnitude of change to the to the perceived character of the GDL will be low, the effect negligible and not significant.

Charleton House GDL

Charleton House GDL lies approximately 9.8 km northeast of the Proposed Development on the lower slopes of Flagstaff Hill and Largo Law. The landscape of the GDL is described as making a major contribution to the surrounding landscape due to its visual prominence from the B942. While there are views south to the Firth of

Forth from the terraced gardens at the main house, these are limited with negligible susceptibility. The sensitivity of the GDL to the Proposed Development is low.

While most of the GDL including the main house lies within the ZTV, woodland on the western boundary will screen the Proposed Development. As the principal orientation of the GDL is south southeast and views are channelled in a southerly direction to the Firth of Forth, the magnitude of change to the perceived character of the GDL will be negligible, with negligible effect and not significant.

Dysart House and Ravenscraig Park GDL

The GDL is located 8.6 km southwest of the Proposed Development and the Inventory identifies extensive views from Dysart House as important to the setting of the GDL. As the GDL is well wooded with enclosed grounds, susceptibility to the Proposed Development is negligible and the sensitivity of the GDL to the Proposed Development is low.

Much of the eastern part of the GDL lies within the ZTV but as this area is wooded potential views of the Proposed Development will be limited to glimpses. As the principal orientation of the GDL is south southeast and the GDL has an elevated outlook, parts of the Proposed Development may be seen at an angle and filtered by vegetation.

Very limited visibility means that the magnitude of change to the perceived character of the GDL will be negligible and significance of effect will be negligible and not significant.

Lahill House GDL

Lahill House GDL lies approximately 8.5 km northeast of the Proposed Development and approximately 1.2 km west of Charleton House GDL. The Inventory identifies panoramic views to the Firth of Forth from the south garden terraces as important. Due to the potential for effects on views from the house and grounds over a medium distance, the sensitivity of the Lahill House GDL to the Proposed Development, is low.

Although the majority of the GDL lies within the ZTV, the well wooded western boundary and watercourse that flowing through the GDL limits visibility of the Proposed Development. The terrace gardens and house are situated atop a steep bank that falls away to the south thereby affording views over the top of vegetation. As these views are oriented to the south, the Proposed Development will be a peripheral feature.

Due to the limited influence on views from Lahill House GDL, the magnitude of change to the perceived character of the GDL will be low and the effect minor and not significant.

Leslie House GDL

Located approximately 11.4 km northwest of the Proposed Development within Glenrothes, the Inventory describes the landscape of the Leslie House GDL as important in the context of Glenrothes and does not identify any important views towards the Firth of Forth. Sensitivity to the Proposed Development is low.

The northern parts of the GDL lie within the ZTV but woodland within the GDL, and vegetation and urban development in the intervening landscape will screen the Proposed Development. The magnitude of change to the to the perceived character of the GDL Leslie House GDL will be low and the significance of effect negligible and not significant.

Newhailes House GDL

The Newhailes House GDL is located approximately 24.8 km south of the Proposed Development and just west of the Fisherrow Sands SLA. The Inventory attributes a high scenic value to the GDL due to its function as an important green buffer between suburban areas on the outskirts of Edinburgh. The landscape of the GDL is described as making an outstanding contribution to the surrounding landscape and there are panoramic views from Balcarres House to the Firth of Forth, the Lothians, the Bass Rock, the Lammermuir Hills and the Edinburgh hills. While the Proposed Development has the potential to affect views of the Firth of Forth and the Edinburgh Hills, due to the GDL's long distance from it, sensitivity to the Proposed Development is low.

The ZTV covers much of the GDL but as it is enclosed by woodland on its south-west and south sides, visibility is limited to the northern half. Newhailes House stands centrally on a slightly elevated plateau above Musselburgh with extensive views out to the north-east and the Firth of Forth. From the Terrace Walk there are views north to the Firth of Forth. The Proposed Development will be discernible from the upper storey of the house and the northeast corner of the plateau. Boundary woodland to the northwest constrains the view.

As the potential effects of the Proposed Development will be limited to visual effects on the setting of the GDL, and there will be limited visibility of it in the distance, the magnitude of change to the perceived character of the GDL will be low, the significance of effect minor and not significant.

Raith Park & Beveridge Park GDL

The Raith Park & Beveridge GDL is located approximately 12 km southwest of the Proposed Development and adjoins the western edge of Kirkcaldy. Raith Park is extensive and well wooded with Raith House located on a ridge from which the Inventory identifies panoramic views of the Firth of Forth and North Berwick Law 30 km away. Due to the limited potential for views of the Firth of Forth to be affected, sensitivity of the GDL to the Proposed Development is low

Figure 5.15 indicates theoretical visibility of the Proposed Development from a small proportion of the GDL at Raith House and at Beveridge Park. Views of the Proposed Development from Raith House are likely to be oblique or peripheral to the principal orientation of eastward views which are focused on the East Lothian coastline. Views of the Proposed Development from Beveridge Park are unlikely due to the screening effect of trees on its boundary and intervening buildings in the adjacent urban area.

Due to the very limited effect on views from the Raith Park & Beveridge GD, the magnitude of change to the perceived character of the GDL will be negligible and the significance of effect negligible and not significant.

Wemyss Castle GDL

The Wemyss Castle GDL is located approximately 4.4 km west of the Proposed Development with most of the GDL lying within the Wemyss Coast LLA. The Inventory describes the scenic contribution of the GDL as "*forming a vital coastal landscape between the settlements of East and West Wemyss*."

The GDL is bounded by stone walls and woodland with an enclosed character of pasture and parkland trees. Although the Inventory does not identify views of the Firth of Forth as important to the GDL, proximity to the Proposed Development site and the topography of the area combine such that sensitivity to the Proposed Development is high.

The majority of the GDL lies within the ZTV, but intervening vegetation will limit views of the Proposed Development. In the limited areas where views of the Firth of Forth are visible the Proposed Development will be a peripheral element. Elsewhere, its uppermost parts may be visible above the enclosing woodland and introducing an industrialising influence on the parkland. Overall, a more complete view of the Proposed Development may sporadically be seen along the coast; or it may be partially glimpsed above the wooded boundary.

The Proposed Development will have a very limited effect on views important to the Wemyss Castle GDL or its setting and the magnitude of effect to the perceived character of the GDL will be low, the effect moderate and not significant.

Table 5.24 - Summary of Potential Effects on Landscape Planning Designations

Landscape Planning Designation	Sensitivity to the Proposed Development	Magnitude of Change	Significance of Effect
Fife			
Cullaloe Hills and Coast LLA	Low	Low	Minor Not significant
East Neuk LLA	Medium	Low	Moderate / minor Not significant
Largo Law LLA	Medium	Low	Moderate / minor Not significant
Lomond Hills LLA	Low	Low	Minor Not significant
Wemyss Coast LLA	High	Medium from shoreline edges of the LLA Low from majority of inland area of the LLA	Major / moderate and **Significant** from shoreline edges of the LLA Moderate and Not Significant from majority of inland area of the LLA
East Lothian			
Fisherrow Sands SLA	Low	Low	Minor Not significant
North Berwick Law SLA	Low	Negligible	Negligible Not significant
North Berwick Law to Seton Sands SLA	Medium	Low	Minor Not significant
Prestonpans Coast SLA	Medium	Low	Minor Not significant
Tantallon Coast SLA	Low	Low	Minor Not significant
Gardens and Designed Landscapes (GDLs)			
Balbirnie House GDL	Low	Negligible	Negligible Not significant
Balcarres GDL	Low	Negligible	Negligible Not significant
Charleton House GDL	Low	Negligible	Negligible Not significant
Dysart House and Ravenscraig Park GDL	Low	Negligible	Negligible Not significant
Lahill House GDL	Low	Low	Minor Not significant
Leslie House GDL	Low	Low	Negligible Not significant
Newhailes House GDL	Low	Low	Minor Not significant
Raith Park and Beveridge Park GDL	Low	Negligible	Negligible Not significant
Wemyss Castle GDL	High	Low	Moderate Not significant

5.10. Cumulative Effect Assessment

5.10.1. Introduction

The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Proposed Development together with other relevant plans, projects and activities. Cumulative effects are therefore the additional or combined effect of the Proposed Development in combination with the effects from a number of different projects, on the same receptor or resource.

GLVIA3 (Landscape Institute and IEMA 2013, p120) defines cumulative landscape and visual effects as those that *'result from additional changes to the landscape and visual amenity caused by the proposal in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future.'*

NatureScot's guidance, Assessing the Cumulative Impact of Onshore Wind Energy Developments (NatureScot 2012) is widely used across the UK to inform the specific assessment of the cumulative effects of windfarms. Both GLVIA3 and NatureScot's guidance provide the basis for the methodology for the cumulative SLVIA undertaken in the SLVIA. The NatureScot (2012) guidance defines:

- *"Cumulative effects as the additional changes caused by a Proposed Development in conjunction with other similar developments or as the combined effect of a set of developments taken together* (NatureScot, 2012: p4);
- *Cumulative landscape effects are those effects that 'can impact on either the physical fabric or character of the landscape, or any special values attached to it'* (NatureScot, 2012, p10); and
- *Cumulative visual effects are those effects that can be caused by combined visibility, which occurs where the observer is able to see two or more developments from one viewpoint and / or sequential effects which occur when the observer has to move to another viewpoint to see different developments"* (NatureScot, 2012, p11).

In accordance with NatureScot guidance and GLVIA3 (para 7.13), existing/operational projects are included in the SLVIA baseline and described as part of the baseline conditions, including the extent to which these have altered character and views, and affected sensitivity to windfarm development.

In line with NatureScot guidance and GLVIA3, cumulative effects are assessed in this SLVIA as the additional changes caused by the Proposed Development in conjunction with other similar developments. The CEA set out in this section of the SLVIA assesses only the additional seascape, landscape and visual effects of the Proposed Development, in addition to the baseline conditions set out in Section 5.5. The CEA considers how the Proposed Development may result in additional cumulative seascape effects over and above those already identified, in conjunction with other plans/projects, such as through potential design discordance or the proliferation of multiple developments affecting particular characteristics or new geographic areas, and ultimately if character changes occur as a result of multiple developments becoming a prevailing characteristic of the seascape or view.

The CEA uses the same geographical scope as the SLVIA and is informed by the cumulative wind farm plan in Figure 5.19, cumulative ZTVs in Figures 5.20a-b and the wirelines in Figures 5.21 to 5.46.

5.10.2. Scope of Cumulative Assessment

The cumulative wind farm plan (Figure 5.19) shows other relevant onshore and offshore wind farm projects are operational, consented or subject of a valid planning application within the SLVIA Study Area. A preliminary assessment of the plans, projects and activities within the SLVIA Study Area has been undertaken and is presented in Table 5.25, listing the cumulative wind energy developments that are considered further in the CEA. Each project or plan has been considered on a case by case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

Table 5.25 – Preliminary cumulative assessment of plans, project and activities

Plan, project or activity	Distance from the Proposed Development (km)	Status of Development	Preliminary Assessment
Projects scoped into CEA			
Kilmux Farm	8.5	Under Construction (1 x 62m blade tip height turbine)	Potential for significant cumulative effects with Proposed Development which are scoped into further assessed as part of this CEA.
Neart na Gaoithe	42.9	Under Construction (54 x 208m blade tip height offshore wind turbines)	
Nether Pratis Farm	7.8	Consented (1 x 62m blade tip height turbine)	
Pyeston	10.0	Consented (1 x 77m blade tip height turbine)	
Clentrie Farm	16.0	Consented (6 x 99.5m blade tip height turbines)	
Cornceres Farm	21.6	Consented (1 x 53.5m blade tip height turbine)	
Toldrie	22.7	Consented (1 x 77m blade tip height turbine)	
Inch Cape	55.8	Consented (72 x 291m blade tip height offshore wind turbines)	
Projects scoped out of CEA			
Fife			
East Fife Football Club	2.7	Consented (1 x 81m blade tip height turbine)	Consented on appeal in 2014 however planning permission is now lapsed. Shown in wirelines for information but not assessed in CEA.
Kenly Farm	22.7	Consented	Limited potential for cumulative effects to occur due to long distance and limited intervisibility with the Proposed Development. Scoped out of further assessment in the CEA.
Lochmalony Farm	23.2	Consented	
Junction 2a	25.8	Application	
East Lothian			
Pogbie Phase 2	39.2	Under Construction	Limited potential for cumulative effects to occur due to long distance and limited intervisibility with the Proposed Development. Scoped out of further assessment in the CEA.
Huntershall	40.0	Under Construction	
Crystal Rig Phase 4	41.7	Consented	
Aikengall IIa	43.7	Under Construction	
Camilty	49.4	Consented	
Tayside			
Dundee Cold Stores Ltd	35.0	Consented	Limited potential for cumulative effects to occur due to long distance and limited intervisibility with the Proposed Development.
Upper Balmachie Farm	42.7	Consented	
Stotfaulds Farm	44.4	Consented	
Frawney	44.8	Consented	
Govals Farm	46.3	Consented	

Plan, project or activity	Distance from the Proposed Development (km)	Status of Development	Preliminary Assessment
Rosebank	50.0	Consented	Scoped out of further assessment in the CEA.
Perth and Kinross			
Binn Eco Park	25.5	Consented	Limited potential for cumulative effects to occur due to long distance and limited intervisibility with the Proposed Development. Scoped out of further assessment in the CEA.
East Blair Farm	29.2	Consented	
Glenfarg Reservoir	29.6	Consented	
East Dron	30.0	Consented	
Temple Hill	30.0	Consented	
Muirside of Kinneddar	36.0	Consented	
Saline	37.1	Consented	
Forestmill	41.0	Consented	

The CEA considers the effects of the addition of the Proposed Development to the projects and plans scoped into the CEA as identified in Table 5.26, focusing on those projects with which the Proposed Development may contribute to significant effects. This consists of six onshore wind energy developments within the 25 km Detailed Assessment Area - the under construction Kilmux Farm and consented Nether Pratis Farm, Pyeston, Clentrie Farm, Cornceres Farm and Toldrie wind turbines. These projects all consist of single wind turbines of less than 80m to blade tip, with the exception of Clentrie Farm, which consists of 6 x 99m turbines located 16.0km to the west of the Proposed Development.

The CEA for offshore wind farm projects extends to the Neart na Gaoithe and Inch Cape offshore wind farms in the outer Firth of Forth. Neart na Gaoithe is under construction offshore 42.9 km from the Proposed Development (since August 2020) and is expected to be commissioned in 2024. Inch Cape offshore wind farm has s36 consent for up to 72 turbines of 291m maximum blade tip height and is located 55.8 km from the Proposed Development. There is potential for operational phase of these projects to overlap with the Proposed Development operational phase to give rise to cumulative effects on coastal character and views/visual amenity, which are assessed further in this CEA. In this CEA, they are assessed as part of the same cumulative effect scenario, covering both under-construction and consented wind farms.

Scoping stage sites are not considered in the CEA. This is in line with best practice in cumulative SLVIA and based on guidance[65], which recommends cumulative assessment goes only as far as assessing projects where an application has been lodged. Current guidance supports the approach of assessing projects with planning consent, such that schemes that are at the pre-planning or scoping stage are not generally considered in the assessment of cumulative effects, because of uncertainty about what will actually occur, that is, is not ‘reasonably foreseeable’. While guidance also recognises that occasionally it may be appropriate to include proposals which are in the early stages of development in an assessment, it is considered that the scoping stage developments shown on Figure 5.19 not require further assessment in the CEA as there will be no likely significant cumulative arising.

The following CEA section describes the effects on landscape/coastal character and visual amenity focusing on the addition of the Proposed Development to the under-construction and consented projects scoped into the CEA as identified in Table 5.26.

[65] Assessing the Cumulative Impact of Onshore Wind Energy Developments’ (NatureScot, 2021).

5.10.3. Cumulative Visual Effects and Effects on Coastal/Landscape Character

The potential for cumulative effects on views and coastal/landscape character arising from the Proposed development is informed by the assessments undertaken in the visual assessment undertaken in Section 5.8, and the coastal character/landscape assessment in Section 5.9, together with the cumulative ZTVs for Neart Na Gaoithe (Figure 5.20b) and Inch Cape (Figure 5.20a), and the cumulative wireline visualisations in Figures 5.21 - 5.46.

The cumulative ZTVs in Figure 5.20a and Figures 5.20b show the theoretical cumulative visibility of the Proposed Development with Inch Cape and Neart Na Gaoithe. From the coastal edges between Sauchar Point (near Elie Ness) and Fife Ness, and the Fife coast between Elie Ness, St Andrews and the Firth of Tay, the Proposed Development will not be visible and will therefore have no simultaneous cumulative visual effects, despite the visibility of Inch Cape and Neart Na Gaoithe (shown in blue in the ZTV) in offshore views from these areas. The intervening landform of the pronounced hills inland of the coast, together with the orientation of the headland of Fife Ness, limits the potential for the Proposed Development to have simultaneous cumulative visual and coastal character effects from Fife's inner Firth of Forth coastline with both Inch Cape and Neart Na Gaoithe.

5.10.3.1. Cumulative effects with Inch Cape

The geographic extent of simultaneous cumulative effects with Inch Cape is very limited (Figure 5.20a), with effects tending to be 'project alone' effects, occurring either a result of the Proposed Development alone from Fife's inner Firth of Forth coastline between Chapel Ness and Kinghorn; or as a result of Inch Cape alone from the Fife coastline between Anstruther, Fife Ness, St Andrews and the Firth of Tay. Simultaneous visibility of the Proposed Development with Inch Cape is very rare and occurs from occasional areas of elevated ground or isolated hill tops between Largo, Elie and Crail, where there may be long distance views of Inch Cape at distances of between 30-45 km to the north-east, in the opposite viewing direction to the Proposed Development to the south-west.

An example of this type of occasional simultaneous effect with Inch Cape is provided in Viewpoint 10 Largo Law (Figure 5.30), where Inch Cape and Neart Na Gaoithe form small scale and distant wind farm influences, 37 km and 48.3 km from the viewpoint respectively. The additional contribution of the Proposed Development to the cumulative effect on views from these occasional areas of elevated ground/isolated hill tops between Largo, Elie and Crail will be of low magnitude and the cumulative effects not significant, due to Inch Cape and Neart Na Gaoithe being visually recessive at such long distance and the Proposed Development having limited association with them, being located in the opposite direction of view to the inner Firth of Forth, where is it seen in an altogether different landscape context.

Inch Cape will not be visible in any of the other representative viewpoints assessed along the Fife coastline between Kinghorn and Elie, as represented by Viewpoints 1-14 and 17. Views of Inch Cape is restricted to the other occasional hill-top viewpoints at East Lomond and Benarty Hill, in the western part of the study area, where there will be very long distance views of Inch Cape and Neart Na Gaoithe (beyond 50km) in the wider panorama beyond the Proposed Development and the additional cumulative magnitude of change is negligible and not significant.

Overall, it is assessed that the Proposed Development will result in no simultaneous cumulative visual effects with Inch Cape from the majority of Fife. It is assessed that the contribution of the Proposed Development to the cumulative effect with Inch Cape on views from Fife will be low at most, from occasional areas of elevated ground/isolated hill tops between Largo, Elie and Crail, and negligible from occasional hill-top viewpoints such as East Lomond and Benarty Hill. Overall, it is assessed that the Proposed Development will result in no significant additional simultaneous cumulative visual effects with Inch Cape on views from representative viewpoints or visual receptors in Fife. The potential cumulative effects arising on aesthetic and perceptual aspects of coastal and landscape character of CCAs and LCTs in Fife are also predicted to be of low or negligible magnitude, given the low levels of cumulative visual effects arising.

Turning to the potential cumulative visual effects of the Proposed Development and Inch Cape from East Lothian, the cumulative ZTV in Figure 5.20a indicates the geographic extent of simultaneous cumulative effects with Inch Cape is very limited from East Lothian, with effects tending to be 'project alone' effects, occurring either a result of the Proposed Development alone from the coastline between Eyebroughty/Gullane Bay and Musselburgh; or as a result of Inch Cape alone from the East Lothian coastline to the east and south of Tantallon. The Proposed Development will have no simultaneous cumulative visual effects on views from these parts of East Lothian between Eyebroughty and Musselburgh, and to the east/south of Tantallon, where there is no simultaneous cumulative visibility of the Proposed Development with Inch Cape.

The cumulative ZTV (Figure 5.20a) indicates that there will be a limited geographic area of the East Lothian coastline and hinterland between Eyebroughty, North Berwick and Tantallon with theoretical visibility of both the Proposed Development and Inch Cape. Inch Cape is however, located over 50 km offshore from this stretch of coastline and will be hardly visible above the horizon, with just blade tips theoretically visible intermittently on the sea skyline, at distances over 50 km to the north-east looking to the outer Firth of Forth, where it is likely to be barely perceptible most of the time and in the prevailing weather conditions. The Proposed Development occurs in the successive view to the north-west, across the Firth of Forth set against the developed landscape context of the Fife coast at Methil, with limited association with Inch Cape. Examples of this type of simultaneous effect with Inch Cape are provided in Viewpoint 20 North Berwick (Figure 5.40) and Viewpoint 21 North Berwick Law. The additional contribution of the Proposed Development to the simultaneous cumulative effect on views from the East Lothian coastline between Eyebroughty, North Berwick and Tantallon will be of low magnitude and the cumulative effects not significant, due to Inch Cape and Neart Na Gaoithe being visually recessive at such long distance and the Proposed Development having limited association with them, being located in the opposite direction of view to the inner Firth of Forth, where is it seen in an altogether different landscape context.

Overall, it is assessed that the Proposed Development will result in no simultaneous cumulative effects with Inch Cape from the majority of East Lothian. It is assessed that the contribution of the Proposed Development to the cumulative effect with Inch Cape on views from East Lothian will be low at most, from the East Lothian coastline between Eyebroughty, North Berwick and Tantallon. Overall, it is assessed that the Proposed Development will result in no significant additional simultaneous cumulative visual effects with Inch Cape on views from representative viewpoints or visual receptors in East Lothian. The potential cumulative effects arising on aesthetic and perceptual aspects of coastal and landscape character of CCAs and LCTs in East Lothian are also predicted to be of low or negligible magnitude, given the low levels of cumulative visual effects arising.

5.10.3.2. Cumulative Effects with Neart Na Gaoithe

The cumulative ZTV in Figure 5.20a shows that there is potential for the Proposed Development to have simultaneous cumulative visibility with Neart Na Gaoithe from the Fife coastline between Kinghorn and Leven. This constitutes the main section of coastline where the Proposed Development will be visible. The wireline visualisations from representative viewpoints 1-6, 11, 14 and 17 along this coastline show however, that Neart Na Gaoithe will be hardly visible above the horizon with just a limited number of blade tips theoretically visible intermittently on the sea skyline, at distances over 40 km to the east looking to the outer Firth of Forth. It is likely to be visually recessive and barely perceptible in the majority of weather conditions. The additional contribution of the Proposed Development to the cumulative effect on views from these areas of the Fife coast between Kinghorn and Leven will be of low to negligible magnitude and the cumulative effects not significant.

Neart Na Gaoithe will not be visible at all from the eastern parts of this coastline between Leven and Elie, where the orientation of the coastline is south and west facing, and there are no views to the Outer Firth of Forth (or Neart Na Gaoithe) due to the intervening headland of Chapel Ness. This is evident in Viewpoints 4, 7, 8, 9, 12 and 13 between Leven, Largo and Elie, where there is no visibility of Neart Na Gaoithe and the Proposed Development therefore results in no additional simultaneous cumulative effects in views from the Fife coast between Level, Largo and Elie.

Simultaneous visibility of the Proposed Development with Neart Na Gaoithe occurs primarily from areas of more elevated coastal terraces and farmland slightly inland of the coast between Crail, Elie and Upper Largo, where there may be long distance views of Neart Na Gaoithe at distances of between 20-30 km to the east, in the opposite viewing direction to the Proposed Development to the west/south-west. Neart Na Gaoithe will be visually recessive at long distance to the east and the Proposed Development has limited association with it, being visible in the wider successive view in the opposite direction of view to the inner Firth of Forth, where is it seen in an altogether different landscape context. The additional contribution of the Proposed Development to the cumulative effect on views from these areas of Fife between Crail, Elie and Upper Largo will be of low magnitude and the cumulative effects not significant.

Overall, it is assessed that the Proposed Development will result in limited simultaneous cumulative effects with Neart Na Gaoithe from the majority of Fife. It is assessed that the contribution of the Proposed Development to the cumulative effect with Neart Na Gaoithe on views from the Fife coastline between Kinghorn and Leven (where the Proposed Development is most visible) and from farmland slightly inland of the coast between Crail, Elie and Upper Largo will be low at most, and dropping to zero change where either Neart Na Gaoithe is not visible, such as from the coastline between Leven and Elie, or where the Proposed Development is not visible, such as from the coastline between Sauchar Point and Fife Ness. Overall, it is assessed that the Proposed Development will result in no significant additional simultaneous cumulative visual effects with Neart Na Gaoithe on views from representative viewpoints or visual receptors in Fife. The potential cumulative effects arising on aesthetic and perceptual aspects of coastal and landscape character of CCAs and LCTs in Fife are also predicted to be of low or negligible magnitude, given the low levels of cumulative visual effects arising.

Turning to the potential cumulative visual effects of the Proposed Development and Neart Na Gaoithe from East Lothian, the cumulative ZTV in Figure 5.20b indicates the geographic extent of simultaneous cumulative effects with Neart Na Gaoithe is very limited from East Lothian, with effects tending to be 'project alone' effects, occurring either a result of the Proposed Development alone from the coastline between Eyebroughty/Gullane Bay and Musselburgh; or as a result of Inch Cape alone from the East Lothian coastline to the east and south of Tantallon. The Proposed Development will have no simultaneous cumulative visual effects on views from these parts of East Lothian between Eyebroughty and Musselburgh, and to the east/south of Tantallon, where there is no simultaneous cumulative visibility of the Proposed Development with Neart Na Gaoithe.

The cumulative ZTV (Figure 5.20a) indicates that there will be a limited geographic area of the East Lothian coastline and hinterland between Eyebroughty, North Berwick and Tantallon with theoretical visibility of both the Proposed Development and Neart Na Gaoithe – these are generally coincident with the area from which Inch Cape will also be visible simultaneously, which will be seen alongside Neart Na Gaoithe in long distance offshore views to the north-east. Neart Na Gaoithe is however, located somewhat closer to closer to this coastline than Inch Cape, at distances of approximately 30-40 km offshore from this stretch of coastline. At this distance on the horizon, Neart Na Gaoithe is likely to be visually recessive on the sea skyline, with visibility frequency reduced in the many of the prevailing weather conditions, however when visible, the Neart Na Gaoithe turbines will be seen in views to the north-east looking to the outer Firth of Forth. The Proposed Development occurs in the successive view to the north-west, across the Firth of Forth set against the developed landscape context of the Fife coast at Methil, with limited association with Neart Na Gaoithe. Examples of this type of simultaneous effect with Neart Na Gaoithe are provided in Viewpoint 20 North Berwick (Figure 5.40) and Viewpoint 21 North Berwick Law. The additional contribution of the Proposed Development to the simultaneous cumulative effect on views from the East Lothian coastline between Eyebroughty, North Berwick and Tantallon will be of low magnitude and the cumulative effects not significant, due to Inch Cape and Neart Na Gaoithe being visually recessive at such long distance and the Proposed Development having limited association with them, being located in the opposite direction of view to the inner Firth of Forth, where is it seen in an altogether different landscape context. The differences in views between very distant offshore wind farms located on a marine horizon and nearshore offshore wind turbine against a land/sky background act on very different parts of a view in different ways and are assessed as not creating significant cumulative impacts.

Overall, it is assessed that the Proposed Development will result in no simultaneous cumulative effects with Neart Na Gaoithe from the majority of East Lothian. It is assessed that the contribution of the Proposed Development to the cumulative effect with Neart Na Gaoithe on views from East Lothian will be low at most, from the East Lothian coastline between Eyebroughty, North Berwick and Tantallon. Overall, it is assessed that the Proposed Development will result in no significant additional simultaneous cumulative visual effects with Neart Na Gaoithe on views from representative viewpoints or visual receptors in East Lothian. The potential cumulative effects arising on aesthetic and perceptual aspects of coastal and landscape character of CCAs and

LCTs in East Lothian are also predicted to be of low or negligible magnitude, given the low levels of cumulative visual effects arising.

5.10.3.1. Cumulative Effects with Onshore Wind Turbines

To inform the cumulative assessment for onshore wind farms, a search plan was identified showing onshore wind energy developments within the SLVIA Study Area, extending out to a radius of 50 km from the Proposed Development (Figure 5.19). Due to the large number of onshore wind turbines and the geographic extent of the area an analysis of the overall pattern of development was undertaken to identify groups of relevant wind energy developments that have potential to give rise to significant cumulative effects. This process has scoped out under-construction, consented and application stage onshore wind energy developments in the wider SLVIA Study Area, largely beyond 25 km from the Proposed Development (Table 5.26 as a necessary step, to help focus the cumulative assessment on potentially significant effects. There are relatively few under-construction, consented and application stage onshore wind energy developments in Fife, with the majority of wind turbines in the locality being operational wind energy developments, which form part of the baseline conditions. Under-construction, consented and application stage onshore wind energy developments that occur within East Lothian are located at long distances 40 - 50 km from the Proposed Development and will be subsumed as additions to within the large-scale operational wind farm groupings in the Lammermuirs (Crystal Rig Phase 4 and Aikengall IIa) and Moorfoot Hills (Pogbie Phase 2 and Hunterstall).

The CEA considers the effects of the addition of the Proposed Development to the onshore wind turbines scoped into the CEA as identified in Table 5.25, focusing on the six onshore wind energy developments within the 25 km Detailed Assessment Area, consisting of the under construction Kilmux Farm and consented Nether Pratis Farm, Pyeston, Clentrie Farm, Cornceres Farm and Toldrie wind turbines. These projects all consist of single wind turbines of less than 80m to blade tip, with the exception of Clentrie Farm, which consists of 6 x 99m turbines located 16.0km to the west of the Proposed Development. It is evident in the wireline visualisations from representative viewpoints along the Fife coast that these cumulative onshore wind energy developments have a very limited influence on views along the coast from the closest sections of Fife Coast near the Proposed Development as evident in VP1 - 9, 11 – 14 and 17; and similarly, also have limited influence in the occasional elevated panoramic views assessed such as VP10, 15 and 16.

The majority of these single turbines lie slightly inland amongst farmland away from the coast, are well dispersed, and are in keeping with the prevailing pattern of wind farm development already present in the baseline, and due to the relatively low blade tip height of these single turbines, their visual influence is likely to be relatively restricted. The additional contribution of the Proposed Development to the simultaneous cumulative visual effects with other under-construction, consented and application stage onshore wind energy developments on views from East Lothian and the wider SLVIA Study Area, will be of low magnitude and the cumulative effects not significant. The potential cumulative effects arising on aesthetic and perceptual aspects of coastal and landscape character of CCAs and LCTs in Fife are also predicted to be of low or negligible magnitude, given the low levels of cumulative visual effects arising.

5.10.3.2. Sequential Cumulative Visual Effects - Fife Coastal Path

The Proposed Development may also result in sequential cumulative effects, where the observer may be able to see the proposed development and other wind farms in sequence when moving through the landscape, from different viewpoints (even though they may not be visible simultaneously from the same viewpoint). These effects are assessed from the Fife Coastal Path, which is identified as the key recreational route from which such simultaneous cumulative effects may occur.

Users of the Fife Coastal Path will observe sequential cumulative effects, mainly due to the Proposed Development, Inch Cape and Neart na Gaoithe, between Pettycur and Newport on Tay. Beyond this length of coast, the Fife Coastal Path has no theoretical visibility of these developments. Travelling eastwards from Pettycur and Kinghorn, along the Burntisland to Buckhaven section, the Proposed Development will be clearly visible while potential visibility of Neart na Gaoithe behind, over 40 km away to the east, will be limited to its blade tips. Entering the Buckhaven to Elie section the Proposed Development will lie behind the viewer, while Inch Cape and Neart na Gaoithe will not be visible, as indicated by Figures 5.20a and 5.20b. Passing Chapel Ness, as the coastal aspect changes, Neart Na Gaoithe will be visible in views channelled along the coastline, while visibility of more distant Inch Cape will be intermittent due to the irregular coastline. Views of Inch Cape and Neart Na Gaoithe become consistent from the Fife Coastal Path east of Anstruther to Fife Ness and Newport on Tay, encompassing the entire Cambo Sands to Leuchars section of the path and much of the Leuchars to Wormit Bay section, with both offshore wind farms gradually situated oblique to walkers on the path as they progress north.

Travelling in the opposite direction, Inch Cape and Neart na Gaoithe will be visible, with the latter lying almost on axis with the Leuchars to Wormit Bay and Cambo Sands to Leuchars sections of the path due to the north-easterly aspect of the coast. Within the Elie to Cambo Sands section, Neart na Gaoithe will become more dominant in the view as the path approaches Fife Ness, where the coastline turns abruptly south-west. With Neart na Gaoithe and Inch Cape now behind the viewer, the Proposed Development will largely remain out of sight until Anstruther, where it will become visible intermittently and at long distance in views south-west. Entering the Buckhaven to Elie section and passing Chapel Ness around Largo Bay, the Proposed Development will become readily apparent for southbound users of the path, until it is passed and the cumulative developments all lie behind the viewer.

The sequential cumulative effects observed from the Burntisland to Buckhaven and Buckhaven to Elie sections of the Fife Coastal Path are likely to be negligible as the offshore windfarms lie over 40 km from this section of coast; and, apart from the three WTGs of Clentrie Farm, onshore developments comprise single WTGs. These lie inland, are well dispersed, and are in keeping with the prevailing pattern of wind farm development. Within these sections, the effect will be observable over a length of approximately 15 km between Pettycur and Buckhaven.

The Elie to Cambo Sands section represents the only section of the Fife Coastal Path with visibility of the Proposed Development and both offshore windfarms, Neart Na Gaoithe and Inch Cape. However, only the approximately 10 km stretch between Chapel Ness and Anstruther Wester has intermittent visibility of the Proposed Development, and the Neart na Gaoithe and Inch Cape offshore wind farms. As these will not be seen together, one will lie behind the viewer no matter their direction of travel, and Neart na Gaoithe lies over 20 km away, the cumulative effect on this section of the coastal path is likely to be low. The remaining sections of the path, from Cambo Sands to Leuchars and Leuchars to Wormit Bay, will have no visibility of the Proposed Development. The Limekilns to Burntisland and Wormit Bay to Newburgh sections have no visibility of the Proposed Development, Neart na Gaoithe or Inch Cape.

The sequential cumulative effects will be occasionally sequential, with long time lapses between appearances of the Proposed Development and Neart na Gaoithe/Inch Cape. There are long, clearly defined and generally separate sections of the Fife Coastal Path with views of the Proposed Development and views of Neart na Gaoithe/Inch Cape, with distance between the viewpoints/sections that each are visible. The sequential visual effects of the Proposed Development from the Fife Coastal Path are assessed as being of low cumulative magnitude and not significant, reflecting this occasional, clearly defined and separated effects and the limited intervisibility of the cumulative developments derived from the combination of the changing aspect of the coastline and the distance separating the offshore windfarms from the coastal path. Overall, it is assessed that no significant sequential cumulative effects will occur to the Fife Coastal Path as a result of the addition of the Proposed Development.

5.11. Statement of Significance

This chapter of the EIAR assesses the effects of the Proposed Development on coastal character, landscape and visual resources, as well as its cumulative effects on these receptors with under-construction, consented, and application stage wind energy developments within the SLVIA Study Area.

The primary effects arising from the Proposed Development will be on the aesthetic and perceptual aspects of landscape and seascape character, and on visual amenity. These effects are related to the height of the proposed wind turbine and the movement of its rotor, which means the Proposed Development will be a noticeable new feature in the seascape, landscape and views, particularly within the 25 km Detailed Assessment Area. The limitation of significant effects is mainly due to the heavily modified context of the Proposed Development site and its location 1.5 km seaward of the Fife Energy Park. These factors reduce the effects on the perceived coastal character, as the Proposed Development is associated more with the inshore waters of the Firth of Forth and the developed coastline at Methil than the rural landward areas.

The Proposed Development will be located off the ‘coal coast’ of Fife (Brown, 2004), which has an industrial history that dates back to the 19th century. This is evident in the presence of large historic coastal structures/landmarks associated with resource utilisation, such as the coal hoists at Methil docks; and former coal mining towns that once housed the local workforce along the coast, at Buckhaven, Methil and East and West Wemyss. Fife Energy Park, an engineering and research zone within the energy sector located in Methil, influences the character of the immediate coastline. An area of industrial development and reclaimed land, it’s abrupt seaward boundary is formed by a quay where barges and other vessels are often moored, with oil rig sheds and yards now used for the fabrication of renewable energy structures, such as jackets for offshore wind turbines. Existing large scale wind turbines comprising the Methil Docks wind turbine and LDT lie on the coastal edge. The influence of existing urban and industrial development on the coast limits it’s qualities of remoteness and tranquillity; and its dark skies.

Significant effects on coastal character and visual amenity resulting from the Proposed Development will be contained within Fife and limited to local geographical areas around the Proposed Development where it will be visible and most prominent. Where there will be limited or no visibility of the Proposed Development, due to screening by local topography, buildings, and vegetation, not significant effects will occur.

The assessment of representative viewpoints has found that there will be significant visual effects at viewpoints along the southern Fife coast including Viewpoint 1. Shore Street, Buckhaven; Viewpoint 2. Fife Coastal Path, East Wemyss; Viewpoint 3. Fife Coastal Path, West Wemyss; Viewpoint 4. Fife Coastal Path, Leven; Viewpoint 6. Kennoway; Viewpoint 7. Fife Coastal Path, Lundin Links; and Viewpoint 8. Lower Largo. From these locations, the Proposed Development will be seen in combination with three existing oil rigs in a relatively open expanse of sea. Within the medium to large scale seascape, these large scale features will appear larger in massing and vertical scale than the Proposed Development, with a comparable lattice/jacket form, and will be the main scale comparison and precedent features in the water.

Significant along the Fife Coastal Path effects will be observed when moving eastwards, between East Wemyss and Buckhaven; and when moving westwards between Lundin Links and Buckhaven; and including viewpoints 2, 3, 4 and 7 along its route. In views from these sections of coast the Proposed Development will be seen with three oil rigs in the firth and the comparably sized LDT, just off the shoreline.

Significant effects on the perceived landscape/coastal character have been assessed as occurring along the shoreline area of the Coastal Hills LCT (192). These effects will occur where the Proposed Development will be visible within channelled views along the coastline from relatively undeveloped and natural sections of coast. Some complexity in the pattern of existing land-use along the coast derived from its variety, and a general absence of focal points, apart from Largo Law, make the existing Methil Dock wind turbine and LDT the main focal points within the LCT. This existing wind turbine influence on the landscape character of the LCT means it may accommodate similar development.

Significant effects on designated areas of landscape have only been identified for the shoreline, and eastern and elevated parts of West Wemyss within Wemyss Coast LLA where there will be visibility of the Proposed Development. Inland areas where undulating topography, hedges, trees and woodland will limit visibility of the Proposed Development, will observe not significant effects.

Significant effects on seascape character have been identified for parts of West Wemyss to Buckhaven (E) CCA and Leven Links (G) CCA. These will occur within the nearest part of the Fife coast to the Proposed Development, where it extends the influence of the existing wind turbines at a larger scale, albeit further offshore. Movement is present in the existing seascape, ranging from the regular, sweeping movements of the existing Methil Docks wind turbine and LDT; the movements of large scale shipping in the water and activity within the docks. Siting the Proposed Development within a seascape with capacity to accommodate such change is the primary mitigation measure that may reduce potentially significant effects. Further primary mitigation measures are also proposed to be incorporated in the layout design of the Proposed Development.

Significant effects on visual amenity due to the Proposed Development will arise at the southern areas of Buckhaven; the esplanade area of Leven; and at the shoreline of East and West Wemyss. The remaining areas of these settlements will not experience significant effects due to the pattern and density of their urban form. The Proposed Development may also contrast with small scale, traditional/historic settlements along the coast, but will also relate to the existing larger scale infrastructure that already exists in the setting of these settlements.

Offshore wind turbine development can conflict in scale with an intricate coastline made up of smaller scale seascapes and offshore islands. At this location, there is potential to accommodate the Proposed Development as the form of the Proposed Development can relate more easily to the simple, open and relatively flat Fife coastline, and the linear backdrop of the East Lothian coast. As the Proposed Development will be sited near to relatively sheltered waters at the transition between the Inner and outer Firth of Forth, the single proposed turbine will appear proportionate and rational to the existing character of nearby energy coast of Fife. While the Proposed Development will result in significant effects on landscape and visual resources within a limited geographic area, such effects occur in on the visual amenity and perceived coastal character of the heavily modified baseline context of the receiving environment and will be reversible at the end of the operational phase on decommissioning of the Proposed Development.

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6. OFFSHORE ORNITHOLOGY

This Chapter evaluates the potential effects of the Proposed Development on offshore ornithology. It contains the following sections:

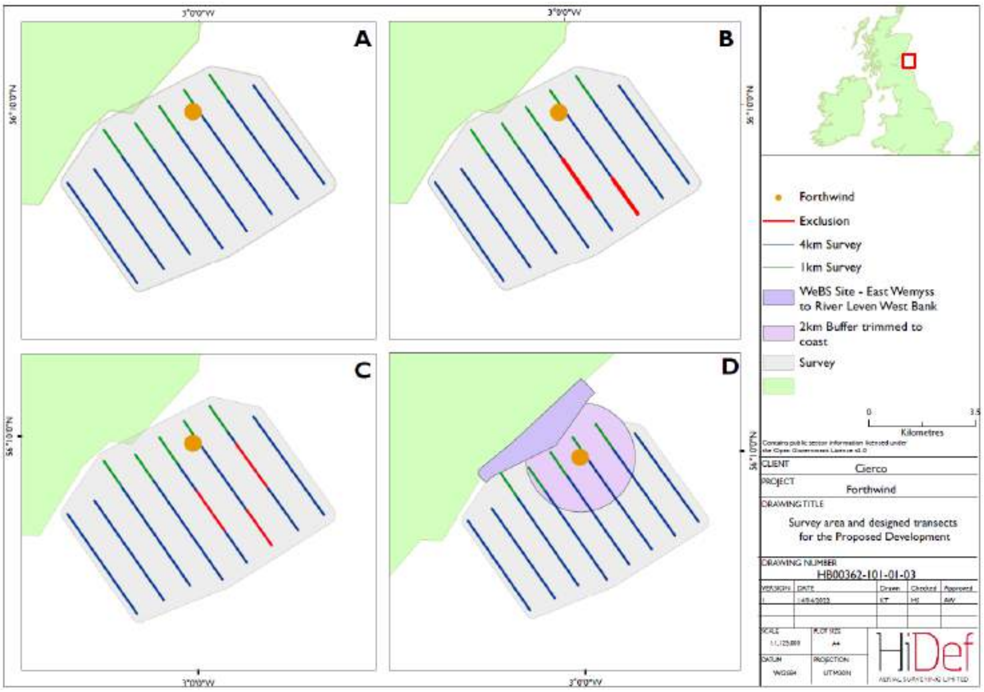
- Introduction;
- Consultation;
- Scope of Assessment;
- Legislative Framework and Guidance;
- Assessment Methods;
- Baseline Characterisation;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

6.1. Introduction

This Chapter sets out the offshore ornithological interest within and around the Proposed Development, a single demonstrator wind turbine off the coast of Methil, Fife in Scotland. The Proposed Development is described in Chapter 3: Project Description and illustrated in Figure 1.1, contained within Volume 2 of this EIAR.

This Chapter addresses those bird species which are known to or are likely to occur within the defined ornithological impact zone comprising the turbine itself and a 2 km buffer around it as illustrated in Figure 6.1, shown below and contained within Volume 2 of this EIAR. The focus is on those seabird species that were recorded during two years of pre-construction boat-based survey work as set out in Technical Appendix 6A, Baseline Data. A range of seaduck and diver species have also been screened into assessment as identified in Section 6.3.2.

Figure 6.1 - Location of proposed Forthwind turbine and a 2 km buffer



The key species of concern are all qualifying interests of Special Protection Areas (SPAs) as set out in Table 6.4 with the associated breeding and non-breeding population defined in Tables 6.6 and 6.7. In this regard, the

Proposed Development is located within the Outer Firth of Forth and St Andrews Bay complex marine SPA and lies close to the Forth Islands SPA and the Firth of Forth SPA. It is therefore unsurprising that it is the birds from these SPAs that have been screened in for assessment.

This Chapter provides the information necessary to follow the process of Habitats Regulations Appraisal (HRA) for the SPA bird species of concern as outlined in Section 6.4.3.1. Potential impacts to birds may arise during the construction, operation and decommissioning of the Proposed Development and are fully discussed below.

The assessment in this Chapter is supported by the following ornithology technical appendices:

- Technical Appendix 6A, Baseline Data
- Technical Appendix 6B, Connectivity and Apportioning
- Technical Appendix 6C, Collision Risk Modelling
- Technical Appendix 6D, Displacement Analysis
- Technical Appendix 6E, Method Statement

The key sources of information used to inform assessment include the following:

- Boat-based survey data collected from March 2015 - February 2017 (Technical Appendix 6A).
- Forthwind (2015) Environmental Statement for two-bladed turbine design;
- Forthwind (2019) Marine Scotland scoping opinion for two turbine demonstrator;
- Scotland's National Marine Plan Interactive (NMPi) website;
- Site selection data for the Outer Firth of Forth and St Andrews Bay complex SPA;
- Most recent Wetland Bird Survey (WeBS) counts for seaduck and diver species, 2015-2020; and
- Marine Scotland's Habitats Regulations Appraisal (HRA) for the Forth and Tay offshore wind farms.

6.2. Consultation

Table 6.1 sets out the ornithological issues raised in the 2021 Marine Scotland scoping opinion and appendix of stakeholder consultation responses that have been addressed in this assessment. Further to receipt of the scoping opinion, meetings were held with MSS and NatureScot on 11 February 2022 and with RSPB on 30 March 2022 and their advice has been incorporated as indicated.

Table 6.1 - Summary of Consultation Undertaken

Matters raised by MS scoping opinion	Project Response
Scottish Ministers advise that an HRA report must be submitted at the time of the application.	HRA requirements for Offshore Ornithology are addressed in this Chapter; potential impacts are assessed against the SPA populations of concern for which there might be 'likely significant effect' as identified in Tables 6.4, 6.6 and 6.7. This EIAR Chapter and the supporting Technical Appendices provide the necessary information to inform Marine Scotland's appropriate assessment and to consider whether potential impacts from the Proposed Development would affect the viability of any breeding SPA populations or the condition status of any non-breeding SPA interests.

Matters raised by MS scoping opinion	Project Response
The validity of existing survey data was referenced in the NatureScot and RSPB representations and therefore the Scottish Ministers advise the collection of a further season of wintering bird survey data. Survey metholds should be discussed and agreed with NatureScot and Marine Scotland Science, should be designed to target the species of most concern (including scoters, divers), and will have to be collected during the winter 2022 - 2023 season.	At the meeting on 11 February 2022, MSS and NS clarified that the request for a further season of wintering bird survey data related solely to the seaduck and diver interests of the Outer Firth of Forth of Forth and St Andrews Bay Complex and was not being suggested in respect of seabird interests. In this regard, Technical Appendix 6D sets out a precautionary 'worst-case' assessment for seaduck and diver displacement impacts which should be sufficient to inform Marine Scotland's appropriate assessment of this issue without the need for a further season of wintering bird survey data. Please see Appendix 6D.1 for further detail.
Scottish Minsters advise the Applicant to fully consider the issues around data analysis and calculation of density estimates for CRM, whether or not to base these on the wider survey area or to consider the Proposed Development as a subset of this.	The boat-based survey data has been analysed by HiDef as set out in Technical Appendix 6A. Distance sampling needed to be applied to total records from the wider survey area as observations of all species were too low to be able to use a subset solely for the impact zone. Densities of seabirds in the wider survey area are considered to be representative of those in the impact zone. In respect of seaduck and diver species, total observations even in the wider survey area were too low to be able to generate density or abundance estimates.
Scottish Ministers expect the Applicant to consider increasing the air gap (the clearance under the blades to sea) as a practical option to mitigate collision risk.	The Proposed Development is a single turbine and is not presenting any significant risk of collision to ornithological receptors, as addressed in Technical Appendix 6C and in Section 6.7.3.4. The airgap proposed within this Project Design Envelope is the maximum airgap achievable with a blade tip height of 280m. An increase in the airgap will increase the blade-tip height.
Indirect effects should be scoped into assessment given the overlap with the Outer Firth of Forth and St Andrews Bay Complex SPA.	Indirect effects are included in Table 6.2 and assessed in Section 6.7
Give further consideration to the approach for assessing significance, RSPB does not support the method outlined in Table 21 (p92) of the scoping report.	The approach in the scoping opinion has not been adopted for this Chapter. Significance of impacts is considered against the SPA populations of seabirds, seaduck and divers screened in for assessment.
MSS and NS consider that there is not enough detail in the scoping report – Section 11.4.11 and Table 22 – and advise that a draft method statement is prepared.	Hidef prepared a draft method statement (dated 15 September 2021) and circulated this to MSS, NS and RSPB for comment on 18th October 2021. A copy of this method statement is included in Technical Appendix 6E, Volume 3 of this EIAR.

Matters raised by MS scoping opinion	Project Response
MSS and NS advise using Band deterministic spreadsheets but include the stochastic CRM for comparison.	The Band (2012) deterministic spreadsheets have been provided alongside Technical Appendix 6C. Given the low collision risk for all species it was not considered necessary to also run the stochastic CRM.
Model both generic flight height distributions and site-specific flight heights. Provide more detail on how the site-specific flight heights are to be validated.	Site-specific flight heights could not be validated and were not recorded in flight height bands that correspond to the turbine specifications, so they have not been modelled. This matter is further considered in Technical Appendix 6C (Section 2.4.4)
Use SNCB recommended avoidance rates (2014) with the Band deterministic spreadsheets.	As presented in Technical Appendix 6C for all species of concern, except gannet where a more precautionary rate of 98% has been used following RSPB advice.
Further discuss the use of SeaBORD for a single turbine.	At the meeting on 11 February 2021, it was agreed that SeaBORD was not required to model seabird displacement impacts for a single turbine in an inshore location.
NS to provide advice on displacement rates for seaducks, divers and shags as soon as possible.	In the absence of guidance, HiDef have used a 100% rate of displacement and 5% rate of mortality for all seaduck and diver species as a worst-case to demonstrate that impacts are not significant.
MSS and NS advise PVA modelling for the impacts of the turbine alone and for cumulative impacts.	Assessment is able to demonstrate that impacts from the Proposed Development are so low that population modelling is not required to determine their significant against any SPA populations of concern. Potential cumulative impacts are considered qualitatively in Section 6.9.

6.3. Scope of Assessment

The scope of ornithological impact assessment includes consideration of the impacts scoped in for assessment, the ornithological receptors of concern and the geographical scope; these are discussed in this section.

6.3.1. Impacts scoped in for assessment

The key ornithological impacts to be scoped in for assessment were advised in the Marine Scotland scoping opinion, issued 21 December 2021, and are summarised in Table 6.2. The focus of assessment is on those impacts which occur during turbine operation; the risk that birds may fly close to the turbine and collide with the turbine blades, termed collision risk, and the risk that birds may avoid the turbine completely, termed displacement. Assessment also considers any temporary impacts on bird species that may arise during turbine construction and turbine decommissioning.

Table 6.2 - Assessment of Ornithological Effects

Impact	Description of Impact and Approach
Collision	Birds may potentially collide with the rotor blades of the operational turbine with such collisions deemed to be fatal. Assessment of collision risk will be based on Band (2012)[66] using deterministic excel spreadsheets. Collision is addressed in Technical Appendix 6C and in Section 6.7.3.2 of this Chapter.
Displacement	Birds may avoid an area around the operational turbine, known as displacement. Displacement assessment will be undertaken using the matrix method advised by the SNCBs (Busch *et al*., 2015[67]; SNCB, 2017[68]). Displacement is addressed in Technical Appendix 6D and Section 6.7.3.3 of this Chapter.
Barrier Effects	Barrier effects have been modelled by Masden *et al*., (2010)[69] and relate to the increase in energy expenditure should birds be required to circumnavigate a barrier in order to access their foraging grounds. Barrier effects are addressed in Section 6.7.3.3 of this Chapter.
Indirect Effects	Indirect effects include the loss of supporting habitat or prey species within the footprint of the Proposed Development, including the turbine, met mast and export cable, all located within the Outer Firth of Forth and St Andrews Bay Complex SPA. Indirect effects are addressed in Section 6.7.3.1 of this Chapter.
Cumulative Effects	A cumulative assessment will be undertaken to consider potential additive effects arising from nearby similar development projects. Cumulative effects are addressed in Section 6.9 of this Chapter.

6.3.2. Ornithological receptors scoped in for assessment

The following ornithological receptors are those that were recorded regularly during the boat-based survey work; Technical Appendix 6A, Baseline Data. These are all scoped in for assessment:

- Gannet (Morus bassanus);
- Kittiwake (Rissa tridactyla);
- Herring gull (Larus argentatus);
- Lesser black-backed gull (Larus fuscus);
- Guillemot (**Uria aalge);**
- Razorbill (Alca torda);
- Puffin (***Fratercula arctica***);
- European shag (***Phalacrocorax*** aristotelis);
- Black-headed gull (***Chroicocephalus ridibundus*****);**

[66] Band, B. (2012). Using a collision risk model to assess bird collision risks for offshore windfarms. The Crown Estate Strategic Ornithological Support Services (SOSS) report SOSS-02.

[67] Busch, M., Buisson, R., Barrett, Z., Davies, S., Rehfish, M. (2015). Review of the habitat loss method for assessing displacement impacts from offshore wind farms. JNCC report, 51

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- Common gull (Larus canus);
- Eider (***Somateria mollissima*****); and**
- Red-throated diver (Gavia stellata).

The following species were not recorded in great enough numbers on-site for distance sampling to be applied, however, they have been scoped in on a precautionary basis and assessed using other available data:

- Common scoter (***Melanitta* nigra);**
- Velvet scoter (***Melanitta fusca*****);**
- Long-tailed duck (***Clangula hyemalis*****);**
- Red-breasted merganser (***Mergus serrator*****);**
- **Slavonian grebe (*Podiceps auritus*); and**
- **Goldeneye (*Bucephala clangula*).**

A full species account for each of the above receptors is provided in Section 6.5.

Species that were identified in the 2019 scoping opinion but for which records were incidental only include:

- Common tern (***Sterna hirundo*****),**
- **Sandwich tern (*Sterna sandvicensis*),**
- **Whooper swan (*Cygnus cygnus*),**
- **Pink-footed goose (*Anser brachyrhynchus*)**

These four species have been screened out of further assessment. Nor has any project-specific assessment been undertaken for other wildfowl or wader species. Instead, reference is made to the strategic collision risk assessment carried out by WWT, on behalf of Marine Scotland[70]. NatureScot/MSS also advise that waders from the Firth of Forth SPA can be scoped out on the basis that they use the intertidal zone to forage and are highly unlikely to occur offshore (as confirmed by the boat-based survey work reported in Technical Appendix 6A).

6.3.3. Geographical Scope

The Proposed Development is located 1.5 km offshore of Methil, on the northern side of the Firth of Forth. Water depths in the Proposed Development area range between 0 and 15 m, with depth increasing with distance offshore. For seabird species during the breeding season the geographic scope relates to the foraging range for each species, mean max plus one standard deviation (SD) as recorded in Woodward et. al (2019)[71].

Table 6.3 - Seabird foraging ranges

Common name	Mean Max (km)	1 SD (km)
Gannet	315.2	194.2
Kittiwake	156.1	144.5
Herring gull	58.8	26.8
Lesser black-backed gull	127.0	109.0
Black-headed gull	18.5	0.0
Common gull	50.0	0.0
Guillemot	73.2	80.5
Razorbill	88.7	75.9
Puffin	137.1	128.3

[70] WWT (2014). Strategic assessment of collision risk of Scottish offshore wind farms to migrating birds. Scottish Marine and Freshwater Science Vol 5 no 12.

[71] Woodward, I., Thaxter, C. B., Owen, E. and Cook, A. S. C. P., (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report, Number 724.

Common name	Mean Max (km)	1 SD (km)
European shag	13.2	10.5

This information is used in the apportioning process to identify those SPAs where there may be connectivity, where breeding seabirds foraging from the SPA may occur within the defined impact zone for the Proposed Development. This impact zone is the turbine location with a 2 km buffer around it, as illustrated in Figure 6.1.

Apportioning is further explained in Section 6.4.1.3 and in Technical Appendix 6B.

6.4. Methodology

6.4.1. Legislative Framework and Guidance

This section outlines the legislation, policy and guidance relevant to the assessment of the potential effects on the bird species listed in Section 6.5.

International Legislation:

- United Nations Convention on Biological Diversity 1992 (the Rio Convention);
- The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the Bern Convention);
- Convention for the Protection of the Marine Environment of the North-East Atlantic 1992 (the OSPAR Convention).

National Legislation:

- The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019;
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;
- The Marine Environment (EU Exit) (Scotland) (Amendment) Regulations 2019;
- The Marine Environment (Amendment) (EU Exit) Regulations 2018;
- The Marine Environment (EU Exit) (Scotland) (Amendment) Regulations 2018;
- Nature Conservation (Scotland) Act 2004;
- Wildlife and Natural Environment (Scotland) Act 2011;
- Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (S.I. No. 572 of 2017);
- The Infrastructure Planning (Decisions) Regulations 2010 (Infrastructure Planning Regulations);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations);
- The Conservation of Habitats and Species Regulations 2017.

National Policy:

- Scotland's National Marine Plan (2015);
- Scottish Energy Strategy: The future of energy in Scotland (2017);
- UK Post-2010 Biodiversity Framework (the successor to, Biodiversity: UK Action Plan 1994).

Guidance:

- Band (2012). Guidance on collision risk modelling for offshore wind farm development;
- CIEEM (2018)[72]. Guidelines on the approach to EIA, recommend that conservation value is taken into account for ecological receptors;
- Furness *et al*. (2013)[73]. Analysis of seabird species sensitivity to offshore wind farm developments, used in each of the species accounts in Section 6.5;

[72] CIEEM, (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. [Online]. https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/

[73] Furness, R.W., Wade, H.M., and Masdfen, E.A., (2013). Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management, 119, pp.56-66.

- Furness (2015)[74]. Report on biologically defined minimum population scales (BDMPS);
- NatureScot (2018)[75]. Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs.
- NatureScot (2020)[76]. Guidance on seasonal periods for birds in the Scottish marine environment;
- SNCB (2014)[77]. Statutory advice on the avoidance rates to use in collision risk modelling;
- SNCB (2017) [78]. Statutory advice on displacement assessment;
- Woodward *et al*. (2019)[79]. Defines the seabird foraging ranges used for screening designated sites into apportioning calculations.

6.4.2. Baseline Characterisation

This sets out the survey methods and desk study used to inform the baseline description and species accounts.

6.4.2.1. Boat-based survey

Regular seabird surveys were conducted from March 2015 to February 2016 (year 1) and March 2016 to February 2017 (year 2). The survey area, 40.8km^2, was sampled over 8 parallel transects running approximately perpendicular to the coast following a visual line transect survey methodology (Camphuysen *et al.*, 2004; Maclean *et al.,* 2009)[80,81] (Figure 6.2).

Data were collected by observers using the European Seabirds at Sea protocol (Camphuysen *et al.*, 2004). Sitting birds and flying birds were recorded in five distance and height bands 0-50 m, 50-100 m, 100-200 m, 200-300 m and >300 m and 0-5m, 5-20m, 20-100m, 100-200m and >200m, respectively. Ornithological target species included ducks, divers, grebes, shearwaters, petrels, gannets, cormorants, skuas, gulls, terns and auks. All other species were also recorded (e.g., passerines).

6.4.2.2. Seabird Monitoring Programme

The Seabird Monitoring Programme (SMP) database contains all records of breeding seabird populations around the UK and has been consulted to obtain this information for the SPA colonies relevant to the Proposed Development. In this regard, the most up-to-date counts were obtained for assessment.

https://app.bto.org/seabirds/public/index.jsp

6.4.2.3. Connectivity and Apportioning

Screening for connectivity, carried out as part of the desk study, determines which breeding seabird SPAs lie within foraging range of the Proposed Development. Foraging ranges are defined for each seabird species based on the mean max foraging distance plus one standard deviation given in Woodward *et al*. (2019). This results in a 'long-list' of breeding seabird SPAs which can then be refined by considering the risk of 'likely significant effect'.

Judgements on the risk of 'likely significant effect' can be informed by referring to the 'apportioning' weightings for each SPA in the 'long-list'. Apportioning follows NatureScot (2018) guidance and the weightings are based on SPA population size (as taken from the SMP database), distance between the Proposed Development and the breeding seabird SPAs within foraging range, and area of sea included in the foraging range. It makes no

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[74] Furness, R.W., (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, Number 164.

[75] NatureScot. (2018). Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs.

[76] NatureScot, (2020). Seasonal Periods for Birds in the Scottish Marine Environment. Short Guidance Note Version 2.

[77] SNCB (2014). Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review.

[78] SNCB (2017). Joint SNCB Interim Displacement Advice Note. [Online].

[79] Woodward, I., Thaxter, C. B., Owen, E. and Cook, A. S. C. P., (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report, Number 724.

[80] Camphuysen, K., Fox, T. A. D., Leopold, M. F. and Petersen, I. B., (2004). Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore windfarms. U.K. Report commissioned by Cowrie Ltd, 38 pp.

[81] Maclean, I. M. D., Wright, L. J., Showler, D. A. and Rehfisch, M. M. (2009). A review of assessment methodologies for offshore windfarms. British Trust for Ornithology Report commissioned by Cowrie Ltd, 76 pp.

reference to any site survey data or impact modelling and can be undertaken as part of the HRA screening stage. Apportioning outputs are presented in Technical Appendix 6B, Connectivity and Apportioning, and used to identify the 'short-list' of SPAs requiring further consideration.

6.4.2.4. Birds of Conservation Concern

The Birds of Conservation Concern (Eaton *et al*. 2015) is published by the BTO and is a review of the status of birds in the UK, Channel Islands and Isle of Man. Using standardised criteria, 244 species with UK breeding, passage, or wintering populations are assessed and assigned to the red, amber or green list of conservation concern. This 'traffic-lighting' system of conservation concern is informed by expert opinion and is referred to in each of the summaries listed in Section 6.5.

6.4.3. Assessment Methods

The Chapter provides the information necessary to follow the process of Habitats Regulations Appraisal (HRA) as set out below.

6.4.3.1. Habitats Regulations Appraisal

HRA applies to any plan or project with the potential to affect the qualifying interests of a European site, including SPAs for the bird species scoped in for assessment (Section 6.3.2). Under Regulation 48 of the Habitats Regulations – Conservation (Natural Habitats, &c.) Regulations 1994[82]:

- Is the plan or project connected with, or necessary for, SPA conservation management?
- Will the plan or project be likely to have a significant effect on the qualifying interests of the SPA either alone, or in combination with each other, or in combination with other plans or projects?
- Can it be ascertained that the plan or project will not adversely affect SPA site integrity, either alone or in combination with other plans or projects?

The last question / stage in the process is called appropriate assessment, to be undertaken by Marine Scotland as the competent authority, based on available information and with advice from NatureScot. It will consider the implications of the plan or project in relation to the conservation objectives for the SPA qualifying interests.

6.4.3.1. Scoping the 'short-list' of species and SPAs under HRA

This is done for SPA breeding colonies in Technical Appendix 6B, Connectivity and Apportioning, and the outputs included below. Assessment considers the fact that the Proposed Development lies within the boundary of the Outer Firth of Forth and St Andrews Bay complex SPA, a marine SPA designated for at sea concentrations of bird species. Table 6.4 presents the 'short-list' of species and SPAs considered in assessment and indicates whether each species is a breeding season interest or non-breeding season interest, based on review of the SPA citations.

Table 6.4 - Forthwind 'short-list' of species and SPAs for assessment

Species	SPA	Seasonality
Gannet	Forth Islands Outer Firth of Forth and St Andrews Bay	Breeding Breeding
Kittiwake	Forth Islands Outer Firth of Forth and St Andrews Bay	Breeding Breeding and non-breeding
Herring gull	Forth Islands Outer Firth of Forth and St Andrews Bay	Breeding Breeding and non-breeding
Lesser black-backed gull	Forth Islands	Breeding
Guillemot	Forth Islands Outer Firth of Forth and St Andrews Bay	Breeding Breeding and non-breeding
Razorbill	Forth Islands	Breeding

[82] https://www.legislation.gov.uk/uksi/1994/2716/contents/made

Species	SPA	Seasonality
	Outer Firth of Forth and St Andrews Bay	Non-breeding
Puffin	Forth Islands Outer Firth of Forth and St Andrews Bay	Breeding Breeding
European shag	Forth Islands Outer Firth of Forth and St Andrews Bay	Breeding Non-breeding
Black-headed gull	Outer Firth of Forth and St Andrews Bay	Non-breeding
Common gull	Outer Firth of Forth and St Andrews Bay	Non-breeding
Eider	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding
Red-throated diver	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding
Common scoter	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding
Velvet scoter	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding
Long-tailed duck	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding
Red-breasted merganser	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding
Slavonian grebe	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding
Goldeneye	Firth of Forth Outer Firth of Forth and St Andrews Bay	Non-breeding Non-breeding

The species accounts provided in Section 6.5 identify how each species will be addressed for assessment and the assessment itself is provided in Section 6.7.

6.5. Baseline Characterisation

6.5.1. Introduction

The following species accounts summarise the information available for each ornithological receptor. Seasons of interest for each species are based on NatureScot (2020) and Furness (2015) as set out in Table 6.5

Table 6.5 -Seabird seasonality for impact assessment

Species	Breeding season (NatureScot, 2020)	BDMPS (Furness, 2015)		
		autumn migration	non-breeding	spring migration
Gannet	mid Mar - Sep	Sep - Nov	n/a	Dec - Mar
Kittiwake	mid Apr - Aug	Aug - Dec	n/a	Jan - Apr
Guillemot	Apr - mid Aug	n/a	Aug - Feb	n/a
Herring gull	Apr – Aug	n/a	Sep - Feb	n/a
Lesser black-backed gull	mid Mar - Aug	Aug - Oct	Nov - Feb	Mar - Apr
Guillemot	Apr - mid Aug	n/a	Aug - Feb	n/a
Razorbill	Apr - mid Aug	Aug - Oct	Nov - Dec	Jan - Mar
Puffin	Apr - mid Aug	n/a	mid Aug - Mar	n/a

Species	Breeding season (NatureScot, 2020)	BDMPS (Furness, 2015)		
		autumn migration	non-breeding	spring migration
European shag	Mar – Sep	n/a	Sep - Jan	n/a

	Breeding season (NatureScot, 2020)	Non-breeding season (NatureScot, 2020)
Black-headed gull	n/a	Sep - Mar
Common gull	n/a	Sep - Mar
Eider	n/a	Sep - mid Apr
Red-throated diver	n/a	mid Sep - Apr
Common scoter	n/a	July - Apr
Velvet scoter	n/a	Sep - Apr
Long-tailed duck	n/a	mid Sep - Apr
Red-breasted merganser	n/a	mid Aug - Mar
Slavonian grebe	n/a	mid Sep - Apr
Goldeneye	n/a	Sep - mid Apr

6.5.2. Gannet

Gannets are a wide-ranging seabird with breeding populations around the UK and Irish coastlines. Gannets are considered to be of high conservation value in Scotland and are amber listed as a Bird of Conservation Concern as well as being listed in the EC Birds Directive as a migratory species (Eaton *et al.,* 2015, JNCC, 2021a[83]). Gannets are identified as being of high sensitivity to collision impacts in Furness *et al.* (2013)[84] and are taken forward for assessment on this basis. While previously considered to be of low sensitivity to displacement there is increasing evidence that they could be at risk, so they have also been assessed for this impact.

Gannets have a wide foraging range as recorded in Woodward *et al*. (2019) (mean max 315.2 km plus 194.2 km one standard deviation), meaning some distant breeding colonies were screened in for HRA connectivity as set out in Technical Appendix 6B. However, apportioning indicates that 100% of birds recorded on-site during the breeding season are likely to be associated with the Forth Islands SPA: the gannetry at the Bass Rock which is the largest breeding population of gannet in the UK and lies further east in the Firth of Forth.

Gannet were recorded in all months of the boat-based surveys except for January and December 2016, and February 2017, and were present in slightly higher numbers over the spring period. Peak abundances in the impact zone were recorded in April 2015 with 79 birds and May 2016 with 48 birds, Technical Appendix 6A.

For assessment both breeding and non-breeding season impacts are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population.

6.5.3. Kittiwake

Kittiwakes are a small gull species with a distinctive call and strictly coastal distribution. During the breeding season, they can be found in seabird colonies around the UK. In late summer and autumn, they can be seen flying offshore, or gathering at roosts and they migrate west across the Atlantic or south depending on food availability.

[83] JNCC, (2021a). Northern gannet (*Morus bassanus*). [Online]. https://jncc.gov.uk/our-work/northern-gannet-morus-bassanus/.

[84] Furness, R.W., Wade, H.M., and Masden, E.A., (2013). Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management, 119, pp.56-66.

In some areas around the UK coast, including Scotland, kittiwake populations are in decline. The reasons appear to relate to climate change and reduced prey availability. As a result, kittiwakes are currently on the red list of the UK Birds of Conservation Concern, on the OSPAR list of Threatened and/or Declining Species and Habitats, and on the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC, 2021b[85]). According to Furness *et al.* (2013), kittiwakes are considered to be sensitive to collision with operational turbines. While at less risk of displacement this impact has also been included for consideration as advised by MSS.

Kittiwakes have a relatively large foraging range, as recorded in Woodward *et al*. (2019) (mean max 156.1 km plus 144.5 km one standard deviation), meaning a large number of SPAs were screened in for HRA connectivity (including Troup, Pennan and Lion`s Heads and Flamborough and Filey Coast), Technical Appendix 6B. However, apportioning indicates that 90.2% of birds recorded on-site during the breeding season are likely to be associated with the Forth Islands SPA.

At the Proposed Development, the abundance of kittiwakes in the impact zone fluctuated throughout the months, with no clear distinction in abundance between the breeding and migration seasons. During the breeding season, a peak abundance was recorded in June 2015 with 66 birds, while a peak abundance of 42 birds was recorded in January 2016, during the migration season, Technical Appendix 6A.

For assessment, breeding season impacts are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population. Assessment also considers **non-breeding season impacts against the non-breeding population of the** Outer Firth of Forth and St Andrews Bay SPA.

6.5.4. Herring gull

Herring gulls are well-known British seabirds, now found inland and in cities as much as on the coast. Due to ongoing population declines, they are currently on the red list of the UK Birds of Conservation Concern, are a UKBAP priority species and are listed in the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC, 2021c[86]). According to Furness *et al.* (2013), they are of high sensitivity to collision risk and low sensitivity to displacement and have been taken forward for assessment on this basis.

Herring gulls have a small foraging range as recorded in Woodward *et al*. (2019) (mean max 58.8 km plus 26.8 km one standard deviation), resulting in only two SPAs to be screened in for HRA connectivity (Forth Islands and St Abb's Head to Fast Castle), Technical Appendix 6B. However, apportioning indicates that 99.8% of birds recorded on-site during the breeding season are likely to be associated with the Forth Islands SPA.

At the Proposed Development, herring gull was one of the most abundant species to be recorded, with a peak density recorded in January 2016; Technical Appendix 6A.

For assessment, breeding season impacts are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population. Assessment also considers **non-breeding season impacts against the non-breeding population of the** Outer Firth of Forth and St Andrews Bay SPA.

6.5.5. Lesser black-backed gull

Lesser black-backed gulls are also now found inland as much as on the coast. During the last national seabird census, Scotland was found to host the second largest proportion of urban-nesting lesser black-backed gull in the UK. They are a migratory species with those that breed farthest north moving the greatest distances south in winter, reaching as far as equatorial Africa (Furness, 2015).

The species is on the amber list of the UK Birds of Conservation Concern because over 40% of the European population is found here, and over half of them are found at fewer than ten breeding colonies (Eaton *et al.,* 2015). Lesser black-backed gulls are also listed on the EC Birds Directive as a migratory species (JNCC, 2021d[87]).

[85] JNCC, (2021b). Black-legged kittiwake (*Rissa tridactyla*). [Online]. http://jncc.gov.uk/our-work/black-legged-kittiwake-rissa-tridactyla/.

[86] JNCC, (2021c). Herring gull (*Larus argentatus*). [Online]. http://jncc.gov.uk/our-work/herring-gull-larus-argentatus/.

[87] JNCC, (2021d). Lesser black-backed gull (*Larus fuscus*). [Online]. http://jncc.gov.uk/our-work/lesser-black-backed-gull-larus-fuscus/.

According to Furness *et al.* (2013), they are of high sensitivity to collision risk and low sensitivity to displacement and have been taken forward for assessment on this basis.

Lesser black-backed gulls were observed during the late spring and summer months but only in low densities, Technical Appendix 6A. They have a medium-sized foraging range as recorded in Woodward *et al*. (2019) (mean max 127.0 km plus 109.0 km one standard deviation) and all birds recorded on-site were apportioned to the Forth Islands SPA, Technical Appendix 6B.

For assessment, potential impacts to lesser black-backed gull are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population.

6.5.6. Black-headed gull

Black-headed gull is one of the most widespread breeding species in the UK, with populations equally breeding inland or on the coast. In the UK and particularly in Scotland, they have been sensitive to the food availability and weather conditions during breeding seasons as well as by predation from the invasive American mink (*Neovison vison*), creating important fluctuations in their productivity and an associated decrease in their population sizes in Scottish colonies.

Black-headed gulls are on the amber list of the UK Birds of Conservation Concern and listed in the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC, 2021e[88]). According to Furness *et al.* (2013), they are of high sensitivity to collision risk and low sensitivity to displacement and have been taken forward for assessment on this basis.

At the Proposed Development, the species was only recorded in the non-breeding season, Technical Appendix 6A, and are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA, Table 6.4. Assessment considers impacts against this non-breeding population of birds in the SPA.

6.5.7. Common gull

In the UK, common gulls breeding populations are mainly distributed in Scotland, which holds approximately 98% of the UK population. Due to intense predation from American mink (Neovison vison), taking eggs, chicks and adults, populations of common gulls have drastically diminished through the years, despite the increase in nesting in coastal regions (JNCC, 202189).

Common gulls are on the amber list of the UK Birds of Conservation Concern and listed on the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC 2021f). According to Furness *et al.* (2013), they are of high sensitivity to collision risk and low sensitivity to displacement.

At the Proposed Development, common gulls were only recorded in the non-breeding season, Technical Appendix 6A, and are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA, Table 6.4. Assessment therefore considers impacts against the non-breeding population of birds in the SPA.

6.5.8. Guillemot

Guillemot are one of the most numerous seabird species recorded at sea around the UK's coasts. They come to land only to nest and the rest of the time are found at sea. Guillemot are of high conservation status in Scotland; they are amber listed as a Bird of Conservation Concern and listed in the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC, 2021g[90]). Guillemot are considered to be sensitive to displacement impacts, but are not considered to be at risk of collision with turbine blades as they do not fly high enough, with only 1% flying at blade height (Furness *et al.* 2013).

Guillemots have a relatively small foraging range as recorded in Woodward *et al*. (2019) (mean max 73.2 km plus 80.5 km one standard deviation), resulting in four close SPAs screened in for HRA connectivity, Technical

[88] JNCC, (2021e). Black-headed gull [Online].http://jncc.gov.uk/our-work/black-headed-gull-chroicocephalus-ridibundus/.

[89] JNCC, (2021f). Common gull (*Larus canus*). [Online]. http://jncc.gov.uk/our-work/common-gull-larus-canus/.

[90] JNCC, (2021g). Guillemot (*Uria aalge*). [Online]. http://jncc.gov.uk/our-work/guillemot-uria-aalge/.

Appendix 6B. Apportioning indicates that 91.9% of birds recorded on-site during the breeding season are likely to be associated with the Forth Islands SPA.

At the Proposed Development, guillemots were the most abundant species, present in all months, with the highest abundances in the impact zone recorded during both the breeding and non-breeding seasons in June 2015 with 589 birds and September 2015 with 510 birds, respectively, Technical Appendix 6A.

For assessment, breeding season impacts are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population. Assessment also considers **non-breeding season impacts against the non-breeding population of the** Outer Firth of Forth and St Andrews Bay SPA.

6.5.9. Razorbill

Razorbill breed commonly around the UK and occur widely at sea where they can sometimes occur in dense concentrations with guillemots. The species is most abundant during the summer and autumn months and disperses mainly southwards during the winter. Like guillemots, the species becomes flightless for an extended period during July and August when the male parent accompanies its chick out to sea.

Razorbill are of high conservation status in the UK, they are amber listed as a Bird of Conservation Concern and listed on the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC, 2021h[91]). Razorbill are considered to be sensitive to displacement impacts but are not considered to be at risk of collision with turbine blades as they do not fly high enough, with only 1% flying at blade height (Furness *et al.* 2013).

Like guillemots, razorbills have a relatively small foraging range as recorded in Woodward *et al*. (2019) (mean max 88.7 km plus 75.9 km one standard deviation), resulting in only three close sites to be screened in for HRA connectivity (Forth Islands, St Abb's Head to Fast Castle and Fowlsheugh), Technical Appendix 6B. Apportioning indicates that 97.3% of birds recorded on-site during the breeding season are associated with Forth Islands SPA.

At the Proposed Development, there is some variability in numbers and the times of the year in which razorbill have been recorded. During the breeding period (April-mid Aug), the peak abundance in the impact zone was 85 birds in June 2015, Technical Appendix 6A. In the non-breeding season, there are two BDMPS periods defined by Furness (2015): migration (Aug-Oct and Jan-Mar) and winter (Nov-Dec). Peak abundances in the impact zone during these times were 88 birds in January 2016 and 111 birds in November 2016, Technical Appendix 6A.

For assessment, breeding season impacts are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population. Assessment also considers **non-breeding season impacts against the non-breeding population of the** Outer Firth of Forth and St Andrews Bay SPA.

6.5.10. Puffin

Puffin are one of the UK's most-recognised seabirds with their bright coloured bills. They are burrow-nesting seabirds so are very vulnerable to terrestrial predators such as rats. As a result, they usually breed on offshore islands and steep coastal cliffs, and such is the case in Scotland. Puffins are migratory; in Scottish waters, they are most abundant during spring and summer then disperse during the winter further out in the North Sea.

They are of high conservation status in Scotland; they are red listed as a Bird of Conservation Concern and listed on the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC, 202i[92]). Puffin are considered to be sensitive to displacement impacts but are not considered to be at risk of collision as they do not fly high enough, with only 1% flying at blade height (Furness *et al.* 2013).

Puffins have a large foraging range as recorded in Woodward *et al*. (2019) (mean max 137.18 km plus 128.3 km one standard deviation), however, due to the sparse distribution of breeding colonies, only two sites have been

[91] JNCC, (2021h). Razorbill (*Alca torda*). [Online]. http://jncc.gov.uk/our-work/razorbill-alca-torda/.

[92] JNCC, (2021i). Atlantic puffin (*Fratercula arctica*). [Online]. http://jncc.gov.uk/our-work/atlantic-puffin-fratercula-arctica/.

screened in for HRA connectivity (Forth Islands and Farne Islands), Technical Appendix 6B. Apportioning indicates that 99.2% of birds recorded on-site during the breeding season are associated with Forth Islands SPA.

At the Proposed Development, the highest abundances in the impact zone were recorded between March and July for both survey years, with peak abundances of 81 birds in June 2015 and 55 birds in April 2016. Few, to no birds were recorded during the non-breeding season, Technical Appendix 6A.

For assessment the breeding season impacts are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population.

6.5.11. European Shag

European shag are one of the deepest divers of the cormorant family and feed benthically, primarily on sandeels (*Ammodytes marinus*). Within the UK, shags are mainly present in Scotland, and as a rocky coastal species, they breed and nest on cliffs. Scottish populations of shag have been facing extreme declines since the Seabird 2000 census, most likely due to reduced food supply (Furness, 2015; JNCC, 2021j[93]). Due to these declines, shag are now on the red list of the UK Birds of Conservation Concern and listed in the EC Birds Directive as a migratory species (Eaton *et al.,* 2015; JNCC, 2021j).

European shag have a small foraging range as recorded in Woodward *et al*. (2019) (mean max 13.2 km plus 10.5 km one standard deviation) and Forth Islands was the only SPA with connectivity so that all birds recorded on-site during the breeding season are associated with this SPA.

At the Proposed Development, shag were recorded in greater densities during the non-breeding season; estimated abundance in the impact zone peaked in December for both survey years, with 46 birds for year 1 and 24 birds for year 2, Technical Appendix 6A.

Shag are considered to be sensitive to displacement impacts but are not considered to be at risk of collision (Furness *et al.* 2013). For assessment, breeding season impacts are considered against the Forth Islands SPA breeding population, the conservation objective that there will be no impact on the viability of this population. Assessment also considers **non-breeding season impacts against the non-breeding population of the** Outer Firth of Forth and St Andrews Bay SPA.

6.5.12. Eider

Eider are the UK's heaviest and fastest flying species of duck and are easily recognisable by their wedge-shaped bill. They live on the coasts, feeding primarily on molluscs. Eider are present on the amber list of the UK Birds of Conservation Concern (Eaton *et al.,* 2015). They are considered to be sensitive to displacement but are not considered to be at risk of collision (Furness *et al.* 2013).

Eider were present throughout the survey period, except for some summer months. Peak abundances were observed during the winter, in December 2015 and February 2017, Technical Appendix 6A. During the second year of survey, the boat-based transects were extended 1km closer to shore and as a result more birds were observed during year 2 (a peak of 137 birds) compared to year 1 (a peak of 16 birds), Technical Appendix 6A.

Eider are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and assessment considers the non-breeding season impacts against this population, Table 6.4.

6.5.13. Red-throated diver

Red-throated divers take their name from their bright red summer breeding plumage. In the northwest of Scotland, they breed during the summer in freshwater pools close to the coast, where all the UK SPAs for this species are located. During the winter, they primarily migrate southwards, through coastal waters to winter in inshore shallow coastal waters such as those in the Outer Firth of Forth and St Andrews Bay SPA.

Red-throated divers are on the green list of the UK Birds of Conservation Concern (Eaton *et al.,* 2015). They are considered to be of risk from displacement and have been assessed on this basis (Furness *et al.* 2013).

[93] JNCC. (2021j). European shag (*Phalacrocorax aristotelis*). [Online]. http://jncc.gov.uk/our-work/european-shag-phalacrocorax-aristotelis/.

During the boat-based surveys, red-throated divers were observed only in few numbers and only during the non-breeding period. This resulted in abundance estimates in the impact zone of between 0 birds and 4 birds in year 1 and between 0 birds and 6 birds year 2, with both peak abundances observed during the month of November, Technical Appendix 6A. The year 2 data are considered to be more representative as this was when the boat-based transects were extended 1km closer to shore.

Red-throated diver are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and assessment considers the non-breeding season impacts against this population, Table 6.4.

6.5.14. Common scoter

Common scoters, often recognized by their all-black feathers, breed near lakes, nesting in tall vegetation (Forrester *et al.,* 2012)[94]. They are great divers, reaching depths of up to 30 m to prey on shellfish. During the winter, flocks gather in shallow inshore areas with soft substrates (Forrester *et al.,* 2012). They are particularly sensitive to pollution, with examples of populations gone extinct in Northern Ireland due to eutrophication of waters, but also to predation by American minks.

Common scoters are red listed as a Bird of Conservation Concern and as priority species in the UK Biodiversity Action Plan (Eaton *et al.,* 2015; Scottish Wildlife Trust, 2022[95]). According to Furness *et al.* (2013), common scoters are considered sensitive to displacement so are addressed in Technical Appendix 6C. Common scoters are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and the site supports ~4.7% of the UK population (JNCC, 2020a[96]; 2020b[97]).

6.5.15. Velvet scoter

Velvet scoter is a seaduck species, often recognized by their black feathers, long bill and thick neck, (Forrester *et al.,* 2012). In Scotland, the species is almost exclusively observed at sea between inshore and offshore environments. Similarly to common scoters, they are great divers, reaching depths of up to 30 m to prey on shellfish (Forrester *et al.,* 2012). They are also sensitive to oil pollution and to predation by American mink.

Velvet scoters are red listed as a Bird of Conservation Concern and considered globally vulnerable on the IUCN list (Eaton *et al.,* 2015). According to Furness *et al.* (2013), velvet scoters are considered sensitive to displacement so are addressed in Technical Appendix 6C. Velvet scoters are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and the site supports their second largest concentration in Scotland, ~23.2% of the UK population (JNCC, 2020a; 2020b).

6.5.16. Long-tailed duck

Long-tailed ducks are small seaducks, often observed gathering in large rafts. During the winter, males are mainly white with elongated tail feathers, while the females are more brown (Forrester *et al.,* 2012). In Scotland, the species is mainly observed in sheltered coasts with sandy substrates and more exposed areas during the winter, with birds generally observed between mid-September and April (NatureScot, 2020). They are great divers, reaching depths of up to 60 m to prey on molluscs (Forrester *et al.,* 2012). They are particularly sensitive to oil pollution and over-exploitation of fishing grounds.

Long-tailed ducks are green listed as a Bird of Conservation Concern (Eaton *et al.,* 2015). According to Furness *et al.* (2013), they are considered sensitive to displacement so are addressed in Technical Appendix 6C. They are

[94] Forrester, R., Andrews, I., McInerny, C., Murray, R., McGowan, B., Zonfrillo, B., Betts, M., Jardine, D. and Grundy, D. (2012). *The birds of Scotland*. The Scottish Ornithologists' Club, Aberlady.

[95] Scottish Wildlife Trust. (2022). *Common scoter.* [Online]. https://scottishwildlifetrust.org.uk/species/common-scoter/.

[96] JNCC. (2020a). *Natura 2000 – Standard data form - Outer Firth of Forth and St Andrews Bay Complex (UK9020316).* [Online]. https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020316.pdf.

[97] JNCC. (2020b). *Outer Firth of Forth and St Andrews Bay Complex.* [Online]. https://jncc.gov.uk/our-work/outer-firth-of-forth-and-st-andrews-bay-complex-spa/..

a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and the site supports approximately 17.7% of the UK population (JNCC, 2020a; 2020b).

6.5.17. Red-breasted merganser

Red-breasted mergansers belong to a group called “sawbills” due to their typical long, narrow and serrated bills, adapted to prey on fish. During the winter, red-breasted mergansers can form flocks of hundreds birds (Forrester *et al.,* 2012; The Wildlife Trusts, 2022). While previously green listed, they have been amber listed as a Bird of Conservation Concern since 2021 (The Wildlife Trusts, 2022; Eaton *et al.,* 2015).

Red-breasted merganser are not addressed in Furness *et al.* (2013) but have been included for analysis in Technical Appendix 6C on a precautionary basis. They are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and the site supports approximately 5.1% of the UK population (JNCC, 2020a; 2020b).

6.5.18. Slavonian grebe

Slavonian grebes can be recognized by their golden ear tufts. In Scotland, the birds breed in a variety of lakes with emergent vegetation and they mainly feed on fish and insect larvae (Forrester *et al.,* 2012).

The species is red listed as a Bird of Conservation and is listed as vulnerable on the global IUCN Red list of threatened species (Eaton *et al.,* 2015; The Wildlife Trusts, 2022b). According to Furness *et al.* (2013), they are considered sensitive to displacement so are addressed in Technical Appendix 6C. They are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and the site supports approximately 2.7% of the UK population (JNCC, 2020a; 2020b).

6.5.19. Goldeneye

Goldeneye are often recognized by their black, white and greenish patches for males and brown head for the females. As other diving duck species, goldeneyes mainly feed on small fish and shellfish (Forrester *et al.,* 2012). In Scotland, goldeneyes breed next to rivers, lakes or marshes, often using nest boxes provided by humans to facilitate their chance of breeding.

Goldeneye are amber listed as a Bird of Conservation Concern (Eaton *et al.,* 2015). According to Furness *et al.* (2013), they are considered sensitive to displacement so are addressed in Technical Appendix 6C. They are a non-breeding interest of the Outer Firth of Forth and St Andrews Bay SPA and the site supports approximately 2.9% of the UK population (JNCC, 2020a; 2020b).

6.6. Development Design Mitigation

This Chapter takes into account measures that have been incorporated in the Proposed Development as standard industry practice and as part of the design process. Together these measures are termed “Proposed Development Design Mitigation”, which is distinct from additional mitigation which is applied where a significant effect is predicted.

The turbine will comprise a tubular tower structure rather than a lattice tower structure. Lattice towers have been documented as increasing the collision risk to birds as they offer perches that attract birds in close proximity to the rotating rotor blades.

6.7. Assessment of Potential Effects

6.7.1. Worst-case Scenario

For ornithological interests, the realistic worst-case scenario for collision risk modelling is described in Technical Appendix 6C. For displacement assessment peak population estimates of birds within the impact zone are modelled where there is sufficient boat-based data. The impact zone is based on a 2 km buffer around the single turbine which is considered worst-case. For seaduck and diver species, a worst-case displacement assessment has been undertaken using worst-case population estimates, and worst-case estimates of displacement and mortality, as discussed in Technical Appendix 6D.

6.7.2. Construction Effects

During construction there may be disturbance to the prey species of seabird species that could affect where they forage. For a single turbine this effect is not anticipated to be very pronounced and will be short-term and temporary. It is not anticipated that construction will give rise to any significant levels of direct disturbance to birds from the presence of construction vessels or from the noise of construction activities, including the work required for installation of the export cable. The additional vessel movements required for construction of the Forthwind turbine are not significant compared to the baseline, including the pre-existing shipping lane in this area. In this regard, under HRA, there will be no significant disturbance of any species during construction, including seaduck and divers as qualifying interests of the Outer Firth of Forth and St Andrews Bay SPA (draft conservation objective 2b).

6.7.3. Operational Effects

Most ornithological impacts arising from the Proposed Development are associated with the operational phase, when the turbine is spinning and birds may be at risk of colliding with the rotor blades, or else deterred from entering the site (displacement). The effects on prey species are currently unknown but birds could be attracted towards the turbine if prey numbers increase or else go elsewhere if prey numbers decrease. Such effects cannot currently be quantified and are considered to be insignificant for each of the ornithological receptors of concern.

6.7.3.1. Supporting Habitats

NatureScot and MSS have also requested that any impacts to supporting habitats be considered for those bird species which are qualifying interests of the Outer Firth of Forth and St Andrews Bay Complex SPA, within which the turbine, met mast and export cable are located (SPA draft conservation objective 2c). In this regard, a benthic survey has been carried out to inform assessment of habitat loss in Section 14.8.3.1 of Chapter 14 on Benthic Ecology; the survey data allows for MESH **(**Mapping European Seabed Habitats) mapping across the wider area as represented in Figure 14.1 contained within Volume 2 of this EIAR.

Review of the available information confirms that none of the recorded biotopes within the impact zone are rare, geographically restricted or of specific conservation importance. They do not play any important role in supporting either the seabird or seaduck and diver interests of the SPA. As set out in Chapter 3, a maximum of four pin piles with a diameter of 3.5 m will be installed for the turbine and one 8 m diameter gravity base for the met mast, totalling 88.5 m2 of habitat loss, plus associated scour protection. Complete surface lay of export and inter array cables with associated protection materials (dimensions 5 m x 1 m) will result in a maximum habitat loss of 10,610 m2 for both cables. In this regard, the loss of any supporting habitat from the Proposed Development is negligible compared to the wider SPA resource available to seabirds, seaduck and diver species.

6.7.3.2. Collision Risk

Collision is a possible impact from the Proposed Development whereby birds may be injured or killed by an encounter or collision with the operational turbine or rotor blades. Band (2012) provides a consistent and quantitative method for offshore collision risk, estimating the likelihood that a bird entering the ‘risk window’, the sweep of the turbine blades, could be struck. As such the calculation assumes no avoiding action, and this is factored in subsequently using an agreed avoidance rate. Birds will take avoiding action to avoid being struck, whether this is by avoiding the wind farm completely (macro-avoidance) or altering their flight path in proximity to the turbine blades (meso and micro-avoidance). There are limitations to the model, but it provides a standard approach to estimating relative risk to the seabird species of concern.

Technical Appendix 6C presents the input parameters and outputs for collision risk modelling. Predicted CRM impacts are apportioned to the SPAs of concern as set out in Technical Appendix 6B.

6.7.3.3. Displacement and Barrier Effects

Displacement is a possible impact from the Proposed Development whereby birds may avoid an area around the operational turbine. Different species are more or less likely to display this behaviour as discussed in the preceding species accounts, Section 6.5.

Furness *et al.* (2013) and Bradbury *et al.* (2014) give a displacement ranking for a range of species based on susceptibility to disturbance and habitat specialisation. This gives an indication of species more likely to be displaced and the potential consequences of that displacement, as discussed in Technical Appendix 6D.

Displacement assessment follows SNCB advice on use of 'displacement matrices' giving a range of displacement rates which are then considered in terms of adult mortality (SNCB 2017). Technical Appendix 6D discusses the approach in detail and provides the full displacement matrices for each species and relevant season of interest.

Predicted displacement impacts are apportioned to the SPAs of concern as set out in Technical Appendix 6B.

Barrier effects have also been considered but the limited scale of the Proposed Development (comprising a single turbine and a met mast) means that it will not in any way act as a barrier and will not result in any significant energetic cost to birds having to fly around the infrastructure.

6.7.3.4. Species Accounts

Quantification of collision risk and of displacement are presented in Technical Appendices 6C and 6D as noted above. These impacts are considered on a species-by-species basis in the accounts given below, with the significance of impacts determined against the relevant reference population either breeding or non-breeding.

All the breeding seabird interests to be assessed are qualifying features of Forth Islands SPA and impacts occurring during the breeding season are considered against the most recent SPA count as set out in Table 6.6.

Seabirds in the non-breeding season and wintering seaduck and diver species are all qualifying interests of the Outer Firth of Forth and St Andrews Bay SPA and impacts occurring during the non-breeding season are considered against the non-breeding SPA citation counts as set out in Table 6.7.

Table 6.6 - SPA seabird breeding populations

Species	SPA	Most recent count	Count unit*	Year
Gannet	Forth Islands	75,259	AOS	2014
Kittiwake	Forth Islands	3,411	AON	2018/2021
Herring gull	Forth Islands	3,615	AON/AOT	2019-2021
Lesser black-backed gull	Forth Islands	1,801	AON/AOT	2018-2021
Guillemot	Forth Islands	20,755	IND	2018-2021
Razorbill	Forth Islands	5,038	IND	2017-2019
Puffin	Forth Islands	78,406	IND	2017-2020
European shag	Forth Islands	441	AON	2018-2021

* Count Units: AOS – apparently occupied sites, AON – apparently occupied nests,
AOT – apparently occupied territory, IND – individuals.

Table 6.7 - SPA non-breeding populations

Species	SPA	Citation count	Count unit
Kittiwake	Outer Firth of Forth and St Andrews Bay	3,191	IND
Herring gull	Outer Firth of Forth and St Andrews Bay	12,313	IND
Guillemot	Outer Firth of Forth and St Andrews Bay	21,968	IND
Razorbill	Outer Firth of Forth and St Andrews Bay	5,481	IND
European shag	Outer Firth of Forth and St Andrews Bay	2,426	IND
Black-headed gull	Outer Firth of Forth and St Andrews Bay	26,835	IND
Common gull	Outer Firth of Forth and St Andrews Bay	14,647	IND

Species	SPA	Citation count	Count unit
Eider	Outer Firth of Forth and St Andrews Bay	21,546	IND
Red-throated diver	Outer Firth of Forth and St Andrews Bay	851	IND
Common scoter	Outer Firth of Forth and St Andrews Bay	4,677	IND
Velvet scoter	Outer Firth of Forth and St Andrews Bay	775	IND
Long-tailed duck	Outer Firth of Forth and St Andrews Bay	1,948	IND
Red-breasted merganser	Outer Firth of Forth and St Andrews Bay	431	IND
Slavonian grebe	Outer Firth of Forth and St Andrews Bay	30	IND
Goldeneye	Outer Firth of Forth and St Andrews Bay	589	IND

6.7.3.4.1. Gannet

Breeding and non-breeding season impacts have been considered together against the Forth Islands SPA population of 75,259 breeding pairs, Table 6.6. Predicted displacement mortalities are zero, Technical Appendix 6D, while there are two predicted collision mortalities during the breeding season and zero predicted mortalities in the non-breeding season (autumn and spring migration). This level of mortality should not give rise to any adverse effects on the viability of the SPA population.

6.7.3.4.2. Kittiwake

Breeding season impacts are considered against the Forth Islands SPA population of 3,411 breeding pairs, Table 6.6. Predicted collision and displacement mortalities are zero over this time, Technical Appendices 6C and 6D, so that there will be no effects on the viability of the SPA population. There are also zero predicted mortalities in the non-breeding season (autumn and spring migration) so that there will be no effects on the non-breeding population of the Outer Firth of Forth and St Andrews Bay complex SPA, numbering 3,191 individuals, Table 6.7.

6.7.3.4.3. Herring gull

Only low densities of herring gull were recorded during the boat-based survey and when modelled for collision risk there are zero mortalities, Technical Appendix 6D. As a result, there are no predicted impacts to herring gull as a qualifying interest of Forth Islands SPA and the Outer Firth of Forth and St Andrews Bay complex SPA.

6.7.3.4.4. Lesser black-backed gull

Only low densities of lesser black-backed gull were recorded during the boat-based survey and when modelled for collision risk there are zero mortalities, Technical Appendix 6D. As a result, there are no predicted impacts to lesser black-backed gull as a qualifying interest of Forth Islands SPA.

6.7.3.4.5. Black-headed gull

Only low densities of black-headed gull were recorded during the boat-based survey and when modelled for collision risk there are zero mortalities, Technical Appendix 6D. As a result, there are no predicted impacts to black-headed gull as a qualifying interest of the Outer Firth of Forth and St Andrews Bay SPA.

6.7.3.4.6. Common gull

Only low densities of common gull were recorded during the boat-based survey and when modelled for collision risk there are zero mortalities, Technical Appendix 6D. As a result, there are no predicted impacts to common gull as a qualifying interest of the Outer Firth of Forth and St Andrews Bay complex SPA.

6.7.3.4.7. Guillemot

Breeding season impacts are considered against the Forth Islands SPA population of 20,755 individuals, Table 6.6. There are six predicted displacement mortalities during the breeding season, Technical Appendix 6D, a level of mortality which should not give rise to any adverse effects on the viability of the SPA population. In the non-breeding season, there are two displacement mortalities to consider, Technical Appendix 6D, which are not considered significant against the non-breeding population of the Outer Firth of Forth and St Andrews Bay complex SPA, numbering 21,968 individuals, Table 6.7.

6.7.3.4.8. Razorbill

Breeding season impacts are considered against the Forth Islands SPA population of 5,038 individuals, Table 6.6. As there are zero predicted displacement mortalities during the breeding season, Technical Appendix 6D, there will not be any adverse effects on the viability of the SPA population. There are also zero predicted displacement mortalities during the non-breeding season, Technical Appendix 6D, so that there will be no effects on the non-breeding population of the Outer Firth of Forth and St Andrews Bay complex SPA, numbering 5,481 individuals, Table 6.7.

6.7.3.4.9. Puffin

Breeding season impacts are considered against the Forth Islands SPA population of 78,406 individuals, Table 6.6. There is one predicted displacement mortality during the breeding season, Technical Appendix 6D, which should not give rise to any adverse effects on the viability of the SPA population.

6.7.3.4.10. European shag

Breeding season impacts are considered against the Forth Islands SPA population of 441 individuals, Table 6.6. As there are zero predicted displacement mortalities during the breeding season, Technical Appendix 6D, there will not be any adverse effects on the viability of the SPA population. There are also zero predicted displacement mortalities during the non-breeding season, Technical Appendix 6D, so that there will be no effects on the non-breeding population of the Outer Firth of Forth and St Andrews Bay complex SPA, numbering 2,426 individuals, Table 6.7.

6.7.3.4.11. Eider

Only non-breeding season impacts are considered for eider, for which there is a predicted worst-case displacement mortality of 58 birds. This is 0.27% of the non-breeding population of 21,546 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7 so is not considered significant.

6.7.3.4.12. Red-throated diver

Only non-breeding season impacts are considered for red-throated diver, for which there are zero predicted displacement mortalities and therefore no effects on the non-breeding population of 851 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7.

6.7.3.4.13. Common scoter

Only non-breeding season impacts are considered for common scoter, for which there is a predicted worst-case displacement mortality of 31 birds. This is 0.66% of the non-breeding population of 4,677 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7, so is not considered significant.

6.7.3.4.14. Velvet scoter

Only non-breeding season impacts are considered for velvet scoter, for which there is a predicted worst-case displacement mortality of four birds. This is 0.52% of the non-breeding population of 775 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7 so is not considered significant.

6.7.3.4.15. Long-tailed duck

Only non-breeding season impacts are considered for long-tailed duck, for which there is a predicted worst-case displacement mortality of three birds. This is 0.15% of the non-breeding population of 1,948 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7, so is not considered significant.

6.7.3.4.16. Red-breasted merganser

Only non-breeding season impacts are considered for red-breasted merganser, for which there is a predicted worst-case displacement mortality of two birds. This is 0.46% of the non-breeding population of 431 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7 so is not considered significant.

6.7.3.4.17. Slavonian grebe

Only non-breeding season impacts are considered for Slavonian grebe, for which there are zero predicted displacement mortalities and therefore no effects on the non-breeding population of 30 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7.

6.7.3.4.18. Goldeneye

Only non-breeding season impacts are considered for goldeneye, for which there is a predicted worst-case displacement mortality of four birds. This is 0.68% of the non-breeding population of 589 individuals in the Outer Firth of Forth and St Andrews Bay complex SPA, Table 6.7, so is not considered significant.

6.7.4. Decommissioning Effects

It is not anticipated that decommissioning will give rise to any significant levels of disturbance to seabirds from the presence of decommissioning vessels or from the noise of decommissioning activities. It is highly unlikely that seabirds would be excluded from foraging over significant areas, or that prey would be significantly disturbed during decommissioning.

6.8. Mitigation Measures and Residual Effects

The effects of the construction, operation and decommissioning of the Proposed Development on ornithological receptors have been assessed against the relevant SPA populations of concern and found to be not significant. Consequently, no additional mitigation measures are proposed in addition to those already adopted in the design of the Proposed Development as detailed within Section 6.6.

6.9. Cumulative Effects Assessment

6.9.1. Construction Effects

Construction of the Proposed Development will not overlap spatially with other projects and is unlikely to overlap temporally (including consideration of the Aberdeen harbour re-development and Rosyth container port works as listed in Table 6.8). It is not anticipated that construction of the Proposed Development will give rise to any significant levels of disturbance to birds from the presence of construction vessels or from the noise of construction activities and therefore it will not contribute significantly to any cumulative impacts.

6.9.1. Operational Effects

The Proposed Development alone does not give rise to a significant level of mortality for any of the focal bird species from either displacement or collision risk impacts; nor are there any significant impacts on prey species or supporting habitats in the Outer Firth of Forth and St Andrews Bay complex SPA. It therefore does not significantly increase the levels of cumulative impact on any of the relevant SPA populations of concern.. Consideration of cumulative impacts has included the operational and / or consented wind farms listed in Table 6.8 and ongoing maintenance work undertaken for the Forth Road Bridge.

Table 6.8 -Development considered for ornithological cumulative impact assessment

Project	Development Type	Status
Levenmouth	Single turbine	Operational
Neart na Gaoithe	Offshore wind farm	Consented
Inch Cape	Offshore wind farm	Consented
Seagreen alpha and bravo	Offshore wind farm	Consented
Kincardine	Offshore wind farm	Operational
Hywind	Offshore wind farm	Operational
European offshore wind deployment centre (Aberdeen Bay)	Offshore wind farm	Operational
Aberdeen harbour re-development	Harbour	In progress
Rosyth container port works	Harbour	In progress
Forth Road Bridge 5-year maintenance	Bridge	Built, maintenance ongoing

6.10. Summary of Effects

Table 6.9 provides a summary of effects relating to offshore ornithology from the Proposed Development.

Table 6.9 -Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction			
Disturbance to seabirds from construction activity	Limited extent for a single turbine; short-term and temporary. Negligible significance.	No mitigation proposed.	Not significant.
Disturbance to prey from construction activity leading to effects on seabirds.	Limited extent for a single turbine; short-term and temporary. Negligible significance.	No mitigation proposed.	Not significant.
Operation			
Loss of SPA supporting habitat for seabirds, seaduck and divers	No supporting habitat recorded in development footprint. Negligible significance.	No mitigation proposed.	Not significant.
Collision risk	'Worst-case' quantified for all species potentially at risk and not found to be significant.	No mitigation proposed.	Not significant.
Displacement and barrier effects	'Worst-case' quantified for all species potentially at risk and not found to be significant.	No mitigation proposed.	Not significant.
Disturbance of prey	Very limited for a single turbine and considered qualitatively; not significant for any species.	No mitigation proposed.	Not significant.
Decommissioning			
Disturbance to seabirds from construction activity	Limited extent for a single turbine; short-term and temporary. Negligible significance.	No mitigation proposed.	Not significant.
Disturbance to prey from construction activity leading to effects on seabirds.	Limited extent for a single turbine; short-term and temporary. Negligible significance.	No mitigation proposed.	Not significant.
Cumulative Effects			
Cumulative effects from the Proposed Development in combination with other projects.	Will not significantly increase levels of impact on any bird species or SPAs of concern.	No mitigation proposed.	Not significant.

6.11. Statement of Significance

The effects of the construction, operation and decommissioning of the Proposed Development on ornithological receptors have been assessed against the relevant SPA populations of concern and found to be **not significant**. The Proposed Development will not significantly increase the levels of cumulative impact on any of the SPA bird populations assessed in this Chapter.

7. MARINE MAMMALS

This chapter evaluates the potential effects of the Proposed Development on marine mammal species. It contains the following sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Legislative Framework and Guidance;
- Assessment Methods;
- Baseline Characterisation;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

7.1. Introduction

This chapter sets out the marine mammal interest within and around the Proposed Development, a single demonstrator wind turbine off the coast of Methil, Fife in Scotland. The Proposed Development is described in Chapter 3: Project Description and illustrated in Figure 1.1 contained within Volume 2 of this EIAR.

This chapter addresses the marine mammal species which may occur in the Firth of Forth, including around the proposed turbine location. It assesses the potential impacts arising from the construction, operation and decommissioning of the Proposed Development on cetaceans, including whales, dolphins and porpoises, and on pinnipeds, including seals.

Cetaceans are European Protected Species (EPS), and bottlenose dolphin are considered part of the Scottish east coast population and a qualifying interest of the Moray Firth Special Area of Conservation (SAC). There are two seal species which need to be considered, grey seal and harbour seal, and both are qualifying interests of SACs within foraging range.

Impacts are considered against defined populations – marine mammal management units for EPS assessment – and SAC populations in relation to Habitats Regulations Appraisal (HRA). Key impacts are clearly highlighted, and relevant mitigation measures are proposed to address these. The chapter concludes with a summary of effects and statement of significance.

7.2. Consultation

Table 7.1 sets out the key marine mammal issues raised in the 2021 Marine Scotland scoping opinion and appendix of stakeholder consultation responses that have been addressed in this assessment.

Table 7.1 -. Summary of Consultation Undertaken

Consultee	Consultee Comments	Project Response
MS-LOT	Scottish Ministers advise that an HRA report must be submitted at the time of the application.	HRA requirements for Marine Mammals are addressed in this Chapter following the process set out in Section 7.4.3.1 This Chapter identifies the SAC marine mammal populations of concern for which there might be 'likely significant effect' (Section 7.4.4) and provides the necessary information to inform Marine Scotland's appropriate assessment to consider whether potential impacts from the Proposed Development would affect the viability of any of these SAC populations (Section 7.7).
MSS	MSS note that there will be no impact piling, and that the four pin piles or single monopile will be installed by drilling. MSS consider that disturbance due to underwater noise during the construction phase poses the only potential significant impact on marine mammals. As with NatureScot, we do not anticipate there to be a risk of auditory injury to cetaceans (European Protected Species) or seals if drilling (rather than impact pile driving) is used for pile installation, as is now planned.	Addressed in assessment in Section 7.7.1
MSS	MSS recommend that the cetacean abundance estimates presented in Appendix 1 of the IAMMWG (2021) report are used.	Relevant to harbour porpoise and referenced in the species account in Section 7.5.3
MSS	MSS advise that the best estimate of the Moray Firth SAC bottlenose dolphin population is 224 (95% = 214 - 234). This is based on a five-year weighted mean using data from 2015 - 2019, which are presented in Arso Civil *et al.* (2021).	Referenced in the species account for bottlenose dolphin, Section 7.5.2
MSS	MSS agree that bottlenose dolphins, harbour porpoise, grey seal and harbour seal should be scoped in the EIAR. MSS acknowledge that other cetacean species may occasionally occur within the Firth of Forth, but any mitigation measures put in place for bottlenose dolphin and harbour porpoise would be effective in reducing potential impacts on other cetacean species.	As set out in scope of assessment, Section 7.3

Consultee	Consultee Comments	Project Response
MSS	MSS agree with the applicant that cumulative effects should be scoped in for construction, operation and decommissioning phases. MSS recommend that cumulative effects should be also considered for the pre-construction.	Addressed in Table 7.2 and Section 7.9
MSS	MSS agree with the applicant that entanglement, changes in EMF and indirect effects (e.g., impacts on prey species) can be scoped out for all phases.	Addressed in Table 7.2.
NatureScot	We advise that underwater noise is the key impact pathway that may raise significant effects for cetaceans and seals during wind farm construction and cable installation. Consideration of this impact will inform the assessment process for both the Habitats Regulations Appraisal and future European Protected Species (EPS) licensing requirements (if consented).	Addressed in assessment in Section 7.7.1
NatureScot	Disturbance of grey and harbour seal at haul outs is unlikely given the distance to the nearest haul outs. Impacts to seals at haul outs designated under the Marine (Scotland) Act 2010 can therefore be scoped out.	No further action.
NatureScot	There are a range of activities likely to be undertaken during the pre-construction period which can emit significant underwater noise e.g., UXO clearance and some geophysical surveys.	Addressed in assessment in Section 7.7.1
NatureScot	We are content that the drill-only method is unlikely to produce noise levels that would cause auditory injury to any European Protected Species or to seals. No specific mitigation is required for this method.	Included as development design mitigation in Section7.6
NatureScot	Disturbance from vessel noise and presence should be both considered. It will be important to understand the likely level and effect of such disturbance and whether it could result in population level effects on marine mammals.	Addressed in assessment in Section 7.7.1
NatureScot	Decommissioning impacts should be assessed with as close to full removal of all deposits as possible, in line with draft MS decommissioning guidance.	Decommissioning impacts are considered in Section 7.7

7.3. Scope of Assessment

The scope of the marine mammals impact assessment is set out in Table 7.2 based on the conclusions of the scoping report and the advice set out in Marine Scotland's scoping opinion. The key impacts are those which occur during turbine construction and turbine decommissioning and are temporary in nature. There are no significant long-term operational impacts predicted from the Proposed Development.

Table 7.2 - Assessment of Marine Mammal Impacts

Impact	Scoping Advice	Description of Impact and Approach
Underwater noise	Scoped in	Underwater noise is addressed in Section 7.7.1 of this chapter; impacts to be considered for pre-construction, construction and decommissioning phases of development.
Vessel presence	Scoped in	Vessel presence is addressed in Section 7.7.2 of this chapter; impacts to be considered for pre-construction, construction and decommissioning phases of development.
Electromagnetic fields	Scoped out	As confirmed in the MS scoping opinion.
Indirect Effects	Scoped out	As confirmed in the MS scoping opinion.
Entanglement	Scoped out	As confirmed in the MS scoping opinion.
Cumulative Effects	Scoped in	Cumulative effects are considered in Section 7.9 of this chapter.

The following marine mammal species and designated sites have been scoped in for assessment:

- Harbour seal from Firth of Tay and Eden Estuary SAC.
- Grey seal from Isle of May SAC and Berwickshire and North Northumberland Coast SAC.
- Bottlenose dolphin from Moray Firth SAC, and as an EPS.
- Harbour porpoise as an EPS.

A full species account is provided in Section 7.5.

7.4. Methodology

7.4.1. Legislative Framework and Guidance

This section outlines the legislation, policy and guidance relevant to the assessment of the potential effects on marine mammal interests.

Legislation:

- United Nations Convention on Biological Diversity 1992 (the Rio Convention);
- The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the Bern Convention);
- Convention for the Protection of the Marine Environment of the North-East Atlantic 1992 (the OSPAR Convention).
- The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014;
- Marine (Scotland) Act, 2010;
- European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive) (as amended);
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Habitats Regulations);

- Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) (Offshore Marine Regulations);
- Nature Conservation (Scotland) Act 2004;
- Wildlife and Countryside Act 1981 (as amended);
- Conservation of Seals Act 1970.

Policy:

- Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas 2008;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention);
- Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention);
- Convention for the Protection of the Marine Environment of the Northeast Atlantic (OSPAR Convention);
- Scotland's National Marine Plan (2015);
- Scottish Energy Strategy: The future of energy in Scotland (2017);
- UK Post-2010 Biodiversity Framework (the successor to, Biodiversity: UK Action Plan 1994).

Guidance:

- European Guidance on wind energy development in accordance with European Union (EU) nature legislation (European Commission (EC), 2010); and
- Oslo Paris Convention (OSPAR) Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008).

7.4.2. Baseline Characterisation

Baseline characterisation utilises the following key data sources:

- JNCC Atlas of cetacean distribution in north-west waters;
- Marine Scotland's list of designated Scottish haul out areas for seals;
- Strategic Environmental Assessment 3 (SEA 3);
- Strategic Environmental Assessment 5 (SEA 5);
- Special Committee on Seals (SCOS) reports;
- Small Cetaceans in the European Atlantic and North Sea (SCANS I, SCANS II and SCANS III);
- Inter-Agency Marine Mammal Working Group (IAMMWG) (2021). Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680, JNCC Peterborough, ISSN 0963-8091.
- NatureScot citations and SAC conservation objectives; and
- Joint Nature Conservation Committee (JNCC) standard data forms.

7.4.3. Assessment Methods

Assessment of marine mammal interests is primarily through desk-based study; informed by MMO observations from two years of boat-based surveys undertaken March 2015 - February 2017. No underwater noise modelling has been undertaken due to the scale and location of the Proposed Development and the proposed foundation installation method, which does not include impact piling. This approach was set out in the applicant's scoping report and agreed via the MS scoping opinion.

Given the mobile nature of marine mammals, this chapter provides a characterisation of the use of the area by marine mammal species in terms of their spatial and temporal distributions, location of key habitats and favoured prey species.

7.4.3.1. Habitats Regulations Appraisal

Habitats Regulations Appraisal (HRA) applies to any plan or project with the potential to affect the qualifying interests of a European site, including SACs for marine mammal interests. Under Regulation 48 of the Habitats Regulations, Conservation (Natural Habitats, &c.) Regulations 1994[98], HRA asks the following questions:

[98] https://www.legislation.gov.uk/uksi/1994/2716/contents/made

- Is the plan or project connected with, or necessary for, SAC conservation management?
- Will the plan or project be likely to have a significant effect on the qualifying interests of the SAC either alone, or in combination with each other, or in combination with other plans or projects?
- Can it be ascertained that the plan or project will not adversely affect SAC site integrity, either alone or in combination with other plans or projects?

The last question / stage in the process is called appropriate assessment, to be undertaken by Marine Scotland as the competent authority, based on available information and with advice from NatureScot.

It will consider the implications of the plan or project for the following conservation objectives relating to marine mammals as an SAC qualifying interest:

To ensure that site integrity is maintained by:

(i) Avoiding deterioration of the habitats of the qualifying species.
(ii) Avoiding significant disturbance to the qualifying species.
To ensure for the qualifying species that the following are maintained in the long term:

(iii) Population of the species as a viable component of the SAC.
(iv) Distribution of the species within the SAC.
(v) Distribution and extent of habitats supporting the species.
(vi) Structure, function and supporting processes of habitats supporting the species.
(vii) No significant disturbance of the species.

For the Proposed Development, the key conservation objective to consider is that of ensuring the long-term maintenance of marine mammal populations as a viable component of each SAC. Assessment of this objective can take account of direct and indirect impacts to marine mammals at sea, well beyond the SAC site boundaries (such is the case for the Proposed Development).

None of the other conservation objectives will require consideration for the Proposed Development as they relate to maintenance of favourable conditions actually within each SAC.

7.4.3.1. European Protected Species

Scottish Government have issued guidance on how to consider potential impacts from offshore activities (such as wind farm development) to marine European protected species (EPS) including bottlenose dolphin and harbour porpoise[99].

Regulation 39(1)(a) of the Habitats Regulations outline a number of specific circumstances in which EPS could be injured or disturbed and Regulation 39(2) gives additional protection to EPS cetaceans by providing that it is an offence to ‘deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean).’

Therefore, disturbance of bottlenose dolphin and harbour porpoise must be considered and assessed in relation to the Proposed Development, and such impacts will require submission of an application for an EPS licence at the appropriate time.

Such an application must demonstrate that:

- there is a licensable purpose;
- there are no satisfactory alternatives; and
- the actions authorised will not be detrimental to the maintenance of the population of the species concerned at favourable conservation status in their natural range.

Therefore, the marine mammals impact assessment presented in this chapter will consider whether there could be any effect on the favourable conservation status of bottlenose dolphin or harbour porpoise as an EPS.

[99] https://www.gov.scot/publications/marine-european-protected-species-protection-from-injury-and-disturbance/

7.4.3.1. Priority Marine Features

In 2014, a list of 81 priority marine features (PMFs) were identified in the seas around Scotland. The list includes a variety of habitats and species which are a priority for conservation in Scotland's seas and will be used to focus future conservation action and marine planning, direct research and education and promote a consistent approach to marine nature conservation advice.

In this regard, harbour seal, grey seal, bottlenose dolphin and harbour porpoise are all listed as PMFs. However, no separate impact assessment is required in this regard as the existing legal frameworks for these species (the EPS and HRA requirements set out above) take precedence. Therefore, no separate PMF assessment is presented in this chapter.

7.4.4. Scope of Assessment

As set out in the MS scoping opinion, the following key species and designated sites are to be addressed, the SAC interests are those where it has been advised that there is 'likely significant effect' (the second question under HRA as described in Section 7.4.3.1):

- Harbour seal from Firth of Tay and Eden Estuary SAC.
- Grey seal from Isle of May SAC and Berwickshire and North Northumberland Coast SAC.
- Bottlenose dolphin from Moray Firth SAC, and as an EPS.
- Harbour porpoise as an EPS.

Assessment will consider whether any of the impacts scoped in, as set out in Table 7.2, could adversely affect the viability of the identified SAC populations of each species, or whether there would be any adverse impact on 'favourable conservation status' of the EPS cetaceans.

Assessment is presented in Section 7.7 below.

7.5. Baseline Characterisation

The following accounts summarise the available information for each marine mammal species scoped in for assessment. This includes the available observations collated from the two years of boat-based survey work (March 2015 - February 2017) as described in Chapter 6: Offshore Ornithology, Section 6.4.2.1.

A single Marine Mammal Observer (MMO) was present on each survey visit. MMOs were JNCC qualified and followed JNCC approved survey methods (JNCC, 2010). They were always equipped with binoculars, a copy of the JNCC guidelines and the 'Marine Mammal Recording Form' during each survey. The MMO positioned themselves to scan the same area as the bird surveyors and recorded visually any sightings of marine mammal species within this area. The bird surveyors also highlighted any marine mammal sightings to the MMO. Marine mammal target species included all seal, porpoise, dolphin, and cetacean species.

Transects were driven at a speed of approximately 7 knots, to allow the surveyor sufficient time to accurately identify species, behaviour, distance, age and count the number of marine mammals per species present.

7.5.1. Harbour seal

Harbour seal are recorded within the Firth of Forth and are a designated feature of the Firth of Tay & Eden Estuary SAC, located approximately 49 km north of the Proposed Development. Harbour seal distribution at sea is constrained by the need to return periodically to land, and there are a number of haul-out sites within the Firth of Forth. There was a single possible record of harbour seal during the two years of boat-based survey work, the sighting was inconclusive due to distance from the MMO (> 500 m).

Harbour seal take a wide range of prey species as part of their diet and the SAC population is reported to favour salmonids (*Salmonidae* spp.) and sandeels (*Ammodytidae* spp.), however, prey can also include haddock (*Melanogrammus aeglefinus*), ling (*Molva molva*), herring (*Clupea harengus*), sprat (*Sprattus sprattus*), other flatfish and squid (*Teuthida*).[100]

[100] SCOS (2014) Scientific Advice on Matters Related to the Management of Seal Populations.

Recent figures demonstrate a general decline of harbour seal numbers around the Scottish coastline; the reasons for which are as yet unknown as grey seals are not showing a decline. Possible causes suggested for the harbour seal decline include climate change (effect on prey items such as sandeel populations) and increased competition between species for reduced prey availability, pollution and predation (for example killer whales). Work was commissioned by Marine Scotland (2015-2019) and undertaken by the Sea Mammal Research Unit (SMRU) of St Andrews University to investigate the harbour seal decline, looking at capture mark-recapture studies and constructing a population model in order to more precisely estimate survival and fecundity rates.[101]

7.5.1. Grey seal

Grey seals are recorded frequently in the Firth of Forth throughout the year. The islands in the Firth of Forth are often used as haul-out sites and the largest colony of grey seals in the Firth of Forth breeds on the Isle of May, designated as an SAC[102,103]. This colony is located approximately 26 km from the Proposed Development. The Berwickshire & North Northumberland Coast SAC is also designated for grey seals, located approximately 53 km from the Proposed Development. Low numbers of grey seal were recorded throughout the two years of boat-based survey work, with between one and two animals seen by the MMO at any given time.

Grey seal pup production is monitored in the Firth of Forth by SMRU. Grey seals are seen more frequently in near-shore waters during pupping, mainly in November and December, whereas during other months, they are observed further afield as foraging areas extend offshore[104]. The Fife Seal Group also holds records of seal numbers (cows, bulls and calves) across the area, with most consistent and highest numbers sighted at the islands of Inchcolm, Inchkeith and Inchmickery.

Grey seals feed mostly on sandeels and gadoids, particularly cod (*Gadus morhua*) and haddock, but their diet can also include whiting (*Merlangius merlangus*), ling, plaice (*Pleuronectes platessa*), sole (*Solea solea*), flounder (*Platichthys flesus*) and dab (*Limanda limanda*).[1] All these prey species live on, or close to, gravel/sand sediments. Grey seals spend approximately 40% of their time near, or at, their haul-out sites, 12% of their time foraging and the remainder of their time travelling between foraging and haul-out sites.

7.5.2. Bottlenose dolphin

Bottlenose dolphin in the Firth of Forth are part of the Moray Firth SAC population, one of two main populations in the UK. Although dolphin species cannot be identified through C-PODs data[105], the results from the East Coast Passive Acoustic Monitoring Array (summer months 2013 and 2014) would suggest an occasional presence of dolphins in the Forth (2-18% detection days). A pod of eight bottlenose dolphin were recorded on two occasions during one survey visit in June 2016 (considered to be the same pod). A small pod (five animals) was also observed on route to the survey area in August 2016.

Bottlenose dolphin are recorded to have a great variety in their diet including bottom dwelling and shoaling fish and invertebrates, especially preying on saithe (*Pollachius virens)*, whiting and cod, as well as, occasionally, on salmon (*Salmo salar)* and cephalopods.[106] As advised in the MS scoping opinion, the best estimate to refer to in assessment of impacts on the Moray Firth SAC bottlenose dolphin population is 224 animals (95% confidence intervals of 214 – 234 animals).

[101] Marine Mammal Scientific Support to Scottish Government | SMRU (st-andrews.ac.uk)

[102] Bennet, T. L. and McLeod, C. R. (1988). East Scotland (Duncansby Head to Dunbar) (MNCR Sector 4) IN: Hiscock, K., ed, Marine Nature Conservation Review. Benthic marine ecosystems of Great Britain and the north-east Atlantic. Coasts and seas of the United Kingdom MNCR series. Peterborough: Joint Nature Conservation Committee.

[103] Hammond, P. S., Northridge, S. P., Thompson, D., Gordon, J. C. D., Hall, A. J., Sharples, R. J., Grellier, K., and Matthiopoulis, J. (2004). Background information on marine mammals relevant to Strategic Environmental Assessment 5. Report to DTI prepared by Sea Mammal Research Unit, St Andrews.

[104] http://www.smru.st-andrews.ac.uk/scos/scos-reports/

[105] C-PODs are fully automated, static, passive acoustic monitoring systems that detect porpoises, dolphins and other toothed whales by recognising the trains of echo-location clicks they make to detect their prey, orientate and interact.

[106] Santos, M. B., Pierce, G. J., Reid, R. J., Patterson, I. A. P., Ross, H. M. and Mente, E. (2001) Stomach contents of bottlenose dolphins (T. truncatus) in Scottish waters. Journal of the Marine Biological Association of the United Kingdom, 81, 873-878

7.5.3. Harbour porpoise

Harbour porpoise is the most frequently observed cetacean species in the Firth of Forth. The data available from the East Coast Passive Acoustic Monitoring Array confirms the almost daily occurrence of harbour porpoise along the east coast of Scotland from Latheron in the north to St Abbs in the south (during the summer months of 2013 and 2014).[107] Harbour porpoise were recorded in at least half of the boat-based survey visits, only one or two individuals at any given time.

Harbour porpoise are predominantly seen in waters between 20 and 40 m in depth, but their presence is often correlated with the substrate type, with an apparent preference for sandy gravels.[108] Their distribution may also be determined by prey availability. However, they are opportunistic feeders, so feed primarily on whiting in winter months when sandeels are not prevalent. Haddock and cod also make up part of their diet.[109]

As advised in the MS scoping opinion, assessment of impacts on harbour porpoise refers to the IAMMWG (2021) guidance on updated abundance estimates for cetacean management units in UK waters110. In this regard, an estimate of 159,632 animals (95% confidence intervals of 127,442 - 199,954 animals) is given for the UK portion of the North Sea management unit for harbour porpoise.

7.6. Development Design Mitigation

This chapter considers measures that have been incorporated in the Proposed Development as standard industry practice and as part of the design process. The key measure directly relevant to marine mammal assessment is the use of drilled pin-pile foundations for the proposed turbine and met mast and confirmation that there will be no impact piling.

7.7. Assessment of Potential Effects

7.7.1. Underwater Noise

The applicant has confirmed that there are no further geophysical (seismic) surveys of the area required prior to construction. Nor has any unexploded ordnance (UXOs) been recorded on-site. Therefore, there is no significant pre-construction activity or noise requiring consideration in respect of marine mammals.

During construction, the noisiest activity is associated with drilling the foundations for the turbine and the met mast. Together, this activity is estimated to take up to one week total. There may also be noise arising from any proposed cable protection to be installed along the cable route, an activity that is estimated to take up to one week total.

Marine mammals or their prey species could be disturbed by such noise and avoid the location of the work while it is taking place. This is a localized impact and temporary in nature; whilst some individuals may be disturbed this disturbance is not so great that it would result in any mortality or impacts on productivity and there would be no associated population-level effects or impacts to population viability.

Assessment confirms that there will be no impact on population viability from construction noise on:

- harbour seal from the Firth of Tay and Eden Estuary SAC;
- grey seal from Isle of May SAC and Berwickshire and North Northumberland Coast SAC; or on
- bottlenose dolphin from Moray Firth SAC.

Nor will there be any impact on favourable conservation status of either bottlenose dolphin or harbour porpoise as EPS, in respect of their respective populations within the relevant management units [111]

107 http://www.gov.scot/Resource/0042/00426891.pdf

108 Clark, N. (2005) The Spatial and Temporal Distribution of the Harbour Porpoise (*P. phocoena*) in the Southern Outer Moray Firth, NE Scotland. Unpublished Master of Science Thesis, University of Bangor.

109 Santos, M. B. and Pierce, G. J. (2003) The diet of harbour porpoise (*P. phocoena*) in the Northeast Atlantic. Oceanography and Marine Biology: an Annual Review 2003, 41, 355–390.

110 Updated abundance estimates for cetacean Management Units in UK waters | JNCC Resource Hub

111 Updated abundance estimates for cetacean Management Units in UK waters | JNCC Resource Hub

Disturbance of individuals can be further mitigated through implementation of an environmental management plan to guide construction activity.

The noise associated with decommissioning activities is less than that during construction so likewise there would be no population-level effects or impacts to population viability. Disturbance of individuals can be further mitigated through implementation of a decommissioning plan to guide this activity.

7.7.2. Vessel Presence

Chapter 13: Shipping and Navigation sets out the vessel requirements in terms of pre-construction, construction and decommissioning phases of the Proposed Development. The additional numbers of vessels are not significant compared to the baseline of vessel activity in this area and are unlikely to lead to any significant disturbance of individual marine mammals and no disturbance of their prey species.

Vessel presence at the Proposed Development will not result in any impacts on population viability for any of the identified marine mammal interests at any of the relevant SACs. Nor will it result in any impact on favourable conservation status of EPS cetaceans.

7.8. Mitigation Measures and Residual Effects

Any disturbance of individual marine mammals arising from construction noise can be further mitigated through implementation of an environmental management plan to guide construction activity. Any disturbance of individual marine mammals arising from decommissioning activities can be further mitigated through implementation of a decommissioning plan.

7.9. Cumulative Effect Assessment

Construction and decommissioning of the Proposed Development is highly unlikely to overlap with that of other projects and is very limited in duration with no associated population level consequences for any marine mammal species. Therefore, there is no scope for it to contribute significantly to any cumulative impacts in this regard.

7.10. Summary of Effects

Table 7.3 Table 6.9 -provides a summary of effects relating to marine mammals from the Proposed Development.

Table 7.3 - Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction			
Underwater noise.	Potential disturbance of individual marine mammals or their prey species, but no impact on viability of SAC populations or on favorable conservation status of EPS cetaceans.	Adoption and implementation of an environmental management plan during construction.	Not significant.
Vessel presence.	No significant disturbance of individual marine mammals or their prey species.	No mitigation proposed.	Not significant.
Decommissioning			
Underwater noise.	Potential disturbance of individual marine mammals or their prey species, but no impact on viability of SAC populations or on	Adoption and implementation of a decommissioning plan.	Not significant.

	favorable conservation status of EPS cetaceans.		
Vessel presence.	No significant disturbance of individual marine mammals or their prey species.	No mitigation proposed.	Not significant.

7.11. Statement of Significance

The Proposed Development has no impact on the population viability of any SAC marine mammal interests, and no impact on the favourable conservation status of any EPS cetaceans.

8. COMMERCIAL FISHERIES

8.1. Introduction

The chapter describes the assessment of potential impacts from the construction, operation and decommissioning activities associated with the Proposed Development on commercial fishing. For the purpose of this report, commercial fishing is defined as any legal fishing activity undertaken for declared taxable profit.

This chapter should be read in conjunction with Chapter 3 - Project Description, Chapter 13 - Shipping and Navigation and Chapter 10 - Fish and Shellfish Ecology of this EIAR.

This chapter contains the following sections:

- Introduction.
- Consultation.
- Scope of Assessment.
- Methodology and Significance Criteria.
- Baseline Description.
- Development Design Mitigation.
- Assessment of Potential Effects.
- Mitigation Measures and Residual Effects.
- Cumulative Effect Assessment.
- Summary of Effects.
- Statement of Significance.

8.2. Consultation

Table 8.1 details the consultation that has been undertaken in respect of the commercial fisheries assessment, detailing how consultation responses have informed the assessment and have been considered within this Chapter.

Table 8.1 - Summary of Consultation Undertaken

Consultee	Consultation Method	Consultee Comments	Project Response
North and East Inshore Fisheries Group	Pre-Application Consultation	There are a number of fishing activities in that area. Norway lobster (Nephrops) trawling, creeling, scalloping and squid trawling all take place in, or in close proximity to, that area at different times of the year • The area is part of or adjacent to, (depending on the time of year) fishing grounds for squid, Nephrops, lobster and velvet crab.	The information provided by the Inshore Fisheries Group (East) has been used to help characterise the baseline environment in terms of commercial fishing.
North and East Inshore Fisheries Group	Pre-Application Consultation	• The main area of activity is inshore of the yellow (special mark) buoy marking the end of the pipeline & diffuser (Diageo's) off Buckhaven. • Squid is fished Aug to Oct using trawls. This includes the within the development area. • Creeling takes place in particular around the diffuser off Buckhaven for lobster and in the area of the export cable route (i.e. in the rockier/reef areas). • The main area of fishing activity is inshore of the yellow buoy marking the end of the Diageo pipeline and diffuser off Buckhaven. • There is some scallop dredging (winter) beyond the buoy and around the area of	This information has been used to inform used to help characterise the baseline environment in terms of commercial fishing and aspects of the navigation and shipping assessment found in Chapter 13 *"Shipping and Navigation".*

Consultee	Consultation Method	Consultee Comments	Project Response
		development. There are a number of fishing activities in that area. Nephrops trawling, creeling, scalloping and squid trawling all take place in, or in close proximity to, that area at different times of the year • The area is part of or adjacent to, (depending on the time of year) fishing grounds for squid, Nephrops, lobster and velvet crab. • Squid is fished Aug to Oct using trawls. This includes the development area. • Creeling takes place in particular around the diffuser off Buckhaven for lobster and in the area of the export cable route. (I.e. in the rockier/reef areas). • There is some scallop dredging (winter) beyond the buoy and around the area of development. • Vessels involved in fishing this area range from 6 m creelers up to 15 m scallopers. • Nephrops trawling takes place throughout the year on a frequent basis on or close to the southern flank of the development area. • Recreational fishing occurs but mainly inshore of the yellow buoy. • In winter, lobster and velvet crab move out beyond the yellow buoy into deeper water. Fishing vessels in transit up and down the coast will tend to stay close to the coast but remain outside the yellow buoy keeping clear of the known creeling areas i.e. passing through the development area.	
Marine Scotland Science	Pre-application Consultation	The proposed commercial fisheries desk based study has been found suitable with regards to meeting the requirements of EIA. Although, proposed consultation approach only refers to engagement through fisheries associations, direct consultation with non-affiliated fishermen is recommended.	Consultation approach has been noted and was undertaken through the shipping and navigation assessment. Further details are provided in Chapter 13: "*Shipping and Navigation*" and the Navigational Risk Assessment Technical Appendix 13A Volume 3.
Marine Scotland Science	Pre-application Consultation	Applicants might find it useful to prepare and maintain a project specific register of local fishermen's groups and associations. MSS would expect to see a specific chapter in the stakeholder section where potential concerns of the fishing community raised during consultation and how these have been addressed. Potential concerns raised by fishermen and fishing organisations often include the potential effects of displacement and the presence of incurred seabed obstacles (e.g. debris from	Effects from displacement and the presence of incurred seabed obstacles are assessed in this Chapter. Advice provided on data sources was used to inform the commercial fisheries baseline section in this chapter.

Consultee	Consultation Method	Consultee Comments	Project Response
		construction and/ or the creation of mud berms). Marine Scotland provided advice on data sources.	
Marine Scotland Science	Scoping Opinion	MSS advises that the Developer considers mitigation measures such as over-trawl surveys to ensure that the area is still, as practically possible, safe for fishing to continue post cable installation. The Scottish Ministers advise that the Developer sets out it’s intention to carry out appropriate survey of cables and its intended mitigation for, or amelioration of, any snagging hazards to fishing operations from cable protection measures in either the EIA Report, the Cable Plan or associated fishery related plans.	Over-trawl surveys will be carried out on the export cables to ensure that the cable burial and protection scheme has been successfully installed. A Forthwind Cable Plan has been produced and is included within Volume 4: Compliance Plans.
	Scoping Opinion	The Scoping Report states that previous assessments will be updated with new information and included within the EIA Report and that the navigational aspects associated with commercial fishery activity will be included within the NRA. The Scottish Ministers are content that this matter is scoped out of further assessment, that the previous assessment, updated with new information is included and that the matters listed above can be effectively addressed with the provision of suitable plans (cable plan, NRA, CFMS). Such plans should accompany the EIA Report and the applications to be considered during the determination of the applications. The reasons or the inclusion of the previous assessments in relation to commercial fisheries in the EIA Report must be clearly stated.	A Forthwind Cable Plan, and a Commercial Fisheries Mitigation Strategy have been produced and are included within Volume 4: Compliance Plans. A Navigational Risk Assessment has been undertaken and is included within Technical Appendix 13 contained in Volume 3 of this EIAR.
Marine Scotland	Scoping Opinion	The Scoping Report fails to highlight that the November 2019 Scoping Opinion identified the need for displacement effect and population effects to be scoped in, does not refer to previous representations advising that effects on fisheries are scoped in and does not provide detail on what the proposed updated information will be. Whilst recognising that the move from two turbines (a previous iteration of this project) to one is considered to represent a probable improvement in the position in relation to fisheries, Fife Council stated an expectation in its representation that any potential impacts on local fisheries would be considered.	Potential displacement and population effects are fully within Section 8.7 the commercial fisheries assessment chapter.
Scottish Fisheries	Scoping Opinion	[REDACTED] and [REDACTED] explained that the main fishing interests in the area were focussed on nephrops interests (lobster, prawn and crab).	Nephrops are assessed within the commercial

Consultee	Consultation Method	Consultee Comments	Project Response
Federation (SFF)		This was undertaken either by trawling or creels nearer to shore. They highlighted that fishing is of strategic importance to the Scottish economy and contributed to Scotland's largest export industry (food and drink).	fisheries assessment chapter.
	Scoping Opinion	It was agreed that Forthwind, as per the Marine Licence condition, would appoint a Fishing Industry Representative (FIR). A representative for the south side of the Firth had not been identified and [REDACTED] confirmed that he could not represent that fishing community. An action was placed on Forthwind to contact [REDACTED] to identify who was the new chair of the Port Seton and Cockenzie Fishermen's Association to help identify an appropriate individual an appropriate individual to act as the FIR for the south side.	A FLO will be appointed if consent is granted for the Proposed Development.
	Scoping Opinion	It was agreed that [REDACTED] will represent the north side of the fishing community as the Fishing Industry Representative (FIR). A representative for the south side of the Firth had not been identified and [REDACTED] confirmed that he could not represent that fishing community. An action was placed on Forthwind to contact [REDACTED] to identify who was the new chair of the Port Seton and Cockenzie Fishermen's Association to help identify an appropriate individual to act as the FIR for the south side.	A FIR will be appointed if consent is granted for the Proposed Development

8.3. Scope of Assessment

With reference to the 2021 Scoping Opinion the aim of this chapter is to update the previous EIAR with new information. Therefore, the scope of the assessment for commercial fisheries remains the same as the original and considers the following impacts on commercial fisheries taking account of the current commercial fisheries baseline and the Proposed Development design.

- Implications for fisheries during the construction phase.
- Implications for fisheries when the Proposed Development is completed and operational.
- Adverse effects on commercially exploited fish and shellfish populations.
- Complete loss or restricted access to traditional fishing grounds.
- Safety issues for fishing vessels.
- Interference with fishing activities.
- Any other concerns raised by local fishermen and fishing organisations.

8.3.1. Geographical Scope

The scope of the assessment is limited to ICES rectangle 41E6 within which the Proposed Development is located. ICES sub-rectangles are the smallest area by which fisheries landings are recorded, and therefore by studying this, the most accurate description of the commercial fishing activity can be obtained. The commercial fisheries study area has therefore been defined with references to ICES rectangles within which the Proposed Development is located as shown in Figure 8.1 presented in Volume II of this EIAR, which covers an area of 0.293 $km^2$of the 41E6 ICES rectangle.

The commercial fisheries study area defined above will be used to identify fisheries active in areas relevant to the Proposed Development. Where relevant however, data and information will be analysed for wider areas to provide context and describe the full extent of the activity of the fisheries included in the assessment.

8.4. Methodology and Significance Criteria

This section presents the impact assessment methodology applied to assess the potential environmental impacts associated with the construction, operation and decommissioning phases of the Proposed Development.

8.4.1. Data Sources

The following data sets have been used to describe the environmental baseline for commercial fishing (see section 8.5).

- Marine Fisheries statistical data from Marine Scotland, which are recorded according to activity / catches from relevant ICES rectangles according to fishery type, species, values and other variables;
- ScotMap (<15 m fishing vessel activity);
- VMS data maps produced by Marine Scotland Science[112];
- Freshwater fisheries statistical data, specifically salmon and trout catch statistics (Marine Scotland, 2020[113]);
- Scotland's Marine Atlas: Information for the National Marine Plan[114]; and
- Other published information and technical reports associated with nearby developments.

Other principal data sources include the following.

- Benthic ecology survey and desk based assessment (information on benthic communities and their support of commercial fishing stocks);
- Fish ecology desk based assessment (information on the likely presence of ecological impacts on commercial fish species which could affect stocks);
- International Council for the Exploration of the Sea (ICES),
- EU Fisheries Committee publications and datasets (Europa and Eurolex);
- Marine Scotland;
- Marine Scotland Science;
- Seafish;
- Scottish Fishermen's Federation;
- Forth Salmon Fishery Board;
- Association of Salmon Fishery Boards;
- Salmon Net Fishing Association of Scotland;
- Atlantic Salmon Trust;
- East of Scotland Inshore Fisheries Group;
- Other regional affiliated fishermen's associations and producers organisations, such as the Aberdeen Fish Producers Organisation;
- Local port merchants and agents;
- Local Harbour Masters; and
- Non-UK National Fisheries Datasets (if available).

Data to inform this chapter has primarily been gathered from the following data sources.

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[112] *Vessel Monitoring System (VMS) data for 40E6, 40E7, 41E6 , 41E7, 41E8, 42E7 and 42E8: EIR release - gov.scot (www.gov.scot)*
[113] *https://www.gov.scot/publications/collecting-salmon-sea-trout-fishery-statistics-marine-scotland-science-topic-sheet-67/*
[114] *Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors) (2011) Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. pp. 191*

- Marine fisheries statistical data from Marine Scotland, which are recorded according to activity/catches from relevant ICES rectangles according to fishery type, species, values and other variables, for the latest five years available (2016-2020). The data available in the Marine Scotland Website is up to 2016 covering a five-year period but the data from the original EIAR is included to have a broader context of the evolution of the fisheries in the study area covering the periods 2009 to 2013 and 2016 to 2020.
    - Annual fisheries landings datasets from 2016 to 2020;
    - Previous ES fisheries landings datasets from 2009 to 2013;
    - Annual fisheries effort datasets from 2016 to 2020; and
    - Previous ES fisheries effort datasets from 2009 to 2013.
- Freshwater fisheries statistical data, specifically salmon and sea trout catch statistics, which are recorded for salmon fisheries in rivers surrounding the Firth of Forth region, 2020 (Marine Scotland, 2020[115]).

Data on Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* have been obtained from each fishery. Each fishery is required to report numbers and total weights of salmon (multi-sea-winter salmon), grilse (one-sea-winter salmon) and sea trout caught in each month of the fishing season, with young sea trout (finnock) sometimes being sorted into a separate category. Reports of fishing effort are also provided by net fisheries, but not by rod and line fisheries. It should be noted that there might be a degree of 'grilse error' due to misclassification of fish between the grilse and salmon stages.

The data gathered from these sources were used to inform baseline characterisation of commercial fishing within the Proposed Development. The latest data available at the time of writing were analysed and summarised to form the descriptions within this Chapter.

8.4.2. Assessment Methods

The impact assessment follows the principles of the approach set out within Chapter 2 "*EIA Methodology"* and the assessment carried out for commercial fisheries follows the same overall key principles used for the assessment in the original ES. In addition, this assessment is based upon guidelines described in the joint CEFAS/ Marine Consents and Environment Unit (MCEU[116]) Guidelines for assessing the impact of offshore wind farms. The following effects on commercial fisheries interests have been considered.

The significance of potential impacts has been evaluated using a systematic approach, based upon identification of the sensitivity to the project activity, together with the predicted magnitude of the impact. The assessment of safety issues for fishing vessels has been reported in Chapter 13 "*Shipping and Navigation".*

8.4.3. Calculation of Value

The landings and VMS recording and sightings data, enable the interpretation of how different fisheries operate within the study area. Compiling an accurate economic evaluation is limited due to the nature of fishing activities, but by using VMS and surveillance data to show a spatial distribution of effort this can be used in collaboration with landings data to produce effort as a proxy for landed value. This is known as the effort as a proxy for landed value technique as detailed in Seafish's Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (2012)[117] and requires five years of landings data. The recommended approach of Seafish however can be constrained by the accuracy and coverage of VMS data.

[115] *https://data.marine.gov.scot/dataset/2019-scottish-sea-fisheries-statistics-fishing-effort-and-quantity-and-value-landings-ices*
[116] *https://www.cefas.co.uk/publications/files/windfarm-guidance.pdf*
[117] *Seafish's Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (2012) available at: http://www.seafish.org/media/634910/ukfen%20ia%20best%20practice%20guidance.pdf*

The Proposed Development is wholly located within ICES Rectangle 41E6 from which landings are used to estimate value (as shown in Figure 8.1). The estimated value of the Proposed Development area is therefore the calculated value of landings from the area, weighted by effort, to give a calculated value.

8.5. Baseline Description

8.5.1. Salmon and Sea Trout

Atlantic salmon and sea trout are both anadromous migratory species, which live in both freshwater and marine habitats during their life cycle (see Chapter 10: *"Fish and Shellfish Ecology"* of this EIA*)*. Salmon and sea trout fisheries target these species principally in river environments and also in some coastal areas.

The main methods for catching salmon and sea trout in Scotland are as follows.

- Rod (rod and line) catch (retained) – generally not used at sea and only within rivers;
- Rod (rod and line) catch (released, or catch and release) – generally not used at sea and only within rivers;
- Fixed engine (bag and stake nets) – restricted to coastal areas, not permitted in estuary limits; and
- Net and coble – generally used in lower estuaries but sometimes in coastal areas.

No salmon and sea trout fisheries have been identified within the Proposed Development. Only rod and line activity is likely to take place within 25 km of the Proposed Development, this activity will be in rivers above the estuary limit. Salmon and sea trout fisheries statistics are split out by 109 districts, which are aggregated into 11 regions. The Proposed Development is in the East region, in district 44: Forth (Marine Scotland, 2020[118]).

The Forth District Salmon Fishery Board (FDSFB)[119] is responsible for more than 3,600 km^2 of water within the Forth district. This includes the mainstream of the River Forth, the estuary and coast, and also the tributaries: Allan, Almond, Avon, Bannockburn, Carron, Devon, Esk, Leny, Leven, Teith, Tyne and the Water of Leith.

In the East region, the majority of salmon and sea trout are caught by rod and line, including catch and release. This is also true at a district level, for the Forth, where all salmon, sea trout, grilse (one-winter salmon) and finnock (young sea trout) are caught by rod and line (including both catch and release, and catch and retain reports) (see Table 8.2 and Table 8.3, derived from Marine Scotland (2020)). No fish were reported to be caught with fixed engine methods, which have not been reported in the district since 1987. The same occurs with net and coble, which have not been reported in the district since 2015. This indicates that rod and line fisheries are by far the most popular fishing method in the district, which is undertaken within rivers. The vast majority of fish caught by rod and line are salmon, and approximately two to three times as many salmon are released compared to those that are retained.

The rod and line fisheries operate from February to October. The highest fishing effort by net and coble operators is between June and September, when up to eight crews can be operating (Marine Scotland, 2013[120]). However, the highest recorded catch is generally in May when fewer crews are operating. Rod and line fisheries are not required to submit records of effort, but the highest records of total catches are in September for retained catches and October for released catches.

There are over 60 coastal netting stations in the Forth district; however, most of these are dormant and netting (net and coble) activity is limited. With increased conservation efforts in response to declining populations, netting has dramatically decreased in recent years (Forth Fisheries Trust 2019[121]). Moreover, Forth Fisheries Trust is recommending removing or limiting the impacts from active netting stations.

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[118] https://www.gov.scot/publications/collecting-salmon-sea-trout-fishery-statistics-marine-scotland-science-topic-sheet-67/
[119] FDSFB (Forth District Salmon Fishery Board) (2013). Forth District Salmon Fishery Board [online]. Available at: http://www.fishforth.co.uk/fdsb/. Accessed: 18/02/2015
[120] https://marine.gov.scot/sma/assessment/salmon-and-sea-trout-fishing
[121] http://forthdsfb.org/wp-content/uploads/2020/03/FDSFB-Annual-Report-2019-Draft2.pdf

Table 8.2 - Number of Wild Salmon, Sea Trout and Finnock Caught and Retained by Rod and Line in the Forth District from 2013 to 2020 (Marine Scotland Data[122]).

Year	Salmon	Sea Trout	Finnock
2013	275	92	0
2014	92	67	4
2015	156	63	1
2016	80	22	0
2017	97	27	2
2018	32	8	0
2019	43	13	0
2020	23	28	20

Table 8.3 -Number of Wild Salmon, Sea Trout and Finnock Caught and Released by Rod and Line in the Forth District from 2013 to 2020 (Marine Scotland Data[12]).

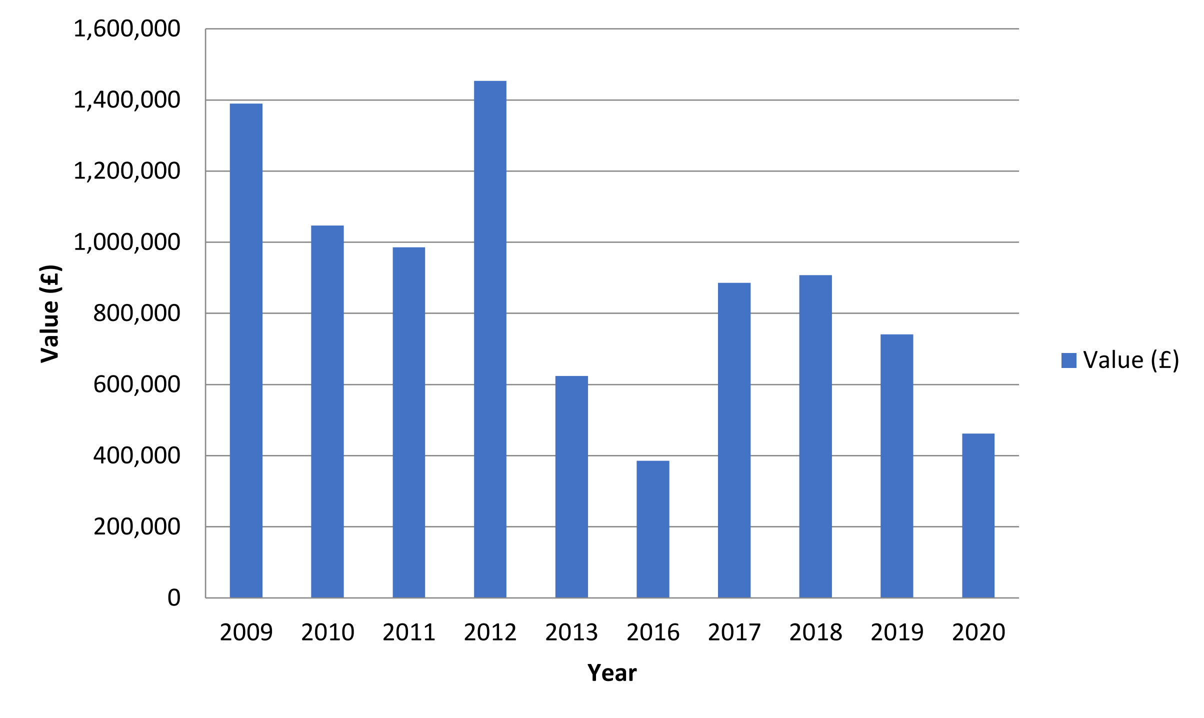
Year	Salmon	Sea Trout	Finnock
2013	798	461	110
2014	452	433	34
2015	529	401	38
2016	719	206	16
2017	643	322	45
2018	412	216	25
2019	512	248	36
2020	771	294	61

8.5.2. Yearly Trends in Landings Value

Yearly landing in ICES rectangle 41E6 vary from just over £1,400,000 in 2012 to a decrease to £460,000 in 2020 (Figure 8.1). Overall, there is a decreasing trend in the landings data however; they do seem quite variable in comparison to other ICES rectangles.

[122] https://www.gov.scot/publications/collecting-salmon-sea-trout-fishery-statistics-marine-scotland-science-topic-sheet-67/

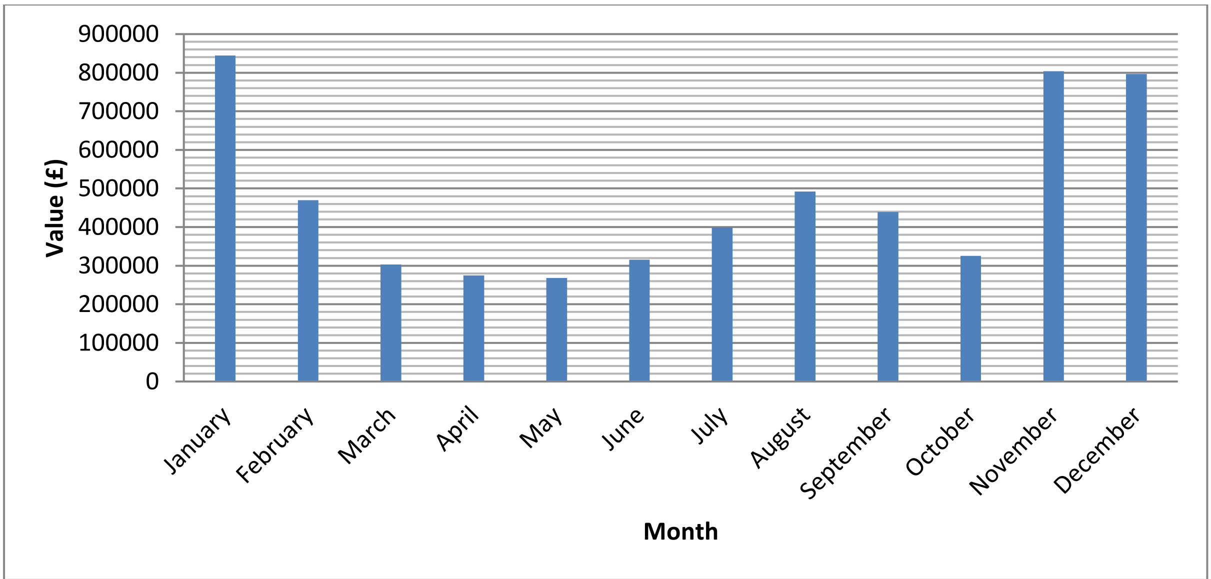
Figure 8.1- Value of landings from ICES Rectangle 41E6 by year (2009 – 2013 and 2016 – 2020)



8.5.3. Seasonal Trends in Landings Value

The peak months for landings as shown in Figure 8.2 are January, November and December with a secondary smaller peak in August. The value of landings in the summer months of November – January is between 50 and 100 % greater than the spring months of March – June.

Figure 8.2 - Average value of landings from ICES Rectangle 41E6 by month (2009 – 2020).



8.5.4. Value of Landings by Species

The main species targeted in the region is Nephrops; this species mainly inhabits muddy substrates (see Chapter 10: *"Fish and Shellfish Ecology"* of this EIA*)*. Nephrops is the most valuable species in this area, comprising an average of 67% of the overall value of landings from ICES rectangle 41E6 each year (Table 8.5). Within the rectangle that covers Middle Bank (41E6), fishing activity resulted in annual Nephrops landings ranging from

£231,332 to £615,049 a year, for the period 2016 to 2020, which is a decrease compared to the period of 2009 to 2013.

ICES rectangle 41E7, to the east of the Proposed Development, covers a much wider marine area and landings of Nephrops were more than three times those of rectangle 41E6.

Whelks are the second most valuable species to commercial fishing in this region. Annual landings of scallops were valued between £3,691 and £185,435 for ICES rectangle 41E6 (2016-2020). Whelk landings contribute an average of 14% to the value of all species caught in this rectangle (Table 8.5).

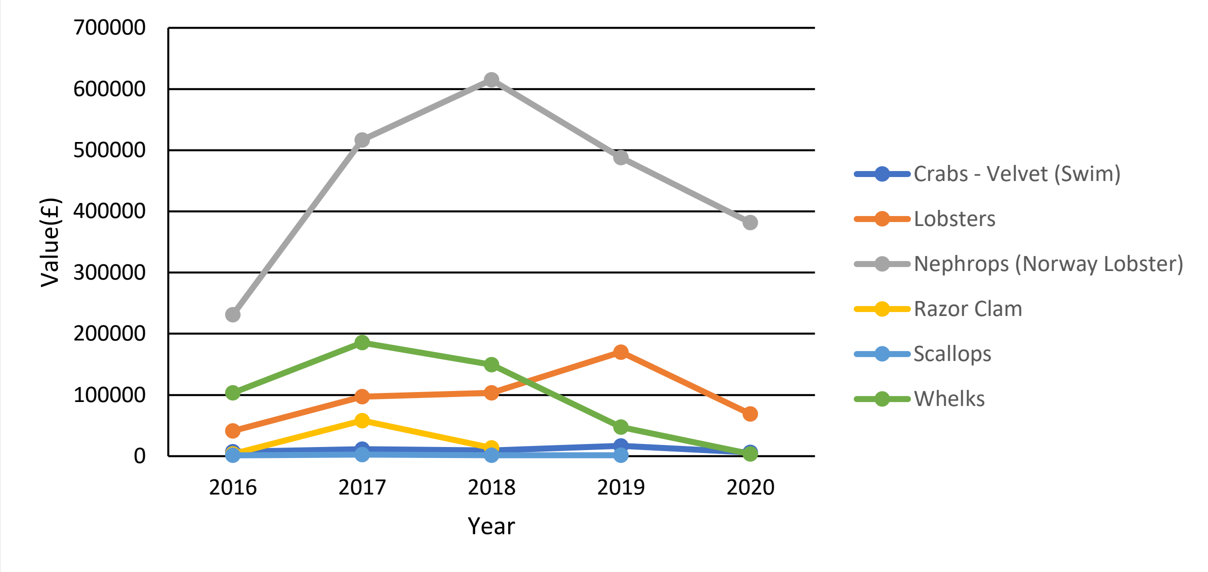
The lobster is the third most valuable species targeted within the region, and mainly inhabits rocky grounds in coastal waters (see Chapter 10: "*Fish and Shellfish Ecology*"). Annual landings of between £41,249 and £170,174 of European lobster were reported for ICES rectangle 41E6 in 2016 to 2020. European lobster landings contribute an average of 14% to the value of all species caught in this rectangle (see Figure 8.3)/

Scallop landings has decreased considerably, compared with the period of 2009-2013. Vessels targeting scallops are restricted by the number of dredges they can use. Vessels fishing outside 12 nautical miles (nm) are allowed up to 14 dredges per side; between 6 and 12 nm offshore up to 10 dredges a side are permitted; and up to 8 dredges inside 6 nm. Therefore, scallop dredgers in the study area are limited to using eight dredges a side. For this reason, scallops only constitutes the 0.2% of landings in the period of 2016-2020.

Table 8.4 - Value of landings by species in ICES Rectangle 41E6 (cumulative 2016-2020)

Species	Sum of Value(£)
Cod	£205
Crabs - Velvet (swimming)	£50,976
Crabs (edible mixed sexes)	£34,111
Green Crab	£415
Halibut	£339
Lobster - Squat	£314
Lobsters	£481,529
Mackerel	£1,943
Mixed Squid and Octopi	£7,315
Monks or Anglers	£751
Nephrops (Norway Lobster)	£2,232,585
Razor Clam	£75,394
Squid	£3,180
Whelk	£490,069

Figure 8.3 - Value of landings in ICES Rectangle 41E6 for the six highest valued species (2016 – 2020)



8.5.5. Spatial Distribution of Fishing Effort

The Proposed Development can be characterised as average or above average for the region in terms of fishing intensity from VMS data for scallops but lower than average for Nephrops, as shown Table 8.5 and Figure 8.3

Scotmap data is collected from small inshore fishing vessels. The Proposed Development seems to be above average for other species trawls (Figure 8.4), which is likely to correlate to the squid trawls identified in consultation in the August - October season. Nephrops trawls and Nephrops pots are also seen to have some significance in the area (Table 8.4) which correlates to Nephrops trawls being described occurring on the southern side of the Proposed Development from consultation.

Lobster and crab pots (Table 8.4) have the highest value of all the inshore fisheries data provided by Scotmap for the Study Area. This agrees with consultation advice provided by the Inshore Fisheries Group for the region, where special consideration is given to the yellow buoy, which marks the end of the Buckhaven outfall, which is targeted for velvet crab and creeling for lobster. It is noted that in winter lobster and velvet crabs move out beyond the end of the outfall into deeper water in the Study Area.

8.5.6. Calculation of Proposed Development Area Value

The average annual value of catch from ICES rectangle 41E6, within which the Proposed Development is located, is £556,255 for the five years 2016 – 2020, a decrease compared with the £1,099,996 for the years 2009 – 2013.

The average fishing intensity from VMS data recordings for ICES rectangle 41E6 is 0.001319 vessels / day / km^2. The average fishing activity from VMS data recordings within the Proposed Development is 0.000387 vessels / day / km^2. The Proposed Development has a higher intensity than the average for the ICES rectangle within which it sits, however, much of ICES rectangle 41E6 is covered by the land with no fishing effort, therefore lowering the average level of fishing effort per km^2 for this rectangle.

The Proposed Development covers an area of 0.293 km^2 within ICES rectangle 41E6 covering an area of 3,451 km^2. Multiplying these areas by their respective intensities gives vessels per day value for the Proposed Development of 0.0045 vessel / day and for ICES rectangle 41E6 of 4.55 vessel /day. The total value of ICES rectangle 41E6 is then divided by its intensity and then multiplied by the intensity for the D. This calculates an area and intensity weighting annual value of £1,383.77 for the Proposed Development.

- Vessel per day in Proposed Development area = 0.293 km^2 X 0.0387 vessel / km^2 /day = 0.0113 vessels / day.
- Vessel per day in ICES Rectangle 41E6 = 3,451 km^2 X 0.001319 vessel / km^2 /day = 4.551 vessels / day.

- Annual value of Proposed Development area = (£556,255 / 4.551 vessel /day) X 0.000113 vessel / day = £1,383.77.

Therefore, using Seafish's Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (2012) and using 5 years of landings data (2016 – 2020) the intensity weighted annual value of the Proposed Development area to the commercial fishing fleet is £1,383.77 as calculated in the paragraph above.

8.6. Development Design Mitigation

Several aspects of the-Proposed Development have been designed to increase navigational safety, which will reduce this impact upon commercial fishing vessel and are detailed in Chapter 13: "*Shipping and Navigation"* of this EIA. In addition, mitigation measures that are incorporated into the design of the Proposed Development are intended to prevent, reduce and where possible offset any significant adverse impacts on commercial fisheries.

- Where possible all array cables will be buried to sufficient depth to protect from fishing activity. Cable burial depths and any protection measures will be confirmed post installation to assist fishing vessel skippers in their assessments in respect of their fishing within Proposed Development.
- Cables will be buried or being protected by other means (i.e. rock dumping, concrete mattresses).

8.7. Assessment of Potential Effects

8.7.1. Worst Case Scenario

The design criteria that will have the greatest impact upon commercial fishing activities are the burial method for the export cables with the worst case scenario being that burial to a depth of 1 m is not possible and the cables are surface laid with remedial protection. The navigational risk to commercial fishing vessels is discussed in Chapter 13*: Shipping and Navigation* of this EIA, however, for this chapter the worst case is expected to be that commercial fishing vessels are displaced entirely from the Proposed Development due the presence of wind turbine, met mast and cables.

8.7.2. Construction Effects

During the construction phase, fishing vessels and gear will be displaced from the Proposed Development area and there may be disruption to nearby fishing activities, as safe distance from construction vessels working at the site is required. This displacement will have an impact upon the available fishing grounds forcing vessels to use other areas, possibly moving fishing effort to adjacent areas and creating increase competition between fishing vessels. The magnitude of the effect is considered to be low as the displacement area is small and the effect is temporary, with the construction of the whole Proposed Development lasting three to six months, and the exclusions in this area likely to be over a smaller period within this overall timetable. The sensitivity of receptors is considered to be medium as a range of commercial fishing methods target the area with specific interest in grounds within and adjacent to the Proposed Development. The significance of the impact is **moderate**.

8.7.3. Operational Effects

8.7.3.1. Adverse Impacts on Commercially Exploited Fish and Shellfish Populations

There are no significant effects on fish populations reported in the fish and shellfish ecology impact assessment (Chapter 10: *Fish and Shellfish Ecology*). Therefore, with no population changes there is no effect – receptor pathway for commercial fisheries to be impacted by an adverse impact on fish or shellfish populations. This impact is, therefore, **scoped out** of assessment.

8.7.3.2. Complete Loss Restricted Access to Traditional Fishing Grounds

Once the Proposed Development is completed, there will not be an exclusion from the entire area, although the presence of physical infrastructure may result in some changes to fishing activities in the area. Most fishing activities focus on areas surrounding the Buckhaven outfall to the west of the Proposed Development; however, some fishing activity does occur within the Proposed Development. The restricted access will cause a reduction in available fishing grounds and the potential displacement of fishing vessels will increase pressure on other similar areas locally. This may include areas targeted for lobsters and crabs (including creeling around the Buckhaven outfall) as well as trawling for squid (August – October), Nephrops (year round) and scallop dredging.

As a worst case scenario, the entire footprint of the Proposed Development will be unavailable for traditional fishing. The calculated landings value from the area is £1,383.77 per year. The effects will be long term (i.e. for the durations of the met mast and turbine being in place); however, the size of area is small making the magnitude of impact low. The value of the commercial fishing in the area is low and the spatial extent is small (0.293 km^2) in context of the wider region and therefore the sensitivity of the receptor is low. Overall, the significance is **minor**. The duration of this impact is short-term as some gear (pots, creels) will be able to return to the area and work safely once construction vessels have completed construction of the Proposed Development.

8.7.3.3. Safety Issues for Fishing Vessels

Consultation indicates that some fishing vessels use the Proposed Development to transit through the Firth of Forth. The impact upon safety issues for commercial fishing vessel navigating in the area are considered in Chapter 13: *Shipping and Navigation*.

8.7.4. Decommissioning Effects

The effects from decommissioning are likely to be the same as those from construction as similar methods and vessels will be used to deconstruct the Proposed Development infrastructure, although the duration is likely to be shorter. The magnitude of the effect is considered to be low as the displacement area is small and the effect is temporary. The sensitivity of receptors is considered to be medium as a range of commercial fishing methods target the area with specific interest in grounds adjacent to the Proposed Development. The significance of the impact is **moderate**.

8.8. Mitigation Measures and Residual Effects

Dialogue will be ongoing throughout all stages of the Proposed Development following best industry practice (FLOWW[123]) to ensure that project information is effectively disseminated to fishing interests, as well as allowing issues to be raised.

A Construction Environmental Management Plan (CEMP) will be developed to address the following aspects.

- Dissemination of project information.
- Application of safety zones and implications for fisheries.
- Incorporation of fishing activities into risk assessments and identification of Emergency Response Procedures (ERP).
- Procedures in the event of interactions between wind farm construction and fishing activities (i.e., claims for lost and/or damaged gear).
- Burial and protection of electricity export cabling.
- Removal of seabed obstacles during and post-construction.
- Post-construction surveys and seabed rectification procedures.

All infrastructure installed during the construction phase will be marked on charts with the above sea-level infrastructure lit, in line with standard industry practise, and as further described in Chapter 13: *Shipping and Navigation* of this EIA. Relevant information will be distributed to fishermen through the agreed channels to be defined in the CEMP and in line with good industry practice.

Forth Ports may implement safety zones to be established during construction and maintenance activities, in line with standard industry practice, to prevent interactions with fishing vessels which could pose a safety risk, reducing the possibility of lost gear.

Cables will be buried to a target depth of 1 m where it is reasonably practicable to do so. In instances where adequate burial cannot be achieved then the developers will seek to install cable protection. This will ensure

[123] *https://www.sff.co.uk/wp-content/uploads/2016/01/FLOWW-Best-Practice-Guidance-for-Offshore-Renewables-Developments-Jan-2014.pdf*

where possible fishing will be able to return the Proposed Development post construction and therefore reduce the effects of exclusion.

Over-trawl surveys will be carried out on the export cables to ensure that the cable burial and protection scheme has been successfully installed; allowing the areas within the Study Area not occupied by the installed infrastructure (turbine and meteorological mast) to be fished post construction and therefore reduce the effects of loss of fishing grounds.

An FIR and FLO will be appointed post-consent.

8.9. Cumulative Effect Assessment

8.9.1. Scope of Cumulative Assessment

This assessment follows the approach used for the assessment of potential effects outlined in Section 8.4.

The geographical scope of the assessment focuses on cumulative effects in the Forth and Tay areas from the Seagreen, Berwick Bank, Inch Cape and Neart Na Gaoithe offshore wind farm developments.

The assessment of cumulative and in-combination effects on commercial fishing activities arising from the consideration of the Proposed Development, in conjunction with other planned development activities, takes into account the following elements.

- Berwick Bank offshore wind farm and export cables (Scottish Territorial Waters (STW)).
- Inch Cape offshore wind farm and export cables (STW).
- Neart Na Gaoithe offshore wind farm and export cables (STW).
- Seagreen offshore wind farm and export cables (STW).
- Shipping.
- Marine Protected Areas (MPAs) and other closed or restricted areas.

8.9.2. Assessment of Cumulative Effects

An assessment of fisheries in the region indicates that both Seagreen and the Inch Cape site are principally located in scallop grounds. There is a low level of scallop dredging activity occurring in the north of the Neart Na Gaoithe offshore site. Considering the scale of these developments in relation to the overall scallop fishing grounds in the region, the contribution made by the Proposed Development to the overall cumulative effect on the scallop fishery is small.

There is no Nephrops fishing activity recorded in either the Inch Cape site or Seagreen sites, however, there are Nephrops targeted within the Neart Na Gaoithe offshore wind farm site, particularly over the proposed cable route. The Proposed Development will contribute to this cumulative effect, but considering the small area of the Proposed Development this is likely to result in a minor cumulative effect and is considered to be not significant.

There is some creeling for crab and lobster in the immediate area of the Inch Cape site, and to a much lesser extent in the area of Seagreen site. The majority of activity is located in inshore areas. It is considered that creeling for crab and lobster is predominantly undertaken by vessels operating close to their local port, and vessels operating gear in the area of the offshore site and cable route will not be the same as those vessels operating in the vicinity of the larger offshore wind farm sites in the outer Firth of Forth. There is not therefore considered to be a cumulative effect on the crab and lobster fishery.

There is the potential for the construction of the Proposed Development to coincide with construction works at all of the Inch Cape, Neart Na Gaoithe and Seagreen Alpha and Bravo sites. The principal cumulative effects of concurrent construction include complete or restricted access to fishing grounds during the construction phases resulting from:

- Safety zones around construction activities; and
- Installed infrastructure.

Access to fishing grounds within the wind farm sites will become increasingly limited as respective construction programmes advance. It is considered that fishing activities will not be able to resume safely until the appropriate post-construction surveys have been completed.

The extent of the impacts from wind farm developments during the operations and maintenance phase of developments in the Forth and Tay area depends on the access fishing vessels regain to grounds within the sites. The site-specific impact assessment for all three offshore wind farms concluded that fishing activities would be able to resume within the sites. As access will be restricted for a short time period over a small area for the construction of the Proposed Development, a minor cumulative effect is likely to result, which is considered not significant.

8.10. Summary of Effects

This chapter has assessed the potential impacts on commercial fisheries of the construction, operation and decommissioning phases of the Proposed Development. Table 8.5 summarises the impact assessment undertaken and the conclusion of residual impact significance, following the application of additional mitigation.

Table 8.5 - Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction			
-Temporary loss or restricted access to traditional fishing grounds -Displacement of fishing activities into other areas -Safety issues for fishing vessels	Implications for fisheries during the construction phase including loss of available fishing area. Duration short but sensitivity of receptor medium. Impact moderate significance.	Dissemination of project information and ongoing liaison (through the Fishing Liaison with Offshore Wind and Wet Renewables Group)	Minor significance.
Operation			
-Complete loss or restricted access to traditional fishing grounds -Displacement of fishing activities into other areas -Safety issues for fishing vessels	Complete loss or restricted access to traditional fishing grounds. Duration is longer but the area is smaller as some gear will be able to return to area. The impacts will be reversible upon decommissioning. Magnitude is low as is sensitivity. Overall significance is minor.	Dissemination of project information.	Minor significance.
Decommissioning			
-Temporary loss or restricted access to traditional fishing grounds -Displacement of fishing activities into other areas -Safety issues for fishing vessels	Implications for fisheries during the decommissioning phase including loss of available fishing area. Duration short but sensitivity of receptor medium. Impact moderate significance.	Dissemination of project information and ongoing liaison.	Minor significance.

8.11. Statement of Significance

The Proposed Development area is of importance to local fishing vessels, especially those targeting lobster, crabs, Nephrops and to a lesser extent scallops; confirmed by landings, tracking data and consultation. Effects could occur during construction and decommissioning when fishing vessels may be excluded completely from the area, however, the duration will be relatively short and mitigation through application of safety zones and proper provision of information should keep disruption to as low as possible reducing the significance to minor.

During the operational phase of the Proposed Development, much of the potting activity will be able to resume operation in close proximity to the Proposed Development, however, if cables cannot be buried a minor impact will occur for fishing methods which are susceptible to snagging.

To mitigate these impacts, procedures will be put in place to manage interactions between wind farm construction activities and fishing activities (i.e., claims for lost and/or damaged gear). Burial, or where not possible, protection of export cabling will be undertaken together with removal of seabed obstacles during and post-construction to reduce snagging risks. A post-construction survey will be undertaken and seabed rectification procedures will be identified.

9. CULTURAL HERITAGE

9.1. Introduction

This chapter presents the assessment of potential impacts from the construction, operation and decommissioning activities associated with the Proposed Development on cultural heritage. This chapter contains the following sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Methodology and Significance Criteria;
- Baseline Description;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

Cultural heritage resources include designated sites such as Scheduled Monuments, Listed Buildings, Conservation Areas, Inventoried Gardens and Designed Landscapes and World Heritage Sites, as well as non-designated archaeological remains and other archaeological sites as indicated by the Council's Historic Environment Record (HER).

The assessment is intended to identify changes to the setting of cultural heritage features during the construction, operation and decommissioning of the Proposed Development as per changes to the design envelope, from previous assessment.

Note that this chapter addresses effects on the terrestrial resource only, as pertaining to potential indirect effects on the settings of cultural heritage assets, as the change in design envelope does not change the nature or accuracy of previous assessments.

9.2. Consultation

In July 2014, a report detailing proposed methodologies and preliminary baseline issued to Marine Scotland Scoping, dated 18th June 2014. A response from Historic Scotland, was received as part of this process, dated 25th August 2014. A summary of the response is provided below. Additionally, Marine Scotland have confirmed that the responses received to the previous 2-B scoping request are still considered valid. In the original consultation exercise in 2010, Fife Council provided data from their Historic Environment Record, which was used in to inform the assessment of potential for unknown archaeological remains to exist; this is relevant to and has been taking into account with respect to the onshore elements of the Proposed Development. Historic Scotland provided a response identifying specific heritage assets they considered to be of potential concern. This response addressed the same list of assets as the original scoping response. As the most recent response covers the same grounds, it is referred to in detail in Table 9.1.

Table 9.1 - Summary of Consultation Undertaken

Consultee	Consultation Method	Consultee Comments	Project Response
Historic Environment Scotland	EIA Scoping Response Letter 24/09/2021	Understanding that proposed changes are limited to offshore and that onshore aspects are scoped out. Remains a requirement to reassess for setting impacts with specific	Accepted and a modification has been made to republish the EIA chapter 9 with a limited scope that presents a reassessment of setting impacts of onshore assets based on the design envelope changes.

Consultee	Consultation Method	Consultee Comments	Project Response
		consideration of potential effects on the settings of; • Macduff's Castle and Dovecot (Scheduled Monument Index no. 860), • Standing Stones of Lundin (Scheduled Monument Index no. 797), • Wemyss Caves (Scheduled Monument Index no. 817), • Wemyss Castle Category A listed Building; and • Wemyss Castle GDL Project shall produce, consult and implement a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) prior to construction activities being undertaken and that HES will be consulted on both the WSI and PAD.	Accepted, to be produced.
Historic Scotland	Consultation Letter 2014	Asked for specific consideration of potential effects on the settings of; • Macduff's Castle and Dovecot (Scheduled Monument Index no. 860), • Standing Stones of Lundin (Scheduled Monument Index no. 797), • Wemyss Caves (Scheduled Monument Index no. 817), • Wemyss Castle Category A listed Building; and • Wemyss Castle GDL Requested an appropriate consideration of potential cumulative effects, to include the ORE Catapult Levenmouth turbine. Requested that the ES be accompanied by appropriate visualisations to illustrate potential effects and support the assessment. The scope and extent of the desk-based assessment for potential effects on the archaeological resource was approved.	The named assets have been assessed (see section 9.6). A cumulative assessment is provided in Section 9.9. Further detail is provided in Chapter 5: Landscape and Visual Impacts. References to view points and photomontages provided as part of Chapter 5 are placed within this chapter as appropriate.

Consultee	Consultation Method	Consultee Comments	Project Response
Historic Environment Scotland	2021 Scoping Opinion	We understand that the project, however, is proposing to product, consult and implement a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) prior to construction activities being undertaken and that HES will be consulted on both the WSI and PAD. We welcome this proposal.	Accepted these will be produced in consultation with HES.
		In terms of terrestrial heritage assets, in out response dated 14 June 2019 we noted a number of historic environment assets that would need to be considered for impacts on their setting. These assets included Macduff's Castle (SM no. 860), Wemyss Caves (SM no 817), Wemyss Castle (HB No. 16709) and Wemyss Castle GDL. We recommend that potential impacts on these heritage assets are assumed within the updated cultural heritage and archaeology chapter of the EIAR.	Accepted and modification has been made to republish Chapter 9 of this EIAR with a limited scope that presents a reassessment of setting impacts of onshore assets based on the Project Design Envelope changes (Section 9.7)

9.3. Scope of Assessment

This assessment update considers potential effects on the terrestrial cultural heritage resource. This assessment considers indirect (visual) effects on the settings of cultural heritage assets which may be adversely affected by the Proposed Development. The previous assessment was based on blade tip height of 198.5 m while the current assessment is based on a blade tip height of 280 m for a total increase of 81.5 m in height (Figure 1.1).

No consideration has been given to direct effects, that is, physical effects on archaeological assets arising from construction activities associated with the cable landfall, as this was previously assessed in the original EIA[124] (2015) and the change to the design envelope will not affect the original ES conclusions.

No consideration is given to potential effects on the marine archaeological resource in this chapter, as this was previously assessed in the EIA and the change to the design envelope will not affect the original ES conclusions.

9.3.1. Geographical Scope

In order to identify cultural heritage features with the potential for their settings to be affected by the Proposed Development, the EIA conducted an initial search area was defined based on boundary 15 km radius of the Proposed Development. During the current assessment distance was used as the principal criterion in determining the likelihood of a significant visual effect on setting for the purposes of this assessment.

Detailed assessment was given to nationally important features within 7.5 km of the Proposed Development, as based on previous experience and using professional judgement, these were judged to have the potential for significant effects upon their settings. As with the previous assessment, consideration was made for features immediately outside of the 7.5 km search radius on a case by case basis. For Category C listed buildings consideration for significant effects are only made within 3.5 km.

[124] ForthWind. 2015. ForthWind Offshore Wind Demonstration Project, Methil, Fife. Volume 1: Environment Statement.

The final assessment is based on the site layout shown in Figure 1.1, contained in Volume 2 of this EIAR and distances to cultural heritage features are taken from the proposed turbine location.

In summary, the most significant effects on the settings of cultural heritage features have the potential to occur within a 3.5 and 7.5 km radius of the Proposed Development within the Zone of Theoretical Visibility (ZTV), and that is what has been defined as the study area (Figure 9.2) However, after an amended evaluation of cultural heritage features no significant affects were identified. This was borne out by the results of the site specific assessments.

9.4. Relevant Legislation and Guidance

9.4.1. Legislation

This assessment has taken into account the following legislation:

Statutory protection for archaeology is principally outlined in the Ancient Monuments and Archaeological Areas Act (1979) as amended by the Historic Environment (Amendment) (Scotland) Act (2011) and nationally important sites are listed in a Schedule of Monuments. Scheduled Monument Consent (SMC) is required before any work affecting the fabric of a Scheduled Monument can be carried out; and

The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment (Amendment) (Scotland) Act (2011) details the duties of National and Local Authorities regarding the desirability of preserving and enhancing settings.

9.4.2. Guidance and Policy

This assessment has taken into account the following guidance:

Scottish Planning Policy, paragraphs 135 to 151, sets out how all types of historic environment assets are to be dealt with within the planning framework[125];and

Scottish Historic Environment Policy (SHEP, updated December 2011) sets out the Scottish Ministers' policies for the historic environment, provides greater policy direction for Historic Scotland and provides a framework that informs the day-today work of a range of organisations that have a role and interest in managing the historic environment. It is a relevant document in the statutory planning, EIA and Strategic Environmental Assessment (SEA) process[126]. This document is regarded as a "living" document, to be updated as required.

9.4.3. Regional and Local Policy

The assessment has also taken into consideration relevant policies dealing with cultural heritage the TAYplan Strategic Development Plan (SDP) (2012) and the Mid Fife Local Plan (the "Local Plan"). These are further discussed in Chapter: 4 Planning Policy of this EIAR.

9.4.4. Other

The following guidance and advice was also considered:

- Standards and Guidance for Archaeological Desk Based Assessments (Institute for Archaeologists,
- rev. 2008). This advises that the aim of a desk-based assessment is to gain information about the known and potential archaeological resource within the Proposed Development boundary and that from this an appraisal can be made on the presence or absence of archaeology;
- Planning Advice Note (PAN) 2/2011: Planning and Archaeology provides advice on the handling of archaeological matters within the planning process and on the separate control over Scheduled Monuments under the Ancient Monuments and Archaeological Areas Act 1979127; and

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[125] *Scottish Government (June 2014) Scottish Planning Policy (SPP); Available at http://www.scotland.gov.uk/Resource/Doc/300760/0093908.pdf (accessed on 19/08/2014).*
[126] *Historic Scotland (December 2011) Scottish Historic Environment Policy. Available at http://www.historic-scotland.gov.uk/shep-dec2011.pdf (accessed on 19/08/2014).*
[127] *Scottish Government (2011) Planning Advice Note 2/2011: Planning and Archaeology. Available at http://www.scotland.gov.uk/Resource/Doc/355385/0120020.pdf (accessed on 19/08/2014)*

- Managing Change in the Historic Environment- Setting, Historic Scotland (October 2010) provides some guidance on assessment of settings of historic assets[128].

9.5. Methodology and Significance Criteria

9.5.1. Assessment Methodology

This assessment considers potential indirect effects (i.e., on settings) of cultural heritage assets which involved:

- Consultation with the statutory and non-statutory consultees on the potential effects of the Development, and to obtain data to inform the baseline conditions for the Proposed Development and its surrounding location;
- Desk-based studies and site visits to contribute to and validate data relevant to establishing the baseline conditions;
- Utilising 3.5 km and 7.5 km buffer of turbine location and ZTV to identify Cultural Heritage Features;
- It is assumed that the most significant effects on the settings of scheduled monuments, listed buildings categories A and B, Designed gardens and landscapes, and conservation areas have the potential to occur within a 3.5 and 7.5 km radius of the Proposed Development;
- It is then assumed that the most significant effects on the settings of category C listed buildings is likely to occur within a 3.5 km radius of the Proposed Development;
- Assessment of the potential effects expected from the Proposed Development on the baseline conditions;
- Assessment of the significance of any identified effects, taking into account the sensitivity of the cultural heritage receptor, the magnitude of potential effects (both direct and indirect); and
- Identification of any measures to mitigate and where possible avoid any predicted effects and consideration of the significance of any residual effects after the implementation of any mitigation.

Data on heritage assets was collected from the datasets held by Historic Scotland out to 15 km from the Proposed Development, in order to identify those cultural heritage assets which have potential for significant effects on their settings, thereby requiring detailed assessment. Detailed consideration was given to those within approximately 3.5 km to 7.5 km, and as well as features highlighted by Historic Environment Scotland in their consultation response. Consideration was given to assets lying within the ZTV, and also to views where heritage assets and the Proposed Development might be seen together (although the location and nature of this Development reduces the likelihood of availability of such “in combination” views). The blade tip ZTV is shown on Figure 9.2.

The landfall site has been subject to previous assessment as part of the EIAR undertaken to inform the previous application for a 2-B Energy turbine at the Fife Energy Park. Therefore, as there is no material change to the design envelope for the landfall or marine intrusive works, it is not considered as part of this assessment.

9.5.2. Indirect (Effect on Setting)

This assessment takes account of the potential for effects on the settings of internationally and nationally important designated cultural heritage features that are situated within the ZTV and within 15 km of the Proposed Development.

The Scottish Planning Policy, in its glossary, defines “setting” to be “more than the immediate surroundings of a site or place” and extends setting to include how a site was designed to function, how it was used to use of a place, or how it was intended to fit within a landscape or townscape, and how it was meant to be seen or to allow areas to be seen. This definition also identifies that setting can include “areas that are important to the protection of the place, site or building”[129].

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[128] *Historic Scotland (2010) Managing Change in the Historic Environment – Setting. Available at http://www.historic-scotland.gov.uk/setting-2.pdf (accessed on 19/08/2014).*
[129] *Scottish Government (June 2014) Scottish Planning Policy (SPP); Available at http:// http://www.scotland.gov.uk/Resource/0045/00453827.pdf (accessed on 18/09/2014*

The setting of a nationally important designated monument, building or landscape is defined by Historic Scotland as the way in which surroundings of a historic asset or place contribute to how it is experienced, understood and appreciated[130].This can incorporate a range of factors including views to, from and across the historic asset or place, key vistas, relationships between both built and natural features, aesthetic qualities, character of the surrounding landscape and non-visual factors such as sensory, historical or artistic factors[131].

Setting can be tangible, such as a defined boundary, or intangible, such as atmosphere or ambience. The main concern for visual effects on a cultural heritage setting is the potential for the Proposed Development to fragment the historic landscape, separate connectivity between historic sites and impinge on views to and from sites with important landscape settings. Although not specific to Scotland, English Heritage's "Wind Energy and the Historic Environment" lists visual dominance, scale, inter-visibility, vistas and sight-lines as well as noise, movement and light as potential effects on features of cultural heritage interest that might be derived from wind farm projects[132].

Indirect effects can occur during construction, operation and decommissioning. The temporary nature of the Proposed Development means that the visual and any other indirect effects are considered temporary (albeit long term) in cultural heritage terms and easily reversible. Finally, the background against which the assessment takes place includes the potential for threats to occur to historic assets from climate change, as acknowledged in "Climate Change and the Historic Environment"[133].

9.5.3. Zone of Theoretical Visibility

The ZTV shown in Figure 9.2, was calculated based on a blade tip height of 198.5 m. The ZTV of the amended analysis was calculated based on the blade tip height of 280 m.

In considering effects using this methodology, the following points should be caveated:

Firstly, the ZTV is a theoretical construct, informed by base terrain modelling only, with no modelling of settlement and vegetation cover. The ZTV therefore represents a "worst case scenario" and in reality visibility of the Proposed Development should be substantially less than suggested.

Secondly, professional judgement is required when carrying out an assessment of potential effects on heritage assets, as systematic application of the methodology (simply based on distance and designated status) may predict effects where, in fact, none may occur, or lead to an overstatement of effects where an impact is identified. In these instances, the predicted effects are discussed in detail within the assessment text (in sections 9.7 and 9.8) and any ameliorating conditions highlighted.

9.5.4. Significance Criteria

The assessment of effects is based on the final form of the Proposed Development and is discussed in

section 9.8. This appraisal proceeds from a consideration of the sensitivity of a cultural heritage feature against the magnitude of any potential change, to arrive at the significance of the effect.

Receptor sensitivity for the purposes of this assessment has been equated with designation status, as shown in Table 9.2.

Listed Buildings are designated and are placed on lists maintained by Historic Scotland. Whilst they are regarded as a nationally important resource, they are subject to a grading process (Category A, B, and C) and for the purposes of this assessment, this categorisation has been taken as indicative of a presumed level of sensitivity,

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[130] Historic Scotland (2010) Managing Change in the Historic Environment: Setting. (p3)
[131] Historic Scotland (2010) Managing Change in the Historic Environment: Setting. (p4)
[132] English Heritage (2005) Wind Energy and the Historic Environment. Available at http://www.english-heritage.org.uk/publications/wind-energy-and-the-historic-environment/ (accessed on 19/08/2014) (p8)
[133] English Heritage (2008) Climate Change and the Historic Environment. Available at http://www.english-heritage.org.uk/publications/pdf/climate –change-and-the-historic-environment/climate-cahnge.pdf [accessed on 19/08/2014] (p6)

based on rarity, period, architectural style, completeness, degree of subsequent alterations and so on. This assessment has assigned the Categories to different levels of sensitivity as shown in Table 9.2.

Table 9.2 - Receptor Sensitivity

Level of Sensitivity	Designation Status
Very High	World Heritage Sites, which are internationally important.
High	Scheduled Monuments (whether or not in State Care), Category A Listed Buildings, Registered Battlefields, Inventoried Designed Landscapes and Historic Gardens. These are considered to be nationally important.
Medium	Category B Listed Buildings, regionally important archaeological features and areas (as defined in the Sites and Monuments Record) and Conservation Areas which are considered regionally important.
Low	Category C Listed Buildings, sites and archaeological features noted as Locally important in the Sites and Monuments Record.
Negligible	Badly preserved / damaged or very common archaeological features / buildings of little or no value at local or other scale.

Magnitude is a measure of the nature of the expected effect. It has been classified, for direct and indirect effects, as shown in Table 9.3 For the purposes of visual assessment, proximity to the Proposed Development (within the ZTV) has been taken as one of the determining attributes. Within the Section 9.7distances are given from the receptor to the turbine of the Proposed Development.

Table 9.3 - Magnitude

Level of Magnitude	Definition
Very High	Total loss of or major alteration to a site, building or other feature (e.g. destruction of archaeological feature. Blocking or severance of key visual or other relationship).
High	Major damage to or significant alteration to a site, building or other feature. Extensive change to the setting of a feature (e.g. loss of dominance, intrusion on key view or sightline).
Medium	Damage or alteration to a site, building or other feature. Encroachment on an area considered to have a high archaeological potential for buried remains. Change in the setting of a feature, e.g. intrusion on designed sight-lines and vistas.
Low	Minor damage or alteration to a site, building or other feature. Encroachment on an area where it is considered there is low potential for buried archaeological remains to exist. Minor change in the setting of a feature (e.g. above historic skylines or in designed vistas).
Negligible	No physical impact. Slight or no change in setting.

The Significance of any potential effect is arrived at by correlating Sensitivity against Magnitude as shown in Table 9.4.

Table 9.4- Significance

Magnitude / Sensitivity	Very High	High	Medium	Low	Negligible
Very High	Major	Major	Moderate	Minor	Minor
High	Major	Major	Moderate	Minor	Not Significant
Medium	Moderate	Moderate	Moderate	Minor	Not Significant
Low	Moderate	Minor	Minor	Not Significant	Not Significant
Negligible	Minor	Not Significant	Not Significant	Not Significant	Not Significant

Where potential scores of moderate or major significance have been predicted for features using the matrix-based approach shown in Table 9.4 such features have been selected for a more detailed consideration in section 9.7. This includes a definition of the setting of each feature, considering its designation status, essential attributes etc. An assessment is made using professional judgement of the extent to which that setting is affected by the Proposed Development and an assessment of significance is given. Potential effects that are scored as minor or not significant are considered to be not significant for purposes of the EIA Regulations, and are not discussed in further detail.

The assessment has taken an approach in which the designation status (sensitivity) of a feature is set against the magnitude of the effect of the Proposed Development. For purposes of assessing indirect (visual) effects upon setting, distance to the Proposed Development is considered a determinant in the degree of magnitude of any change that might be caused. Simple inter-visibility with the Proposed Development is not necessarily considered to be harmful, unless this negatively affects the setting so as to diminish its contribution to the significance of the asset. Where considered appropriate, consideration has been given to the effect that the Proposed Development will have on the settings of historical assets in views towards the asset which include the Proposed Development, as well as in views towards the Proposed Development from the asset. Distances where given are always from the nearest proposed turbine.

It is also important to consider that forestry and woodlands, as well as buildings, can provide visual screening to cultural heritage features. However, it is noted that in managed forests the level of screening will alter and views may be opened up over time, which previously did not exist.

No detailed consideration of potential effects from noise or shadow flicker (see Chapters 11: *Noise Impact* and 16 *Miscellaneous Issues* of this EIA) has been undertaken for cultural heritage features, since no substantial above-ground or built heritage features exist within or immediately adjacent to the Proposed Development to receive any such effects.

9.6. Baseline Description

9.6.1. Baseline Assessment

The initial desk-based assessment was undertaken by Headland Archaeology to establish the baseline condition for the Proposed Development based on a study area (the Initial Development Area. Although undertaken in 2011, it is still considered relevant. It is not proposed to repeat the information with the Headland Archaeology report here, but the following sections have drawn upon that work, supplemented by an updated assessment of the baseline, as well as of cultural heritage features at a greater distance from the Proposed Development (which may be subject to indirect effects upon their settings).

9.6.2. Site Description

The Proposed Development site is described fully in Chapter 3: Project Description in the EIA. It consists of one offshore wind turbine, 280 m in height and based on a tubular steel tower and the metmast, the interconnecting cable between the turbine and the metmast, and the offshore cable situated approximately 1.5 km offshore of the Fife Energy Park with associated elements of the Proposed Development located onshore.

9.6.3. Features beyond the site boundary

9.6.3.1. Scheduled Ancient Monuments

There are 51 Scheduled Ancient Monuments of all periods within approximately 15 km of the Proposed Development. Of these, five lie within 7.5 km (and within the predicted ZTV) and were identified as having the potential to receive a significant effect on their settings within the preliminary assessment. These are listed on the Table 9.5 below and identified by their Index number. Sir Andrew Woods's Tower, Largo House is included because it lies just outside of the study area at 7.52 km from the Proposed Development.

Table 9.5 - Scheduled monuments within 7.5 km

Index No.	ES Update Index number	Name
860/817	--*	Macduff's Castle and Dovecote Wemyss Caves (Consists of one scheduled monument designation but different elements are evaluated separately)
861	--	Maiden Castle Motte, Windygate
--	IR-001	Kilmux Colliery, beam engine house, 630m SW of Kilmux House
797	--	Standing Stones of Lundin, Lundin Links
--	IR-002	Balgonie Castle, artillery fortification
--	IR-003	Sir Andrew Wood's Tower, Largo house

* -- Means that where applicable the index number from the initial evaluation was used, the prefix Index Revised (IR) indicates where a previous index number was not assigned, so a new number was created.

Potential impacts upon the settings of these Scheduled Monuments are considered in section 9.7.3, based on the operational form of the wind turbine.

9.6.3.2. Listed Buildings

There are 1786 Listed Buildings of all grades within 15 km of the Proposed Development, the majority lying within Kirkcaldy, Glenrothes, Leven, Methil, Largo and other smaller settlements such as Kennoway, Windygates, Ceres, Falkland, Earlsferry and Elie. Of these, approximately 280 records of all Categories lie within 7.5 km of the Proposed Development (note that some of these buildings represent multiple "entities" under the same listing number),and might have the potential to receive an effect upon their settings.

There are five buildings of the highest listing grade within 7.5 km. These are listed in Table 9.6 below.

Table 9.6 -Category A Listed buildings within 7.5 km

Index No.	ES Update Index number	Name
--	IR-004	Balgonie Castle
--	IR-005	Durie House
--	IR-006	Office Court, Durie House
--	IR-007	Sundial, Durie House
2132	--	Wemyss Castle

9.6.3.3. Conservation Areas

Seven conservation areas have been identified within 7.5 km of the Proposed Development. They are considered in Section 9.7.3. They are presented in Table 9.7 below.

Table 9.7 - Conservation areas within 7.5 km

Index No.	ES Update Index number	Name
--	IR-051	LINKS ROAD, LEVEN
--	IR-052	COALTOWN OF WEMYSS
--	IR-053	KENNOWAY
--	IR-054	LOWER LARGO

Index No.	ES Update Index number	Name
--	IR-055	UPPER LARGO
--	IR-056	WEST WEMYSS

9.6.3.4. Historic Gardens and Designed Landscapes

Although there are eleven Gardens and Designed Landscapes within 15 km and within the ZTV of the Proposed Development boundary, only one of these lie within 7.5 km, and may potentially receive a significant effect on their settings. The nearest is at Wemyss Castle, the eastern-most point of the designated area being approximately 3.4 km west of the turbine. It is listed below, considered in detail in section 9.7.3, and a final assessment of significance given.

Table 9.8 - Historic Gardens and Designated Landscapes within 7.5 km

Index No.	EIAR Update Index number	Name
2132	--	Wemyss Castle

9.6.3.5. Archaeological Potential

On the basis of the above it is considered that there no potential for unknown archaeological remains to survive within the site that may be disturbed during construction of the onshore elements of the Proposed Development. The study area, is a coastline that has a long history of habitation and utilisation by humans. There is a high potential for additional archaeological sites to be identified along the coastline and further inland. However, the possibility of additional finds and potential direct impacts are not considered here because the previous assessments and design envelope concluded that the changes to the scope of the Proposed Development will not affect the original EIA assessment.

9.7. Assessment of Potential Effects

9.7.1. Worst Case Scenario

Potential effects upon settings of heritage assets are considered based on the Proposed Development location (see Figure 8.1 contained within Volume 2 of this EIAR). The assessment is based on a proposed turbine maximum height of up to 280 m. Where appropriate, the distance to the proposed turbine is provided in the relevant areas of the assessment detailed below.

As a result of this work presenting an update to a previous assessment, each site will be organised as having an *initial evaluation* and *Amended Evaluation*, if they were previously assessed, or simply as *evaluation* if they are newly assessed in detail in this study.

Operational Effects

9.7.2. Direct Effects

As a result of the Project Design Envelope not materially changing the direct seabed impact, the original ES conclusions are maintained. There are no direct effects anticipated.

9.7.3. Indirect Effects

There are potential indirect, visual effects upon the settings of some cultural heritage features within 7.5 km of the Proposed Development. These are discussed below. The locations of features falling within 7.5 km of the Proposed Development, and lying within the ZTV are shown on Figure 9.2. The assessment below is based solely on the increased blade tip height of the turbine, the supporting infrastructure not being visible from beyond the Fife Energy Park boundary (where the export cable makes landfall), or being otherwise beneath the surface. All features included in the assessment are shown on Figure 9.1.

9.7.3.1. Scheduled Ancient Monuments within 3.5 km

There are two scheduled ancient monuments within 3.5 km of the Proposed Development site boundary and within the ZTV. Both are considered to be nationally important and of “high” sensitivity. According to the matrix on Table 9.2 these would have the potential to receive an impact upon their settings of “high” magnitude, resulting in an effect of “major” significance. However, they are further assessed below in relation to their settings and associations and a final statement of the significance of any impact upon setting is provided following this.

- Macduff’s Castle and Dovecot (Index number 860; Designation code SM817)

Initial Evaluation

The monument consists of the ruined remains of a castle (with an associated dovecot carved into a cave) set above the coastal cliffs overlooking the Forth. The castle and dovecot are also listed as Category B (HB Numbers 16707 and 16708 respectively). The castle is located approximately 2.5 km to the west of the turbine.

The castle lies within scrubland adjacent to the coast, and can be approached from the north (along a track adjacent to a large municipal cemetery) and from the south east along a path climbing from the coast. There is some degree of cover provided by vegetation in views toward the south-east from around the castle’s base and this will limit the presence of the Proposed Development in views in that direction. There is no public access to the upper floors, so unrestricted elevated views can no longer be experienced. Current views from the base of the monument include the urban fringes of Buckhaven and Methil, with the structures associated with the steel fabrication yard, port and former power station beyond (a representative viewpoint and photomontage from the Coastal Path south-east of the monument is presented as VP4 in Figure 5.30 of the original ES). It is noted that the operational ORE Catapult Levenmouth turbine is currently present in views to the north-east. The Proposed Development will be visible in views to the east and south-east, but will not be out of place in the context of the urban and industrial background of this well-developed part of the coast.

The ruined nature of the remains prevents access for views from the upper levels of the castle. It is considered that the availability of long views along the coast is important to the castle’s setting, not specifically what was in those views (particularly in views out to sea rather than along the coast). The presence of the Proposed Development will not affect, restrict or impede any currently available long views (i.e., along the coast) towards the monument. The primary purpose of the scheduling in ensuring the physical preservation of the castle’s fabric and associated archaeological evidence will not be affected by the Proposed Development. The remains are of “high” sensitivity by virtue of their designation. Despite the large scale and proximity of the Proposed Development, the magnitude of change is considered to be of “low” magnitude, due to the distance and industrial background and in the context of the developed coastal area against and within which the Proposed Development will be seen. The potential effect upon the setting of the monument is therefore assessed as “minor” and this is not considered to be significant for purposes of the EIA Regulations. It should be noted that the minor effect the Proposed Development has upon the setting of this feature must be regarded as temporary (albeit long-term, and lasting for the consented lifespan of the Proposed Development), but is fully reversible upon decommissioning.

Amended Evaluation

As previously stated, the primary purpose of the scheduling of this monument is to ensure the physical preservation of the castle’s fabric and associated archaeological evidence. Despite the increased height of the blade tip, the presence of the Proposed Development will not affect, restrict or impede any currently available long views (i.e., along the coast) towards the monument. Therefore the evaluation of impact remains the same as before. The asset is of “high” sensitivity, and the magnitude of change remains “low”, therefore the potential effect upon the setting is still assessed as “minor” and this is not considered to be significant for the purposes of the EIA Regulations. However, it should still be noted that the minor effect of the Proposed Development upon the setting of this feature must be regarded as temporary (albeit long-term, and lasting for the consented lifespan of the Proposed Development), but is fully reversible upon decommissioning.

- Wemyss Caves (Index number 817; Designation code SM817)

Initial Evaluation

The scheduling includes 5 caves set in the coastal cliffs on the northern side of the Forth, the nearest of which is approximately 2.3 km to the west of the turbine. They are scheduled for their archaeological and historic value, as they retain features and evidence of their exploitation and occupation in the past. The caves have openings facing towards the North Sea, i.e. in a south-east direction, in which the Proposed Development (in particular the turbine) is likely to be visible. As there are no long views towards the caves, and the caves and Proposed Development can't be seen together, their settings are considered to be limited to the coastal cliff and shorelines. This setting, the historic associations of the caves to each other, to the coast and to the remains of the Scheduled Macduff's Castle (see above) above them on top of the cliff are not considered to be affected. Whilst the Proposed Development may be visible from (some of) the cave entrances, or from the open areas immediately in front of the caves, visibility to the sea does not appear to be a key or defining attribute. The magnitude of change is considered to be "negligible" upon these features of "high" sensitivity (by virtue of their designation) and the potential effect upon their setting is therefore assessed as "negligible" and therefore not significant in terms of the EIA Regulations.

Amended Evaluation

As previously stated, this monument is scheduled for its archaeological and historical value. Despite the increased height of the blade tip, the settings of the caves are considered to be limited to the coastal cliff and shorelines. Whilst the Proposed Development may be visible from (some of) the cave entrances, or from the open areas immediately in front of the caves, visibility to the sea does not appear to be a key or defining attribute. The magnitude of change is considered to remain "negligible" upon these features of "high" sensitivity (by virtue of their designation) and the potential effect upon their setting is therefore still assessed as "negligible" and therefore not significant in terms of the EIA Regulations.

- Scheduled Ancient Monuments within 3.5 to 7.5 km

There are four Scheduled Monuments within 3.5 – 7.5 km of the Proposed Development site boundary and within the ZTV. An additional scheduled monument was included as it lay in the immediately outside the 7.5 km buffer. All are considered to be nationally important and of "high" sensitivity. According to the matrix on Table 9.2 these would have the potential to receive an impact upon their settings of "medium" magnitude, resulting in an effect of "high" significance. However, they are further assessed below in relation to their settings and associations and a final statement of the significance of any impact upon setting is provided following this.

- Maiden Castle, Motte, Windygates (Index number 861; Designation code SM861)

Initial Evaluation

The monument consists of the remains (the mound and associated earthworks) of a former Motte fortification, now covered partially with scrub and surrounded by a mature hedge. It is situated on higher ground above a tributary of the River Leven, on the southern outskirts of Kennoway. The A916 (as well as the course of a former railway) lies close to the west, along with adjacent houses, with farmland to the east. The remains of the monument has a relatively limited presence within the landscape, and its setting is considered to be related to the small valley and road corridor to Kennoway.

There are only limited views towards the monument, due to the surrounding terrain and local vegetation cover. Although intended originally as a defensible site, and one in which visibility is considered to be important to its function, views from the site have been much altered since its original construction.

The Proposed Development is not considered to affect the understanding of the monument's relationship to the approaches to Kennoway, nor will it affect the preservation of archaeological evidence for the previous use and development of the site. The Proposed Development will constitute a new component in views to the south from the monument (at a distance of approximately 4.9 km from the currently proposed location for the proposed turbine, but these views already include the urban areas of Methilhill, Methil and Buckhaven along with the larger structures of the steel fabrication yard, port and former power station (and currently including the ORE Catapult Levenmouth turbine).

The magnitude of the effect of the Proposed Development upon the setting of the Motte is therefore considered to be "low" (as an additional feature in an already changed view to the south), despite their size, upon a feature of "high" sensitivity by virtue of its designation. The potential effect of the Proposed Development upon the Motte's setting is therefore assessed as being of "minor" significance. This is not considered to be significant for the purposes of the EIA Regulations.

Amended Evaluation

As previously stated, this asset is scheduled for its archaeological and historical value. Despite the increased height of the blade tip, the change to the setting is unlikely to be increased by the added height. The remains of the monument has a relatively limited presence within the landscape, and its setting is considered to be related to the small valley and road corridor to Kennoway. There are only limited views towards the monument, due to the surrounding terrain and local vegetation cover. Although intended originally as a defensible site, and one in which visibility is considered to be important to its function, views from the site have been much altered since its original construction.

The magnitude of the effect of the Proposed Development upon the setting of the Motte is therefore considered to remain "low" (as an additional feature in an already changed view to the south), despite their size, upon a feature of "high" sensitivity by virtue of its designation. The potential effect of the Proposed Development upon the Motte's setting is therefore still assessed as being of "minor" significance. This is not considered to be significant for the purposes of the EIA Regulations.

- Standing Stones of Lundin (Index number 797; Designation code SM797)

Initial Evaluation

The monument consists of three irregular standing stones, in sandstone, set within 16 m of each other. The tallest, 5.1 m high, stands separate from the others (which are 4.3 and 4.2 m high). The stones lie approximately 6 km north-east of the currently proposed location for the turbine. The scheduled are covers a circle of 40 m diameter, to ensure that associated, buried archaeological remains that may survive are protected.

Although visibility to and from the stones is likely to have been important to their original function, their current setting is much altered. The stones are now within a golf course, with housing to their immediate south (along the northern side of the A915 in Lundin Links). There are open views towards the stones from within the golf course itself, and from the minor road to the west, as well as in intermittent views from the main Leven-Largo road to south, however in most of these views the turbine will not be visible. The turbine will be visible in long views from the vicinity of the stones, (behind and above the existing structures in Leven and Methil), and in views including the stones in approaches across the golf course from the east and north-east.

There may have been visual linkage with other monuments, which are no longer perceptible in the landscape. Any linkage with the Balgrummo standing stone 3 km to the west will not be affect by the distant presence of the proposed turbine in the periphery of such views (at over 70 degrees from the principal axis). Important views to the northeast from the stones, in which the hill of Largo Law is framed by the stones will similarly be unaffected (the proposed turbine will be behind the viewer in this view).

Given limited arc of view from the stones in which the turbine would be visible, as well as the distance and the presence of other industrial elements (including a wind turbine) in views to the south-west, the Proposed Development is considered to form a slight change in the setting of the stones, of "negligible" magnitude. The Stones are considered to be of "high" sensitivity. The potential effect upon the setting of the stones is therefore assessed as being "not significant" for purposes of the EIA regulations.

Amended Evaluation

As previously stated, given limited arc of view from the stones in which the turbine would be visible, as well as the distance and the presence of other industrial elements (including a wind turbine) in views to the south-west, the Proposed Development is considered to form a slight change in the setting of the stones, of "negligible" magnitude. Despite the increased height of the blade tip, the change to the setting is unlikely to be increased by the added height.

The magnitude of the effect of the Proposed Development upon the setting of the stones is therefore considered to remain “negligible”. The Stones are still considered to be of “high” sensitivity. The potential effect upon the setting of the stones is therefore still assessed as being “not significant” for purposes of the EIA regulations.

- Kilmux Colliery, beam engine house, 630m SW of Kilmux House (Index number IR-001; Designation code SM7769)

Evaluation

This monument is included due to the increased height of the blade tip and was not previously evaluated. The monument consists of well-preserved remains of a beam engine house which served the small colliery at Kilmux from 1838. There are footings of ancillary structures visible to the west and south of the building; while just to the south there are also the footings of two cottages. The scheduled area is approximately 7.12 km north north-west of the currently proposed location for the turbine. The scheduled area covers a roughly-rectangular area approximately 50 m north-south by 70 m east-west to include remains of the beam engine house and the above ground associated features. The area is located in agricultural fields that is bisected by road A916.

The monument is of national importance as a fine example of a beam engine house and associated features, not due to its setting or relationship to other features in the area. The building is now roofless preventing access to view the sea at an elevated height. Moreover, visibility to and from the coast is unlikely to have been important to the original function.

There are only limited views towards the monument, due to the surrounding vegetation cover and modern buildings. The Proposed Development will not affect the preservation of archaeological evidence for the previous use and development of the site. The Proposed Development will constitute a new component in views to the south from the monument (at a distance of approximately 7.12 km from the currently proposed location for the proposed turbine, but these views already include the urban areas of Leven, Baintown, Kennoway, and Buckhaven along with nearby modern structures.

The magnitude of the effect of the Proposed Development upon the setting of the building is therefore considered to be “low” (as an additional feature in an already changed view to the south), despite their size, upon a feature of “high” sensitivity by virtue of its designation. The potential effect of the Proposed Development upon the building’s setting is therefore assessed as being of “minor” significance. This is not considered to be significant for the purposes of the EIA Regulations.

- Balgonie Castle, artillery fortification (Index number IR-003)

Evaluation

This monument is included due to the increased height of the blade tip and was not previously evaluated. The monument consists of a 17th century earthen ravelin with a prominent ditch on its southern side. It likely dates to the 1640s when Balgonie Castle (located to the immediate north of the monument) was extensively remodelled. The fortification survives as a grass covered mound measuring approximately 75 m east-west by 25 m north south. The scheduled area is irregularly-shaped to include the remains of associated features, and an area likely to contain evidence relating to the monument’s construction, use and abandonment. The scheduled area is located in a landscaped lawn that is partially bisected by an unnamed road. The fortification is approximately 7.26 km northwest from the turbine.

The monument is of national importance as a well-preserved artillery fortification built to strengthen the defences of the Bulgonie Castle. The monument is scheduled due to its historical and archaeological value, as they retain features and evidence of building techniques and lifeways in the past during a period of great instability. Its value is not due to its setting. The interrelationship of the fortification to Bulgonie Castle and its associated features will not be impacted by the Proposed Development as the location of the Proposed Development is approximately 7.26 km to the south.

There are only limited views towards the monument from the Proposed Development, due to the surrounding vegetation cover and modern buildings. The Proposed Development will not affect the preservation of archaeological evidence for the previous use and development of the site. The Proposed Development will constitute a new component in views to the southeast from the monument (at a distance of approximately 7.24 km from the currently proposed location for the proposed turbine, but these views already include the urban areas of Milton of Balgonie, Methil, and Buckhaven.

The magnitude of the effect of the Proposed Development upon the setting of the building is therefore considered to be “low” (as an additional feature in an already changed view to the south), despite their size, upon a feature of “high” sensitivity by virtue of its designation. The potential effect of the Proposed Development upon the building’s setting is therefore assessed as being of “minor” significance. This is not considered to be significant for the purposes of the EIA Regulations.

- Sir Andrew Wood’s Tower, Largo House (Index number IR-003; Designated code SM874)

Evaluation

This monument is included due to the increased height of the blade tip and was not previously evaluated. The monument consists of a circular tower, a fragment of a major 16th and 17th century house on the site of an earlier, documented castle and a small area around the tower. The tower once formed the southwest angle of an extensive quadrangular residence of the later sixteenth and early seventeenth centuries. The tower, and indeed the whole house, were preceded by an earlier castle, built after the lands were granted to Sir Andrew Wood in 1482-3. A license to build was granted in 1491. It is likely that the 1491 building formed the basis for continuous development of the house up to its abandonment about 1750, and that the name of Sir Andrew Wood came to be associated with the later elements by association. The scheduled area is roughly-rectangular, measuring 50 m east-west by 35 m north-south, to include the tower and potential remains of the residence and earlier castle.

The importance of the site is derived from its architectural associations with domestic architecture from defensive origins. Its value is not due to its setting. The interrelationship of the tower to nearby Category B listed buildings and their associated features will not be impacted by the Proposed Development as the location of the Proposed Development is approximately 7.52 km to the south.

There are only limited views towards the monument from the Proposed Development, due to the surrounding vegetation cover and modern buildings. The Proposed Development will not affect the preservation of archaeological evidence for the previous use and development of the site. The Proposed Development will constitute a new component in views to the southeast from the monument (at a distance of approximately 7.52 km from the currently proposed location for the proposed turbine, but these views already include the village of Lower Largo.

The magnitude of the effect of the Proposed Development upon the setting of the building is therefore considered to be “low” (as an additional feature in an already changed view to the south), despite their size, upon a feature of “high” sensitivity by virtue of its designation. The potential effect of the Proposed Development upon the building’s setting is therefore assessed as being of “minor” significance. This is not considered to be significant for the purposes of the EIA Regulations.

Listed Buildings

There are 280 Listed Buildings of all categories within 7.5 km of the Proposed Development which lie within the ZTV. Many of these are listed entities represented under the same Historic Building Number (HBNUM) listing. Most are listed at Category C and the majority are located in settlements such as Methil, Leven, Windygates, Buckhaven, East Wemyss and West Wemyss, and as such are considered to have settings defined by their urban and streetside locations. This does not define them as having an urban/streetside setting, but they are ruled out in all but the closest proximity as per the previous assessment.

Only five buildings of the highest level of grading (Category A) lie within the 7.5km radius. All are considered to be nationally important and of “high” sensitivity. They are assessed individually below.

- Durie House, with Court of Offices and Sundial and walled garden (Index number IR-005, IR-006, IR-007; Designated Code LB16699)

Initial Evaluation

This Listing covers three separate entities, namely the House, with a courtyard and offices (now converted to accommodation) to its north, along with sundial within a walled garden to its east. The property is located within landscaped grounds, approximately 5.2 km to the north-north-west from the proposed turbine situated to the north of Leven and is approached from the east via a tree lined track.

There is extensive plantation to the north and east of the property and landscaped planting to its west and south-west. The principal aspect of the house is its south facing elevation, from which there will be extensive views over Leven and Methil and over the Firth of Forth. Although the Proposed Development will be visible in these views, it will not affect their character in that the views already take in the urban and industrial character of Leven and Methil (and currently include the FEPOWDT). These views have changed extensively since 1769 when the house was built.

The Proposed Development will occupy only a small arc of the view to the south-south-west, and this is considered to be a potential change of “low” magnitude, upon a feature of “high” sensitivity. The potential effect of the Proposed Development upon the setting of the House (and associated courtyard and garden) is therefore assessed as of “minor” significance only, and this is not significant for purposes of the EIA Regulations.

Amended Evaluation

As previously stated, these buildings are listed for their archaeological and historical value. Despite the increased height of the blade tip, the change to the setting is unlikely to be increased by the added height. There are only limited views towards the monument, due to the surrounding terrain, local vegetation cover, and built up urban areas of Leven, Methil and Sillerhole.

The Proposed Development will occupy only a small arc of the view to the south-south-west, and this is still considered to be a potential change of “low” magnitude, upon a feature of “high” sensitivity. The potential effect of the Proposed Development upon the setting of the House (and associated courtyard and garden) therefore remains assessed as of “minor” significance only, and this is not significant for purposes of the EIA Regulations.

- Wemyss Castle (Index number 2132; Designated code LB16709 (and associated structures))

Initial Evaluation

The castle is located approximately 4.3 km from the proposed position of the turbine. It lies on the coastal cliffs between East and West Wemyss, within an Inventoried Historic Park and Designed Landscape, which is assessed separately below. The House is grouped with a number of other Category B listed buildings within the Garden, namely the Pink House (part of the Home Farm, HB Number 49183) and the Category A Home Farm Courtyard and Stables (HB Number 46952) located to the north of the Castle. The group is considered as a whole, in relation to the Castle, for purposes of this assessment.

The castle is irregular in plan and dates back to the 15th century, with later additions. Primary approaches are from the south-east, then turning to face the courtyard in front of the north-west facing elevation and the entrance. The castle entrance is on the north-western elevation, with the main south-eastern elevation facing over the cliffs and across the Firth. The north-eastern elevation provides views along the coast towards Methil.

To the north and west of the castle are formal lawns and gardens, with plantations which screen the stables and associated buildings (including the Pink House) from sight from the castle itself. Close to the north of the Castle lies the Red House, listed at Category B (HB number 46053). Further north are three other associated listed cottages within the estate (HB Number 46051, three entities), as well as the ruined Orangery and walled garden (HB Number 46054) all listed at Category C. To the south of the castle, lies the category B listed dovecot.

The interrelationship of the castle to the associated structures and spaces within the Garden is not affected by the Proposed Development. The Proposed Development will not be directly visible from the principal elevations of the castle, but will be visible in the distance and above intervening settlement from the upper stories on north-eastern elevation, in the periphery of views from the south-eastern elevations. Vegetation within the Gardens and surrounding the castle close to its north will prevent views towards the Proposed Development at ground level from that side, but there is some potential for views from outside of the south-eastern facing elevation across the firth, in which the Proposed Development will be clearly visible. The vegetation in the grounds of the Castle limits the potential for long views towards the castle in which the Proposed Development will also be visible (other than in the periphery, where such views may be available).

Sea and coastal views are an important aspect of the castles setting, sited as it is above a cliff. However, it is considered that it is the availability of such views that is key, not what the views contain. Whilst the Proposed Development will constitute a new element in such views (towards the east), the coastline is quite well developed, and the firth is relatively well used for commercial shipping. Weather permitting, fine views toward the Pentlands and Lammamuir Hills to the south and east as well as to other topographic features within the firth or along the cost to north-east and south-west will still be available, albeit with the Proposed Development in the foreground in some directions. This is not considered to jeopardise the significance of the Castle itself, nor it architectural, historic or other attributes, nor its relationships with the surrounding structures and spaces within the Designed landscape.

The potential magnitude of change of the Proposed Development upon the setting of the castle is considered to be of "low" magnitude, in that the Proposed Development will only be visible from upper floors of the castle, or from the exterior of the south-eastern elevation or glimpsed above tree lines in occasional views from within the grounds and in the vicinity of associated structures within the estate. The Proposed Development will not affect the prominence of the castle in any available long views towards the castle (along the coast). A representative Viewpoint from the Coastal path south of the Castle is presented as VP 7 in Figure 5.3a of the EIAR.

Further, the Proposed Development will not affect the interrelationship of the Castle to the Historic Garden, which is considered to form its setting, nor to elements within that setting, namely the associated listed buildings, spaces and gardens. Although the Castle (and grouped structures) is of "high" sensitivity, the potential for significant effects to occur upon its setting is assessed as "minor" in significance. This is not significant for purposes of the EIA Regulations.

Amended Evaluation

As previously assessed the interrelationship of the castle to the associated structures and spaces of the associated features of the castle will not be affected by the Proposed Development. Due to their positioning on the landscape the increased height of the blade tip will not impact any of these visual relationships. These interrelationships are considered to form the buildings' settings. However there is the possibility that with the additional height, the Proposed Development may become visible to lower stories on the north-eastern elevation, in the periphery of views form the south-eastern elevation. Vegetation within the Gardens and surrounding the castle close to its north will prevent views towards the Proposed Development at ground level from that side, but there is some potential for views from outside of the south-eastern facing elevation across the firth, in which the Proposed Development will be clearly visible.

The increased height will not change what the view contains as the previous assessment was also for a wind turbine. This is not considered to jeopardise the significance of the Castle itself, nor it architectural, historic or other attributes, nor its relationships with the surrounding structures and spaces within the Designed landscape.

The potential magnitude of change of the Proposed Development upon the setting of the castle is considered to be of "low" magnitude, in that the Proposed Development will only be visible from upper and possibly lower floors of the castle, or from the exterior of the south-eastern elevation or glimpsed above tree lines in occasional views from within the grounds and in the vicinity of associated structures within the estate. The Proposed Development will not affect the prominence of the castle in any available long views towards the castle (along the coast). A representative Viewpoint from the Coastal path south of the Castle is presented as VP 7 in Figure 5.3a of the EIAR.

Despite the possibility of additionally viewing the Proposed Development from the aforementioned lower stories, the assessment of its impact remains the same. The Castle (and grouped structures) is of "high" sensitivity, the potential for significant effects to occur upon its setting is assessed as "minor" in significance. This remains not significant for purposes of the EIA Regulations.

- Balgonie castle with curtain walls, boundary walls, gatepiers and well (Index number IR-004; Designated code LB16664)

Evaluation

This castle is included in this assessment due to the increased height of the blade tip and was not previously evaluated. The castle is located approximately 7.26 km form the proposed position of the turbine. It lies immediately north of an associated scheduled monument that is an artillery fortification described above. The building is a late 14th early 15th century courtyard castle. Additions were added in the 16th and 17th century by John Mylne Junior. The castle is built with a steep drop to the north and a double moat on the remaining sides. The features associated with the listing include curtain walls, boundary walls, gatepeirs and well. The keep in particular is one of the best of its class in Scotland. The value of the site is based on its historical and archaeological interest.

Modern approaches to the castle is primarily from the south. Surrounding the castle is landscaped lawn surrounded by the River Levan to the north east and west, with associated riverine tree copse, and agricultural fields to the south. Also to the west are the Balgonie policies walled Garden a category B listed building (HB number LB16665), and a Balgonie Policies, gardeners cottage with outbuilding and boundary walls (HB number LB42967) a category C listed building. The Proposed Development will not obscure the interrelated views of the Castle to these structures which were built after the castle in the 18th and 19th centuries.

Sea and coastal views are an important aspect of a castle's setting, sited as it is on a rise in the landscape. However, it is considered that it is the availability of such views that is key, not what the views contain. Whilst the Proposed Development will constitute a new element in such views (towards the southeast), the coastline is quite well developed. Weather permitting, fine views toward the Pentlands and Lammamuir Hills to the south and east as well as to other topographic features within the castle or along the cost to north-east and south-west will still be available, albeit with the Proposed Development in the foreground in some directions. This is not considered to jeopardise the significance of the Castle itself, nor it architectural, historic or other attributes, nor its relationships with the surrounding structures and spaces within the Designed landscape.

The potential magnitude of change of the Proposed Development upon the setting of the castle is considered to be of "low" magnitude. The Proposed Development will not affect the prominence of the castle in any available long views towards the castle (along the coast). The Castle (and grouped structures) is of "high" sensitivity, the potential for significant effects to occur upon its setting is assessed as "minor" in significance. This remains not significant for purposes of the EIA Regulations.

Category B Listed Buildings

Category B are considered regionally important and of "medium" sensitivity. There are 116 entries within 7.5 km, the majority of which lie within the settlements of Windygates (primarily associated with the Cameron Hospital), Leven and Kennoway. Those within 3.5 km (17 entries) are assessed separately and in detail below. The buildings between 3.5 – 7.5 km are considered in groups (as related structures or by settlement) where appropriate.

Category B Listed Buildings within 3.5km

- Randolph Wemyss Memorial Hospital (Index number IR-008; Designated code LB22716)

Initial Evaluation

The hospital was built in 1908 and has an extension built in 1965. It lies approximately 2 km north of the proposed turbine. It setting is determined by it urban location with a residential street to either side (including between it and the Fife Energy Park).

The main entrance and elevation are on the south-eastern facing side of the building (towards the Proposed Development), so that views towards this elevation will not include the Proposed Development. The Proposed Development will be visible above and between intervening structures in views to the south-east from the grounds and upper floors, but although large in scale, are not out of keeping with other industrial elements visible from the hospital (including the cranes and structures of the Fife Energy Park along with the FEPOWDT).

Long views towards the hospital are limited by its urban location, and the extension is the most prominent feature in those limited views that are available (mainly from south-west to the north-east, along the streets on either side). There are no views of the main elevations in which the Proposed Development will intrude into the foreground.

The hospital is of "medium" sensitivity by virtue of its level of designation, and despite the proximity and scale of the Proposed Development, the Proposed Development is considered to cause a change of "negligible" magnitude in its setting. This is due to the limited views to and from the hospital, and takes into account its current urban setting. The potential effect upon the setting of the hospital is therefore assessed as being of "not significant".

Amended Evaluation

As previously mentioned the Proposed Development will not obscure the visibility between the hospital and its associated buildings. Despite the added height of the turbine blade tip, long views towards the hospital will remain limited by its urban location, and the extension is the most prominent feature in those limited views that are available (mainly from south-west to the north-east, along the streets on either side). There are no views of the main elevations in which the Proposed Development will intrude into the foreground. Therefore the outcome of the original assessment will remain the same.

The hospital is of "medium" sensitivity by virtue of its level of designation, and despite the proximity and scale of the Proposed Development, the Proposed Development is considered to introduce a change of "negligible" magnitude in its setting. This is due to the limited views to and from the hospital, and takes into account its current urban setting. The potential effect upon the setting of the hospital is therefore assessed as being of "not significant".

- St Andrews Theatre, Buckhaven (Index number IR-009; Designated code LB22711)

Initial Evaluation

The theatre is a conversion of a former church dating back to the 1820's, with an extension built in the 1980s. It lies approximately 1.8 km north north-west of the proposed turbine. Its principal entrance and elevation are on its eastern side, so that views towards it will not include the Proposed Development. Its setting is considered to be streetside and urban in character, fronting onto the B944.

The Proposed Development is unlikely to be visible from the streets around the theatre (and where any visibility is possible (for example along the B944), this is likely to be confined to tips of blades only. The building's essential streetside setting is considered to be unchanged, and the way in which it is experienced will not be altered. This considered to constitute a change of "negligible" magnitude only (in that the skyline will receive a substantial change) upon a building of "medium" sensitivity. The Proposed Development will not fundamentally change the immediate setting of the building, nor affect its current function, nor jeopardise the ability to appreciate the building's special architectural and historic interest. The potential effect upon its setting is therefore assessed to be "not significant".

Amended Evaluation

Due to the increased height of the blade tips it is more likely that the blade tips will be visible along the B944. However, the building's essentially streetside setting is considered to be unchanged, and the way in which it is experienced will not be altered. This is considered to constitute a change of "low" magnitude only (in that the skyline will receive a substantial change) upon a building of "medium" sensitivity. The Proposed Development will not fundamentally change the immediate setting of the building, nor affect its current function, nor jeopardise the ability to appreciate the building's special architectural and historic interest. The potential effect upon its setting is therefore assessed to be "minor". This is not considered to be significant for the purposes of the EIA Regulations.

- Methilhill 1-8 Wilson Square (Index number IR-010 ; Designated code LB19129 (and associated structures) (8 entries))

Initial Evaluation

These single storey buildings (in three terraces) lie on the north, western and eastern sides of a square fronting on to the B932, at a distance of approximately 3.1 km north-north-west of the proposed. The setting of the buildings is considered to be defined by their relationship to the square itself, to the B932 to the south and to the surrounding residential developments; including the residential properties present on the southern side of the road.

The buildings themselves are not visible from long distance, being surrounded by neighbouring properties, and views from the south into the square (and towards the principal elevations of the properties) will not include the Proposed Development. The Proposed Development may be visible above intervening structures in views to the south-south-east from the square, but this is considered to be a change of “low” magnitude in the setting, in that there is a change in the current skyline only.

The integrity of the design around the square is not affected, nor is the ability to appreciate the architectural and socio-historic interest in the buildings, which are considered to be of “medium” sensitivity by virtue of their level of designation. The potential effect upon the sitting of the buildings is therefore assessed as being “minor” and this applies only to the change to the existing views to the south from the square (and within the south facing range). This is not considered significant for purposes of the EIA regulations.

Amended Evaluation

The extended height of the blade tips will encroach more upon the skyline of the setting surrounding these buildings. As mentioned above but this is considered to be a change of “low” magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the square is not affected, nor is the ability to appreciate the architectural and socio-historic interest in the buildings, which are considered to be of “medium” sensitivity by virtue of their level of designation. The potential effect upon the sitting of the buildings is therefore still assessed as being “minor” and this applies only to the change to the existing views to the south from the square (and within the south facing range). This is not considered significant for purposes of the EIA regulations.

- Methilhill House, Methilhill (Index number IR-011; Designated code LB46080)

Initial Evaluation

This 19th century house lies within a large garden, with its principal elevation facing to the south-east (towards the Proposed Development, and approximately 3.2 km from the proposed turbine). The front elevation of the house is screened by vegetation within the garden.

Views towards the house are limited by adjacent properties and the boundary wall (which forms part of the listing). The setting of the house is considered to be defined by the garden to its south, the neighbouring buildings to its west, along with the minor access road and Leisure Centre to its east and north east.

The setting as described above is not considered to be changed by the Proposed Development, nor is architectural interest in the house jeopardised, even where the Proposed Development may be visible in views to the south-east. The effect is considered to be “negligible” in magnitude, upon a feature of “medium” sensitivity, and therefore the potential effect of the Proposed Development upon the setting of Methilhill House is assessed to be “not significant”.

Amended Evaluation

The extended height of the blade tips may encroach more upon the skyline of the setting of the garden to the south. This is considered to be a change of “low” magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the house is not affected, nor is the ability to appreciate the architectural and socio-historic interest in the building, surrounding buildings, and its garden, which are considered to be of “medium” sensitivity by virtue of their level of designation. The potential effect upon the sitting of the buildings is therefore still assessed as being “minor” and this applies only to the change to the existing views to the south from the square (and within the south facing range). This is not considered significant for purposes of the EIA regulations.

- Methil Parish Church (Index number; Designated code LB22712

Initial Evaluation

The listing includes the boundary walls and gatepiers. The church is located within a churchyard within Methil, approximately 2.3 km to the north of the proposed location of the turbine. Although there is open greenspace to the southwest of the church, its setting is considered to be essentially urban, with residential housing to its north and south.

Long views towards the church are only available from the south-west, and these will not include the Proposed Development. The Proposed Development may be visible in glimpsed views between and above intervening structures from the churchyard. It is noted that these views will already include residential housing blocks and the structures belonging to the steel fabrication yard that occupies the north-eastern part of the Fife Energy Park site. The addition of the Proposed Development to the skyline in views to the south-west from the church is considered to be a change of only “low” magnitude in the setting of a feature of “medium” sensitivity, the significance of which is assessed as being “minor”. This is not considered to be significant for purposes of the EIA regulations.

Amended Evaluation

The extended height of the blade tips will encroach more upon the skyline of the setting surrounding the church and its associated churchyard. As mentioned above but this is considered to be a change of “low” magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the square is not affected, nor is the ability to appreciate the architectural and socio-historic interest in the church, which is considered to be of “medium” sensitivity by virtue of its level of designation. The potential effect upon the sitting of the buildings is therefore still assessed as being “minor” and this applies only to the change to the existing views to the south from the square (and within the south facing range). This is not considered significant for purposes of the EIA regulations.

Aberhill Primary School, Methil (Index number IR-013 ; Designated code LB46076)
The school is located approximately 2.6 km north of the proposed turbine. It is single storey and has an unusual cruciform plan, and sits within its own schoolyard, enclosed by a boundary wall. The building’s setting is considered to be urban and limited by the boundary wall (which forms part of the listing). It is surrounded by residential development to south, east and west, with industrial units and warehousing across rough ground to its north.

The school’s setting is not considered to be affected by the Proposed Development even where the Proposed Development may be visible from within the schoolyard, or its immediate proximity, and the architectural interest in the building is not considered to be jeopardised. The Proposed Development is considered to have an effect of “negligible” magnitude upon the setting of a feature of “medium” sensitivity, which is assessed as “not significant”.

Amended Evaluation

Due to the setting being limited to the boundary wall of the school, the extended height of the blade tips will not create any further changes to the setting. The assessment of the school will remain the same where its sensitivity is “medium” by virtue of its level of designation. The Proposed Development is still considered to have an effect of “negligible” magnitude upon the setting, which is then assessed as “not significant”.

- Ashgove House, Methilhill (Index number IR-014; Designated code LB22715)

Initial Evaluation

This building is located on the outskirts of Methil, approximately 3.5 km north north-west of the turbine, on the south side of the B932. The building's setting defined by its roadside location and by the residential properties in close proximity to its north and open fields to the south. The Proposed Development will be visible in views to the south-east, above the school and other intervening structures, including the ORE Catapult Levenmouth turbine. The presence of the Proposed Development will not affect the immediately setting as described above, but will constitute additional vertical elements in the views to south-east.

Given the intervening urban structures, and other tall structures along the coast in Methil, the Proposed Development is considered to cause a change of "low" magnitude (upon a feature of "medium" sensitivity) in the setting, which is assessed as having an effect of "minor" significance upon the building's setting. This is not significant for purposes of the EIA regulations.

Amended Evaluation

The extended height of the blade tips will encroach more upon the skyline of the setting surrounding the building. As mentioned above but this is considered to be a change of "low" magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the building is not affected, nor is the ability to appreciate the architectural and socio-historic interest in the building, which is considered to be of "medium" sensitivity by virtue of its level of designation. The potential effect upon the sitting of the building is therefore still assessed as being "minor" and this applies only to the change to the existing views to the southeast. This is not considered significant for purposes of the EIA regulations.

- Greig Institute, Leven (Index number IR-015; Designated code LB37349);
- 40 High Street (TSB), Leven (Index number IR-016; Designated code LB46500);
- St. Margaret's Church (Index number IR-017; Designated code LB37347).

Initial Evaluation

The buildings and structures listed above are all located within Leven at distances of between 3.2 to 3.5 km north and north north-east of the Proposed Development. They are all considered to have settings determined by their streetside locations and can be characterised as urban.

These settings are not considered to be changed, even where the Proposed Development may visible above, between and behind intervening structures and vegetation, and the architectural and historic interest in the buildings will not be harmed. In all cases the magnitude of the potential change in setting of these structures of "medium" sensitivity is considered to be "negligible". The potential effect upon their settings is therefore assessed as "not significant".

Amended Evaluation

Due to the setting being limited to their streetside location the extended height of the blade tips will not create any further changes to the settings. The assessment of the buildings will remain the same where its sensitivity is "medium" by virtue of its level of their designation. The Proposed Development is still considered to have an effect of "negligible" magnitude upon the setting, which is then assessed as "not significant".

Category B listed buildings from 3.5-7.5

- Balgonies Policies, Walled Garden (Index number IR-018; Designated code LB16665)

Evaluation

This asset is a late 18th early 19th century rectangular plan walled garden, it was not included in the initial assessment as it is located approximately 7.5 km from the Proposed Development. It measures roughly 170 m by 280 m with a dilapidated dividing wall running east to west. The dividing wall appears to have been partly demolished the east to allow for the building of a Gardener's Cottage (Category C, LB42967). The garden is located next to Balgonie Castle described above, and the view of the castle or gardener's cottage from the garden will not contain the Proposed Development. The long view to the south of garden may include the Proposed Development but the urban area of Buckhaven is in the foreground.

The Proposed Development will encroach upon the skyline to the south but this is considered to be a change of “low” magnitude in the setting, in that there is a change in the current skyline only. The integrity of the design around the garden is not affected, nor is the ability to appreciate the architectural and socio-historic interest in the garden, which is considered to be of “medium” sensitivity by virtue of its level of designation. The potential effect upon the sitting of the buildings is therefore still assessed as being “minor” and this applies only to the change to the existing views to the south from the square (and within the south facing range). This is not considered significant for purposes of the EIA regulations.

- Burnside Of Letham Including Watermill With Wheel And Steading (Index number IR-019; Designated code LB49899 (5 entries))

Evaluation

This is a mid to late 18th century farm group with later alterations that includes a farmhouse, waterwheel, watermill with wheel, and steading rubble. The value of the buildings are due to their historical and archaeological value rather than its setting. The view of the sea is unlikely to have played an important role in the function of the farm. The group is located approximately 6.7 km from the turbine.

The group’s setting is not considered to be affected by the Proposed Development even where the Proposed Development may be visible from within the group or its immediate proximity, and the architectural interest in the buildings are not considered to be jeopardised. The Proposed Development is considered to have an effect of “negligible” magnitude upon the setting of a feature of “medium” sensitivity, which is assessed as “not significant”.

- East and West Wemyss

Evaluation

West Wemyss (also a conservation area) village and East Wemyss village are joined by a garden and designed landscape that extends from the north of West Wemyss to the southern end of East Wemyss and contain numerous listed buildings. Listed Buildings at its eastern end of West Wemyss are typically newer and generally listed at Category C. Those within the village core and towards the western (harbour) end are older and generally of a higher category. Within East Wemyss the Category B buildings are generally cluttered in the east by the seaside with more Category C buildings scattered throughout the central part of the village. There are approximately 25 records for category B listed buildings in East and West Wemyss (some of which are multiple entities associated with single Historic Building numbers), situated between approximately 4.5 and 5 km to the west south-west of the proposed turbine. They are assessed together, in part due to their group value, and due to them having essentially the same setting. The majority of these, included the Tolbooth (IR-020; LB16694) are located along Main Street. Most of the buildings face north on to the street, with their backs to the strip of land on the coastward side (facing south or south south-east). Some, such as the Harbour structure itself (IR-021; LB16675), are not predicted to be intervisible with the Proposed Development, and others, such as the Belvedere Hotel with associated structures (IR-022; LB46055), are predicted to have only limited intervisibility. Realistically, all of the buildings will have limited visibility with the Proposed Development, especially from along Main Street. However, there may be oblique views of the Proposed Development from rear (upper floor) windows.

Their settings are essentially defined by their place within the village, facing north onto the main street leading west towards the harbour (and the village’s historic role in fishing). Whilst the Firth-side setting is important in terms of understanding the village’s existence as a fishing port, many of the residential structures face away from the sea, and are more closely linked to each other and to the harbour structures; sea views do not seem to be important for the majority of the buildings under consideration.

The view of (IR-023, LB16407; and IR-024, LB46041) a Former Parish with associated gate and gate pier, and graveyard with walls and gravestones, in East Wemyss are most like to have view of the turbine when looking northeast, however the approach to these structures is from the west and the view to the structures from surrounding buildings will not be obscured by the Proposed Development. The visual impact of the Proposed Development will be limited to the skyline.

It is considered that there is not a single case where the architectural or historic interest of these buildings is reduced or harmed by occasional views of the Proposed Development from the rear of the structures, or in glimpsed views between and behind buildings fronting on to the main street. The Proposed Development is unlikely to be visible at all from the core of the villages along Main Street; or from the harbour and its immediate vicinity. The approach into the village from the north will not include views of the Proposed Development, and there are no long views towards the village (in particular towards the Harbour and Main Street) along the Coastal Path in which the Proposed Development will intrude. The ability to experience the buildings and their relationships to each other and to the harbour, and to understand the function and evolution of the settlement is not in any case jeopardised. The Proposed Development is considered to constitute a change of “low” magnitude upon assets of “medium” sensitivity, and the effect on the settings of these buildings is assessed in every case as “minor” and this is not significant for the purposes of EIA Regulations. Their value as a group, and as contributors, to the value of the villages as a Conservation Area is also not considered to be diminished.

- Coaltown of Balgonie, Barrell Bridge (Index number IR-025; Designated code LB42980)

Evaluation

This is an early 18th century double arch bridge with cutwater buttresses to the centre pier. Rubble spandrels are present with squared and coursed rubble soffits. The value of this bridge is based on its historical and architectural associations. The view to the sea did not play an important role in the original function of the bridge. It is located approximately 7.02 km from the Proposed Development to the south east. The Proposed Development will likely be visible from the bridge when looking to the southeast but the urban area of East Wemyss is in the foreground.

The bridge’s setting is not considered to be affected by the Proposed Development even where the Proposed Development may be visible from the bridge or its immediate proximity, and the architectural interest in the bridge is not considered to be jeopardised. The Proposed Development is considered to have an effect of “negligible” magnitude upon the setting of a feature of “medium” sensitivity, which is assessed as “not significant”.

- Leven (Category B’s)

Evaluation

There are twelve Category B listed buildings, some of these buildings have associated features within a single reference, in the vicinity of Leven. They are approximately 3.1 to 5.1 km north from the turbine location of the Proposed Development. They are assessed together, in part due to their group value, and due to them having essentially the same setting. The majority of these are located along Carberrry Road which runs northeast/southwest through village. The view of the sea almost entirely blocked by surrounding buildings the blade tips of the Proposed Development may be visible in the skyline in between buildings.

Their settings for the majority of the structures are essentially defined by their place within or surrounding the village, most facing northwest on streets away from the Proposed Development. However, the Duniface Farmhouse and steading, outbuilding, boundary wall, gate piers and gates (IR-026; LB42982) is located on the northwest outskirt of Leven. The significance of this mid-19th century farmhouse and its associated features is due to its historical associations. It is likely that the blade tips of the Proposed Development will be visible in the skyline of the upper stories of the house. It is unlikely however, that the view of the sea was important to the original function of the farm. The view of the Proposed Development from the house will also be partially obstructed by the modern buildings of the village of Levin.

It is considered that there is not a single case where the architectural or historic interest of these buildings is reduced or harmed by occasional views of the Proposed Development from the rear of the structures, or in glimpsed views between and behind buildings fronting on to the main streets. The Proposed Development is unlikely to be visible at all from Carberry Road. The approach into the village from the south will not include views of the Proposed Development, and there are no long views towards the village (in particular towards the Harbour and Main Street) along the Coastal Path in which the Proposed Development will intrude. The ability to experience the buildings and their relationships to each other and to the harbour, and to understand the function and evolution of the settlement is not in any case jeopardised. The Proposed Development is considered to constitute a change of “low” magnitude upon assets of “medium” sensitivity, and the effect on the settings of these buildings is assessed in every case as “minor” and this is not significant for the purposes of EIA Regulations. Their value as a group is also not considered to be diminished.

- Kennoway Village

Evaluation

There are ten Category B listed buildings, some of these buildings have associated features within a single reference number in the vicinity of Kennoway. They are approximately 5.34 to 6.14 km northwest from the turbine location of the Proposed Development. They are assessed together, in part due to their group value, and due to them having essentially the same setting. The majority are located along New Road which becomes Cupar road. This road runs roughly north south through the village. The houses are facing the road to their east and west. With no primary views south towards the Proposed Development. The Proposed Development may be partially visible between buildings in the skyline, but this view will be obscured by the modern buildings in the villages of Methil and Buckhaven.

Their settings for the majority of the structures are essentially defined by their place within or surrounding the village, most facing northwest on streets away from the Proposed Development. However the Kingsdale House including ancillary buildings and walled garden (IR-027; LB10009) is on the outskirts of Kennoway. This 19th century house and garden is significant for its historical associations. It is located southwest of the more urban area of Kennoway and the view to the southeast from the garden and the house may include the blade tips of the Proposed Development. However this view will likely be obscured by the modern buildings of Windygates, Buckhaven and Methil in the foreground.

It is considered that there is not a single case where the architectural or historic interest of these buildings is reduced or harmed by occasional views of the Proposed Development from the rear of the structures, or in glimpsed views between and behind buildings fronting on to the main streets. The Proposed Development is unlikely to be visible at all from Cupar Road. The approach into the village from the south will not include views of the Proposed Development. The ability to experience the buildings and their relationships to each, and to understand the function and evolution of the settlement is not in any case jeopardised. The Proposed Development is considered to constitute a change of “low” magnitude upon assets of “medium” sensitivity, and the effect on the settings of these buildings is assessed in every case as “minor” and this is not significant for the purposes of EIA Regulations. Their value as a group is also not considered to be diminished.

- Upper and Lower Largo

Evaluation

There are 21 Category B listed buildings, some of these buildings have associated features within a single reference number, in the vicinity of Upper and Lower Largo. They are approximately 6.3.to 7.5 km northwest from the Proposed Development. They are assessed together, in part due to their group value, and due to them having essentially the same setting. The majority are located along Main Street in Lower Largo (also a conservation area). Main Street runs roughly east-west through the village. The buildings on the north side of Main Street will have a view of the Proposed Development interspersed between buildings located on the south side of Main Street and primarily form upper stories. While the buildings on the South side of Main Street will have a view of the Proposed Development to the southwest of their rear entrances. Their settings for the majority of the structures in Lower Largo are essentially defined by their place within or surrounding the village.

The three buildings in Upper Largo the Upper Largo home farm dovecot (IR-028; LB8988), Upper Largo, Largo House (IR-029; LB8966), and Upper Largo Road Eaglegate gatepiers (IR-030; LB8991) are also located in a conservation area. The Largo the Upper Largo home farm dovecot and Upper Largo, Largo House are associated with the Sir Andrew Woods Tower Scheduled monument discussed above. The Proposed Development will not impede the interrelated nature of these structures. The view on the approach to these buildings from the south will not include the Proposed Development. The blade tips of the turbine will possibly be visible when looking southwest, but the view will include the urban development of Lower Largo, and the nature of the view will be limited to the skyline.

It is considered that there is not a single case where the architectural or historic interest of these buildings is reduced or harmed by occasional views of the Proposed Development from the rear of the structures, or in glimpsed views between and behind buildings fronting on to the main streets. The Proposed Development is unlikely to be visible at all from Main Street. The approach into the villages from the south will not include views of the Proposed Development. The ability to experience the buildings and their relationships to each other, and to understand the function and evolution of the settlement is not in any case jeopardised. The Proposed Development is considered to constitute a change of “low” magnitude upon assets of “medium” sensitivity, and the effect on the settings of these buildings is assessed in every case as “minor” and this is not significant for the purposes of EIA Regulations. Their value as a group is also not considered to be diminished.

- Lundin Links

Evaluation

There are four Category B listed buildings, some of these buildings have associated features within a single reference number in the vicinity of the Lundin Links Golf Course. They are approximately 4.9 to 6.1 km northwest from the turbine location of the Proposed Development. They are assessed together, in part due to their group value, and due to them having essentially the same setting. The three structures Largo Road, Obertal (IR-031; LB37352), Lundin Town (IR-032; LB8956) are located on the periphery of the golf course. Their importance is due to their architectural associations. Their setting is not considered of importance, however, the Proposed Development will likely be included in views to the southwest which will include the modified landscape of the golf course. The Proposed Development will not be visible in views approaching the structures from the south.

The Silver Burn House Estate Offices (IR-033; LB16679) is a category B listed building but is associated closely with four Category C listed buildings. This mid-19th century two-story house is important due to its historical associations a flax mill and the houses built for its workers. The Proposed Development will not impact the interrelated connections of the buildings. And when approaching the buildings from the south the Proposed Development will not be included in the view. The areas to the south and east of the buildings are all golf course. But the Proposed Development will likely be visible when looking southwest although this view will also include a modern caravan park along the coastline.

It is considered that there is not a single case where the architectural or historic interest of these buildings is reduced or harmed by views of the Proposed Development. The ability to experience the buildings and their relationships to each other, and to understand the function and evolution of the settlement is not in any case jeopardised. The Proposed Development is considered to constitute a change of “low” magnitude upon assets of “medium” sensitivity, and the effect on the settings of these buildings is assessed in every case as “minor” and this is not significant for the purposes of EIA Regulations. Their value as a group is also not considered to be diminished.

- Milton of Balgonie

Evaluation

There are four Category B listed buildings in the vicinity of Milton of Balgonie. They are approximately 5.9 to 6.5 km northwest from the turbine location of the Proposed Development. They are assessed together, in part due to their group value, and due to them having essentially the same setting. Their importance is derived from their architectural and historical associations rather than their setting. They are located in the near agricultural fields near the eastern extent of Milton of Balgonie. Their settings are essentially defined by their place within or surrounding the village. Views approaching the buildings from the west will not include the Proposed Development. But views to the southeast will include the Proposed Development with the urban areas of Buckhaven and Methil in the foreground.

It is considered that there is not a single case where the architectural or historic interest of these buildings is reduced or harmed by views of the Proposed Development. The ability to experience the buildings and their relationships to each other, and to understand the function and evolution of the settlement is not in any case jeopardised. The Proposed Development is considered to constitute a change of “low” magnitude upon assets of “medium” sensitivity, and the effect on the settings of these buildings is assessed in every case as “minor” and this is not significant for the purposes of EIA Regulations. Their value as a group is also not considered to be diminished.

- Windygates

Evaluation

There are 13 Category B listed buildings in the vicinity of Windygates. They are approximately 3.8 to 4.2 km northwest from the turbine location of the Proposed Development. They are assessed together, in part due to their group value, and due to them having essentially the same setting. Several are associated with the Cameron hospital (Cameron Hospital, Haig House IR-034, LB16684; Cameron Hospital, Pavilion wards and Loges, IR-035, LB43384 (5 entities); and Cameron House, IR-036, LB43009). All are closely related to the River Leven at the northwest of the turbine. These settings are related to each other and the grounds in which they are situation, the perimeter of which is marked by trees. The setting also includes their relationship to the river (and distillery beyond). Their surrounding spaces, even where the Proposed Development may be visible at distance and above or between trees and intervening structures from within the hospital’s grounds. The architectural and historic interest in the buildings is not considered to be jeopardised.

The other structures in the north of Windygates are buildings whose significance is based on architectural and historical significance rather than their setting. Their settings are essentially defined by their place within or surrounding the village. The approach to the village from the south and west will not include the Proposed Development. Any views of the Proposed Development will be restricted to the skyline when looking to the southeast. This view will also include the modern structures of the villages of Buckhaven and Leven.

It is considered that there is not a single case where the architectural or historic interest of these buildings is reduced or harmed by views of the Proposed Development. The ability to experience the buildings and their relationships to each other, and to understand the function and evolution of the settlement is not in any case jeopardised. The Proposed Development is considered to constitute a change of “negligible” magnitude upon assets of “medium” sensitivity, and the effect on the settings of these buildings is assessed in every case as “minor” and this is not significant for the purposes of EIA Regulations. Their value as a group is also not considered to be diminished.

- Agricultural Fields along Standing Stane Road

Evaluation

There are three Category B farms that lie in farmland to the west of Windygates, over 4.1 km and 4.6 km respectively north-west and north-north-west from the Proposed Development, along Standing Stane Road. The settings of both are determined by their surrounding gardens, and proximity to the associated barns and outbuildings. Woodbank (IR-037, LB43018) lies in close proximity to the A915 which lies immediately to the south and has a substantial barn/warehouse close to its eastern side. Little Lun (IR-038, LB42985) has screening from mature trees to its south and east. Newton Farmhouse (IR-039, LB46046) has screening from mature trees to its east, west, and south. The settings of all the buildings are considered to be defined by their gardens, proximity to outbuildings and other ancillary structures.

It may be possible that the blade tips are visible when looking southeast but the view will include the modern development of Buckhaven in the foreground. In all three cases the Proposed Development will constitute a change of “negligible” magnitude in the setting of features of “medium” sensitivity, and the effect upon their settings is therefore assessed as “minor” and this is not significant for the purposes of EIA Regulations.

- Newton Hall (Index number IR-040, Designated code LB10010)

Evaluation

This building was constructed in 1829, it is a two-story Tudor mansion with a gabled stone porch, low service wing and courtyard to the west. The building is significant due to its architectural and historical associations. It is located northwest of Balcurvie approximately 6.4 km from the Proposed Development. The view southeast from the courtyard is screened by mature trees and is unlikely to include the Proposed Development. The view from the upper-stories of the house are the only locations likely to have a view of the bladetips due to additional screening at the ground level of mature trees north of Balcurvie.

It is not considered that the architectural or historic interest of these buildings is reduced or harmed by views of the Proposed Development. The ability to experience the building and to understand the function and evolution of the site is not in any case jeopardised. The Proposed Development is considered to constitute a change of “negligible” magnitude upon asset of “medium” sensitivity, and the effect on the setting of this building is assessed as “minor” and this is not significant for the purposes of EIA Regulations.

Category C buildings within 3.5 km

For purposes of this assessment Grade C is considered to be locally important and of “low” sensitivity. Only those lying within 3.5 km of the Proposed Development location have been considered, numbering 59 buildings in total. The category C buildings located within 3.5 km of the Proposed Development are discussed in relationship to their respective communities in detail below.

- Methil and Buckhaven

Evaluation

These two areas are joined by conurbation and so are considered together for the purposes of this analysis. There are 49 listed buildings with the densest clusters around Cowley Street in Methil (IR-041, LB46071; 24 entries) This cluster is named the Miners Cottages, Cowley Street. It consists of a single entry whose records refer to the two curved terraces of single story miners cottages along Cowley Street (Denbeath, Methil). The cottages were originally built in the late 19th century and reworked in the early 20th century. Their setting is considered to be urban and streetside, facing south with more modern housing on the southern side of the road. Industrial units lie in close proximity to north and north-west.

The Proposed Development will be visible from the street frontages, but above intervening structures. The proposed turbine is roughly 2.08 km south of the southernmost point of the terraces. The streetside character and urban setting is not considered to be affected, even where the Proposed Development may be visible, and the architectural and socio-historic interest preserved in the fabric of the buildings is not harmed.

The second cluster St. Andrews Square, Lower Methil (IR-042, LB46074) consists of 12 entities. This terrace of early 20th century local authority housing lies approximately 2.2 km north of the proposed turbine and is located on the south and eastern sides of a small square, which is open to the street on its north western side. The main entrances to the properties face to the north and west. There are adjacent residential properties in views from both front and rear of the terrace.

The setting is considered to be defined by the surrounding street and houses and is urban in character. This setting is not considered to be changed, even where the Proposed Development may be visible, and the architectural and socio-historic interest preserved in the fabric of the buildings will also not be harmed.

The remaining Category C buildings in Methil are important due to their architectural and historical associations. The settings are considered to be defined by the surrounding street and houses and is urban in character. This setting is not considered to be changed, even where the Proposed Development may be visible, and the architectural and socio-historic interest preserved in the fabric of the buildings will also not be harmed.

The final cluster of buildings in Buckhaven there are 6 category C buildings, including the Parish Church (IR-043, LB46068), the Royal Bank of Scotland (IR-044, LB46069) the community centre (IR-045, LB46070), the Miners Welfare Institute (IR-046, LB46072) and former Denbeath Parish Church and Hall (IR-047, LB50126; 2 entities). Again, all are considered to have streetside settings which are urban in character.

For the entirety of the Category C buildings in Methil and Buckhaven, the presence of the Proposed Development will not substantially change the character of this setting, even where visible in views between or above intervening structures. The architectural and socio-historic interest of the individual buildings are also not affected. The potential change in the settings of these buildings is considered to be “low” in magnitude and this is assessed as “not significant”.

- Leven (Category C’s)

There are ten Category C buildings in Leven. Six of which are clustered together along School Lane in Leven, under four entries: 2 Forth Street, Bank Of Scotland Building And Forth House (IR-048, LB46497) a 19th century house important for its historical associations; 68 And 70 High Street, Royal British Legion (IR-049, LB46501) a 19th century house important for its architectural associations; 74, 76 And 76a High Street (IR-050, LB46502) important for its architectural associations.; and 82 High Street And North Street (HB number Lb46503) important for its architectural associations. All are considered to have streetside settings which are urban in character. The Proposed Development will be visible from the street frontages, but above intervening structures.

The remaining for category C buildings in Leven are also important due to their architectural and historical associations. All are considered to have streetside settings which are urban in character. The Proposed Development will be also likely be visible from the street frontages, but above intervening structures.

For the entirety of the Category C buildings in Leven, the presence of the Proposed Development will not substantially change the character of this setting, even where visible in views between or above intervening structures. The architectural and socio-historic interest of the individual buildings are also not affected. The potential change in the settings of these buildings is considered to be “low” in magnitude and this is assessed as “not significant”.

9.7.3.2. Gardens and Designed Landscapes

There is one Inventoried Gardens and Designed Landscape within 7.5 km of the Proposed Development. This is Wemyss Castle. Further consideration of this landscapes is also given in the Landscape and Visual Assessment of the EIAR.

- Wemyss Castle (Index Number 2132; Designated code GDL0384)

Initial Evaluation

The Garden is located along the northern coast of the Firth of Forth, being approximately 3.4 km from the proposed turbine at its nearest point.

The Garden is centred on the Category A listed Castle (itself approximately 4.3 km from the Proposed Development). The enclosed park at Wemyss extended along the coast from ‘Weems Town [sic]’ (West Wemyss) to the Chemyss Burn by the early-mid 1700s. By 1775, the park was well delimited by perimeter planting alongside the West Wemyss to East Wemyss road. By the early 19th century a public road north of the Castle, dividing it from the ‘orchard’, had been transformed into a tree-lined drive. Wooded pleasure grounds lay to the south-east of the Castle and an ornamental parkland approach led to West Wemyss. Outer areas of the policies were planted with serpentine perimeter belts and clumps.

The extent of the designed landscape remains unchanged. Although the majority of the designated area is predicted to lie within the ZTV, is it likely that the extensive tree cover available within the park; in particular within the formal lawns close to the Castle itself, and along the principal avenues, will limit the extent to which the Proposed Development will be visible. The internal associations of the buildings and spaces within the parkland will not be affected, even where the Proposed Development may be visible above tree lines and at some distance, and the architectural record of the Proposed Development of the castle will not be subject to change. The Garden is considered to be outstanding by Historic Scotland and is therefor of “high” sensitivity, but the Proposed Development is considered to constitute a change of “low” magnitude due to its limited intervisibility from within the parkland, and the fact that the primary associations within the park are not affected. The potential effect of the Proposed Development is therefore considered to be “minor” change in setting, with some visibility above historic skylines. This is not considered to be significant for purposes of the

EIA regulations. It is noted that any effect upon the park's setting is temporary, albeit long-term and fully reversible upon decommissioning.

Amended Evaluation

The extended height of the blade tips will encroach more upon the skyline of the setting surrounding the park. As mentioned above but this is considered to be a change of "low" magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the landscape is not affected, nor is the ability to appreciate the beauty and design of the park, which is considered to be of "high" sensitivity by virtue of Historic Scotland's designation of outstanding. The potential effect upon the sitting of the building is therefore still assessed as being "minor" and this applies only to the change to the existing views to the southeast. This is not considered significant for purposes of the EIA regulations.

9.7.3.3. Conservation Areas

Six conservation areas have been identified within 7.5 km of the Proposed Development. These are in Leven, Coaltown of Wemyss, Upper and Lower Largo, Kennoway, and West Wemyss.

- Links Road, Leven (Index number IR-051, Designated code CA162)

Initial Evaluation

The Conservation Area consists of a small area of Leven above the promenade, approximately 3.4 km (at its closest point) to the north north-east of the proposed turbine. It setting is considered to be urban, and limited by the surrounding parts of Leven and the promenade and sea front to the south. This is not considered to be changed, even where the Proposed Development will be visible. Views towards the Proposed Development will already include the infrastructure associated with the Fife Energy Park and other development around Methil and its docks. The change is considered to be of "low" magnitude upon an asset of "medium" sensitivity, and therefore the potential effect of the Proposed Development upon the setting of the conservation area is assessed as being of "minor" significance and this is not considered to be significant for purposes of the EIA regulations.

Amended Evaluation

The extended height of the blade tips will encroach more upon the skyline of the setting surrounding the conservation area. This is considered to be a change of "low" magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the area is not affected, nor is the ability to appreciate the architectural, character, and historic value in conservation area, which is considered to be of "medium" sensitivity by virtue of its level of designation. The potential effect upon the setting of the area is therefore still assessed as being "minor". This is not considered significant for purposes of the EIA regulations.

- West Wemyss (Index number IR-056; Designated code CA174)

Initial Evaluation

The Area lies at between 5.2km to 4.5km south west of the Proposed Development. The southern (western) end of the conservation area includes the harbour and associated structures. The designation includes the main street running east up to the car park, church and cemetery at the eastern end of the area. The internal arrangements of the area are not affected, and the relationship of the area to the Garden and Designed landscape of Wemyss Castle is also not changed. The Proposed Development will be a relatively prominent new addition to views to the north-east from the eastern end of the Area. However, it is noted that such views will already include the developed and industrialised coast of at Buckhaven and Methil, including the infrastructure at the Fife Energy Park site and the ORE Catapult Levenmouth turbine. Views directly south and west are not affected, and the Proposed Development will only occupy a small arc of views to the east, down the Firth.

The essential character (and appearance) of the Area as a coastal small fishing port is not considered to be changed. The value of the area in terms of its contribution to the settings of the listed buildings within it (and their contribution to the Area's character) is undiminished. The presence of the Proposed Development in views to the north-east is considered to constitute a change of "low" magnitude upon a feature of "medium" sensitivity, and this is assessed as being of "minor" (and significant for purposes of the EIA regulations).

Amended Evaluation

The extended height of the blade tips will encroach more upon the skyline of the setting surrounding the conservation area. This is considered to be a change of "low" magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the area is not affected, nor is the ability to appreciate the architectural, character, and historic value in conservation area, which is considered to be of "medium" sensitivity by virtue of its level of designation. The potential effect upon the setting of the area is therefore still assessed as being "minor". This is not considered significant for purposes of the EIA regulations.

- Coaltown of Wemyss (Index number IR-052; Designated code CA139)

Initial Evaluation

The area lies approximately 4.2 km west of the Proposed Development and incorporates almost all of this planned settlement. The majority of the streets run approximately north-east to south-west, so that properties generally have facing north-west to south-east. The settlement is bounded by mature trees to its south. Approaches to the area from the north-east will not include views of the Proposed Development. Approaches from the south-west will have only occasional views, including the Proposed Development, due to the distance and the trees and structures at the western end of the village.

Intervening structures limit views out of the core of the area and views to the south and south-east are limited by tree cover on the settlement boundary. The interrelationship of the structures and spaces within the settlement will not be affected by the Proposed Development, even when visible in occasional glimpsed views. The magnitude of the potential change is considered to be "negligible" upon a feature of "medium" sensitivity. The effect of the Proposed Development upon the setting of the conservation area is therefore assessed as "negligible".

Amended Evaluation

The extended height of the blade tips will more likely encroach upon the skyline of the setting surrounding the conservation area. This is considered to be a change of "low" magnitude in the setting, in that there is a change in the current skyline only.

Despite the change in blade tip height, the integrity of the design around the area is not affected, nor is the ability to appreciate the architectural, character, and historic value in conservation area, which is considered to be of "medium" sensitivity by virtue of its level of designation. The potential effect upon the setting of the area is therefore assessed as being "minor". This is not considered significant for purposes of the EIA regulations.

- Kennoway (Index number IR-053; Designated code CA150)

This conservation area lies 5.58 km northwest of the Proposed Development area, as such it was not included in the initial assessment. The extent of the conservation area includes the original small market settlement of the village before modern development of the land spread to the north and east. There are no scheduled monuments but the area is considered archaeologically sensitive due to the antiquity of the settlement. The Maide Castle motte, to the south of the area is an indicator of early activity in the surrounding area. The Proposed Development will be a relatively prominent new addition to views to the southeast from the eastern end of the Area. However, it is noted that such views will already include the developed and industrialised coast of at Buckhaven and Methil, including the infrastructure at the Fife Energy Park site and the ORE Catapult Levenmouth turbine. Views directly south and west are not affected, and the Proposed Development will only occupy a small arc of views to the southeast.

The essential character (and appearance) of the Area as a market town is not considered to be changed. The value of the area in terms of its contribution to the settings of the listed buildings within it (and their contribution to the Area's character) is undiminished. The presence of the Proposed Development in views to the south-east is considered to constitute a change of "low" magnitude upon a feature of "medium" sensitivity, and this is assessed as being of "minor" (and not significant for purposes of the EIA regulations).

- Lower Largo (Index number IR-054; Designated code CA163)

This conservation area lies 6.34 km northwest of the Proposed Development area, as such it was not included in the initial assessment. The extent of the conservation area includes the buildings along Main Street on the coast at Lower Largo running east west from Harbour Wynd to Temple Road. The built heritage character of the conservation area is mostly that of a traditional East Neuk fishing village, although no fishing currently takes place. The Proposed Development will be a relatively prominent new addition to views to the southeast from the eastern end of the Area. However, it is noted that such views will already include the developed and industrialised coast of at Buckhaven and Methil, including the infrastructure at the Fife Energy Park site and the ORE Catapult Levenmouth turbine. Views directly south and west are not affected, and the Proposed Development will only occupy a small arc of views to the southeast.

The essential character (and appearance) of the Area as a fishing town is not considered to be changed. The value of the area in terms of its contribution to the settings of the listed buildings within it (and their contribution to the Area's character) is undiminished. The presence of the Proposed Development in views to the south-east is considered to constitute a change of "low" magnitude upon a feature of "medium" sensitivity, and this is assessed as being of "minor" (and not significant for purposes of the EIA regulations).

- Upper Largo (Index number IR-055; Designated code CA173)

This conservation area lies 6.9 km northwest of the Proposed Development area, as such it was not included in the initial assessment. The extent of the conservation area includes the designed landscape of Largo House and the essentially 19th century settlement of Kirkton of Largo which is centred on its 12th-century parish church. The setting of the village was originally cultured around the Parish Church which is sited on a knoll to the west of what is now Main Street. The Proposed Development will be a relatively prominent new addition to views to the southeast of the Area. However it is noted that such views will already include the developed and industrialised coast of Lower Largo. Views directly south and west are not affected, and the Proposed Development will only occupy a small arc of views to the southeast.

The essential character (and appearance) of the Area as a village is not considered to be changed. The value of the area in terms of its contribution to the settings of the listed buildings within it (and their contribution to the Area's character) is undiminished. The presence of the Proposed Development in views to the south-east is considered to constitute a change of "low" magnitude upon a feature of "medium" sensitivity, and this is assessed as being of "minor" (and not significant for purposes of the EIA regulations).

9.7.4. Decommissioning Effects

No direct effects are anticipated from the decommissioning of the Proposed Development. Any residual "minor" indirect effects on settings of some heritage assets will be removed. No additional significant indirect effects are anticipated from the short term presence of plant, etc., required during this phase.

9.8. Mitigation Measures and Residual Effects

No terrestrial recorded features within the site will be directly affected by the construction and decommissioning of the Proposed Development. As a result of previous development of the onshore site, industrial with substantial depths of made ground, it is considered that there is no potential for existing unknown archaeological remains to be damaged by the Proposed Development.

No mitigation is proposed or considered necessary in respect of any direct impacts.

No mitigation is proposed or considered necessary or practicable in respect of the "minor" effects upon the settings of any cultural heritage assets. The Proposed Development lifespan is of limited duration and is considered temporary and fully reversible.

9.8.1. Residual Effects

No residual direct effects are anticipated upon cultural heritage features within the Proposed Development site as no potential for such remains to exist has been identified.

There will be changes in the settings of some cultural heritage features (as noted in section 9.7 above). These are temporary, albeit long-term and fully reversible upon the decommissioning of the Proposed Development.

9.9. Cumulative Effect Assessment

A cumulative effect is considered to be an additional effect on cultural heritage resources arising from the Proposed Development in combination with other existing, consented, or proposed developments likely to affect the cultural heritage environment.

No additional cumulative effects have been introduced as part of this assessment, as no further relevant projects were identified for consideration. There remains an equivalent impact as a result of the material changes to the project design of those identified and during the EIAR.

9.10. Summary of Effects

Indirect effects (i.e. primarily visual effects) on the settings of heritage assets outwith the Proposed Development boundary are considered in relation to the operational phase of the Proposed Development.

No significant effects are anticipated during construction or decommissioning from short-term presence of plant etc. during these phases see Table 9.9.

Table 9.9 - Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
No direct effects on terrestrial archaeology are predicted.	None	None	None
Operation			
Effects on the settings of the following Heritage assets.	"Minor", from visual intrusion to setting, and are fully reversible. None are significant for purposes of the EIA regulations. This rating includes: • 6 Scheduled Monuments; • 141 Listed Buildings • 1 Garden and Designed Landscape 6 Conservation Areas	None	Continuation of "Minor" effects on settings, none of which are significant for purposes of the EIA regulations.
Decommissioning			
Restoration of existing settings	Removal of effect	None	Removal of impact

9.11. Statement of Significance

No significant effects are anticipated to occur as a result of impact to the settings of any cultural heritage assets arising from the construction, operation or decommissioning of the Proposed Development. Although a number of non-significant (i.e. effects of "minor" or lower significance) have been identified, these are considered temporary (albeit long term) and fully reversible upon the decommissioning of the Proposed Development. For a detailed list of every cultural heritage feature considered individually, see Table 9.10.

Table 9.10 - Cultural heritage features individually considered

Designated Code	Index Number	Name
SM7769	IR-001	Kilmux Colliery, beam engine house, 630m SW of Kilmux House
SM861	861	Maiden Castle,motte,Windygates
SM797	797	Standing Stones of Lundin, Lundin Links
SM6411	IR-002	Balgonie Castle, artillery fortification
SM817	860	MacDuff's Castle and Dovecot and the Caves at East Wemyss
SM874	IR-003	Sir Andrew Wood's Tower, Largo House
LB16664	IR-004	Balgonie Castle
LB16699	IR-005	Durie House
LB16699	IR-006	Office Court, Durie House
LB16699	IR-007	Sundial, Durie House
LB16709	2132	Wemyss Castle
LB22716	IR-008	Randolph Wemyss Memorial Hospital
LB22711	IR-009	St Andrews Theatre, Buckhaven
LB19129	IR-010	Methilhill 1-8 Wilson Square
LB46080	IR-011	Methilhill House, Methilhill
LB22712	IR-012	Methil Parish Church
LB46076	IR-013	Aberhill Primary School, Methil
LB22715	IR-014	Ashgove House, Methilhill
LB37349	IR-015	Greig Institute, Leven
LB46500	IR-016	40 High Street (TSB), Leven
LB37347	IR-017	St. Margaret's Church HB Number
LB16665	IR-018	Balgonies Policies, Walled Garden
LB49899	IR-019	Burnside Of Letham Including Watermill With Wheel And Steading
LB16694	IR-020	Tolbooth
LB16675	IR-021	Harbour structure
LB46055	IR-022	Belvedere Hotel
LB16407	IR-023	Former Parish with associated gate and gatepier
LB46041	IR-024	Graveyard with walls and gravestones
LB42980	IR-025	Coaltown of Balgonie, Barrell Bridge
LB42982	IR-026	Duniface Farmhouse and steading, outbuilding, boundary wall, gate piers and gates
LB10009	IR-027	Kingsdale House including ancillary buildings and walled garden
LB8988	IR-028	Upper Largo the Upper Largo home farm dovecot
LB8966	IR-029	Upper Largo, Largo House
LB8991	IR-030	Upper Largo Road Eaglegate gatepiers
LB37352	IR-031	Largo Road, Obertal

Designated Code	Index Number	Name
LB8956	IR-032	Lundin Town
LB16679	IR-033	Silver Burn House Estate Offices
LB16684	IR-034	Cameron Hospital, Haig House
LB43384	IR-035	Cameron Hospital, Pavilion wards and Loges
LB43009	IR-036	Cameron House
LB43018	IR-037	Woodbank
LB42985	IR-038	Little Lun
LB46046	IR-039	Newton Farmhouse
LB10010	IR-040	Newton Hall
LB46071	IR-041	Miners Cottages, Cowley Street
LB46074	IR-042	St. Andrews Square, Lower Methil
LB46068	IR-043	Parish Church
LB46069	IR-044	Royal Bank of Scotland
LB46070	IR-045	community centre
LB46072	IR-046	Miners Welfare Institute
LB50126	IR-047	Denbeath Parish Church and Hall
LB46497	IR-048	2 Forth Street, Bank Of Scotland Building And Forth House
LB46501	IR-049	68 And 70 High Street, Royal British Legion
LB46502	IR-050	74, 76 And 76a High Street
GDL0384	2132	Wemyss Castle
CA139	IR-052	COALTOWN OF WEMYSS
CA150	IR-053	KENNOWAY
CA162	IR-051	LINKS ROAD, LEVEN
CA163	IR-054	LOWER LARGO
CA173	IR-055	UPPER LARGO
CA174	IR-056	WEST WEMYSS

10. FISH AND SHELLFISH

This Chapter evaluates the potential effects of the Proposed Development on fish and shellfish interests. It contains the following Sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Legislative Framework and Guidance;
- Assessment Methods;
- Baseline Characterisation;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

10.1. Introduction

This Chapter sets out the fish and shellfish interests within and around the Proposed Development, a single demonstrator wind turbine off the coast of Methil, Fife in Scotland. The Proposed Development is described in Chapter 3: Project Description and illustrated in Figure 1.1, contained in Volume 2 of the EIAR.

This Chapter summarises the previous assessment carried out for fish and shellfish interests at the consented Forthwind Demonstration Project; a two turbine, twin-bladed design in the same location off Methil, consented by Marine Scotland on 21 December 2016. The baseline characterisation and beam trawl survey carried out for the consented project are summarised in this Chapter and used to inform the impact assessment presented in Section 6.7.

The impacts have been re-scoped for the current application, as agreed in the Marine Scotland scoping opinion issued on 21 December 2021: the scoping decisions and key impacts to address are set out in Table 10.2. Key impacts include underwater noise, particularly from construction activities, and the effects of electromagnetic fields (EMF) arising from the installed export cable over the operational phase of the Proposed Development.

10.2. Consultation

Table 10.1 sets out the key issues raised in the 2021 Marine Scotland scoping opinion and appendix of stakeholder consultation responses that have been addressed in this assessment.

Table 10.1 - Summary of Consultation Undertaken

Consultee	Consultee Comments	Project Response
MS-LOT	Scottish Ministers advise that an HRA report must be submitted at the time of the application.	HRA requirements for Fish and Shellfish are addressed in this Chapter following the process set out in Section 10.4.1.2 This Chapter identifies freshwater SACs on the Scottish east coast (Table 10.4) and considers whether or not the Proposed Development could give rise to any 'likely significant effect' on the Atlantic salmon or sea lamprey interests of these SACs (Section 10.7.2).

Consultee	Consultee Comments	Project Response
MSS	MSS is content that the direct effect of the Proposed Development on spawning, nursery and foraging resource for fish and shellfish will be negligible, considering it has reduced in scale to a single turbine.	Addressed in Table 10.1
MSS	MSS recommend that increased underwater noise effects are included in the scope for marine fish similar to marine mammals, as fish also have the potential to be negatively impacted from increased underwater noise from construction activities. MSS also recommend that marine fish are included in the updated desk-based assessment for marine mammals and given consideration to within any mitigation proposed.	Marine fish are fully addressed in this EIAR Chapter, including underwater noise impacts in Section 10.7.1.1
MSS	MSS do not agree that EMF effect for the operation of the subsea cabling should be scoped out. MSS recommends that EMFF effects are scoped in and consideration is given to recent literature and research on the topic of EMF and potential effects on marine species… MSS is keen to gain *in situ* measurements of EMF emissions from cables in order to validate models and inform environmental impact assessments. MSS would welcome involvement of the developer in any future strategic work on the topic of EMF.	EMF is scoped in, in Table 10.2 and addressed in Sections 10.7.1.1 and 10.7.2.1. As indicated, the Applicant would consider making *in situ* measurements of EMF emissions as part of a wider study potentially co-ordinated via ScotMER.
MSS	MSS is content that accidental spillage of pollution is scoped out on the basis that a Pollution Prevention Plan will be implemented.	As required by the MS scoping opinion, a Pollution Prevention Plan has been submitted as part of the CEMP, and is contained Volume 4: Compliance Plans.
MSS	MSS advise that diadromous fish should be scoped in. We do not agree with NatureScot that diadromous fish can be scoped out, nor do we agree with the statement by NatureScot that there will not be any likely significant effect on Atlantic salmon and sea lamprey. However, we are content with this statement being made for river lamprey which may not use the outer Firth of Forth to a significant extent.	This advice from MSS contradicts that of Marine Scotland's statutory adviser for Habitats Regulation Appraisal (HRA), namely NatureScot. However, diadromous fish have been scoped in for assessment on the basis of the MSS advice and are addressed in Section 10.5.2, Baseline Characterisation, and in Section 10.7.2 on Assessment of Potential Effects.

Consultee	Consultee Comments	Project Response
MSS	To date, there has been no survey work within the Firth of Forth targeted at diadromous fish, so there is no information on migration routes within the firth and very limited information on the spatial distribution. As noted previously, the site may provide opportunities for useful studies to be carried out. MSS welcome that Forthwind are content to engage with ScotmER, where appropriate, in future monitoring work, but that due to the size and scale of the proposed development it is no longer considered proportionate to include this aspect in the application. MSS would point the developer to the Diadromous Fish evidence map https://www.gov.scot/policies/marine-renewable-energy/science-and-research/ produced by ScotMER for further information.	Impacts on diadromous fish are assessed as negligible under EIA. Assessment under HRA concludes that there are no likely significant effects on any SAC for diadromous fish – see Section 10.7.2. While the Applicant is content to engage with MSS and with ScotMER on other issues requiring attention (such as ornithological monitoring or proactive EMF work), there is no justifiable reason for them to have to engage over any future monitoring work for diadromous fish.
MSS	MSS do not agree with EMF being scoped out for diadromous fish, which may make use of geomagnetic cues to navigate. This will need consideration in the EIAR.	EMF is scoped in, in Table 10.2 and addressed in Section 10.7.2.1 for diadromous fish.
NatureScot	We have no significant issues to raise in relation to fish (including diadromous fish) and agree that impacts on diadromous fish and marine fish Priority Marine Features (PMFs) can be scoped out. We also advise there will not be any likely significant effect on Atlantic salmon, river lamprey and sea lamprey as features of the River Teith SAC. We refer Forthwind to Marine Scotland Science for advice for commercial marine fish species.	Noted.

10.3. Scope of Assessment

The scope of the fish and shellfish assessment is set out in Table 10.2 based on the conclusions of the scoping report and the advice set out in Marine Scotland's scoping opinion, issued on 21 December 2021.

Table 10.2 - Assessment of Fish and Shellfish Impacts

Impact	Scoping Advice	Description of Impact and Approach
Marine Fish and Shellfish		
Underwater Noise	Scoped in	Underwater noise impacts on marine fish and shellfish are addressed in Section 10.7.1.1; impacts are to be considered for the construction phase of development.

Impact	Scoping Advice	Description of Impact and Approach
Marine Fish and Shellfish		
Electromagnetic Fields (EMF)	Scoped in	EMF effects from the proposed export cable are considered in Section 10.7.1.1.
Direct Impacts on Spawning, Nursery and Foraging Grounds	Scoped out	As confirmed in the MS scoping opinion.
Indirect Effects	Scoped out	As confirmed in the MS scoping opinion.
Accidental Spillages	Scoped out	On the basis that a Pollution Prevention Plan is submitted as part of the application.
Cumulative Effects	Scoped in	Cumulative effects are considered in Section 10.9 of this Chapter.
Diadromous Fish		
Underwater Noise	Scoped in	Underwater noise impact on diadromous fish are addressed in Section 10.7.2.1; impacts are to be considered for construction, operation and decommissioning phases of development.
Electromagnetic Fields (EMF)	Scoped in	EMF effects from the proposed export cable are considered in Section 10.7.2.1.
Direct Impacts on Spawning, Nursery and Foraging Grounds	Scoped out	As confirmed in the MS scoping opinion.
Indirect Effects	Scoped out	As confirmed in the MS scoping opinion.
Accidental Spillages	Scoped out	On the basis that a Pollution Prevention Plan is submitted as part of the application.
Cumulative Effects	Scoped in	Cumulative effects are considered in Section 10.9 of this Chapter.

10.4. Methodology

10.4.1. Legislative Framework and Guidance

This Section outlines the legislation, policy and guidance relevant to the assessment of the potential effects on fish and shellfish interests.

Legislation:

- United Nations Convention on Biological Diversity, 1992 (the Rio Convention);
- The Convention on the Conservation of European Wildlife and Natural Habitats, 1979 (the Bern Convention);
- Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992 (the OSPAR Convention);
- Marine (Scotland) Act, 2010;
- European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive) (as amended);
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Habitats Regulations);
- Offshore Marine Conservation (Natural Habitats, &c.) Regulations, 2007 (as amended);
- European Council Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (MSFD);
- European Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD);
- European Council Regulation No 1100/2007 establishing measures for the recovery of the stock of European eel;
- Nature Conservation (Scotland) Act, 2004;
- Wildlife and Countryside Act, 1981 (as amended).

Policy:

- Scotland's National Marine Plan, 2015;
- Scottish Energy Strategy: The future of energy in Scotland, 2017;
- UK Post-2010 Biodiversity Framework (the successor to, Biodiversity: UK Action Plan 1994);
- List of Priority Marine Features (PMFs) in Scotland's Seas, 2014.

Guidance:

- European Guidance on wind energy development in accordance with European Union (EU) nature legislation (European Commission (EC), 2010);
- Oslo Paris Convention (OSPAR) Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008);
- Chartered Institute of Ecology and Environmental Management (CIEEM). Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine, 2018.

10.4.2. Baseline Characterisation

Baseline characterisation utilises the following key data sources:

- • Site-specific benthic survey (2 m beam trawling) - species identification semi-quantitative abundance;
- Centre for Environmental, Fisheries and Aquaculture Science (Cefas): areas of sensitivity related to nursery and spawning grounds; details on feeding and predation of key species; fish migration; and general fish and shellfish ecology and biology;
- NatureScot citations and conservation objectives for freshwater SACs;
- UK Marine Life Information Network (MarLIN) Guidance to the likely distribution and assemblage of the fish and shellfish species within the Firth of Forth.
- Collaborative Offshore Wind Research into the Environment (COWRIE) Environmental effects of noise and electromagnetic fields and mitigation measures.
- Marine Scotland general information on species found in Scottish waters.
- International Union for Conservation of Nature (IUCN) Biodiversity risks and opportunities of offshore renewable energy.
- OSPAR information on fish biology and ecology.
- Other Journals, PhD theses, white papers and research articles.

10.4.1. Assessment Methods

10.4.1.1. Environmental Impact Assessment

Environmental Impact Assessment (EIA) is carried out for the marine fish and shellfish interests described in Section 10.5.1, with assessment reported in Section 6.7. EIA is also carried out for diadromous fish species other than Atlantic salmon (*Salmo salar*) and sea lamprey (*Petromyzon marinus*), again reported in Section 6.7.

Assessment follows the CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine. Assessment considers how the baseline conditions will change as a result of the Proposed Development, accounting for the magnitude and extent of impacts, their duration and reversibility as well as sensitivity of the receptor to the impacts in question. Mitigation and management measures are also taken into account as discussed in Section 10.6 and Section 10.8.

10.4.1.2. Habitats Regulations Appraisal

The Marine Scotland scoping opinion advises that HRA will be required for Atlantic salmon on migration between marine and freshwater rivers, most of which are designated as SACs. Sea lamprey are also screened in to the HRA, whereas river lamprey (*Lampetra fluviatilis*) are screened out due to lack of connectivity. Under Regulation 48 of the Habitats Regulations, Conservation (Natural Habitats, &c.) Regulations 1994[134], HRA asks the following questions:

- Is the plan or project connected with, or necessary for, SAC conservation management?
- Will the plan or project be likely to have a significant effect on the qualifying interests of the SAC either alone, or in combination with each other, or in combination with other plans or projects?
- Can it be ascertained that the plan or project will not adversely affect SAC site integrity, either alone or in combination with other plans or projects?

Table 10.4 lists the freshwater SACs which could have potential connectivity with the Proposed Development. Section 6.7then considers whether there could be any 'likely significant effect' (the second stage in the process). If required, the last question / stage in the process is called appropriate assessment, to be undertaken by Marine Scotland as the competent authority, based on available information and with advice from NatureScot.

10.4.2. Scope of Assessment

The EIA process applies to all the fish and shellfish species other than Atlantic salmon and sea lamprey considering whether any of the impacts scoped in (Table 10.2) will significantly alter the baseline.

The HRA process applies to Atlantic salmon and sea lamprey as qualifying interests of the various freshwater SACs which could potentially have connectivity with the Proposed Development, see Table 10.4.

Assessment is presented in Section 6.7 below.

10.5. Baseline Characterisation

10.5.1. Marine fish and shellfish

As set out in Table 10.2 direct impacts on spawning, nursery and foraging grounds have been scoped out from re-assessment, therefore these aspects of the baseline environment are not further described. Instead, this summary focuses on the findings of the trawl survey carried out in 2014 as part of the benthic ecology survey in support of the consented 2015 project. Five trawl sites were selected across the benthic survey array and the survey work was undertaken between 9th October and 13th October 2014. The epibenthic beam trawling was carried out using an industry standard (Lowestoft design) 2 m scientific beam trawl fitted with a knotless cod end liner (5 mm mesh). Of the five sites identified for trawling, The trawling was attempted at three of the five sites due to obstructive substrate being observed. At all of the sites attempted a successful sample was recovered. This trawl survey recorded 17 marine fish and shellfish taxa as set out in Table 10.3

[134] https://www.legislation.gov.uk/uksi/1994/2716/contents/made

Plaice were most abundant, representing 34% of the fish recorded, followed by sand goby (27%) and dab (17%). Eight of the 17 recorded taxa are potentially of commercial importance, including fish species such as plaice, cod, dab and lemon sole, as well as shellfish species such as brown crab, common whelk and scallop.

Smaller-bodied, non-commercial species were also recorded such as pogge and common dragonet. These species are ecologically important because they act as a vital food source to marine predators that include larger commercial fish, birds and marine mammals.

Of the species recorded in Table 10.3, cod and sand goby are listed as Priority Marine Features (PMFs) in the seas around Scotland and considered a priority for conservation action[135].

Table 10.3 - Fish and shellfish recorded during the trawl survey and grab sampling survey

Scientific name	Common name	Total abundance
Pleuronectes platessa	Plaice	102
Pomatoschistus minutus	Sand goby	81
Limanda limanda	Dab	46
Syngnathus acus	Greater pipefish	22
Agonus cataphractus	Pogge	15
Callionymus lyra	Common dragonet	8
Pomatoschistus	Sand goby genus	8
Gadus morhua	Cod	6
Buccinum undatum	Common whelk	5
Myoxocephalus scorpius	Bull rout	4
Microstomus kitt	Lemon sole	2
Pholis gunnellus	Butterfish	2
Ammodytes	Sandeel spp.	1
Cancer pagurus	Brown crab	1
Gobiidae	Goby family	1
Pecten maximus	Scallop	1
Zoarces viviparus	Viviparous blenny	1

10.5.2. Diadromous fish

On the basis of the 2021 MS scoping opinion, the following diadromous fish species have been considered in the assessment: Atlantic salmon, sea lamprey, European eel (*Anguilla anguilla*), sea trout (*Salmo trutta*), sparling (smelt) (*Osmerus eperlanus*) and allis shad (*Alosa alosa*).

10.5.2.1. Atlantic salmon

Salmon is a widespread anadromous species in Scotland – living at sea but returning to freshwater to spawn. Once spawned, migration to the sea takes place by juveniles known as smolt between April and June. Smolts begin to shoal up and will initially migrate at night following the tidal currents, however once water temperatures reach 12°C smolts will begin to migrate during the day as well as night[136]. Upon entering the marine environment salmon smolts are thought to utilise shallow (<10 m) coastal areas, where water

[135] Marine environment: Priority Marine Features - gov.scot (www.gov.scot)

[136] Potter, E. C. E. and Dare, P. J. (2003) Research on migratory salmonids, eel and freshwater fish stocks and fisheries. Sci. Ser. Tech Rep., CEFAS Lowestoft, 119: 64pp.

temperatures are warmer[137]. However, the supporting data shows a considerable amount of variation depending upon where the smolts originate[1]. It is not therefore possible to describe the migratory routes taken by salmon smolt when in the marine environment. Once at sea the young sea smolt grow rapidly, however their time in the marine environment varies from one winter (grilse) to four (Multi-Sea Winter (MSW) salmon). After this time, they migrate back to their natal (place of birth) freshwater river.

Again, it is not possible to describe the exact route taken by returning adults, but it is likely to be coastal based on the theory that returning adults rely on their olfactory (smell) sense to locate their natal spawning rivers. This is supported by the known routes taken by returning adult salmon in northern Scottish waters, which show a bias towards the mainland coast[1]. In the open ocean salmon may use celestial navigation using the position of the stars and sun as well as bio magnetic particles to act as an inbuilt compass[138], supporting the prediction that the Earth's magnetic field assists the highly directed migration to the natal river[3].

Atlantic salmon are a designated interest of the freshwater SACs presented in Table 10.4

10.5.2.2. Sea lamprey

Sea lamprey is an anadromous species that is present along most of the Atlantic coast of western and northern Europe[139].

In British rivers, spawning for sea lampreys usually occurs in late May or June, when the water temperature reaches 15°C. After hatching the larvae spend several years in the silt bed, until they stop feeding and the metamorphosis into the adult stage; usually around mid-to late summer[140].

Young adult sea lamprey then migrate downstream and out into the marine environment where they will feed and mature. Little information is available about the adult life stage at sea although they have been found in both shallow coastal regions and deep offshore waters[3]. When in the marine environment the adults become an exoparasite of a variety of large fish including basking shark, cod and salmon[3]. Adults will return to freshwater between April and May in Europe to spawn[3].

Sea lamprey are a designated interest of the freshwater SACs presented in Table 10.4.

Table 10.4 – Scottish east coast SACs designated for Atlantic salmon and sea lamprey

Species	Spey	Dee	South Esk	Tay	Teith	Tweed
Salmon	✓	✓	✓	✓	*✓	✓
Sea lamprey	✓	×	×	*✓	✓	*✓
Key: ✓/× = Features/does not feature under designation						
Note: *Species present as qualifying feature, but not a primary reason for site selection						

137 Malcolm, I. A., Godfrey, J. and Youngsen, A. F. (2010) Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables Scottish Marine and Freshwater Science, 1(14).

138 Potter, E. C. E. and Dare, P. J. (2003) Research on migratory salmonids, eel and freshwater fish stocks and fisheries. Sci. Ser. Tech Rep., CEFAS Lowestoft, 119: 64pp.

139 Maitland, P.S. (2003a). Ecology of the River, Brook and Sea Lamprey Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough. Available from: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=SMURF_lamprey.pdf Accessed Nov 2014.

140 Gardiner, R. (2003) Identifying Lamprey. A Field Key for Sea, River and Brook Lamprey Conserving Natura 2000 Rivers Conservation Techniques Series No. 4. English Nature, Peterborough.

10.5.2.3. European eel

The European eel is the only catadromous (feeds in freshwater and spawns in the marine environment) species known to occur in the Firth of Forth[141] and is therefore likely to be present within all its associated tributaries.

Adults enter the marine environment between April and November to start their long spawning migration across the Atlantic Ocean to the Sargasso Sea. Very little is known about the migration routes or swimming behaviours used by adult eel[3]. It is during this outward migration that increased numbers of adults may be passing through the wider study area.

Newly hatched larval eel are thought to undertake a passive drift migration using the Gulf Stream and the North Atlantic Current back to the continental shelf of Europe and North Africa[142]. Upon reaching the coast the larvae metamorphose into a transparent stage and become known as elvers, or glass eel. Elvers approach the UK coast and enter estuaries from around October to November, though they do not actively migrate upstream until spring[143].

The majority of elvers pass the tidal limit of rivers from April to early summer where they develop pigment and become known as "yellow" eels. Not all yellow eels move upstream and some remain in tidal waters and enter the river in subsequent years, while others may spend the whole of their lives in the marine environment. European eels therefore occur in coastal waters and estuaries right through to the uppermost accessible reaches of a river catchment.

10.5.2.4. Sea trout

Sea trout share much of their life cycle with salmon[144]. However, there are temporal and spatial differences, with sea trout tending to migrate over shorter distances to reach their feeding grounds and therefore spending less time within the marine environment.

Marine bound smolts will be present between April and July with returning adults present between August and September and again post spawning in December and January[8]. It is not possible to fully describe the migratory routes taken by sea trout when in the marine environment due to a lack of scientific data. However, tracking studies suggest that adult sea trout originating from the east coast of Scotland undertake relatively wide ranging migrations1 and could be present in the Forth estuary.

10.5.2.5. Sparling (smelt)

Sparling is primarily an anadromous species with adults inhabiting coastal waters and estuaries where they mature and feed as well as freshwater riverine environments where they spawn.

Adults congregate in large shoals in upper estuaries during the winter before moving into riverine environments to spawn in early spring. Migration into freshwater is thought to be governed by a number of physical factors that include temperature, water flow and tidal conditions[145]. Migratory timings therefore vary depending on latitude, but in general spawning takes place during the highest of spring tides when the water temperature has reached 5°C[146].

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[141] Malcolm, I. A., Godfrey, J. and Youngsen, A. F. (2010) Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables Scottish Marine and Freshwater Science, 1(14).

[142] OSPAR (2010) Background Document for European eel. Anguilla Anguilla. Biodiversity Series 2010. Available from: http://qsr2010.ospar.org/media/assessments/Species/P00479_european_eel.pdf Accessed Nov 2014

[143] Ibbotson A, Smith J, Scarlett P and Aprahamian M (2002) Colonisation of freshwater habitats by the European eel Anguilla anguilla. Freshwater Biology 47, 1696-1706.

[144] De Laak, G. A. J. (2012) Knowledge document trout, Salmo trutta. Knowledge document 7. Sportvisserij Nederland, Bilthoven, the Netherlands. Available from: http://www.living-north-sea.eu/uploads/files/Knwoledge document trout.pdf Accessed Nov 2014.

[145] Maitland, P. S. (2003b) The status of smelt *Osmerus eperlanus* in England. English Nature Research Reports Number 516.

[146] Lyle, A. A., Maitland, P. S. and Sweetman, K. E. (1996) The spawning migration of smelt *Osmerus eperlanus* in the River Cree, S. W. Scotland Biological Conservation, 80, 303-311.

Larval sparling move downstream to inhabit the lower reaches of their natal rivers and estuaries. Estuaries are particularly important to juvenile sparling as they provide essential nursery areas[147]. The close association to estuarine and coastal waters means that sparling do not migrate over any great distance, unlike salmon.

Over the last century the sparling population in the Forth estuary underwent a severe decline but has since recovered and is once again common[148].

10.5.2.6. Allis shad

Allis shad are also present in the Firth of Forth, although recorded only occasionally[149]. This species is a relative of the herring, and like sparling, moves into freshwater to spawn. Little is known about their habitat requirements in freshwater but almost all adults die after spawning[150.]

Allis shad receive some protection under Schedule 5 of the Wildlife and Countryside Act 1981 and Schedule 3 of the Habitats Regulations[151]; this legislation regulates how they can be killed or taken, primarily in freshwater.

The risk of Allis shad being present in vicinity of the Proposed Development is extremely low, however, as advised in the MS scoping opinion they are included in the assessment of potential effects, see Section 10.7.2.

10.6. Development Design Mitigation

This Section considers measures that have been incorporated in the Proposed Development as standard industry practice and as part of the design process. The key measures directly relevant to fish and shellfish are:

- Use of drilled pin-pile foundations for the proposed turbine and met mast (no impact piling).
- Agreement and implementation of a Construction Environmental Management Plan (draft version included within Volume 4: Compliance Plans of this EIAR).

10.7. Assessment of Potential Effects

10.7.1. Marine fish and shellfish

10.7.1.1. Underwater noise

During construction, the noisiest activity is associated with drilling the foundations for the turbine and the met mast. Together this activity is estimated to take up to a week in total. In a review of studies associated with wave and tidal energy sites, the amount of noise associated with drilling operations was likened to that arising from a moderately sized shipping vessel[152]. Such a level of noise could potentially give rise to disturbance, as considered further, but would not result in any risk of injury to marine fish or shellfish species.

There may also be noise arising from installing any proposed cable protection along the cable route, not yet confirmed. Finally, there may also be a slightly increased level of noise associated with the presence of construction vessels (very slight above baseline vessel activity in this area).

In this regard, shellfish species are considered insensitive to noise, apart from particle motion (vibration) in very close proximity to the noise source. Their sensitivity is judged to be low; the magnitude and extent of impact is judged to be negligible and of short-duration. Effects of underwater noise on shellfish are therefore judged to be negligible and non-significant in EIA terms.

[147] Dadswell, M. J. (1988). Diadromous fish in estuaries – an overview. Abstract: Fish in estuaries Southampton University, Fisheries Society of the British Isles

[148] Maitland, P.S. and Lyle, A.A (1996) The Smelt *Osmerus Eperlanus* in Scotland. Freshwater Forum, 6, 57-68.

[149] Rare Migratory Fish of the Firth of Forth | Forth Rivers Trust

[150] Allis shad (Alosa alosa) - Special Areas of Conservation (jncc.gov.uk)

[151] Protected species: fish | NatureScot

[152] **Robinson**, S.P **and Lepper**, P.A. "Scoping study: Review of current knowledge of underwater noise emissions from **wave and tidal** stream energy devices". The Crown Estate, 2013.

The same is true for those fish species which lack a swim-bladder, such as plaice and lemon sole, where the effects of underwater noise on these species are also judged to be negligible and non-significant in EIA terms.

Fish which have a fully functional swim-bladder such as cod are more sensitive to noise[153]. In this regard, the noise associated with construction activities is mainly of low frequency (below 1 kHz). While the majority of noise-sensitive fish hear best at frequencies between 200 Hz up to 800 Hz there is often also good detection in the low frequency range of sounds below 200 Hz. Noise-sensitive fish will therefore be able to detect the low frequency sounds produced by the construction activities proposed. Their sensitivity is judged to be medium, and the magnitude and extent of impact is judged to be negligible and of short duration. Effects of underwater noise on cod and other noise-sensitive fish are therefore judged to be negligible and non-significant in EIA terms.

10.7.1.1. EMF

Electromagnetic fields (EMF) may arise from the electricity export cable and could have the potential to affect electrosensitive marine fish and shellfish species. In this regard, there were no elasmobranch species recorded during the site-specific trawl survey, however, spurdog (*Squalus*) and tope (***Galeorhinus galeus*)** may potentially have nursery grounds in the wider area and may come into contact with the Proposed Development. The electricity export cable comprises a single 66 kV cable of 1.5 km in length as set out in Chapter 3: Project Description. It will be buried to a target depth of 1.5 m and/or covered by cable protection materials (concrete matressing / rock armour) up to 1 m thick; these measures will act to reduce the EMF.

Consideration has been given to the available literature on EMF recommended by MSS in the scoping opinion[154],[155]. Uncertainty in the assessment is acknowledged, however, the limited likelihood of electrosensitive marine fish and shellfish occurring along the cable route combined with the predicted small magnitude of effect results in a judgement of non-significance. In this regard, the proposed length of the Forthwind export cable (at 1.5 km) is significantly less than that of the three consented wind farms in the Forth and Tay area, Neart na Gaoithe, Inch Cape and Seagreen, at 37 km, 85 km and 100 km respectively. It will therefore not make any significant addition to the EMF effects that are already consented (see Section 10.9 on cumulative effects).

Although EMF effects from the Proposed Development are judged to be negligible and non-significant on marine fish and shellfish species, the Applicant would consider making in situ measurements of emissions as part of a wider study potentially co-ordinated via ScotMER.

10.7.2. Diadromous fish

10.7.2.1. Underwater noise

The types of underwater noise that may arise during construction are described in Section 10.7.1.1 above. For even the loudest noise (drilling the piles), there is no risk of injury to diadromous fish species. For diadromous fish, the MS scoping opinion advises that operational noise also be considered and noise arising during decommissioning. Operational noise will comprise any noise arising from the vibration/movement of the turbine (as transmitted through the water column) and any additional noise (above baseline) from vessel movements during operations and maintenance activity. Decommissioning plans are yet to be finalized but it is likely that foundations and cabling will remain in situ and that only infrastructure above the seabed will be removed. This being the case, the underwater noise associated with decommissioning will be less than that required for construction.

Construction noise: as a 'worst case' each of the diadromous fish in question, Atlantic salmon, sea lamprey, European eel, sea trout, sparling (smelt) and allis shad, is judged to be of medium sensitivity to underwater

[153] Halvorsen, M. B., Casper, B. M., Woodley, C. M., Carlson, T. J., Popper, A. N. (2012) Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive PileDriving Sounds PLoS ONE, 7(6): e38968.

[154] Hutchison, Z. L., Gill, A. B., Sigray, P. He, H., King, J. W. (2020). Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species. Scientific Reports 10, 4219.

[155] Hutchison, Z. L., Gill, A. B., Sigray, P., He, H. and King, J. W. (2021) An evaluation of electromagnetic fields emitted by buried subsea power cables and encountered by marine animals: Considerations for marine renewable energy development. Renewable Energy 177.

noise: they have the potential to hear the noise and to react to it (a potential for disturbance). However, their risk of exposure is slight as the spatial extent, magnitude and duration of noise arising from the drilling of a single turbine and met mast is judged to be negligible; certainly, *de minimus*, when compared against the amount of pile-driving required for the consented Forth and Tay wind farms.

In this regard, while there may be the potential for connectivity in relation to Atlantic salmon and sea lamprey between the Proposed Development and the SACs listed in Table 10.4 there would not appear to be any risk of 'likely significant effect' under HRA: only slight risk of exposure for the species in question and a negligible magnitude of effect (negligible reactions/disturbance of individuals). Should Marine Scotland, as competent authority, come to a different view, however, then any such 'likely significant effect' will be avoided through the adoption and implementation of the proposed Construction Environmental Management Plan (Section 10.6).

Operational noise: the operational noise arising from vibration/movement of wind turbine has been reviewed in a recent study updating previous work and indicating that source levels are at least 10–20 dB lower than ship noise in the same frequency range[156]. Therefore, operational noise from a single turbine and any noise from operations and maintenance vessels (again for a single turbine) is judged to be insignificant above baseline conditions. There will be no measurable effects, and no 'likely significant effect' for any of the SACs scoped into assessment.

Decommissioning noise: as noted above, decommissioning noise will be much less than that assessed for construction. In this regard, the spatial extent, magnitude and duration of any noise from decommissioning vessels or from removal of the single turbine and the met mast, is judged to be negligible. There will be no measurable effects, and no 'likely significant effect' for any of the SACs scoped into assessment.

As there are negligible effects from underwater noise on diadromous fish species and no 'likely significant effect' on Atlantic salmon or sea lamprey at any SAC, then it would not appear reasonable for the Applicant to need to be involved in ScotMER in this regard.

10.7.2.1. EMF

The potential for EMF from the proposed export cable is as described in Section 10.7.1.1. In this regard, Atlantic salmon, sea trout and European eel may be affected by EMF as they are known to use the earth's magnetic field during migration[157,158]. The effect of the EMF is related to the proximity of the fish to the cable; the strength of the magnetic field decreases rapidly, both horizontally along the sediment and vertically through the water column with distance from the cable.

Available data on the migratory movements of adult Atlantic salmon and sea trout in Scotland indicate that they may swim relatively close to the sea surface whilst migrating[159], so that interaction with EMF from the proposed export cable is unlikely. Cable burial/cable protection reduces this risk yet further. So, while they are judged to be sensitive to EMF, their risk of exposure and risk of interaction is judged to be negligible. EMF from the cable would not act as a barrier to any migratory movements of Atlantic salmon or sea trout, if indeed they are that close to the coast in this location. In this regard, there is no 'likely significant effect' from EMF on Atlantic salmon at any of the SACs listed in Table 10.4.

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[156] Tougaard*, J.,* Hermannsen*, L.,* and Madsen, P.T. (2020) How loud is the underwater noise from operating offshore wind turbines? The Journal of the Acoustical Society of America **148**, 2885 https://doi.org/10.1121/10.0002453

[157] Westerberg, H. and Begout-Anras, M. L. (2000) Orientation of silver eel (*Anguilla anguilla*) in a disturbed geomagnetic field In: A. Moore and I. Russell (eds.) Advances in Fish Telemetry. Proceedings of the 3rd Conference on Fish Telemetry Lowestoft: Cefas, pp. 149-158. As cited in Westerberg, H. and Lagenfelt, I. (2008) Sub-sea Power Cables and the Migration Behaviour of the European eel Fisheries Management and Ecology, 15(5-6), 369-375.

[158] Sadowski, M., Winnicki, A., Formicki, K., Sobocinski, A. and Tanski, A. (2007) The effect of magnetic field on permeability of eggshells of salmonid fishes *Acta ichthyologica etpiscatorial* 37, 129-135.

[159] Malcolm, I. A., Godfrey, J. and Youngsen, A. F. (2010) Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables Scottish Marine and Freshwater Science, 1(14).

European eel are recorded migrating at a variety of depths within the water column, so potentially may have more chance of interacting with EMF from the export cable. However, studies indicate that there is no major effect; their swimming speeds may slow temporarily if they are in very close proximity to a high voltage alternating current (HVAC) cable, however, they are not prevented from crossing it. Cable burial/cable protection will further reduce any such effect. Therefore, EMF from the cable would not act as a barrier to any migratory movements of European eel in the Forth estuary.

While sea lamprey are also electrosensitive and may be able to detect EMF there is no indication of any major response[160,161] as exemplified by one study of wild-caught adult sea lampreys where they demonstrated very little active behaviour during exposure to weak electric fields[162.] Impacts are therefore judged to be negligible and EMF from the cable would not act as a barrier to any migratory movements of sea lamprey in this location. In this regard, there is no 'likely significant effect' from EMF on sea lamprey at any of the SACs listed in Table 10.4.

The other diadromous fish species under consideration – sparling and allis shad – are not deemed to be sensitive to EMF, their sensitivity is low, the magnitude of effect is negligible, and therefore impacts are judged to be negligible and non-significant.

Although EMF effects from the Proposed Development are judged to be negligible and non-significant on diadromous fish, with no risk of any 'likely significant effect' for any SAC interest, the Applicant would consider making in situ measurements of emissions as part of a wider study potentially co-ordinated via ScotMER.

10.8. Mitigation Measures and Residual Effects

There are no significant impacts from underwater noise or EMF on fish and shellfish interests. Under HRA, should Marine Scotland determine 'likely significant effect' from construction noise on SAC interests, Atlantic salmon and sea lamprey, then any such effect can be avoided by adoption and implementation of a Construction Environmental Management Plan.

10.9. Cumulative Effect Assessment

There are no significant impacts arising from the Proposed Development in relation to either underwater noise or EMF on marine fish and shellfish or on diadromous fish and no scope for it to contribute significantly to any cumulative impacts in combination with any other development including the consented Forth and Tay wind farms.

10.10. Summary of Effects

Table 10.5 provides a summary of effects relating to fish and shellfish from the Proposed Development.

Table 10.5 - Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Marine fish and shellfish			
Underwater noise during construction.	Not significant.	None required.	Not significant.
EMF	Not significant.	Cable burial/cable protection.	Not significant.
Diadromous fish			

[160] Peters, R.C., Eeuwes, L.B. M. Eeuwes and Bretschneider, F. (2007). On the electrodetection threshold of aquatic vertebrates with ampullary or mucous gland electroreceptor organs. Biological Reviews 82, 361-373.

[161] Gill, A.B. and Bartlett, M. (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage Commissioned Report No.401

[162] Chung-Davidson, Y.W., Yun, S.S., Teeter, J., and Li, W.M. (2004). Brain pathways and behavioural responses to weak electric fields in parasitic sea lampreys (Petromyzon marinus). Behavioural Neuroscience, 118, 611-619.

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Underwater noise during construction, operation and decommissioning.	Not significant. Under HRA, no likely significant effect on Atlantic salmon or sea lamprey at any SAC.	Implementation of a Construction Environmental Management Plan, proposed as part of development design mitigation (Section 10.6).	Not significant.
EMF	Not significant. Under HRA, no likely significant effect on Atlantic salmon or sea lamprey at any SAC.	Cable burial/cable protection.	Not significant.

10.11. Statement of Significance

The Proposed Development has no significant impacts on any fish or shellfish species and no likely significant effect on Atlantic salmon or sea lamprey as qualifying interests of any freshwater SACs.

11. AIRBORNE NOISE

11.1. Introduction

This chapter of the EIAR evaluates the effects of the proposed Forthwind demonstration project (hereafter referred to as "the Proposed Development") in terms of noise on nearby sensitive receptors. This chapter contains the following sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Methodology and Significance Criteria;
- Baseline Description;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

No additional assessment of construction noise effects is undertaken in the present chapter, as this can be controlled using standard measures. The present chapter focuses on operational impacts, both for the scheme in isolation and cumulatively with other developments in the area. Specifically, the operational Levenmouth Demonstration Turbine (the LDT) will be assessed in addition to the Proposed Development. The LDT was granted in 2018 an extension to its operational life (until 2031). The impact of a turbine consented[163] on land south-east of the New Bayview Stadium, in Methil, was also considered, as well as an existing turbine[164] also located on the Methil Docks area. Other, more distant wind farms were not considered because their potential noise contribution was considered negligible.

The following data sources will be referenced in the assessment:

- 2015 ES for the consented Forthwind Demonstration Project and consent conditions;
- 2017 EIA update report for the LDT (chapter 6 and Appendix A6.1) and consent conditions.

11.2. Consultation

Table 11.1 details the consultation that has been undertaken in respect of the airborne noise assessment, detailing how consultation responses have informed the assessment and have been considered within this Chapter.

Table 11.1- Summary of Consultation Undertaken – airborne noise

Consultee	Consultation Method	Consultee Comments	Project Response
Marine Scotland (MS)	Scoping report	MS make reference to a previous Scoping Opinion for a similar project in November 2019 which stated that baseline data collected in 2015 would be too old to reflect the current situation and that new baseline data should be collected. On this basis MS require that new baseline data is collected to update the 2015 baseline data.	The 2019 scoping advice from MS requiring new baseline monitoring reflected a representation from ORE Catapult, the operators of the LDT. However, acquiring new baseline noise data would represent considerable

[163] Planning permission reference 12/03185/EIA, consented on appeal reference PPA-250-2184 on 8/09/2014.
[164] Planning Application 07/01334/CFULL, consented 21/09/2009.

Consultee	Consultation Method	Consultee Comments	Project Response
		MS agree with the proposal to scope out airborne noise during construction and decommissioning and advise that operational noise (including cumulative) is scoped in.	difficulties and would require the LDT turbine to stop operating during a substantial part of these measurements. There have been no changes to the area which since 2015 are likely to have substantially altered the baseline noise environment and therefore similar results would be expected. This was specifically discussed with Fife Council, the statutory consultees (see below).
Fife Council	Meeting (video call) 24/09/2021)	Agreed with Fife Council Environmental Health that previous baseline data measured for the 2015 ES and LDT assessments can be referenced in the present assessment.	The present chapter will reference the previous data and no further monitoring was considered to be required.
Marine Scotland (MS)	Scoping report	MS make reference to a previous Scoping Opinion for a similar project in November 2019 which stated that baseline data collected in 2015 would be too old to reflect the current situation and that new baseline data should be collected. On this basis MS require that new baseline data is collected to update the 2015 baseline data. MS agree with the proposal to scope out airborne noise during construction and decommissioning and advise that operational noise (including cumulative) is scoped in.	The 2019 scoping advice from MS requiring new baseline monitoring reflected a representation from ORE Catapult, the operators of the LDT. However, acquiring new baseline noise data would represent considerable difficulties and would require the LDT turbine to stop operating during a substantial part of these measurements. There have been no changes to the area which since 2015 are likely to have substantially altered the baseline noise environment and therefore similar results would be expected. This was specifically discussed with Fife

			Council, the statutory consultees (see below).

11.3. Scope of Assessment

The Forthwind Offshore Wind Demonstration Project Environment Statement, Methil Fife, July 2015 considered the impact of construction noise for a 2 turbine development (Section 14.9.1). The assessment concluded that the "*construction noise will be of limited impact and duration, being confined to working hours as agreed with Fife Council through planning condition. The application of mitigation measure where applicable will also ensure that any noise from site will be adequately controlled such that construction noise affects are considered not significant*".

As the location of the turbine proposed for the Proposed Development, the supporting infrastructure (onshore and offshore), the duration of the construction activities and the construction techniques of the revised design will be similar or with a reduced extent/intensity than the original consented development, construction and decommissioning noise effects can be scoped out of the assessment. As noted in Table 11.1, MS accepted this within the 2021 December Scoping Opinion.

Once constructed and operating, wind turbine may emit two types of noise. Firstly, aerodynamic noise is a 'broad band' noise, sometimes described as having a characteristic modulation, or 'swish', which is produced by the movement of the rotating blades through the air. Secondly, mechanical noise may emanate from components within the nacelle of a wind turbine. This is a less natural sounding noise which is generally characterised by its tonal content. Traditional sources of mechanical noise comprise gearboxes or generators. Due to the acknowledged lower acceptability of tonal noise in otherwise 'natural' noise settings, modern turbine designs have evolved to minimise mechanical noise radiation from wind turbine. The relationship between wind turbine noise and the naturally occurring masking noise at residential dwellings lying around the project area will therefore generally form the basis of the assessment of the levels of noise against accepted standards.

Previous research has demonstrated that vibration resulting from the operation of wind farms is imperceptible at typical separation distances. Therefore, vibration effects during operation do not warrant detailed assessment and have not been considered further as part of this chapter.

The following effects have been assessed in full:

- the potential effect of noise during operation of the proposed development, including cumulative effects.

11.3.1. Geographical Scope

The study area comprises the residential onshore receptors nearest to the Proposed Development. These are the same as those considered in the 2015 ES for the consented Forthwind Demonstration Project and are discussed below in section 11.5.

11.4. Methodology and Significance Criteria

The relevant planning guidance remains similar to that described in the 2015 ES, with Scottish Planning Policy (SPP[165]) and Planning Advice Note PAN1/2011 providing general advice[166] on evaluating noise in the context of the planning system.

11.4.1. Scottish Government Planning Information on Onshore Wind

[165] Scottish Planning Policy (SPP), Scottish Government, 2014.
[166] PAN1/2011 Technical Advice Note – Assessment of Noise, Scottish Government, March 2011.

The Scottish Government's Online Renewables Planning Advice[167] makes reference to the recommendations of 'The Assessment and Rating of Noise from Wind Farms'[168] (ETSU-R-97). It advises that ETSU-R-97 *"should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments"*.

11.4.2. ETSU-R-97 and current good practice

The assessment of operational noise impacts has been carried out in accordance with the methodology set out in ETSU-R-97. ETSU-R-97 has become the accepted standard for such developments within the UK and is specified as the appropriate assessment and rating guidance for wind farms in current Scottish planning policy.

Technical guidance on current good practice in the application of the ETSU-R-97 methodology, as described in the Institute of Acoustics (IOA) Good Practice Guide (GPG[169]) has also been referenced, as is recommended in the Scottish Government's Online Renewables Planning Advice on Onshore wind turbines.

The acceptable limits for wind turbine operational noise are clearly defined in ETSU-R-97. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby noise sensitive properties lie below the noise limits derived in accordance with ETSU-R-97.

In addition, the noise limits defined in ETSU-R-97 relate to the total noise occurring at a dwelling due to the combined noise of all operational wind turbines. The assessment will therefore need to consider the combined operational noise of the Proposed Development with other wind farms in the area to be satisfied that the combined cumulative noise levels are within the relevant ETSU-R-97 criteria.

11.4.3. Infrasound and Amplitude Modulation

With regard to infrasound and low frequency noise, the above-referenced Online Renewables Planning Advice refers to a report for the UK Government which concluded that '*there is no evidence of health effects arising from infrasound or low frequency noise generated by the wind turbines that were tested'*. The current recommendation is therefore that ETSU-R-97 should continue to be used for the assessment and rating of operational noise from wind farms, accordingly infrasound and low-frequency noise are not assessed and not discussed further.

There has been in recent years some research on the subject of wind turbine blade swish or Amplitude Modulation (or AM), some of which is set out in the 2015 ES. The IOA has also published[170] an objective technique developed for quantifying AM noise. The UK Government commissioned a review on subjective response to AM noise which outlines considerations for the control of this feature, based on the IOA methodology, which was published[171] in late 2016. The Scottish Government is currently reviewing these recommendations in the context of the Scottish planning system[172]. As noted above, current Scottish Planning Policy endorses ETSU-R-97 and the IOA GPG, neither of which propose a specific control for AM.

11.4.4. Baseline Characterisation

As agreed in consultation (Table 11.1), the baseline noise measurements previously undertaken at the nearest noise-sensitive receptors continue to be representative of the area, in the absence of any substantial changes

[167] Scottish Government, Online Renewables Planning Advice, Onshore Wind Turbines (http://www.gov.scot/Resource/0045/00451413.pdf). Updated May 28, 2014.
[168] ETSU R 97, the Assessment and Rating of Noise from Wind Farms, Final ETSU-R-97 Report for the Department of Trade & Industry. The Working Group on Noise from Wind Turbines, 1997.
[169] A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, M. Cand, R. Davis, C. Jordan, M. Hayes, R. Perkins, Institute of Acoustics, May 2013.
[170] Institute of Acoustics (IOA) Amplitude Modulation Working Group, Final Report, A Method for Rating Amplitude Modulation in Wind Turbine Noise, June 2016.
[171] Review of the evidence on the response to amplitude modulation from wind turbines, WSP for Department for Business, Energy & Industrial Strategy. October 2016
[172] Scottish Government, Onshore Wind Policy Statement (January 2017), http://www.gov.scot/Publications/2017/01/7344/6

to the background noise environment, and will be referenced in the assessment. This is described further in section 11.5 below.

11.4.5. Assessment Methods

Residential receptors are considered noise-sensitive. This chapter assesses the potential effects of airborne noise generated by the Proposed Development on onshore residential receptors.

Planning policy in Scotland states that ETSU-R-97 should be used to assess and rate operational noise from proposed wind farm developments, taking into account current good practice. The acceptable limits for wind turbine operational noise are clearly defined in the ETSU-R-97 document and these limits should not be breached. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission[173] levels at nearby noise sensitive properties are within the noise limits derived in accordance with ETSU-R-97.

In summary, ETSU-R-97 noise limits are defined in relation to measured background noise levels during quiet periods and their variation with wind speeds:

- For day-time periods, the limit is either a fixed level between 35 dB(A) and 40 dB(A), or 5 dB(A) above the derived background noise level, whichever is the highest; and
- For night-time periods, the limit is either a fixed level of 43 dB(A), or 5 dB(A) above the derived background noise level, whichever is the highest.

ETSU-R-97 is clear that the noise limits described apply to the total operational noise from all operating wind turbines. Therefore, the total calculated cumulative wind turbine noise immission levels will be compared to noise limits derived in accordance with the extant consent for the LDT. As the Proposed Development would operate in the future without the LDT (when that scheme's consented operational life expires in 2031), the Proposed Development is first assessed in section 11.7 in isolation against the applicable noise limits. In section 11.9, the cumulative total noise from both turbines is then assessed.

The IOA GPG states that if the contribution of another wind farm is 10 dB or more below that of another wind farm, its relative contribution is considered negligible.

11.4.6. Noise prediction methodology

The predictive noise model used is based on the ISO 9613-2 standard[174]. The model accounts for the attenuation due to geometric spreading, atmospheric absorption, as well as barrier and ground effects. All attenuation calculations have been made on an octave band basis and therefore account for the sound frequency characteristics of the turbine. All noise level predictions have been undertaken using a receiver height of four metres above local ground level and an air absorption based on a temperature of 10°C and 70% relative humidity. This follows the recommendations of the IOA GPG for noise predictions.

All wind farm noise immission[173] levels in this chapter are presented in terms of the L_{A90} noise indicator in accordance with the recommendations of the ETSU-R-97 report, obtained by subtracting 2 dB(A) from the calculated $L_{Aeq,T}$ noise levels based on the turbine sound power levels (described below).

As the proposed turbine is located offshore, propagation over water occurs and in that case a ground factor of G=0 was used (to represent acoustically reflective propagation). In addition, several references[175,176] also

173 The term 'noise immission' relates to the sound pressure level (the perceived noise) at receptor locations as opposed to the term 'noise emission' which relates to the sound power level radiated by a source such as a wind turbine.
174 ISO 9613-2:1996 'Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation', International Standards Organisation, 1996.
175 M. Boué (KTH/Vinforsk), Long-Range Sound Propagation Over the Sea with Application to Wind Turbine Noise, Final report for the Swedish Energy Agency project 21597-3.
176 Swedish Environmental Protection Agency, Measuring and Calculating Sound from Wind Turbines, Guidance Document, June 2013.

propose an additional factor of *+10log (d/d₀)* is added beyond a reference distance d_0: this represents the enhanced propagation which can occur in some conditions due to atmospheric effects over the sea. The reference distance d_0 would vary in reality based on a range of factors, and although the references cited above suggest d_0 values of 700 m to 1000 m, this is based on studies of sources of low height or using simplified predictive models. It was considered, due to the height of the proposed source (with a hub height of 152 m), that a transition distance of at least d_0 = 2000 m would be more representative. This was supported by initial modelling undertaken using the Danish BEK 135 prediction method[177], which has been validated through recent experimental studies[178].

In addition, a detailed study[175] points out that when the offshore noise propagation reaches the shore, reflection effects of the shoreline lead to reductions of typically 3 decibels (dB). Therefore, for properties which are clearly located inland (as detailed below in section 11.5) a factor of 3 dB was deducted from the calculated levels for the Forthwind turbine. For the other assessment locations which are situated on the edge of the shore, this reduction was not applied as a precautionary measure.

Noise levels from the LDT were determined based on operational measurements in 2017 EIA update report for the LDT. The measurements were supplemented by a predictive noise model to represent the variation in turbine noise levels from the LDT at all wind speeds, as well as allowing an assessment of the relative decrease of noise levels at more distant locations. These results will be referenced in the assessment of cumulative effects.

11.4.7. Operational Significance criteria

Depending on the levels of background noise the satisfaction of the ETSU-R-97 derived limits can lead to a situation whereby, at some locations under some wind conditions and for a certain proportion of the time, wind turbine noise may be audible. Nonetheless, if predicted noise levels are within the ETSU-R-97 criteria, operational noise is considered acceptable and not a significant effect; if predicted noise levels are above the ETSU-R-97 criteria, operational noise is considered unacceptable and a significant effect.

11.5. Baseline Description

11.5.1. Previously measured data

In 2010, Arcus undertook background monitoring at three representative locations neighbouring the LDT. This was supplemented by additional monitoring in 2015 at three similar positions within the Fife Energy Park, during a period in which local industrial activity was relatively low. The additional monitoring in 2015 was undertaken both in periods when the LDT was operating and not operating: the aim was to evaluate how both background noise and turbine noise levels varied at the Site with regard to wind speed and wind direction.

For example, it was observed that background noise levels appeared to increase under broadly onshore winds likely due to the influence of coastal waves. Following additional consultation with Fife Council, and as a simplifying assumption, it was decided to consider two main wind direction sectors:

- Onshore: wind directions of 20 to 190 degrees from north.
- Offshore: wind directions of 190 to 20 degrees from north.

Levels measured during onshore wind conditions tended to be higher, likely due to the influence of the sea. The analysis in the present chapter will focus on the onshore wind conditions, as propagation from the proposed turbine in offshore wind conditions would be substantially reduced.

In both 2010 and 2015, measurements were undertaken at the following locations (or at locations representative of these positions):

- 20 Wellesley Road, Buckhaven.
- 94 Wellesley Road, Buckhaven.

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[177] BEK 135, 07/02/2019, Bekendtgørelse om Støj Fra Vindmøller (Executive Order on noise from wind turbines), Ministry of the Environment and Food, Denmark.
[178] L.S. Søndergaard, et. al., “Long distance noise propagation over water for an elevated height-adjustable sound source”, 9th International Conference on Wind Turbine Noise, 18-21 May 2021.

- 12 Erskine Street, Buckhaven.

Following consultation with Fife Council and Marine Scotland, the day-time analysis was undertaken over the entire day-time period, 07:00 to 23:00. Although the general procedure of ETSU-R-97 defines day-time limits based on backgrounds measured during quiet periods of the day (see 2012 ES), ETSU-R-97 does allow for consideration of other periods of the day in some cases. In the present case, the strong influence of industrial activities in the noise environment at the site makes this a relevant consideration. However, this industrial activity was relatively reduced during the 2015 survey, which means that the combination of the 2010 and 2015 datasets represents a relatively conservative dataset.

The results and analysis of the background noise surveys, based on the combination of the 2010 and 2015 data, were detailed in Appendix A6.1 of the 2017 EIA update report for the LDT. The data was analysed in line with good practice, with periods of rainfall and atypical noise excluded where relevant. In both cases, the measurements were referenced to wind speeds at the LDT turbine's hub height of 110 m and expressed at a standard height of 10 m (standardised wind speed).

Reference is also made to additional measurements reported in the 2015 ES for the consented Forthwind Demonstration Project, to supplement data measured at properties closer to the LDT turbine. These measurements were also referenced to standardised wind speed derived at a 110 m height. This comprised measurements at:

- 3 Cave Cottages, East Wemyss; and
- Flats 51-57, West High Street, Buckhaven.

11.5.2. Consent conditions for previously consented schemes

The consent conditions for the Forthwind Demonstration Project did not specify noise limits for the turbines but required a Noise Measurement and Mitigation Scheme to be produced prior to the turbines operating. This scheme had to include several elements, including a definition of the applicable noise limits, a compliance monitoring and reporting procedure and an agreement between the operators of the Forthwind Demonstration Project and the LDT that noise from the combined developments would not exceed relevant noise limits.

The 2018 consent for the LDT specifies in condition 13 that the Proposed Development must not exceed certain noise limits, and that if monitoring determines that this is the case, operation of the turbines should cease until this can be remedied through suitable mitigation measures. In addition, condition 13 states that:

> *"If the Forthwind Ltd Development is built under authority of their current consent, the Company must control power production to limit noise production so that the cumulative noise output of the two developments does not breach permitted limits. "*

The conditions applied to the consented Forthwind Demonstration Project and the LDT therefore secure acceptable cumulative noise levels in practice should both schemes operate simultaneously.

The applicable limits, in line with ETSU-R-97, are defined in Annex 3 of the 2018 updated LDT consent as follows:

> *At standardised 10 m wind speeds not exceeding 12 ms^{-1}, the rating level of noise emissions (measured as $L_{A90,10\ min}$) from the wind turbine, when measured at any dwelling in existence prior to the installation of the Development or at any dwelling which has been given planning permission prior to such installation, shall not exceed:*
>
> - *The greater of 35 dB(A) or 5 dB above the prevailing background noise ($L_{A90,10\ min}$) between the hours of 07:00-23:00; and*
> - *The greater of 43 dB(A) or 5 dB above the prevailing background noise ($L_{A90,10\ min}$) between the hours of 23:00-07:00.*

11.5.3. Assessment locations and applicable noise limits

Table 11.2 sets out a list of the noise-sensitive receptors considered in the analysis. These are identical to the receptors considered in the 2015 ES for the consented Forthwind Demonstration Project as well as the 2017 EIA update report for the LDT. This list of receptor locations is not intended to be exhaustive but sufficient to be representative of the receptors closest to the Proposed Development and the LDT.

Table 11.2 – Assessment locations and survey data referenced. Locations marked with an asterisk (*) are considered inland for the purpose of the noise predictions (see 11.4.6).

No.	Property	Easting	Northing	Survey property referenced.
1	20 Wellesley Road*	336441	698727	20 Wellesley Road
2	94 Wellesley Road*	336229	698480	94 Wellesley Road
3	12 Erskine St*	336092	698226	12 Erskine St
4	13 Shore Street	336120	698042	12 Erskine St
5	26 Back Dykes	333834	696495	3 Cave Cottages
6	3 Cave Cottages	334211	696883	3 Cave Cottages
7	51-57 West High Street	335791	697727	51-57 West High Street
8	9 Shore Street	335955	697932	51-57 West High Street

The applicable operational noise limits at these properties, when defined on the same basis as previous assessments and considering onshore wind conditions (20-190 degrees from north), are set out in Table 11.3 below. These noise limits are based on measurements obtained during periods in which the LDT was not operational, in accordance with the requirements of ETSU-R-97.

Table 11.3 – Noise limits (L_{A90}, dB) determined from the noise survey in line with ETSU-R-97 (onshore winds).

	Standardised Wind Speed (m/s)								
Property	4	5	6	7	8	9	10	11	12
Day-time									
20 Wellesley Road	45.0	47.1	49.6	52.1	54.4	56.6	58.3	59.6	60.4
94 Wellesley Road	43.5	44.4	45.8	47.6	49.6	51.7	53.7	55.4	56.5
12 Erskine Street	45.0	47.6	50.4	53.1	55.6	57.8	59.6	61.2	62.5
13 Shore Street	45.0	47.6	50.4	53.1	55.6	57.8	59.6	61.2	62.5
26 Back Dykes	42.2	43.7	45.0	46.0	46.9	47.7	48.3	48.8	49.2
3 Cave Cottages	42.2	43.7	45.0	46.0	46.9	47.7	48.3	48.8	49.2
51-57 West High Street	44.5	46.1	47.4	48.4	49.2	49.8	50.2	50.6	50.9
9 Shore Street	44.5	46.1	47.4	48.4	49.2	49.8	50.2	50.6	50.9
Night-time									
20 Wellesley Road	43.0	43.0	45.4	49.5	53.1	55.6	56.2	56.2	56.2
94 Wellesley Road	43.0	43.0	43.0	43.8	46.6	49.5	51.9	52.8	52.8
12 Erskine Street	43.0	44.6	47.6	51.1	54.9	58.0	59.7	59.7	59.7
13 Shore Street	43.0	44.6	47.6	51.1	54.9	58.0	59.7	59.7	59.7
26 Back Dykes	45.4	45.5	45.6	45.9	46.2	46.5	46.9	47.4	47.9
3 Cave Cottages	45.4	45.5	45.6	45.9	46.2	46.5	46.9	47.4	47.9
51-57 West High Street	47.2	47.4	47.6	47.9	48.2	48.6	49.0	49.4	49.9
9 Shore Street	47.2	47.4	47.6	47.9	48.2	48.6	49.0	49.4	49.9

11.6. Development Design Mitigation

During the Proposed Development design, the distance between the turbine and neighbouring properties was maximised where possible, in order to minimise the effects of noise. Noise immissions at surrounding receptors were considered during the main layout iterations and contributed to the Proposed Development of the assessed layout.

11.7. Assessment of Potential Effects

11.7.1. Worst Case Scenario

The Proposed Development comprises a single turbine which would be installed at the following coordinates: easting/northing 337808 / 697337 (Ordnance Survey British National Grid), as shown on Figure 11.1. The indicative turbine model considered as a representative worst-case for the purpose of this assessment is a 3-bladed model with a rotor diameter of up to 255 m and a hub height of approximately 152 m above the water (Highest Average Tide or HAT), with a capacity of up to 20 MW.

Detailed manufacturer data on noise emissions was not available at this stage given that turbines of this scale are currently in development. As a basis for the assessment, the emission levels of Table 11.4 were assumed based on indicative data obtained for comparable turbines, adjusted based on manufacturer information that the sound power for the turbine of the type which could be used for the Proposed Development would not exceed 120 dB(A). Corresponding spectral emission data are also set out in Table 11.4 based on available profiles for similar turbines[179]. The emission levels assumed are comparable to those determined for the LDT, but more than 10 dB higher than emission levels assumed for turbines generally considered for onshore wind turbine developments. This data is considered sufficiently robust for the purpose of this assessment and representative of warranted levels in line with the requirements of the IOA GPG.

Table 11.4 - Wind Turbine Sound Power Levels (dB, L_{Aeq}) Used in the Noise Assessment

Description	Standardised Wind speed (m/s) 3	4	5	6	7	8	9	10	11	12
Data assumed: 152 m hub height.	105.5	108.1	113.5	118.1	119.8	120.0	120.0	120.0	120.0	120.0
Data corrected for comparison with standardised wind speeds for 110 m height.	108.1	113.5	118.1	119.8	120.0	120.0	120.0	120.0	120.0	120.0
Octave Band Centre Frequency (Hz)			**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Octave Band Sound Power Spectrum			101.7	110.4	113.5	114.0	113.5	111.7	105.1	87.2

As noted above, the baseline noise data previously obtained to determine the applicable noise limits Table 11.3 was referenced to standardised wind speeds determined for a hub height of 110 m, whereas the noise emission data initially set out in Table 11.4 is referenced to the Proposed Development turbine hub height of 152 m. To account for these differences in wind speed references and enable a meaningful comparison between predictions and noise limits, a 1 m/s shift[180] was applied to the assumed emission levels: see Table 11.4. By shifting the source levels to lower wind speeds, this results in higher (and therefore more conservative) noise levels at any given wind speed.

11.7.2. Operational Effects

Table 11.5 sets out the resulting predicted noise levels at all assessment locations of Table 11.2 in accordance with the methodology of section 11.4.6, for each wind speed from 4 m/s to 12 m/s inclusive, based on the assumed emission levels of Table 11.4. This is considered applicable for onshore wind conditions and substantially reduced levels would be obtained in offshore winds.

[179] Dounreay Trì Floating Wind Demonstration Project, environmental statement, Appendix 29.1 (2016) and private communications.

[180] The 1m/s shift assumed is considered robust as it would be representative of wind speed differences between 110 m and 152 m for wind shear exponents of 0.6 (at low wind speeds) to 0.4 (at higher wind speeds) which is considered relatively high and representative of the coastal/offshore location of the Development.

Table 11.5 – Predicted noise levels (L_{A90}, dB) for the Proposed Development turbine at all noise assessment locations

Property	Standardised Wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
20 Wellesley Road	30.6	35.2	36.9	37.1	37.1	37.1	37.1	37.1	37.1
94 Wellesley Road	30.6	35.2	36.9	37.1	37.1	37.1	37.1	37.1	37.1
12 Erskine Street	31.0	35.6	37.3	37.5	37.5	37.5	37.5	37.5	37.5
13 Shore Street	34.4	39.0	40.7	40.9	40.9	40.9	40.9	40.9	40.9
26 Back Dykes	27.8	32.4	34.1	34.3	34.3	34.3	34.3	34.3	34.3
3 Cave Cottages	28.8	33.4	35.1	35.3	35.3	35.3	35.3	35.3	35.3
51-57 West High Street	33.0	37.6	39.3	39.5	39.5	39.5	39.5	39.5	39.5
9 Shore Street	33.7	38.3	40.0	40.2	40.2	40.2	40.2	40.2	40.2

The ETSU-R-97 noise limits assume that the wind turbine noise contains no audible tones. Where tones are present a correction is added to the measured or predicted noise level before comparison with the recommended limits. The audibility of any tones can be assessed by comparing the narrow band level of such tones with the masking level contained in a band of frequencies around the tone called the critical band. The ETSU-R-97 recommendations suggest a tone correction which depends on the amount by which the tone exceeds the audibility threshold and should be included as part of the consent conditions. The turbines to be used for this site will be chosen to ensure that the noise emitted will comply with the requirements of ETSU-R-97 including any relevant tonality corrections.

The predicted operational noise levels of Table 11.5 are then compared with the derived noise limits of Table 11.3: see Table 11.6. For the avoidance of doubt, negative numbers in the following table indicate that the predicted noise immission levels are below the limit.

Table 11.6 – Comparison between the derived Noise Limits and the Predicted L_{A90} Immission Levels for the Proposed Development.

Property	Standardised Wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
Day-time									
20 Wellesley Road	-14.4	-11.9	-12.7	-15.0	-17.3	-19.5	-21.2	-22.5	-23.3
94 Wellesley Road	-12.9	-9.2	-8.9	-10.5	-12.5	-14.6	-16.6	-18.3	-19.4
12 Erskine Street	-14.0	-12.0	-13.1	-15.6	-18.1	-20.3	-22.1	-23.7	-25.0
13 Shore Street	-10.6	-8.6	-9.7	-12.2	-14.7	-16.9	-18.7	-20.3	-21.6
26 Back Dykes	-14.4	-11.3	-10.9	-11.7	-12.6	-13.4	-14.0	-14.5	-14.9
3 Cave Cottages	-13.4	-10.3	-9.9	-10.7	-11.6	-12.4	-13.0	-13.5	-13.9
51-57 West High Street	-11.5	-8.5	-8.1	-8.9	-9.7	-10.3	-10.7	-11.1	-11.4
9 Shore Street	-10.9	-7.9	-7.5	-8.3	-9.1	-9.7	-10.1	-10.5	-10.8
Night-time									
20 Wellesley Road	-12.4	-7.8	-8.5	-12.4	-16.0	-18.5	-19.1	-19.1	-19.1
94 Wellesley Road	-12.4	-7.8	-6.1	-6.7	-9.5	-12.4	-14.8	-15.7	-15.7
12 Erskine Street	-12.0	-9.0	-10.3	-13.6	-17.4	-20.5	-22.2	-22.2	-22.2
13 Shore Street	-8.6	-5.6	-6.9	-10.2	-14.0	-17.1	-18.8	-18.8	-18.8
26 Back Dykes	-17.6	-13.1	-11.5	-11.6	-11.9	-12.2	-12.6	-13.1	-13.6
3 Cave Cottages	-16.6	-12.1	-10.5	-10.6	-10.9	-11.2	-11.6	-12.1	-12.6
51-57 West High Street	-14.2	-9.8	-8.3	-8.4	-8.7	-9.1	-9.5	-9.9	-10.4
9 Shore Street	-13.6	-9.2	-7.7	-7.8	-8.1	-8.5	-8.9	-9.3	-9.8

It is apparent from Table 11.6 that predicted noise levels from the Proposed Development are clearly compliant with the applicable ETSU-R-97 noise limits at all wind speeds and all assessment locations, with a margin of 5 dB(A) to 7 dB(A) or more. Operational noise levels from the Proposed Development are therefore acceptable and not significant.

11.8. Mitigation Measures and Residual Effects

The selection of the final turbine to be installed for the Proposed Development would be made on the basis of enabling the relevant ETSU-R-97 noise limits to be achieved at the surrounding properties, including any relevant tonality corrections.

This means that the operational noise immission levels are acceptable in terms of the guidance commended by planning policy for the assessment of wind farm noise, and therefore considered not significant in EIA terms.

11.9. Cumulative Effect Assessment

11.9.1. Scope of Cumulative Assessment

This section considers the effects of operational noise from the Proposed Development as well as the LDT (over its consented operational life). Two other single turbine developments in the Methil Docks area have also been considered (see section 11.1). Other wind turbines are located further away and would have negligible contributions.

11.9.2. Assessment of Cumulative Effects

Considering firstly the two single turbines located in the Methil Docks area, these are located more than 1.5 km from the assessment locations considered above. The turbine proposed to be installed east of the New Bayview Stadium is an EWT Directwind 54 wind turbine, which has a sound power not exceeding 104 dB(A), with a tip height not exceeding 81 m. The EIA for this application[163] suggests that the existing turbine at Methil Docks is a GWP 47 turbine model, with similar dimensions and noise emissions. Using the above-derived noise model which assumes hard ground conditions (but without offshore propagation corrections), the combined noise from both turbines would be less than 27 dB L_{A90} at the nearest assessment location, 20 Wellesley Road. This is more than 10 dB below the noise limits set out in Table 11.3 and the predicted noise levels for the Proposed Development in Table 11.5. Similar conclusions can be made for other receptors of Table 11.2 which are located further away. Therefore, the contribution from the existing and consented single turbine schemes represent a negligible impact for the receptors considered in this Chapter. The predicted noise levels from the Proposed Development using the above-described prediction model at properties nearest to the single turbines considered (on South Street for example), which are approximately 2.5 km away from the proposed turbine, would be of less than 33 dB L_{A90}. This is also more than 10 dB below the derived noise limits for the Methil Docks[164] turbine at wind speeds of 7 m/s and above, and was derived on a conservative basis, and would therefore also represent a negligible contribution in practice.

Operational Noise levels from the LDT are based on an analysis of measured noise levels described in detail in the 2017 EIA update report for the LDT (chapter 6 and Appendix A6.1 of the 2017 application). Data assessed in onshore wind conditions only is considered in the present chapter for the purpose of the cumulative noise analysis with the Proposed Development.

The above-referenced operational noise assessment for the LDT turbine noted that the operational levels determined exceeded in some cases the derived noise limits (Table 11.3) in certain conditions during day-time or night-time periods; however, mitigation was proposed, through either curtailment of the LDT turbine in these conditions or operation of the turbine in reduced noise modes, such that compliance with the derived noise limits can be achieved. This outcome was secured through the planning conditions described above in section 11.5.2. The assessment of cumulative effects in the present chapter is undertaken on the basis of operational noise levels for the LDT adjusted such that compliance with the derived limits is just achieved at all wind speeds and for all locations, which is considered to represent a worst-case assumption. The resulting operational noise levels are set out below in Table 11.7.

Table 11.7 – Derived operational noise levels for the LDT turbine (L_{A90}, dB) – onshore winds.

Property	Standardised Wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
Day-time									
20 Wellesley Road	38.8	42.0	45.0	47.0	47.0	47.0	47.0	47.0	47.0
94 Wellesley Road	39.2	42.4	45.4	47.4	47.4	47.4	47.4	47.4	47.4
12 Erskine Street	37.1	40.3	43.3	45.3	45.3	45.3	45.3	45.3	45.3
13 Shore Street	36.7	39.9	42.9	44.9	44.9	44.9	44.9	44.9	44.9
26 Back Dykes	19.2	22.4	25.4	27.4	27.4	27.4	27.4	27.4	27.4
3 Cave Cottages	21.2	24.4	27.4	29.4	29.4	29.4	29.4	29.4	29.4
51-57 West High Street	31.9	35.1	38.1	40.1	40.1	40.1	40.1	40.1	40.1
9 Shore Street	34.3	37.5	40.5	42.5	42.5	42.5	42.5	42.5	42.5
Night-time									
20 Wellesley Road	38.8	42.0	45.0	47.0	47.0	47.0	47.0	47.0	47.0
94 Wellesley Road	39.2	42.4	43.0	43.8	46.6	47.4	47.4	47.4	47.4
12 Erskine Street	37.1	40.3	43.3	45.3	45.3	45.3	45.3	45.3	45.3
13 Shore Street	36.7	39.9	42.9	44.9	44.9	44.9	44.9	44.9	44.9
26 Back Dykes	19.2	22.4	25.4	27.4	27.4	27.4	27.4	27.4	27.4
3 Cave Cottages	21.2	24.4	27.4	29.4	29.4	29.4	29.4	29.4	29.4
51-57 West High Street	31.9	35.1	38.1	40.1	40.1	40.1	40.1	40.1	40.1
9 Shore Street	34.3	37.5	40.5	42.5	42.5	42.5	42.5	42.5	42.5

A comparison between Table 11.7 and predicted noise levels for the Proposed Development (Table 11.5) shows that the noise from the LDT is substantially higher (with differences of 6 to 10 dB) than that from the Proposed Development at properties closest to the LDT (in particular those on Wellesley Road). The contribution from the Proposed Development is therefore relatively negligible in many cases at these properties.

The resulting cumulative levels are then set out in Table 11.8 and Table 11.9 compares these predicted noise levels with the derived noise limits of Table 11.3. This shows that, in some conditions for properties on Wellesley Road, predicted cumulative noise levels are marginally above the derived noise limits (by no more than 1 dB). For these properties, the contribution of the Proposed Development is either negligible[181] (less than 0.5 dB) or marginal (1 dB or less), and this excess, although potentially significant, would not be considered perceptible in most situations. It should also be noted that this assessment is based on robust assumptions for the emission levels of the Proposed Development and the LDT and that lower noise levels may be achieved in practice. At all other properties, Table 11.9 demonstrates that predicted cumulative levels are clearly below the derived noise limits.

Table 11.1 – Derived cumulative operational noise levels (L_{A90}, dB) – onshore winds.

Property	Standardised Wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
Day-time									
20 Wellesley Road	39.4	42.8	45.6	47.4	47.4	47.4	47.4	47.4	47.4

[181] The IOA GPG suggests that cumulative noise effects need not be considered where differences between existing and proposed wind farm noise levels are 10 dB or more. The addition of a noise source 10 dB(A) below that of another theoretically adds 0.4 dB to the total but is not considered to require assessment according to the IOA GPG. Therefore, any increase of cumulative total noise levels by 0.4 dB or less is not considered acoustically relevant.

Property	Standardised Wind speed (m/s) 4	5	6	7	8	9	10	11	12
94 Wellesley Road	39.8	43.2	46.0	47.8	47.8	47.8	47.8	47.8	47.8
12 Erskine Street	38.1	41.6	44.3	46.0	46.0	46.0	46.0	46.0	46.0
13 Shore Street	38.7	42.5	44.9	46.3	46.3	46.3	46.3	46.3	46.3
26 Back Dykes	28.4	32.8	34.7	35.1	35.1	35.1	35.1	35.1	35.1
3 Cave Cottages	29.5	33.9	35.8	36.3	36.3	36.3	36.3	36.3	36.3
51-57 West High Street	35.5	39.6	41.8	42.8	42.8	42.8	42.8	42.8	42.8
9 Shore Street	37.0	40.9	43.2	44.5	44.5	44.5	44.5	44.5	44.5
Night-time									
20 Wellesley Road	39.4	42.8	45.6	47.4	47.4	47.4	47.4	47.4	47.4
94 Wellesley Road	39.8	43.2	44.0	44.6	47.1	47.8	47.8	47.8	47.8
12 Erskine Street	38.1	41.6	44.3	46.0	46.0	46.0	46.0	46.0	46.0
13 Shore Street	38.7	42.5	44.9	46.3	46.3	46.3	46.3	46.3	46.3
26 Back Dykes	28.4	32.8	34.7	35.1	35.1	35.1	35.1	35.1	35.1
3 Cave Cottages	29.5	33.9	35.8	36.3	36.3	36.3	36.3	36.3	36.3
51-57 West High Street	35.5	39.6	41.8	42.8	42.8	42.8	42.8	42.8	42.8
9 Shore Street	37.0	40.9	43.2	44.5	44.5	44.5	44.5	44.5	44.5

Table 11.2 – Comparison between the derived Noise Limits and the Predicted cumulative L_{A90} Immission Levels.

Property	Standardised Wind speed (m/s) 4	5	6	7	8	9	10	11	12
Day-time									
20 Wellesley Road	-5.6	-4.3	-4.0	-4.7	-7.0	-9.2	-10.9	-12.2	-13.0
94 Wellesley Road	-3.7	-1.2	**0.2**	**0.2**	-1.8	-3.9	-5.9	-7.6	-8.7
12 Erskine Street	-7.0	-6.0	-6.1	-7.1	-9.6	-11.8	-13.6	-15.2	-16.5
13 Shore Street	-6.3	-5.1	-5.5	-6.8	-9.3	-11.5	-13.3	-14.9	-16.2
26 Back Dykes	-13.8	-10.9	-10.3	-10.9	-11.8	-12.6	-13.2	-13.7	-14.1
3 Cave Cottages	-12.7	-9.8	-9.2	-9.7	-10.6	-11.4	-12.0	-12.5	-12.9
51-57 West High Street	-9.0	-6.5	-5.6	-5.6	-6.4	-7.0	-7.4	-7.8	-8.1
9 Shore Street	-7.5	-5.2	-4.2	-3.9	-4.7	-5.3	-5.7	-6.1	-6.4
Night-time									
20 Wellesley Road	-3.6	-0.2	**0.2**	-2.1	-5.7	-8.2	-8.8	-8.8	-8.8
94 Wellesley Road	-3.2	**0.2**	**1.0**	**0.8**	**0.5**	-1.7	-4.1	-5.0	-5.0
12 Erskine Street	-5.0	-3.0	-3.3	-5.1	-8.9	-12.0	-13.7	-13.7	-13.7
13 Shore Street	-4.3	-2.1	-2.7	-4.8	-8.6	-11.7	-13.4	-13.4	-13.4
26 Back Dykes	-17.0	-12.7	-10.9	-10.8	-11.1	-11.4	-11.8	-12.3	-12.8
3 Cave Cottages	-15.9	-11.6	-9.8	-9.6	-9.9	-10.2	-10.6	-11.1	-11.6
51-57 West High Street	-11.7	-7.8	-5.8	-5.1	-5.4	-5.8	-6.2	-6.6	-7.1
9 Shore Street	-10.2	-6.5	-4.4	-3.4	-3.7	-4.1	-4.5	-4.9	-5.4

In a similar way as for the extant consent for the Forthwind Demonstration Project and the LDT, discussed in section 11.5.2, the operators of both schemes can operate their respective schemes such that cumulative noise levels comply with the applicable noise limits in all cases when both schemes operate simultaneously. In consultation with Fife Council, the Applicant has been in discussion with the LDT turbine operator in order to agree procedures to suitably manage cumulative noise levels. This can be secured through planning conditions as with the existing consented schemes. On this basis, no significant cumulative operational noise levels will result.

In offshore wind conditions, noise at the assessment locations from the Proposed Development would be reduced such that the contribution of the Proposed Development to cumulative noise levels would be negligible and not significant.

11.10. Summary of Effects

Table 11.3 - Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Operation			
Operational noise levels comply with applicable noise limits	Acceptable and therefore not significant.	Selection of final turbine model in line with noise limits.	Acceptable and therefore not significant.
Cumulative noise levels exceed applicable noise limits in some cases.	Significant	Operational noise restrictions under specific conditions.	Acceptable and therefore not significant.

11.11. Statement of Significance

The assessment of the operational noise associated with the Proposed Development has been shown to comply with criteria derived in accordance with ETSU-R-97 which is recommended in Scottish Planning Policy. Therefore, operational noise effects are considered acceptable and not significant in the context of the EIA Regulations.

When considering potential cumulative effects, firstly two consented and operational single turbine developments on Methil Docks were considered, and the associated cumulative impacts were determined to be negligible. Based on the available information, it was concluded that the potential cumulative effects of the LDT turbine would either be negligible or such that cumulative operational noise would remain below the derived noise limits in most cases. Although some limited exceptions were identified for properties closest to the LDT, the operators of both schemes can operate their turbines such that suitable noise levels can be achieved in practice, and this can be secured by conditions similar to those applicable to the extant consents. Therefore, cumulative operational noise levels would remain acceptable and not significant.

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12. SHADOW FLICKER

12.1. Introduction

This Chapter of the EIA evaluates the potential shadow flicker effects of the proposed Forthwind demonstration project (hereafter referred to as "the Proposed development") on residential property receptors.

This Chapter contains the following sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Methodology and Significance Criteria;
- Baseline Description;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

This Chapter of the EIAR is supported by the following figures provided in Volume 2:

- Figure 12.1: Shadow Flicker Study Area.
- Figure 12.2: Shadow Flicker Casting Map.
- Figure 12.3: Cumulative Shadow Flicker Study Areas.

This Chapter of the EIAR is supported by the following technical appendices provided in Volume 3:

- TA 12a: Potential Shadow Flicker Effects at Assessed Locations.
- TA 12b: Potential Cumulative Shadow Flicker Effects at Assessed Locations.
- TA 12c: Potential Shadow Flicker Effects from the Levenmouth Demonstration Turbine.

This Chapter has been written by Cameron McAllister at Arcus and has been technically reviewed by Sophie Williams and Fiona MacGregor. Arcus have carried out extensive Shadow Flicker assessments in the past across the UK and Ireland, as well as internationally.

This assessment has made use of OS mapping and Address Base data to inform the assessment.

12.2. Consultation

Table 12.1 details the consultation that has been undertaken in respect of the shadow flicker assessment, detailing how consultation responses have informed the assessment and have been considered within this Chapter. No comments from the 2021 Scoping Report have been received with regards to shadow flicker, however consultee comments were received on the 2019 Scoping Report and can be seen below in Table 12.1.

Table 12.1 - Summary of Consultation Undertaken

Consultee	Consultation Method	Consultee Comments	Project Response
ORE Catapult	2019 Scoping Opinion	We would simply raise that, in our opinion, a cumulative assessment should be carried out which includes any effects arising from the Levenmouth Demonstration Turbine and other windfarm developments within the potential shadow flicker zone.	A shadow flicker assessment has been carried out and included within this EIAR to assess the shadow flicker impacts associated with the Proposed Development.

Consultee	Consultation Method	Consultee Comments	Project Response
Marine Scotland	2021 Scoping Opinion	The Scottish Ministers are content that shadow flicker and cumulative shadow flicker are scoped in.	As above.

12.3. Scope of Assessment

This Chapter evaluates the effects of shadow flicker from the Proposed Development on nearby receptors. Under certain combinations of geographical position and time of day, the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. Shadow flicker is an effect that can occur when the shadow of a blade passes over a small opening (such as a window), briefly reducing the intensity of light within the room, and causing a flickering to be perceived. Shadow flicker effects only occur inside buildings where the blade casts a shadow across an entire window opening. The likelihood and duration of the effects depends on a range of factors including the direction, distance and aspect of residential dwellings in relation to the turbines, turbine height and rotor diameter, the topography between residential dwellings and turbines, the time of year and day, and the local weather conditions.

This Chapter assesses shadow flicker effects from the Proposed Development located at National Grid Reference (NRG) 337812, 697333. The Proposed Development has a worst-case scenario hub height of 152.5 meters (m) and a rotor diameter of 255 m.

If significant shadow flicker effects on residential dwellings are identified as part of this assessment, technical solutions to mitigate shadow flicker will be provided.

12.3.1. Geographical Scope

In line with current guidance as described in Section 12.4, a 10 x rotor diameter study area (2,550 m) (the Study Area) has been used to assess shadow flicker effects at nearby dwellings. Figure 12.1 shows the shadow flicker Study Area for the Proposed Development.

12.4. Methodology and Significance Criteria

Guidance, policy and legislation was used to inform how receptors be identified and how significance of effects be determined. The following guidance, legislation and information sources have been considered in carrying out this assessment.

1. Scottish Government Onshore Wind Turbines: Planning Advice

This document[182] provides planning advice for onshore wind developments including consideration of shadow flicker effects. This is the most current Scottish planning advice for Shadow Flicker and has been used to inform the methodology for this assessment. It states:

"…where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), "shadow flicker" should not be a problem".

2. Fife Council Supplementary Guidance: Low Carbon Fife

In terms of guidance with regard to shadow flicker effects, the Fife Council supplementary guidance[183] acknowledges the Scottish government guidance and agrees that turbines should be located beyond 10 rotor diameters from residential properties to ensure that there are no problems caused by shadow flicker. However, it is also stated that the Council:

[182] Scottish Government (2014) Onshore Wind Turbines: Planning Advice [Online]. Available at: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ (Accessed on 29/09/2021)
[183] Fife Council (2019) Supplementary Guidance, Low Carbon Fife [Online] Available at: https://www.fife.gov.uk/__data/assets/pdf_file/0019/162316/Low-Carbon-Fife-Supplementary-Guidance-Jan-2019.pdf (Accessed 30/09/21)

"…will consider each proposal on its own merits taking into account detailed information on site specific circumstances such as likely noise, visual impact and shadow flicker."

3. Review of Light and Shadow Flicker Effects from Wind Turbines in Scotland

A review of light and shadow effects from wind turbines was commissioned by ClimateXChange to review how light and shadow flicker effects are considered in the development planning process in Scotland.

This document[184] includes a review of current UK guidance, along with a review of how the current guidance is applied through the selection and review of case studies. The review provides a number of recommendations regarding the content of guidance on shadow flicker. These include:

- Guidance should not include reference to the occurrence of shadow flicker throw 'within 130 degrees of north';
- Guidance should exclude reference to the 10 rotor diameter distance; and
- There is a need for guidance on the thresholds of exposure to shadow flicker in Scotland.

It should be noted that since the publication of this review (2017), shadow flicker guidance in Scotland has not changed, and as such, the guidance in the Scottish Government Onshore Wind Turbines: Planning Advice remains extant. As seen in Section 12.2, there was no further consultee advice regarding the guidance that should be used in undertaking the assessment; the Scottish Government Onshore Wind Turbines: Planning Advice will therefore be used in this assessment.

12.4.1. Baseline Characterisation

The assessment of shadow flicker is a desk-based assessment, and as such, no on-site survey specific to shadow flicker has been undertaken.

As discussed in Section 12.3.1, a Study Area has been applied to the Proposed Development to identify residential properties for the assessment of shadow flicker effects. Potential sensitive receptors in the area around the Proposed Development were identified from Ordinance Survey (OS) 1:25,000 scale digital mapping and online aerial imagery. OS Address Base data was used to confirm the locations and names of permanent dwellings in the Study Area.

The Proposed Development is located approximately 1,827 m southeast from the nearest settlement, Buckhaven and 2,093 m south of Methil. Buckhaven and Methil comprise of a large number of properties including multi-storey and two storey flats, and single and two storey houses etc. A full baseline description relating to this assessment can be found in Section 12.5 below.

12.4.2. Assessment Methods

12.4.2.1. Modelling Methodology

A recognised computer software package[185] was used to calculate theoretical specific times and durations of shadow flicker effects at each property located within the Study Area.

This software creates a mathematical model of the Development and its surroundings, based on:

- Turbine locations, hub height and rotor diameter (based on turbine dimensions of a 255m rotor diameter and 152.5 m hub height);
- Topography (obtained from OS Land-Form Panorama elevation data on a 50 m horizontal grid);
- Latitude and longitude of the Site (used in calculating the position of the sun in relation to time of day and year); and

[184] LUC (2017) Review of Light and Shadow Effects from Wind Turbines in Scotland [Online] Available at: https://www.climatexchange.org.uk/research/projects/review-of-light-and-shadow-effects-from-wind-turbines-in-scotland/ (Accessed 29/09/2021)
[185] Resoft WindFarm 4.2.1.7

- Location of residential dwellings within 10 rotor diameters of the turbines.

It is assumed that if shadow flicker effects experienced at properties within these search areas are not significant, then effects experienced by properties further afield will be reduced and therefore also not significant.

The following assumptions have been made for all potential receptors in order to identify all potential effects as a worst case:

- All windows have been assumed to measure 1 m by 1 m (for larger windows the intensity of the effect would be reduced). For ground floor, these have been situated at a height of 3 m above ground level. For multiple storey dwellings, windows are positioned at 3 m increments above ground level (e.g., 6 m representing first floor, 9 m representing second floor etc.);
- Each property is located at the grid reference given in Table 12.2 (as per details from OS Address Base data); and
- Windows facing towards each of the cardinal compass point directions (North, South, East and West) have been modelled in order to identify effects from all possible directions. In practice, not all of these directions face the Development, and the buildings may not have windows on each facade.

The above calculations are intended to investigate a worst-case scenario by indicating a theoretical maximum potential duration of effects and to provide an approximation of the times of day and year that these would occur rather than a precise prediction.

For much of a given year, weather conditions will be such that shadows would not be cast or would be weak and thus would not give rise to shadow flicker effects. At the closest weather station at Kirkcaldy, bright sunshine occurred for around 32% of daylight hours from January 1991 to December 2020[186]. This factor of 32% of daylight hours will be used to calculate the likely hours of shadow flicker occurrence which will then be used as the basis for the assessment of significance effects.

In practice some of this time would be in non-windy conditions when the turbine blades would not be rotating. In windy conditions, the wind direction may not have been aligned with the direction of the sun, such that shadows were not being cast as widely as in the worst-case. In practice, other factors such as the potential for screening by vegetation or intervening structures will also reduce or prevent flicker incidence even further, as compared to the theoretical maximum period or the likely period of effect suggested by the calculations. The actual potential impact is therefore likely to be only a fraction of the theoretical maximum.

12.4.2.2. Significance Criteria

No formal guidance is available regarding what levels of shadow flicker may be considered acceptable in the UK. However, 'Wind Energy Development Guidelines' published by the Northern Ireland Department of the Environment, Heritage and Local Government (2009)[187] states that:

"It is recommended that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year ***or*** *30 minutes per day."*

This assessment predicts the potential maximum effects that occur, and a likely maximum duration for effects once prevailing weather conditions are taken into account. The Northern Irish guidance threshold has been adopted for all residential receptors as a measure of assessing the significant of predicted shadow flicker effects. If shadow flicker effects are assessed to be over the 30 hours per year or 30 minutes a day threshold, effects will be considered as significant, however professional judgement will also be used in determining the level of significance.

[186] Bright sunshine of 26% based on data from Kirkcaldy where an annual average of 1,425.6 sunshine hours was measured, and where daylight hours are assumed to be half of all hours throughout the year. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcvz0r35b (Accessed 16/02/2022).

[187] Department of the Environment, Best Practice Guidance to Planning Policy Statement 18 'Renewable Energy', 2009

12.5. Baseline Description

3,673 residential properties were identified within the Study Area however, it is not practical or considered necessary to assess the effects of shadow flicker on every potential receptor. As such, 32 representative assessment locations were chosen for assessment purposes, including:

- Permanent two- storey dwellings situated along the Buckhaven and Methil shorefronts that would have a potentially clear view of the Proposed Development;
- Randolph Wemyss Memorial Hospital and Denbeath Primary School;
- Multiple storey dwellings that are less likely to be screened by other intervening buildings; and
- All receptors which were assessed as part of the original 2012 ES for the Levenmouth Demonstration Turbine.

These receptors were chosen to represent properties that would be most likely to be impacted by shadow flicker due to close proximity to the Proposed Development, as well as having the most unobstructed views of the Proposed Development in their respective locations.

Table 12.2 details the receptors within the Study Area, as shown in Figure 12.1. As can be seen from Figure 12.1, when selecting representative receptors, it was noted that OS Address Base data did not specify property numbers, therefore for assessment purposes, we have numbered in chronological order for consistency.

Table 12.2 – Shadow Flicker Assessment Locations

Property Name	Easting (NRG)	Northing (NRG)	Distance to Turbine (Metres)
Viewforth a	**335499**	**697937**	**2,389**
Viewforth b	335649	697770	2,207
West High Street	**335787**	**697733**	**2,063**
Lawson Lane	335955	697933	1,951
Shore Street	**336063**	**697995**	**1,869**
Lady Wynd a	336170	698119	1,820
Rising Sun Road	336133	698283	1,929
Wellesley Road a	336195	698518	2,005
Wellesley Road b	336408	698754	1,998
Wellesley Road c	336587	698894	1,984
Wellesley Road d	336739	699158	2,117
Forth Street	**336547**	**698930**	**2,031**
Randolph Wemyss Memorial Hospital	**336326**	**698751**	**2,055**
Shepherds Park	336965	699281	2,125
High Street a	337102	699418	2,202
Main Street	**337260**	**699394**	**2,134**
South Grove	337363	699461	2,175
High Street b	337541	699732	2,414
Swan Court	**336898**	**699242**	**2,116**
Lady Wynd b	336146	698111	1,834
Bethune Way	336099	698024	1,842
Denbeath Primary School	**336217**	**698851**	**2,197**
Anderson Lane	**335973**	**697964**	**1,939**
Den Walk a	**335895**	**698719**	**2,357**
Omar Crescent	**335940**	**698534**	**2,219**
Den Walk b	**335975**	**698872**	**2,391**
Braehead Gardens	**335969**	**698077**	**1,983**
Clyde Street	**336521**	**698992**	**2,097**
Wellesley Road e	**336524**	**698876**	**2,005**
Ward Street	336304	698898	2,154

Property Name	Easting (NRG)	Northing (NRG)	Distance to Turbine (Metres)
Wellesley Road f	336283	698618	1,976
Swan View	**336723**	**699126**	**2,093**
***Properties highlighted in bold are regarded as multi-storey receptors.**			

12.6. Development Design Mitigation

It is not possible to include any development design mitigation measures to reduce shadow flicker effects within the Proposed Development.

12.7. Assessment of Potential Effects

Shadow flicker effects on identified receptors were assessed using worst case assumptions, and the significance of these effects were determined.

12.7.1. Worst Case Scenario

A worst-case approach has been taken, whereby a bare earth scenario has been assessed, i.e. screening effects provided by trees or other buildings have not been taken into account, nor has any account been taken of which building facades have windows (it has been assumed for the purposes of the assessment that all facades have windows directly facing the Proposed Development).

Worst-case assumptions that are made in the calculation include:

- Weather conditions are such that shadows are always cast during each day of the year, i.e. bright sunshine every day;
- The turbine rotor will always be facing directly towards the property and that the property has a window directly facing the turbines, maximising the size of the shadow and hence the frequency and duration of the effect;
- The turbines will always be rotating; and
- There will be no intervening structures or vegetation (other than topography) that may restrict the visibility of the Proposed Development, preventing or reducing the effect.

In practice these assumptions are not going to be accurate. There will be periods of non-windy conditions when the turbine blades would not be rotating. In windy conditions, the wind direction may not have been aligned with the direction of the sun, such that shadows were not being cast as widely as in the worst-case. Other factors such as the potential for screening by vegetation or intervening structures will also reduce or prevent flicker incidence even further, as compared to the theoretical maximum period or the likely period of effect suggested by the calculations. The actual potential impact is therefore likely to be only a fraction of the theoretical maximum.

12.7.2. Construction Effects

Shadow flicker is a phenomenon that only occurs once the turbines are installed and operational and thus no shadow flicker effects are anticipated during the construction phase of the Proposed Development.

12.7.3. Operational Effects

TA 12a details the theoretical maximum minutes of shadow flicker per day, and hours of shadow flicker per annum, based on the worst-case assumptions discussed in Section 12.7.1.

There is no percentage of average daily sunshine. In practice, this percentage will be variable across the day. For the purpose of this assessment and in order to quantify likely minutes per day a receptor will receive shadow flicker effects, cloud cover has been assumed at 68% (as per the average annual sunshine hours as discussed in Section 12.4.2.1) as 100% sunshine will unlikely occur in practice.

The theoretical maximum number of minutes per day, and hours per annum, as shown in TA 12a, is for all windows and accounts for any overlap where effects may be experienced at different windows.

It has been calculated that theoretical shadow flicker is likely to occur at 28 of the 32 assessed properties (as shown in Figure 12.2). TA 12a shows only those receptors which are assessed to be affected by shadow flicker and thus does not include the four receptors which received no shadow flicker effects i.e. High Street a, High Street B, Main Street and South Grove. Wellesley Road c is expected to receive the highest levels of shadow flicker effects, calculated as being possible for up to a theoretical maximum of 39.9 hours per annum.

Based upon weather conditions required to facilitate shadow flicker occurring for only 32% of the time (as outlined above), the likely number of hours per year where shadow flicker could potentially occur is reduced to 12.8 hours per annum at Wellesley Road c. This figure is likely to comprise an over-estimate of actual effects, given the conservative aspects of this assessment as set out in the assessment methodology.

As seen from TA 12a, all other properties that receive shadow flicker effects are predicted to receive likely shadow flicker effects for durations below the guidance threshold of 30 minutes per day or 30 hours per year. As such, shadow flicker due to the Proposed Development is therefore considered **not significant** in terms of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ('the EIA Regulations')[188].

12.7.4. Decommissioning Effects

Shadow flicker is a phenomenon that only occurs once the turbines are installed and operational and thus no shadow flicker effects are anticipated during the decommissioning phase of the Proposed Development.

12.8. Mitigation Measures and Residual Effects

As shadow flicker effects from the Proposed Development have been assessed as not significant, no mitigation measures are suggested.

However, in the event that complaints are made regarding shadow flicker effects from the Proposed Development and that these complaints are proven to constitute a Statutory Nuisance, then measures can be taken which would allow for shadow flicker to be reduced or prevented to comply the terms of any notice that may be issued under the terms of the Environmental Protection Act 1990 (as amended).

For example, a control system can be employed as part of the wider turbine control system to calculate, in real time, whether shadow flicker may affect a particular property, based on pre-programmed co-ordinates for the properties and wind turbine, and the intensity of sunlight, as measured by a device attached to the turbine tower. When the control system calculates that the sunlight is bright enough to cast a shadow and that the turbine is orientated in such a way that shadow will fall on a particular property, it would then automatically shut the turbine down, re-starting it when the shadow has moved away from the property. An option also exists within this mechanism to define larger areas to which shutdowns may be employed.

12.9. Cumulative Effect Assessment

The assessment methodology for cumulative effects remains the same as that described in Section 12.7.2. The study areas for cumulative sites remains as 10 rotor diameters in line with current guidance. If any cumulative development study areas overlap with that of the Proposed Development shadow flicker study area, the cumulative development will be assessed as part of the cumulative assessment.

12.9.1. Scope of Cumulative Assessment

Cumulative sites were selected for cumulative assessment by checking if their respective 10 x rotor diameter study areas for shadow flicker overlapped with Proposed Development's Study Area. Two potential cumulative sites were identified.

The Hydrogen Office Wind Turbine at Methil Docks, located approximately 2,374 m north of the Proposed Development, has a 10 x rotor diameter distance of 560 m. This 560 m study area does not overlap with any of the receptors identified in Table 12.2, therefore the Hydrogen Office Wind Turbine at Methil Docks has not been included in this cumulative assessment.

[188] The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 [Online] Available at: https://www.legislation.gov.uk/ssi/2017/101/contents/made (Accessed 28/09/2021)

The Levenmouth Demonstration Turbine, situated approximately 1,434 m northwest of the Proposed Development on the Methil shoreline, has been included within the cumulative assessment as it's 10 x rotor diameter study area (1,712 m) overlaps with the receptors assessed in Section 12.7. Therefore, it has determined that assessed receptors predicted to receive shadow flicker effects from the Proposed Development may receive cumulative shadow flicker effects also. Only those receptors which receive cumulative impacts from both the Proposed Development and the Levenmouth Demonstration turbine have been included in TA 12b. Both study areas can be seen in Figure 12.2.

12.9.2. Assessment of Cumulative Effects

TA 12b lists the theoretical and likely hours per annum in which shadow flicker effects are predicted to occur. As can be seen from TA 12b, shadow flicker effects may theoretically exceed 30 hours per annum however, when the percentage of bright sunshine is taken into account, effects are decreased and based on calculations alone, predictions show that effects may exceed 30 hours per annum at eleven locations. The eleven locations where shadow flicker exceeds 30 hours per annum are: Shore Street, Lady Wynd a, Wellesley Road b, Wellesley Road c, Forth Street, Randolph Wemyss Memorial Hospital, Lady Wynd b, Bethune Way, Clyde Street, Wellesley Road d, and Wellesley Road e.

However, it should be noted, the Levenmouth Demonstration Turbine is the main contributor of these shadow flicker effects as shown in TA 12c where the abovementioned receptors receive between 25 - 37 hours per year from the Levenmouth Demonstration Turbine in isolation. As such, given the Proposed Development has been assessed as not significant in terms of shadow flicker, cumulative significant shadow flicker effects from the Proposed Development are unlikely to be experienced.

As mentioned in Section 12.8, a control system may be employed for those circumstances where shadow flicker could be attributed specifically to the Proposed Development.

12.10. Summary of Effects

Table 12.3 - Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Operation			
Shadow flicker impacts on receptors within 10 x rotor diameters of the Proposed Development	Shadow Flicker will take place at all assessed receptors but will be within acceptable levels throughout the 25 year lifespan of the Proposed Development. This is **not significant** in terms of EIA Regulations	No mitigation has been proposed.	Shadow flicker will be experienced by a number of receptors as seen in TA 12a however, likely levels of flickering will be below the recommended thresholds.
Cumulative Shadow flicker impacts on residential properties.	Significant levels of shadow flicker are predicted to occur at several of the assessed receptors. These significant effects are mostly attributed to the existing Levenmouth Demonstration Turbine which was deemed to be not significant. As such, cumulative shadow flicker effects are not significant in terms of EIA Regulations.	No mitigation has been proposed however should it be proven that significant shadow flicker effects are attributed to the Proposed Development, control systems may be implemented.	Cumulative shadow flicker effects will be experienced by a number of receptors as seen in TA 12b however, effects are attributed to the Levenmouth Demonstration Turbine in isolation, as shown in TA 12c. Levels of flickering from the Proposed Development will be under the recommended thresholds.

12.11. Statement of Significance

An assessment of potential shadow flicker effects associated with the Proposed Development has been carried out in line with Scottish Government guidance. The theoretical maximum and likely hours of shadow flicker occurrence per year have been calculated 32 representative receptors located within 10 x rotor diameters (2,550 m) of the Proposed Development.

During the operational phase, it has been calculated that 28 of the 32 assessed properties are expected to experience shadow flicker effects from the Proposed Development; no likely effects are predicted to exceed the threshold of 30 hours per annum in line with recommended guidance. Therefore, the effects are **not significant** in terms of the EIA Regulations. No shadow flicker effects will occur during construction or decommissioning.

Cumulative shadow flicker effects are expected to surpass the 30 hour per annum threshold at 11 receptors. However, cumulative shadow flicker exceedances have been proven to be attributed to the Levenmouth Demonstration Turbine. No likely cumulative effects are predicted to exceed the shadow flicker thresholds from the Proposed Development. As such, cumulative shadow flicker effects from the Proposed Development are **not significant** in terms of the EIA Regulations.

It should be noted that flicker effects are expected to be further reduced in practice due to numerous factors, including screening and wind direction impacting on varying orientations of the turbine. The potential for shadow flicker effects at distances greater than 10 x rotor diameters from the Proposed Development are unlikely and are deemed not significant. As the assessed properties are those that, for the most part, will have a clear, unobstructed view of the turbine with minimal screening, the assessment presents a worst-case scenario and any properties behind these will experience lesser shadow flicker effects.

With the implementation of micro-siting, shadow flicker due to the Proposed Development is considered to remain **not significant** at the identified properties.

In the event that complaints are made regarding shadow flicker effects and that these complaints are proven to constitute a Statutory Nuisance, then measures can be taken which would allow for shadow flicker to be reduced. A control system could be employed for those circumstances where shadow flicker could be attributed specifically to the Proposed Development.

13. SHIPPING AND NAVIGATION

This chapter of the Environmental Impact Assessment Report (EIAR) evaluates the effects of the proposed Forthwind Demonstration Project (hereafter referred to as "the Proposed Development") on shipping and navigation. This chapter contains the following sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Methodology and Significance Criteria;
- Baseline Description;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

Section 13.4.1 provides an outline of the transfer of terminology between this chapter (which uses Environmental Impact Assessment (EIA) terminology) and the Navigational Risk Assessment (NRA) (which uses Maritime and Coastguard (MCA) terminology).

13.1. Introduction

This chapter of the EIAR evaluates the effects of the Proposed Development on shipping and navigation during the construction, operation and maintenance and decommissioning phases of the Development. An assessment of potential effects is undertaken based on various relevant guidance with inputs to the assessment including:

- Baseline description (which includes a review of navigational features, meteorological and oceanographic conditions, vessel traffic movements, emergency response resources and historical incident data);
- Consultation feedback;
- Lessons learnt from existing offshore developments; and
- Expert opinion.

Much of the inputs outlined above are detailed in full in the NRA which is an important requirement of the EIA for offshore projects and follows the guidance provided in *Marine Guidance Note (MGN) 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response* (MCA, 2021).

Data sources used to inform this Chapter include:

- Automatic Identification System (AIS) data between Kinghorn and North Berwick within the Firth of Forth covering 24th January to 20th February (28 days, winter) and 3rd to 30th June 2021 (28 days, summer).
- Anatec's Ship Routes database (2021).
- Marine Accident Investigation Branch (MAIB) incident database (2010 to 2019).
- Royal National Lifeboat Institution (RNLI) incident database (2010 to 2019).
- Department for Transport (DfT) UK civilian Search and Rescue (SAR) helicopter taskings data (2015 to 2021).
- United Kingdom Hydrographic Office (UKHO) Admiralty Charts 1407-0, 734-0 and 741-4 (2021).
- *Admiralty Sailing Directions North Sea (West) NP54* (UKHO, 2021).
- *Methil Offshore Windfarm Metocean Study* (ABPmer, 2015).

13.2. Consultation

Table 13.1 details the consultation that has been undertaken in respect of the shipping and navigation assessment, detailing how consultation responses have informed the assessment and have been considered within this Chapter.

Table 13.1 - Summary of Consultation Undertaken

Consultee	Consultation Method	Consultee Comments	Project Response
Scottish Fishermen's Federation (SFF) and Fife Fishermen's Association	Hazard Workshop	The floating foundation option would create additional problems for fishing.	Floating foundations are no longer considered as part of the Design Envelope.
Forth Ports	Hazard Workshop	The area marked as foul ground that intersects the development was historically a mine practice area but is no longer active.	Noted in the characterisation of the baseline environment (see Section 13.4.2) and a full unexploded ordnance (UXO) survey will be undertaken prior to installation.
Forth Ports	Hazard Workshop	Tugs headed out of the Port of Methil are typically based in Leith and used for towing barges in and out of Methil with a variety of infrastructure as well as rigs. The frequency of such operations is very variable but re-routeing would be required, resulting in slightly longer transits.	A main commercial route between Methil and Leith was identified in the characterisation of the baseline environment (see Section 13.4.2).
SFF and Fife Fishermen's Association	Hazard Workshop	There are smaller vessels in the region not carrying AIS including fishing vessels under 15 metres (m) which frequently turn off their AIS when engaged in fishing activity. Questioned whether Forth Ports could track smaller vessels using Radio Detection and Ranging (Radar).	Noted and taken into consideration in the assessment of potential effects (see Section 13.6). Forth Ports confirmed that small targets are difficult to track for any length of time.
Fife Fishermen's Association	Hazard Workshop	Not all fishing activity is local to the region, and more inshore fishing occurs in the sheltered waters closer to the coast during the winter months with vessels coming from ports further afield such as Arbroath.	The vessel traffic data covers both summer and winter periods to ensure seasonal variation is incorporated as per MGN 654 requirements for vessel traffic surveys.
Royal Yachting Association (RYA) Scotland	Hazard Workshop	Recreational traffic in the study area is most likely headed to Port Edgar and Granton and generally consists of non-local vessels.	Noted in the characterisation of the baseline environment (see Section 13.5.2) and the NRA.
Forth Yacht Clubs Association	Hazard Workshop	The cruising routes identified in the RYA dataset are likely to be within inshore areas and used by mariners with local knowledge and visitors less	Noted in the characterisation of the baseline environment

Consultee	Consultation Method	Consultee Comments	Project Response
		likely to be familiar with the Project are less likely to be passing in proximity to the Project.	(see Section 13.5.2) and the NRA.
Forth Ports	Hazard Workshop	Anchor berths K1 and K2 would likely require removal although acknowledged that there are numerous other anchoring locations in the region and so this is not considered a significant issue.	Noted in the assessment of potential effects (see Section 13.6) although the revised Design Envelope includes a greater distance between the Proposed Development and the anchor berths mentioned.
Forth Ports	Hazard Workshop	Semi submersibles generally anchor within the port of Methil anchorage areas and given their anchor spread could encroach upon the Project.	Noted in the characterisation of the baseline environment (see Section 13.5.2) and the NRA.
Forth Ports	Hazard Workshop	Pilot boarding would not be notably affected by the Project since the embarking location, which is located within a small vessel anchorage area, can be moved further north away from the Project.	Noted in the assessment of potential effects (see Section 13.6).
SFF	Hazard Workshop	Notices to Mariners are not always quickly distributed and additional sources including Kingfisher, Fishsafe and Fishfinder are noted.	Promulgation of information via Kingfisher Bulletins is included as a development design mitigation (see Section 13.6).
Forth Yacht Clubs Association	Hazard Workshop	There are a significant number of beach landings at Largo Bay and Elie where angling boats launch from, with nearshore activity generally as far as the 20 m contour.	Noted in the characterisation of the baseline environment (see Section 13.5.2) and the NRA.
RYA Scotland	Hazard Workshop	Kite and wind surfers may be scoped out of the assessment as they do not launch from nearby locations and are limited in the distance they can travel.	Kite and wind surfers have not been scoped in as receptors for the assessment (see Section 13.3.3).
Northern Lighthouse Board (NLB) and Forth Ports	Hazard Workshop	The Proposed Development may result in the visual impairment of vessels visiting the Port of Methil, with the harbour lights not clearly visible through the wind farm; amendments may be needed to the leading lights and this will be reviewed.	Noted in the assessment of potential effects (see Section 13.6).
Forth Ports	Hazard Workshop	Impacts relating to Very High Frequency (VHF) will be reviewed following installation of the Project.	Effects on communication, Radar and positioning systems have been scoped out of the assessment of

Consultee	Consultation Method	Consultee Comments	Project Response
			potential effects (see Section 11 of the NRA).
MCA	Teleconference meeting	Forth Ports should be considered the primary stakeholder, followed by the MCA.	Ongoing consultation with Forth Ports is included as a development design mitigation (see Section 13.6).
Forth Ports	Teleconference meeting	Pilot boarding for Methil is not typically undertaken in proximity to the charted pilot boarding station and is typically done where the vessel has anchored within the anchorage area.	Noted in the assessment of potential effects (see Section 13.6).
Forth Ports	Teleconference meeting	An exclusion zone could be applied and the location of the anchorage area and pilot boarding station reconfigured; however this will be a consideration for post consent when the final design parameters are known.	Noted in the assessment of potential effects (see Section 13.6).
Forth Ports	Teleconference meeting	The location of the development is far enough away from navigational features in the area including Energy Park Fife.	Noted in the assessment of potential effects (see Section 13.6).
Forth Ports	Teleconference meeting	Small vessels could be an issue but this would be for the VTS to manage and can be revisited post consent.	Development within the VTS area, thus allowing Forth Ports as the competent harbour authority to control the movement of vessels is included as a development design mitigation (see Section 13.6).
RYA Scotland	Teleconference meeting	The vessel traffic data collected may not be comprehensive for local recreational vessels not broadcasting on AIS but no additional data collection is requested.	Noted in the characterisation of the baseline environment (see Section 13.5.2) and the NRA.
		Recreational vessels are unlikely to utilise the pilotage services for the Port of Methil and would not be expected to anchor in the area given water depths. Additionally, the grounding risk to recreational vessels is considered minimal with directional drilling and the water depths.	Noted in the assessment of potential effects (see Section 13.6).
		Additional lighting and marking may cause confusion for mariners, noting the Craigkelly transmitter has three noticeable lights at night and in suitable conditions the Inch Cape Meteorological Mast (Met Mast) can be seen from a far distance.	Noted in the assessment of potential effects (see Section 13.6).

13.3. Scope of Assessment

13.3.1. Geographical Scope

The geographical scope of the assessment of shipping and navigation is defined by two study areas.

The traffic study area within which the vessel traffic baseline has primarily been characterised is undertaken in an approximately 15 nautical miles (nm) wide segment of the Firth of Forth between Kinghorn and North Berwick.

For commercial vessel routeing, the traffic study area would incorporate significant volumes of vessels entering and exiting the Firth of Forth to the east and compressing for the Queensferry Bridge to the west. Such vessel traffic is not considered directly relevant to the assessment of shipping and navigation given the distance from the Proposed Development and therefore an 8 nm buffer of the two structures has been used for the purposes of identifying the main commercial routes and the collision and allision risk modelling.

The relevant baseline information from both study areas has been considered in the assessment of potential effects (see Section 13.6).

13.3.2. Temporal Scope

The temporal scope of the assessment of shipping and navigation is the full 25-year design life of the Wind Turbine Generator (WTG)[189], including the construction, operational and decommissioning phases.

13.3.3. Receptors

Based on the geographical and temporal scope, the following receptors are scoped into the assessment of shipping and navigation:

- Commercial vessels – including cargo vessels, tankers, passenger vessels, tugs and other offshore support vessels undertaking commercial operations.
- Commercial fishing vessels – including commercial fishing vessels in transit.
- Recreational vessels – including recreational craft (both powered and sailing) between 2.4 and 24 m length.
- Military vessels – including military vessels in transit.
- Emergency responders – including RNLI lifeboats, SAR helicopters on behalf of the MCA and marine pollution responders.
- Project vessels – including project vessels associated with the construction, operation, maintenance and decommissioning of the Proposed Development.

13.3.4. Scoped In Effects

The following effects are scoped into the assessment of shipping and navigation for the construction phase:

- Displacement of vessels due to the presence of construction activities associated with the Proposed Development and subsequent increased vessel to vessel collision risk and/or restrictions on port access for third-party vessels.
- Disruption to pilot boarding activities due to the presence of construction activities associated with the Proposed Development.

The following effects are scoped into the assessment of shipping and navigation for the operational phase:

- Displacement of vessels due to the presence of the Proposed Development and subsequent increased vessel to vessel collision risk and/or restrictions on port access for third-party vessels.
- Creation of a vessel to structure allision risk for third-party vessels, including a vessel dragging anchor, due to the presence of surface infrastructure associated with the Proposed Development.

[189] The Meteorological Mast (Met Mast) has an operational life of five years but is anticipated to be decommissioned only at the end of the WTG's design life.

- Increased grounding risk for third-party vessels due to the presence of subsea cable protection associated with the Proposed Development.
- Disruption to emergency response and SAR operations due to the presence of the Proposed Development.
- Disruption to pilot boarding activities due to the presence of surface infrastructure associated with the Proposed Development.
- The presence of surface infrastructure associated with the Proposed Development may prevent the use of existing aids to navigation.

The following effects are scoped into the assessment of shipping and navigation for the decommissioning phase, noting that it is anticipated that effects will be broadly similar to those identified for the construction phase:

- Displacement of vessels due to the presence of decommissioning activities associated with the Proposed Development and subsequent increased vessel to vessel collision risk and/or restrictions on port access for third-party vessels.
- Disruption to pilot boarding activities due to the presence of decommissioning activities associated with the Proposed Development.

13.3.5. Scoped Out Effects

Based on the findings of the NRA, the following effects has been scoped out:

- Displacement of vessels from historical adverse weather routes due to the presence of the Proposed Development (all phases).
- Restrictions on access to safe havens due to the presence of the Proposed Development (all phases).
- The presence of project vessels undertaking construction/maintenance/decommissioning activities associated with the Proposed Development may increase vessel to vessel collision risk between project vessels and third-party vessels (all phases).
- Creation of a vessel to structure allision risk for project vessels due to the presence of surface infrastructure associated with the Proposed Development (operational phase).
- Effects on vessel use of communication, Radar and positioning systems on vessels due to the presence of the Proposed Development (operational phase).

13.4. Methodology and Significance Criteria

13.4.1. Terminology

Table 13.2 summarises differences in terminology between this chapter (which uses EIA terminology) and the NRA (which uses Formal Safety Assessment (FSA) terminology).

Table 13.2- Summary of Differences in Terminology Between EIA and NRA

EIA Term	NRA Term	Definition
Project design parameter	Cause	An event or activity that may create an effect.
Effect	Hazard	A potential to threaten human life, health, property or the environment.
Development design measure	Mitigation measure	A means of controlling a single element of effect, usually expressed as embedded (standard or good practice measures utilised or in place) or additional (in addition to embedded controls for reducing effect to As Low as Reasonably Practicable (ALARP)).
Significance of effect	Risk	The combination of the frequency of occurrence and the severity of consequence of an effect which results in a statement of significance.
Receptor(s)	User(s)	An effect sufferer(s).

13.4.2. *Baseline Characterisation*

The baseline for shipping and navigation has been characterised using a number of desk-based sources including AIS data, RNLI, MAIB and DfT incident data and UKHO Admiralty Charts. The desk-based sources are summarised in Table 13.3.

Table 13.3 - Summary of Desk Based Data Sources

Source	Summary	Purpose
Vessel traffic	AIS data (56 days, January/ February and June 2021)	Characterising vessel traffic movements in proximity to the Proposed Development.
	Anatec's Ship Routes database (2021)	Validation of AIS data.
Maritime incidents	RNLI incident data (2010 to 2019)	Characterising incident rates in proximity to the Proposed Development.
	MAIB marine accidents database (2000 to 2019)	
	DfT UK civilian SAR helicopter taskings (April 2015 to March 2021)	
Other navigational features	Admiralty Charts 1407-0, 734-0 and 741-4 (UKHO, 2021)	Characterising other navigational features in proximity to the Proposed Development.
	Admiralty Sailing Directions North Sea (West) Pilot NP54 (UKHO, 2021)	
Meteorology oceanography	*Methil Offshore Wind Farm Metocean Study* (ABPmer, 2015)	Characterising weather conditions in proximity to the Proposed Development for use as input to the collision and allision risk modelling.
	Admiralty Sailing Directions North Sea (West) Pilot NP54 (UKHO, 2021)	

It is noted that the vessel traffic data is proportional to the scale and location of the Proposed Development[190]. The vessel traffic data does not include Radar or visual observations; however it is within the limits of Forth Ports and therefore consultation has been undertaken with Forth Ports as the providers of the VTS. Consultation feedback from recreational and fishing representatives including RYA Scotland, Forth Yacht Clubs Association, SFF and Fife Fishermen's Association ensure that the baseline characterisation of small craft activity is sufficient.

13.4.3. *Assessment Methods*

The assessment of potential effects has been undertaken in line with the International Maritime Organization's (IMO) FSA process (IMO, 2018) which consists of five basic steps – identification of hazards (effects), risk analysis, risk control options, Cost Benefit Analysis (CBA) and recommendations for decision making.

The significance of effects is determined based on an aggregate of frequency and consequence, with these two facets of each effect ranked based on a number of inputs, including:

- Baseline assessment;
- Relevant development design mitigation;
- Level of stakeholder concern and outputs of consultation;
- Lessons learnt from other offshore wind farm developments; and
- Expert opinion.

[190] The MCA Methodology states that for small-scale developments the use of "*quantitative techniques*" may be sufficient (MCA, 2021).

A risk ranking matrix is used to determine the significance of effects from the frequency occurrence and severity of consequence, as presented in Table 13.4.

Table 13.4 - Risk Ranking Matrix for Shipping and Navigation

Consequences					
	Catastrophic	Tolerable with Additional Controls	Tolerable with Modifications	Unacceptable	Unacceptable
	Major	Tolerable with Monitoring	Tolerable with Additional Controls	Tolerable with Modifications	Unacceptable
	Minor	Broadly Acceptable	Tolerable with Monitoring	Tolerable with Additional Controls	Tolerable with Modifications
	Insignificant	Broadly Acceptable	Broadly Acceptable	Tolerable with Monitoring	Tolerable with Additional Controls
		Extremely Remote	**Remote**	**Reasonably Probable**	**Frequent**
		Frequency			

The significance of effect is determined to be in one of five categories:

- **Broadly Acceptable** significance of effect is low and deemed not significant in EIA terms.
- **Tolerable with Monitoring** significance of effect is low/intermediate and deemed not significant in EIA terms.
- **Tolerable with Additional Controls** significance of effect is intermediate and requires additional mitigation to be deemed not significant in EIA terms.
- **Tolerable with Modifications** significance of effect is intermediate/high and requires modifications to the project design to be deemed not significant in EIA terms.
- **Unacceptable** significance of effect is high and deemed significant in EIA terms.

13.5. Baseline Description

13.5.1. Navigational Features

A plot of key navigational features within the Firth of Forth in proximity to the Proposed Development is presented in Figure 13.1.

The key navigational features identified in proximity to the Proposed Development are detailed in Table 13.5.

Table 13.5 - Details of Key Navigational Features

Navigational Feature	Details
Ports and harbours	There are numerous ports and harbours located in the area with the closest being the Port of Methil, located approximately 0.9 nm north of the Proposed Development.
Pilot boarding stations	A pilot boarding station for the Port of Methil is located approximately 290 m north east of the WTG.
Anchorage areas	There are numerous designated anchorage areas located in the area with the closest being the small vessel anchorage associated with the Port of Methil, located approximately 170 m north east of the WTG. There are also deep water anchor berths associated with Methil and Kirkcaldy located south and east of the Proposed Development.
No anchorage area	A no anchorage area is located approximately 2.4 nm east of the WTG and runs across the Forth to protect a gas pipeline.
Aids to navigation	There are several aids to navigation situated in proximity to the Proposed Development, including:

Navigational Feature	Details
	• A special mark located approximately 0.5 nm west of the Met Mast designating a charted obstruction; • Multiple spherical buoys located approximately 0.6 nm north west of the WTG designating the perimeter of Energy Park Fife; and • Leading lights for the Port of Methil with a nominal range of 5 nm located approximately 0.9 nm north of the WTG.
Spoil ground / foul ground	An area of spoil ground is located approximately 940 m east of the WTG and a large area of foul ground is located approximately 1.2 nm south of the Met Mast.
Wrecks / obstructions	There is an obstruction at a charted water depth of between 5 and 7 m below Chart Datum (CD), located approximately 0.6 nm west of the Met Mast. There are no charted wrecks in close proximity to the Proposed Development.
Other developments	The Energy Park Fife, a decommissioning facility, is located approximately 400 m south west of the Port of Methil.

13.5.2. Vessel Traffic

This section provides an overview of the vessel traffic within the traffic study area. This includes 56 full days of vessel traffic data over two periods:

- 24th January to 20th February 2021 (28 days winter); and
- 3rd to 30th June 2021 (28 days summer).

These data periods allow for the assessment to account for seasonal variation. Although the vessel traffic data consists of AIS only which is not comprehensive for small craft, RYA Scotland noted during consultation that no additional data collection is required.

A number of vessel tracks recorded were classified as temporary (non-routine), such as tracks associated with survey operations. These have therefore been excluded from the analysis. Oil and gas platforms/drilling rigs moored within the traffic study area have been retained for analysis.

Figure 13.2 presents the vessels recorded (excluding temporary vessels) throughout the 56-day period within the traffic study area, colour-coded by vessel type.

For the 56 days analysed, there were an average of 29 unique vessels per day recorded within the traffic study area. The main vessel types recorded throughout the study period within the study area were tankers (30%), cargo vessels (20%) and commercial fishing vessels (20%).

Vessel lengths overall (LOA) was available for approximately 87% of vessels throughout the 56-day period and ranged from a 5 m RNLI lifeboat to a 382 m crane vessel. The average length of all vessels (excluding unspecified) was 87 m. Vessel draught was available for approximately 67% of vessel tracks recorded throughout the 56-day period and ranged from 1.1 m for an RNLI lifeboat to 21.8 m for a crane vessel. The average draught of all vessels (excluding unspecified) was 6.0 m.

Main routes have been identified using the principles set out in MGN 654 (MCA, 2021). Vessel traffic data are assessed and vessels transiting at similar headings and locations are identified as a main commercial route. A total of nine main commercial routes were identified from the AIS data studied within the routeing study area. These routes and corresponding 90th percentiles (areas within which 90% of vessel traffic transiting a route are situated as per MGN 654) are shown relative to the Proposed Development in Figure 13.3.

Relevant details of each route are given in Table 13.6. This includes key destinations; however, it should be considered that these are based on the most common destinations transmitted via AIS by vessels on those routes and therefore it should not be assumed that a transit on a given route will to be one of the destinations listed.

Although anchored vessels can be identified based upon their navigational status broadcast on AIS, it is common for vessels not to update their navigational status if only at anchor for a short period of time. For this reason, those vessels which travelled at a speed of less than 1 knot (kt) for more than 30 minutes had their corresponding vessel tracks individually checked for patterns characteristic of anchoring activity. After applying these criteria, an average of ten unique vessels per day were deemed to be at anchor. As shown in Figure 13.4, vessels typically anchored within the various charted anchorage areas although one tug was noted anchoring between the structure locations on 14 unique days – this occurred during the summer period and was associated with operations at Energy Park Fife.

Table 13.6 - Main Commercial Route Details

Route	Key Destinations	Vessels per Day	Vessel Type Breakdown
1	Grangemouth (UK) to Rotterdam (Netherlands)	2 to 3	Tankers (54%) and cargo vessels (46%).
2	Rotterdam to Grangemouth	1 to 2	Cargo vessels (62%) and tankers (38%).
3	Leith (UK) / Mukran (Germany)	0 to 1	Cargo vessels (100%).
4	Rotterdam / Grangemouth	0 to 1	Tankers (48%), cargo vessels (33%) and oil and gas vessels (19%).
5	Scapa Flow (UK) / Grangemouth	0 to 1	Oil and gas vessels (59%), cargo vessels (24%) and tankers (17%).
6	Leith / Tay (UK)	0 to 1	Oil and gas vessels (62%), cargo vessels (38%).
7	Leith / Methil (UK)	0 to 1	Pilot vessels (60%) and tugs (40%).
8	Methil / Montrose (UK)	0 to 1	Tugs (51%) and cargo vessels (49%).
9	Antwerp (Belgium) / Kirkcaldy (UK)	0 to 1	Cargo vessels (100%).

13.5.3. Historical Maritime Incidents

Historical incident data from the RNLI has been analysed below, with incident data from DfT and MAIB also considered within the NRA.

The incidents responded to by the RNLI within the traffic study area between 2010 and 2019 are presented in Figure 13.5, colour-coded by incident type.

A total of 358 incidents were recorded by the RNLI within the traffic study area between 2010 to 2019, which corresponds to an average of 36 incidents per year. Eight incidents were identified within 1 nm of the Proposed Development.

The most common incident types were “person in danger” (35%) and “machinery failure” (19%). In terms of casualty type, “person in danger” (35%) was again the most common, followed by “recreational” (25%). Kinghorn (58%) was the station most commonly responding to incidents within the traffic study area, followed by Anstruther (24%) and North Berwick (13%).

13.6. Development Design Mitigation

The following development design mitigation has been adopted to reduce the potential for effects on shipping and navigation receptors:

- Cable burial risk assessment – cable protection will be suitably implemented and monitored where adequate burial depth as identified via risk assessment is not feasible, with any damage, destruction or decay of cables notified to MCA, NLB, Kingfisher and UKHO no later than 24 hours after discovered.
- Charting of infrastructure – infrastructure associated with the Proposed Development (both surface and subsea) will be appropriately marked on UKHO Admiralty Charts.
- Compliance with MGN 654 – compliance with the requirements of MGN 654 and its annexes, including SAR Annex 5 (MCA, 2021), will ensured, where applicable.
- Development within a VTS area – will allow Forth Ports as the competent harbour authority to control the movement of vessels including project vessels.
- Guard vessel – use of a guard vessel as required by risk assessment.
- Lighting and marking – lighting and marking of the Proposed Development will be in agreement with NLB and in accordance with IALA Recommendation O-139 (IALA, 2013).

- Marine licence conditions – the marine licence may specify additional documentation post consent to further manage vessel traffic.
- Minimum blade tip clearance – the minimum blade tip clearance of the WTG will be at least 25 m above Highest Astronomical Tide (HAT).
- Promulgation of information – information relating to the Proposed Development including project vessel routes, timings and locations will be promulgated via Kingfisher Bulletins

13.7. Assessment of Potential Effects

13.7.1. Worst Case Scenario

Since the Proposed Development utilises a Design Envelope, a worst case scenario has been defined for the assessment of each shipping and navigation effect, as summarised in Table 13.7. By applying the worst case scenario to the assessment of each shipping and navigation effect, the resulting significance of effect is considered a worst case, with the application of any alternative parameters in the Design Envelope resulting in a significance of effect no greater than that resulting from the worst case scenario.

Table 13.7 - Summary of Worst Case Scenario for Each Effect

Phase	Effect	Parameters Associated with Worst Case Scenario	Justification
Construction	Vessel displacement, collision risk and restrictions on port access for third-party vessels	• Two phases of construction consisting of foundation and main structure installation taking place over a two to three month period. • Locations of the WTG and Met Mast as per Chapter 3: Project Description. • Interconnector cable with length 625 m. • Export cable with length 0.82 nm. • One jack-up vessel for each phase of construction making minimal movements once on-site and a lifting vessel. • One cable lay vessel and a possible secondary support vessel for cable installation. • Use of a Remotely Operated Vehicle (ROV) for post cable installation inspection and burial.	Maximum extent, maximum number of vessel activities and maximum duration resulting in maximisation of vessel displacement.
Construction	Disruption to pilotage services	• Two phases of construction consisting of foundation and main structure installation taking place over a two to three month period. • Locations of the WTG and Met Mast as per Chapter 3: Project Description. • Interconnector cable with length 625 m. • Export cable with length 0.82 nm. • One jack-up vessel for each phase of construction making minimal movements once on-site and a lifting vessel. • One cable lay vessel and a possible secondary support vessel for cable installation.	Maximum extent, maximum number of vessel activities and maximum duration resulting in maximisation of vessel displacement.

Phase	Effect	Parameters Associated with Worst Case Scenario	Justification
		• Use of an ROV for post cable installation inspection and burial.	
Operational	Vessel displacement, collision risk and restrictions on port access for third-party vessels	• Operational phase of 25 years for the WTG and five years for the Met Mast. • Locations of the WTG and Met Mast as per Chapter 3: Project Description.	Maximum extent, maximum number of vessel activities and maximum duration resulting in maximisation of vessel displacement.
Operational	Allision risk for third-party vessels	• Operational phase of 25 years for the WTG and Met Mast. • Locations of the WTG and Met Mast as per Chapter 3: Project Description. • WTG and Met Mast on monopile foundations.	Maximum extent, maximum number and size of surface infrastructure and maximum duration resulting in maximisation of vessel to structure allision risk.
Operational	Increased grounding risk for third-party vessels	• Operational phase of 25 years for the WTG and Met Mast. • Interconnector cable with length 625 m. • Export cable with length 0.82 nm. • Target burial depth for subsea cables of 1 to 1.5 m. • Use of cable protection where cable burial is not possible/effective.	Maximum extent of seabed infrastructure and maximum duration resulting in maximisation of grounding risk.
Operational	Disruption to emergency response and SAR operations	• Operational phase of 25 years for the WTG and Met Mast. • Locations of the WTG and Met Mast as per Chapter 3: Project Description. • Use of a Crew Transfer Vessel (CTV) to enable maintenance activities. • Use of an ROV to undertake cable inspections with an appropriate frequency.	Maximum extent, maximum number of vessel activities, maximum number of surface infrastructure and maximum duration resulting in maximisation of disruption to emergency response and SAR operations.
Operational	Disruption to pilotage services	• Operational phase of 25 years for the WTG and Met Mast. • Locations of the WTG and Met Mast as per Chapter 3: Project Description. • Use of a CTV to enable maintenance activities.	Maximum extent, maximum number of vessel activities and maximum duration resulting in maximisation

Phase	Effect	Parameters Associated with Worst Case Scenario	Justification
		• Use of an ROV to undertake cable inspections with an appropriate frequency.	of vessel displacement.
Operational	Prevention of use of existing aids to navigation	• Operational phase of 25 years for the WTG and Met Mast. • Locations of the WTG and Met Mast as per Chapter 3: Project Description.	Maximum extent and maximum duration resulting in maximisation of prevention of use of existing aids to navigation.
Decommissioning	Vessel displacement, collision risk and restrictions on port access for third-party vessels	• Two phases of decommissioning consisting of foundation and main structure decommissioning taking place over a two to three month period. • Locations of the WTG and Met Mast as per Chapter 3: Project Description. • One jack-up vessel for each phase of decommissioning making minimal movements once on-site and a lifting vessel. • Cables left in situ.	Maximum extent, maximum number of vessel activities and maximum duration resulting in maximisation of vessel displacement.
Decommissioning	Disruption to pilotage services	• Two phases of decommissioning consisting of foundation and main structure decommissioning taking place over a two to three month period. • Locations of the WTG and Met Mast as per Chapter 3: Project Description. • One jack-up vessel for each phase of decommissioning making minimal movements once on-site and a lifting vessel. • Cables left in situ.	Maximum extent, maximum number of vessel activities and maximum duration resulting in maximisation of vessel displacement.

13.7.2. Construction Effects

Displacement of vessels due to the presence of construction activities associated with the Proposed Development and subsequent increased vessel to vessel collision risk and/or restrictions on port access for third-party vessels.

Offshore construction will be undertaken over a two to three month period in two phases (foundation installation and main structure installation). Across the two phases there will be a jack up vessel making minimal movements once on-site other than transiting between the WTG and Met Mast over a 0.5 day period and a lifting vessel. For the subsea cables, a cable lay vessel, a possible secondary support vessel and an ROV for post cable installation inspection and burial will be present.

These activities and the presence of the structure foundations once installed may result in the displacement of vessels. Given that only two structures will be installed and associated vessel activities will be local to the locations of the structures it follows that any vessel displacement will be limited to the proximity of the Proposed Development. From the vessel traffic data, there are two main commercial routes pass in proximity to the Proposed Development, headed in and out of the Port of Methil (Routes 7 and 8). Both of these routes are low use (each less than one vessel per day) and are typically operated by tugs, small cargo vessels and pilot vessels.

However, as part of the pre wind farm modelling, it was identified that there are a high level of encounters occur on the approach to the Port of Methil.

No restrictions on navigation will be implemented in proximity to the Proposed Development by the Applicant, noting that since the Proposed Development is located within the jurisdiction of Forth Ports, it is possible that Forth Ports may implement safety zones, exclusion zones or speed restrictions. Based on experience at other under construction offshore installations, it is anticipated that commercial vessels will choose not to navigate in close proximity to the structures and will instead maintain a safe passing distance, including avoiding passing between the WTG and Met Mast locations. However, taking this and the existing mean positions of the main commercial routes in and out of Methil into account, no deviations from the mean positions of the routes are anticipated. Some squeezing of vessel traffic on the routes may occur to maintain safe distances from the structures and construction activities but will be limited. Subsequently the level of vessel to vessel collision risk for commercial vessels is not expected to increase substantially. This is reflected in the collision risk modelling undertaken which indicated a return period of one in 1,060 years for the base case post wind farm scenario, equating to an increase of 0.01% from the pre wind farm scenario, which is considered a negligible change.

Should vessels on the passing routes take a highly conservative approach, then there is sufficient sea room to allow some deviation, noting the need to account for the pilot boarding station for Methil, various designated anchorages and the nearshore area. Any such deviations are not expected to affect a vessel's ability to access the Port of Methil.

For smaller craft (fishing vessels and recreational vessels), the vessel traffic data indicates very low volumes in the area. However, it is noted that there may be non-AIS vessel presence in the area, as indicated by the SFF and Forth Yacht Clubs Association during consultation. Small craft may be displaced by the presence of the construction activities but the level of displacement will be low, and there is sufficient sea room to allow such deviations. There may be a risk of displaced small craft interacting with the pilot boarding station for Methil and various designated anchorages but given the frequency of use of these navigational features, the effect is likely to be minimal. Subsequently the level of vessel to vessel collision risk for small craft is not expected to increase substantially.

In the event that an encounter between third-party vessels occurs, collision avoidance action will be implemented by the vessels in line with the Convention on International Regulations for Preventing Collisions at Sea (COLREGs) (IMO, 1972/77). Should the encounter develop into a collision incident then any contact would likely occur at low speeds given the proximity to the coast and the Port of Methil, resulting in minor damage to the vessels. The casualty vessels could then head for a local port and undertake a full inspection. Additionally, emergency response facilities are located locally in the area to provide swift assistance as required.

The following development design mitigations will reduce the significance of effect:

- Charting of infrastructure – will assist in raising awareness of the Proposed Development and allow mariners to passage plan in advance, reducing the likelihood of a need for late course changes which would increase collision risk.
- Guard vessel – when on-site will assist in raising awareness of the Proposed Development and alerting a vessel on a closing point of approach to a project vessel.
- Lighting and marking – will assist in raising awareness of the Proposed Development, reducing the likelihood of a need for late course changes which would increase collision risk.
- Promulgation of information – will assist in raising awareness of the Proposed Development, reducing the likelihood of a need for late course changes which would increase collision risk.

Overall, the frequency of the effect is considered **Extremely Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Broadly Acceptable** which is not significant in EIA terms.

Disruption to pilot boarding activities due to the presence of construction activities associated with the Proposed Development.

Offshore construction will be undertaken over a two to three month period in two phases (foundation installation and main structure installation). Across the two phases there will be a jack up vessel making minimal movements once on-site other than transiting between the WTG and Met Mast over a 0.5 day period and a lifting vessel. For the subsea cables, a cable lay vessel, a possible secondary support vessel and an ROV for post cable installation inspection and burial will be present.

The pilot boarding station for the Port of Methil is located approximately 290 m north east of the WTG location. Its use is compulsory for vessels inbound to Methil over 60 m length or carrying dangerous cargoes and over 45 m length.

No use of pilot boarding services was observed in the vessel traffic data. Although the vessel traffic data includes AIS only, given the requirements for pilotage at the Port of Methil it is not anticipated that any non-AIS vessels would utilise the pilotage services. Furthermore, during consultation Forth Ports indicated that pilot boarding for the Port of Methil is not typically undertaken in proximity to the charted pilot boarding station and is typically done where the vessel has anchored within the anchorage area. RYA Scotland added that recreational vessels are unlikely to utilise the pilotage services.

Since the displacement of existing vessel traffic is expected to be limited, there is not anticipated to any additional interaction with the pilotage activities compared to the pre wind farm scenario, and thus minimal disruption. This was reflected by Forth Ports during consultation, with an indication that the pilot boarding station could be shifted further away from the Proposed Development, noting that the Proposed Development lies within a VTS area and therefore Forth Ports have jurisdiction over traffic movements.

In the unlikely event that there was disruption to pilotage activities, vessels requiring pilotage services may not be able to access the Port of Methil, with commercial implications. There would also be a vessel to vessel collision risk associated with vessels requiring pilotage but any contact would likely occur at low speeds given the proximity to the coast and the Port of Methil.

The following development design mitigations will reduce the significance of effect:

- Charting of infrastructure – will assist with awareness of the Proposed Development and allow mariners to passage plan in advance, reducing the risk of an unsafe approach to or use of the pilot boarding station at the Port of Methil.
- Guard vessel – when on-site will assist in raising awareness of the Proposed Development and alerting a vessel on a closing point of approach to a project vessel.
- Lighting and marking – will assist in raising awareness of the Proposed Development, reducing the risk of an unsafe approach to or use of the pilot boarding station at the Port of Methil.
- Promulgation of information – will assist in raising awareness of the Proposed Development, reducing the risk of an unsafe approach to or use of the pilot boarding station at the Port of Methil.

Overall, the frequency of the effect is considered **Extremely Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Broadly Acceptable** which is not significant in EIA terms.

13.7.3. Operational Effects

Displacement of vessels due to the presence of the Proposed Development and subsequent increased vessel to vessel collision risk and/or restrictions on port access for third-party vessels.

The design life of the WTG and Met Mast is 25 years. Both the Met Mast and WTG will be decommissioned as a whole after 25 years operation. A CTV will be used to enable maintenance activities to be undertaken on-site and an ROV will be used to undertake cable inspections with an appropriate frequency.

The presence of the structures and maintenance activities may result in the displacement of vessels. As with the equivalent construction phase effect, given that only two structures will be installed and associated vessel activities will be local to the locations of the structures it follows that any vessel displacement will be limited to the proximity of the Proposed Development.

The affected receptors and extent of the deviations is anticipated to be similar to the construction phase. Therefore, no deviations from the mean positions of the routes are anticipated. Some squeezing of vessel traffic on the routes may occur to maintain safe distances from the structures and construction activities but will be limited. Subsequently the level of vessel to vessel collision risk for commercial vessels is not expected to increase substantially and a vessel's ability to access the Port of Methil is not expected to be affected. It is also noted that, given the duration of the operational phase, mariners navigating in the area will develop a high level of familiarity and awareness with the Proposed Development.

The consequences in the event of an encounter or collision incident occurring are analogous to those described for the equivalent construction phase effect. The same development design mitigation are proposed as for the equivalent construction phase effect.

Overall, the frequency of the effect is considered **Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Tolerable with Monitoring** which is not significant in EIA terms.

Creation of a vessel to structure allision risk for third-party vessels, including a vessel dragging anchor, due to the presence of surface infrastructure associated with the Proposed Development.

The design life of the WTG and Met Mast is 25 years The WTG and Met Mast will be decommissioned as a whole after 25 years operations.

Allision risk is considered in three distinct parts:

- Powered allision risk;
- Drifting allision risk; and
- Anchor dragging risk.

In all three cases any effect is limited to within proximity of the Proposed Development.

For powered allision risk, vessels navigating in and out of the Forth will have good awareness of navigating in proximity to offshore installations given the presence of the Outer Firth of Forth offshore wind farms (with the first to start construction, the Neart na Gaoithe (NnG) Offshore Wind Farm, expected to be fully commissioned in November 2022 (EDF Renewables, 2020)). Those vessels which navigate exclusively within the Forth (typically smaller craft) may have less awareness.

Noting that since the Proposed Development is located within the jurisdiction of Forth Ports, it is possible that Forth Ports may implement safety zones, exclusion zones or speed restrictions, thus enforcing a greater passing distance for vessels.

With the main commercial route deviations associated with the post wind farm scenario in place, the powered allision return period is estimated to be one in 28,800 years for the base case scenario. This is very low compared to the return period estimated for other UK offshore wind farm developments and is reflective of the low number of structures and relatively low volume of vessel traffic in the area.

Based on historical incident data, there has been one reported instance of a third-party vessel alliding with an operational wind farm structure in the UK. Given that the Proposed Development is located in proximity to the Port of Methil and several navigational features (such as a pilot boarding station and designated anchorages) it is anticipated that the masters of third-party vessels will have a heightened level of alertness. It is also noted that, given the duration of the operational phase, mariners navigating in the area will develop a high level of familiarity and awareness with the Proposed Development.

In the event that an allision incident occurs, the consequences will depend on multiple factors including the energy of the impact, structural integrity of the vessel and sea state at the time of impact. Small craft (commercial fishing vessels and recreational vessels) are most susceptible given the potential for non-steel construction, although any allision would likely occur at low speeds given the proximity to the coast and the Port of Methil, resulting in minor damage to the vessel. The casualty vessel could then head for a local port and undertake a full inspection. Additionally, emergency response facilities are located locally in the area to provide swift assistance as required.

For recreational vessels under sail there are additional effects to consider such as wind shear, masking and turbulence. From previous studies of offshore wind farm developments, it has been concluded that WTGs do reduce wind velocity downwind of a WTG (MCA, 2008) but no negative effects on recreational craft have been reported, noting that such an instance would be short-term (especially given that there are only two structures) and similar to that experienced when passing a large vessel or close to other large structures (such as bridges) or the coastline.

For recreational vessels with a mast there is an additional effect of blade allision if navigating in proximity to the WTG. The RYA recommend a minimum blade tip clearance of 22 m above HAT to minimise this allision risk.

For drifting allision risk, and with the main commercial route deviations associated with the post wind farm scenario in place, the drifting allision return period is estimated to be one in 760,000 years for the base case scenario, which is considered a negligible value. This is very low compared to the return period estimated for other UK offshore wind farm developments and is reflective of the low number of structures and relatively low volume of vessel traffic in the area.

It is also noted that a vessel adrift may only develop into an allision situation if in proximity to the Proposed Development. This is only the case where the adrift vessel is located in close proximity to the structures and the direction of the wind and/or tide directs the vessel towards one of the structures. From meteorological data the predominant wind direction is from the south west and therefore a vessel would be more likely to drift towards a structure on the north-south approach to and from the Port of Methil.

Based on historical incident data, there have been no reported instances of a drifting third-party vessel alliding with an operational wind farm structure in the UK. Moreover, in the local area the majority of incidents responded to by the RNLI have involved a person in danger with no potential for a drifting vessel.

In the unlikely event that a drifting allision incident develops, the adrift vessel would initiate emergency response procedures to avoid an allision occurring. This may include emergency anchoring following a check of relevant nautical charts, noting that the only subsea features in proximity which may influence a decision to emergency anchor would be an obstruction approximately 0.6 nm west of the Met Mast and the subsea cables for the Proposed Development itself. Additionally, other vessels including project vessels if on-site may be able to render assistance including under International Convention for Safety of Life at Sea (SOLAS) obligations (IMO, 1974) and there is a possibility the adrift vessel could regain power prior to an allision occurring, albeit the likelihood of this is low given the likely short distance that would be covered between the vessel becoming adrift and the contact occurring.

The consequences of a drifting allision occurring would be similar to those noted for a powered allision, with the addition that the adrift vessel would be even more likely to make contact at low speed given that propulsion would be dictated primarily by the wind and/or tide. Again, emergency response facilities are located locally in the area and would be able to provide swift assistance as required.

Anchor snagging is considered a special case of drifting, and refers to an instance where, despite having the anchor deployed, a vessel drifts without holding power. In the case of the Proposed Development, anchor snagging would likely occur from one of the designated anchorages, including the small vessel anchorage for the Port of Methil located approximately 170 m north east of the WTG.

An average of 10 unique vessels per day were recorded at anchor within the traffic study area throughout the study period, with the majority consisting of tankers in the anchor berths south of the Proposed Development. There was infrequent use of the small vessel anchorage and also a case of a tug anchoring between the proposed structures. During consultation, RYA Scotland confirmed that recreational vessels would not be expected to anchor in the area given water depths.

The likelihood of an anchor failing to hold and a vessel drifting is very low, and in any case Forth Ports have acknowledged during consultation that this is not a significant issue since sensitive anchor berths may be moved or removed, noting that there are numerous designated anchorage locations in the area and the Proposed Development lies within a VTS area (therefore Forth Ports have jurisdiction over traffic movements). As with a standard drifting incident, a vessel dragging anchor may only develop into an allision situation if in proximity to the Proposed Development and with the direction of the wind and/or tide directing the vessel towards one of the structures.

The consequences of a drifting allision arising from anchor snagging would be similar to those noted for a powered and drifting allision, with the addition that the anchor could be damaged or snagged on subsea infrastructure such as the subsea cables associated with the Proposed Development. However, the latter option would likely prevent an allision from occurring. Again, emergency response facilities are located locally in the area and would be able to provide swift assistance as required.

The following development design mitigations will reduce the significance of effect:

- Charting of infrastructure – will assist in raising awareness of the Proposed Development and allow mariners to passage plan in advance, reducing the likelihood of a need for late course changes which would increase powered allision risk.
- Development within a VTS area – will assist in ensuring clear coordination and communication for all vessels including project vessels in relation to providing assistance under SOLAS obligations should a drifting allision incident develop.
- Guard vessel – when on-site will assist in raising awareness of the Proposed Development, alerting a vessel on a closing point of approach to a wind farm structure or in the event of a lighting and marking failure.
- Lighting and marking – will assist in raising awareness of the Proposed Development, reducing the likelihood of a need for late course changes which would increase powered allision risk.
- Minimum blade tip clearance – ensures compliance with RYA recommendations for minimum blade tip clearance for minimising blade allision risk.
- Promulgation of information – will assist in raising awareness of the Proposed Development, reducing the likelihood of a need for late course changes which would increase powered allision risk.

Overall, the frequency of the effect is considered **Extremely Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Broadly Acceptable** which is not significant in EIA terms.

Increased grounding risk for third-party vessels due to the presence of subsea cable protection associated with the Proposed Development.

The design life of the WTG and Met Mast is 25 years. An ROV will be used to undertake cable inspections with an appropriate frequency.

MGN 654 (MCA, 2021) states that any cable protection should not reduce the under keel clearance by more than 5%, with any changes greater than 5% to be discussed in consultation with the MCA and NLB. This stance is supported by the RYA which recommend that "*minimum safe under keel clearance over submerged structures and associated infrastructure should be determined in accordance with the methodology set out in MGN 543 [now superseded by MGN 654]*" (RYA, 2019).

From the vessel traffic data, there is one main commercial route passes in proximity to the Proposed Development including crossing the subsea cables, headed in and out of the Port of Methil (Route 7). This route is low use (less than one vessel per day) and is typically operated by tugs and pilot vessels with draughts up to 3 m. The draught of vessels on this route (where available) are under 2.5 m against charted water depths of between 7 and 10 m where the route crosses the export cable.

Given the length of the subsea cables and that cable protection will only be implemented where cable burial is not possible/effective, it is not anticipated that there will be a large presence of cable protection. Taking into account the requirements of MGN 654, maintaining a 5% change in water depth may be challenging given the shallow waters where vessel traffic crosses the export cable. However, this is offset by the relatively low draughts of vessels navigating in the area, resulting in a very low likelihood of a an underwater allision occurring.

In the unlikely event of an underwater allision incident occurring, the vessel in question would likely suffer minor damage and be able to make port noting the proximity of the Port of Methil. As a worst case, the vessel could be grounded and require assistance to be released. Emergency response facilities are located locally in the area and would be able to provide swift assistance as required. A grounding could result in pollution but this is considered highly unlikely.

The following development design mitigations will reduce the significance of effect:

- Cable burial risk assessment – will help ensure the under keel clearance is sufficient for safe navigation (either by cable burial or protection), reducing the likelihood of an underwater allision incident.
- Compliance with MGN 654 – will help ensure the under keel clearance in relation to cable protection is reduced by no more than 5%.

Overall, the frequency of the effect is considered **Extremely Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Broadly Acceptable** which is not significant in EIA terms.

Disruption to emergency response and SAR operations due to the presence of the Proposed Development.

The presence of the Proposed Development may increase the number of incidents in the area and reduce access for emergency responders, hindering the ability to respond to an incident including SAR operations.

The operational life of the WTG and Met Mast is 25 years. A CTV will be used to enable maintenance activities to be undertaken on-site and an ROV will be used to undertake cable inspections with an appropriate frequency.

The most likely immediate responder to an incident in the area is the RNLI given that there are multiple RNLI lifeboat stations located within the Forth, with the closest at Kinghorn approximately 8.1 nm to the south west. From historical incident data, there are a relatively high number of incidents in the area responded to by the RNLI (an average of 43 incidents per year within the traffic study area over the 10-year period between 2010 and 2019) including eight incidents within 1 nm of the Proposed Development.

On this basis, the likelihood of an incident requiring an emergency response in proximity to the Proposed Development is high. However, since there will be only two structures, it is not anticipated that their presence will materially affect the likelihood of an incident, noting that only 10 collision or allision incidents associated with UK offshore wind farms have been reported to date, corresponding to an average of one incident per 1,700 operational WTG years (as of November 2021).

Additionally, it is not anticipated that the Proposed Development will impede upon the capability of emergency responders including SAR assets. The lack of the internal array characteristic of large-scale offshore wind farm developments will allow SAR assets greater freedom in the approach to undertaking a search in proximity and the 625 m spacing between the two structures is sufficient to allow both marine and air based searches to navigate between the structures.

In the event of an incident occurring in proximity that requires emergency response, other vessels including project vessels if on-site may be able to render assistance including under SOLAS obligations (IMO, 1974). This is reflected in past experience, with nine known instances of a vessel (or persons on a vessel) being assisted by an industry vessel for a nearby UK offshore wind farm.

It is also noted that Forth Ports, as the competent harbour authority in the area, have a suite of emergency plans in place for responding to an incident within their jurisdiction, including a contingency plan.

In the unlikely event of an incident occurring where the presence of the Proposed Development hinders emergency responders, the consequences could be significant, including potential loss of life (PLL) and pollution.

The following development design mitigations will reduce the significance of effect:

- Compliance with MGN 654 – will ensure the Proposed Development is designed and operated in line with the requirements of SAR Annex 5, including the implementation of an Emergency Response Cooperation Plan (ERCoP) and completion of a SAR checklist.
- Development within a VTS area – will assist in ensuring clear coordination and communication for all vessels including project vessels in relation to providing assistance under SOLAS obligations as support for emergency responders.

Overall, the frequency of the effect is considered **Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Tolerable with Monitoring** which is not significant in EIA terms.

Disruption to pilot boarding activities due to the presence of surface infrastructure associated with the Proposed Development.

As noted for the equivalent construction phase effect, the pilot boarding station for the Port of Methil is located approximately 290 m north east of the WTG location. Its use is compulsory for vessels inbound to Methil over 60 m length or carrying dangerous cargoes and over 45 m length.

No use of pilot boarding services was observed in the vessel traffic data. Although the vessel traffic data includes AIS only, given the requirements for pilotage at the Port of Methil it is not anticipated that any non-AIS vessels would utilise the pilotage services. Furthermore, during consultation Forth Ports indicated that pilot boarding for the Port of Methil is not typically undertaken in proximity to the charted pilot boarding station and is typically done where the vessel has anchored within the anchorage area.

This effect is considered to be broadly similar in nature to that assessed for the equivalent construction phase effect. Additionally, given the duration of the operational phase, mariners navigating in the area will develop a high level of familiarity and awareness with the Proposed Development, including when approaching the pilot boarding station for the Port of Methil. The same development design mitigation are proposed as for the equivalent construction phase effect.

Overall, the frequency of the effect is considered **Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Tolerable with Monitoring** which is not significant in EIA terms.

The presence of surface infrastructure associated with the Proposed Development may prevent the use of existing aids to navigation.

The design life of the WTG and Met Mast is 25 years and therefore the Proposed Development as a whole will be operational for 25 years.

Aids to navigation local to the Proposed Development include:

- Special mark located approximately 0.5 nm west of the Met Mast designating a charted obstruction;
- Multiple spherical buoys located approximately 0.6 nm north west of the WTG designating the perimeter of Energy Park Fife; and
- Leading lights for the Port of Methil with a nominal range of 5 nm located approximately 0.9 nm north of the WTG.

The special mark and spherical buoys are designed for navigational use when in close proximity and so the presence of the Proposed Development is anticipated to have a negligible effect on their use, noting that during consultation Forth Ports indicated that the Proposed Development is located far enough away from navigational features in the area, including Energy Park Fife.

For the leading lights at the Port of Methil, the nominal range of 5 nm will result in interaction with the Proposed Development. From the vessel traffic data, there are two main commercial routes in and out of the Port of Methil (Routes 7 and 8), with both low use (less than one vessel per day).

For Route 8, there is not expected to be a negligible effect given that vessels on this route will not have the Proposed Development directly between them and the port at any time. For Route 7, there may be some blocking of the leading lights for vessels on approach to the Port of Methil, although this will be limited up until 1 nm from the port at which point vessels will be passing the Met Mast.

During consultation RYA Scotland noted that the Craigkelly transmitter has three noticeable lights at night and in suitable conditions the Inch Cape Met Mast can be seen from a far distance.

However, with only two structures present, the effect will be minor and short-term in nature, with the mostly likely consequence temporary visual confusion. As a worst-case a mariner may lose track of their vessel's position and allide with one of the structures or run aground in the nearshore area. However, such a scenario is considered highly unlikely, particularly given that mariners navigating in the area will develop a high level of familiarity and awareness with the Proposed Development.

The following development design mitigations are proposed to reduce the significance of effect:

- Lighting and marking – will assist in providing alternative means of navigation for vessels approaching the Port of Methil to navigate if use of the leading lights is compromised.
- Promulgation of information – will assist in raising awareness of possible short-term periods where the leading lights for the Port of Methil are compromised, reducing the risk of temporary visual confusion.

Overall, the frequency of the effect is considered **Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Tolerable with Monitoring** which is not significant in EIA terms.

13.7.4. Decommissioning Effects

Displacement of vessels due to the presence of decommissioning activities associated with the Proposed Development and subsequent vessel to vessel collision risk and/or restrictions on port access for third-party vessels.

Offshore decommissioning is expected to follow a similar process, method and timescale to offshore construction, as detailed in Table 13.7, although the subsea cables are assumed to be left in situ. Therefore, the effect is expected to be similar in nature to the equivalent construction phase effect including no deviations from the mean positions of the routes and limited squeezing of vessels. The same development design mitigation are proposed as for the equivalent construction phase effect.

Overall, the frequency of the effect is considered **Extremely Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Broadly Acceptable** which is not significant in EIA terms.

Disruption to pilot boarding activities due to the presence of decommissioning activities associated with the Proposed Development.

Offshore decommissioning is expected to follow a similar process, method and timescale to offshore construction, as detailed in Table 13.7 although the subsea cables are assumed to be left in situ. Therefore, the effect is expected to be similar in nature to the equivalent construction phase effect including minimal disruption to pilotage activities. The same development design mitigation are proposed as for the equivalent construction phase effect.

Overall, the frequency of the effect is considered **Extremely Remote** and the consequences are considered **Minor**. Therefore, the significance of the effect is considered **Broadly Acceptable** which is not significant in EIA terms.

13.8. Mitigation Measures and Residual Effects

The following mitigation measure is suggested to further reduce the potential for effects on shipping and navigation receptors:

- Ongoing consultation with Forth Ports.

Forth Ports – as the competent harbour authority and operator of the VTS area within which the Proposed Development is located – controls vessel traffic in the area and has jurisdiction over traffic monitoring and the navigation features in the VTS area (such as pilot boarding stations and anchorage areas). Therefore, ongoing consultation with Forth Ports is considered vital throughout all phases of the Proposed Development and is relevant for all of the effects which have been assessed.

In terms of residual effects, the majority of effects are already considered **Broadly Acceptable**. However, with this mitigation measure in place, the residual effect for the following effects which are currently **Tolerable with Monitoring** may also be considered **Broadly Acceptable**:

- Vessel displacement, collision risk and restrictions on port access for third-party vessels (operational phase).
- Disruption to emergency response and SAR operations (operational phase).
- Disruption to pilotage services (operational phase).
- Prevention of use of existing aids to navigation (operational phase).

13.9. Cumulative Effect Assessment

13.9.1. Scope of Cumulative Assessment

A screening process for other future developments which have the potential to result in cumulative effects on shipping and navigation has been undertaken. This includes (but is not limited to) consideration of:

- Offshore wind farm developments;
- Other surface piercing infrastructure such as oil and gas installations;
- Marine aggregate dredging areas; and
- Subsea cables and pipelines.

A key element of this process was establishing the geographical scope within which a cumulative effect may exist. It was determined that only future developments within the Firth of Forth have the potential to result in a cumulative effect on shipping and navigation on the basis that outwith the Firth of Forth there is not a direct pathway between the Proposed Development and any other future developments, i.e. there is negligible interaction with vessel traffic that may be displaced by the Proposed Development. This includes the offshore wind farm developments located in the Outer Firth of Forth such as NnG, Seagreen Offshore Wind Farm, Inch Cape Offshore Wind Farm and Berwick Bank Wind Farm.

Following the screening process, no relevant future developments were identified.

13.9.2. Assessment of Cumulative Effects

Since no future developments are considered to have the potential to result in cumulative effects on shipping and navigation, no assessment of cumulative effects is required.

13.10. Summary of Effects

Table 13.8 summarises the assessment of effects for shipping and navigation.

Table 13.8 - Summary of Effects

Effect	Significance of Effect	Additional Mitigation Proposed	Residual Effect
Construction			
Vessel displacement, collision risk and	Broadly Acceptable	Ongoing consultation with Forth Ports	Broadly Acceptable

Effect	Significance of Effect	Additional Mitigation Proposed	Residual Effect
restrictions on port access for third-party vessels			
Disruption to pilotage services	Broadly Acceptable	Ongoing consultation with Forth Ports	Broadly Acceptable
Operation			
Vessel displacement, collision risk and restrictions on port access for third-party vessels	Tolerable with Monitoring	Ongoing consultation with Forth Ports	Broadly Acceptable
Allision risk for third-party vessels	Broadly Acceptable	Ongoing consultation with Forth Ports	Broadly Acceptable
Increased grounding risk for third-party vessels	Broadly Acceptable	Ongoing consultation with Forth Ports	Broadly Acceptable
Disruption to emergency response and SAR operations	Tolerable with Monitoring	Ongoing consultation with Forth Ports	Broadly Acceptable
Disruption to pilotage services	Broadly Acceptable	Ongoing consultation with Forth Ports	Broadly Acceptable
Prevention of use of existing aids to navigation	Tolerable with Monitoring	Ongoing consultation with Forth Ports	Broadly Acceptable
Decommissioning			
Vessel displacement, collision risk and restrictions on port access for third-party vessels	Broadly Acceptable	Ongoing consultation with Forth Ports	Broadly Acceptable
Disruption to pilotage services	Broadly Acceptable	Ongoing consultation with Forth Ports	Broadly Acceptable

13.11. Statement of Significance

The effects of the Proposed Development on shipping and navigation have been considered for all phases of the Proposed Development, with numerous effects identified involving a number of receptors. The significance of effect has been determined as either **Extremely Remote** or **Remote** in terms of frequency of occurrence and **Minor** in terms of severity of consequence, with the significance of effect either **Broadly Acceptable** or **Tolerable with Monitoring**, which are both not significant in EIA terms. A mitigation measure involving ongoing consultation with Forth Ports, as the competent harbour authority for the area where the Proposed Development will be installed, is suggested and will result in the residual effect of all effects being **Broadly Acceptable**. Since no future developments are considered to have the potential to result in cumulative effects on shipping and navigation, no cumulative effects have been considered.

13.12. References

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14. SOCIO ECONOMIC ASSESSMENT

14.1. Introduction

This chapter of the EIAR summarises the assessment of the socio-economic effects of the proposed Forthwind demonstration project, hereafter referred to as "the Proposed Development". The chapter comprises the following sections:

- Introduction;
- Scope of Assessment;
- Methodology and Significance Criteria;
- Baseline Context;
- Strategic Context;
- Assessment of Potential Effects and
- Statement of Significance

The purpose of this chapter is to consider the socio-economic impacts of the construction and operation of the Proposed Development and identify, where appropriate, mitigation measures to offset potential negative impacts and increase socio-economic benefit respectively.

14.2. Scope of the Assessment

The geographical and technical scope of this assessment is set out below:

- Geographical scope: the assessment considers the impacts of the Proposed Development on local communities, primarily coastal communities in closest proximity to the location of the Proposed Development, and the wider regional and national economy, where appropriate;
- Technical scope: the assessment considers key potential social and economic impacts, including:
    - Impacts caused to local residents and communities, arising from construction and operational activity;
    - Employment and skills training; and
    - Impacts to tourism and the tourist economy in the region.

The assessment draws upon the findings of wider technical assessments to inform its consideration of direct and cumulative effects, including the assessments of airborne noise, seascape, landscape and visual impacts, and shipping and navigation effects, amongst others.

The assessment does not explore some socioeconomic considerations. These were scoped out due to the scale and location of the Proposed Development. A single turbine on industrial land which is already dedicated to energy and innovation will not create the same socioeconomic impact which a larger development on a site which was previously dedicated to other use could potentially have.

This chapter has sought to consider socioeconomic impacts which could conceivably have a measurable effect on the local community. Scoped out potential effects are justified within the chapter.

14.3. Methodology and Significance Criteria

This assessment draws upon established methodological practice and approach for the identification of socio-economic effects of proposed projects, as part of the EIA process and informing the planning and consent process. This approach comprises:

- Review of baseline data to determine the current socio-economic content within which the Proposed Development will be developed, as set out in section 14.4;
- Assessment of potential effects, both negative and positive, of the construction, operation and decommissioning of the Proposed Development, as set out in section 14.6 and including:
    - Direct effects: opportunities that can be created as an immediate effect of the Proposed Development, for example opportunities in the construction, operation, and decommissioning of the site;

  - Indirect effects: opportunities that will be created by the Proposed Development further down the supply chain. For example, companies providing services to the Proposed Development during construction, operation, and decommissioning of the site; and
  - Induced effects: for example, employments created by the additional spend of wages into the local economy and the purchasing of basic materials, equipment and office space for staff.
- Identification of mitigation and enhancement measures, as set out in section 14.7; and
- Cumulative impacts and overall assessment of significance, as set out in section 14.8.

14.3.1. Pre-Application Consultation

The Applicant undertook a Pre-Application Consultation in December 2021. A public event was held at the Fife Renewables Innovation Centre on 13 December 2021, which took the format of a drop-in event between 10.00 and 19.00. Table 14.1 below sets out the stakeholder groups who were notified of this event and Table 14.2 below sets out the methods for publicly advertising the event.

Table 14.1: Stakeholder Organisations notified of the event on 13 December 2021

The commissioners of Northern Lighthouses
The Maritime and Coastguard Agency
The Scottish Environment Protection Agency
NatureScot
Fife Council

Table 14.2: Public Advertisement of the events on 13 December 2021

Publication	Date
The East Fife Mail	27th October 2021
Fife Free Press	28th October 2021
Glenrothes Gazette	3rd November 2021
Herald & Citizen	29th October 2021
FifeToday.co.uk	27th October 2021

A postal address and an email address was provided within the public advertisement to allow comments from members of the public who were unable to attend the event in person.

The event presented details of the Proposed Development through a series of display boards throughout the exhibition space; including projections of the visual aspects of the offshore infrastructure from the following key locations:

- Shore Street, Buckhaven;
- Fife Coastal Path, West Wemyss;
- Fife Coastal Path, Leven; and
- Gullane Beach, East Lothian.

There were around five attendees at the exhibition including councilman David Graham, and a few individuals who either work, or just happened to be, in the Fife Renewables Energy Centre that day. Those whom attended the event noted the following aspects:

- Current Scottish and UK Renewable Energy incentives and renewable energy policy;
- Socio-economic impact of the Proposed Development at a local level (including the potential of utilising the Harland and Wolff yard in Methil as a manufacturing, deployment and/or project host site);
- Potential for alternative forms of energy (including hydrogen);
- Local visual impact; and
- Project timescales.

Opportunities to provide written feedback on the Proposed Development was provided through the supply of a "have your say" feedback form. The form also provided contact details (both email and postal address) where comments on the Proposed Development could be sent.

A number of visitors took a copy of the "Have Your Say" forms with them, however none were filled in during the event.

An email from one visitor was received on 15th December. This response included two comments with regards to the inclusion of a Community Benefit payment being made, as well as including training and employment opportunities for the local population.

No other comments from stakeholders in response to the public exhibition have been sent to Forthwind following the event.

No specific comments on the project design or layout have been received from the public during the pre-application consultation process. The feedback provided focussed mainly on the local economic impacts the Proposed Development could have on the local and Scottish supply chain.

More information is available in the Pre-Application Consultation Report contained within Volume 3: Technical Appendix 14.

14.4. Baseline

14.4.1. Baseline data

The assessment has drawn upon relevant baseline data collated to inform the Environmental Statement for the previously consented 2-B Energy Development, which has been updated by additional desk-based research undertaken in 2021.

The following sources of information have been used to inform the baseline description set out in this chapter:

- National Statistics Online (www.statistics.gov.uk);
- NOMIS Official Labour Market Statistics (www.nomisweb.co.uk);
- Office of National Statistics (ONS);
- Fife Council (www.fife.gov.uk);
- Visit Scotland (www.visitscotland.com);
- Renewable UK (www.renewableuk.com); and
- Crown Estate Scotland (www.crownestatescotland.com).

14.4.2. Location and demographics

The Proposed Development will be located on the northern shore of the Firth of Forth at Fife Energy Park, Methil. The coastal town of Methil is located 2.3 km south-west of Leven and approximately 12 km north-east of Kirkcaldy in Levenmouth

Fife is Scotland's third largest Local Authority area based on the population. Based on the most recent NOMIS figure (2020) the population of Fife was 374,100 representing 6.8% of Scotland's total, and a rise of 3.2% since 2010. The population is expected to continue to grow by 7% to around 400,000 by 2033[191]. Fife's proportion of working age population is slightly smaller than Scotland or the UK's; at 62%, compared with 63.9% in Scotland and 62.4% in the UK.

14.4.3. Employment and the local economy

The latest statistics (2020) show Fife has a marginally higher population of those who are economically active; 77.2 %, compared to Scotland as a whole at 76.4%. Unemployment has been decreasing steadily in Fife since 2013 and current unemployment figures from 2020 stand at 5.0% % in Fife as compared to 4.6% in both Scotland and 4.9% in the UK[192].

[191] *Climate Fife: Sustainable Energy and Climate Action Plan (2020-2030)*
[192] Labour Market Profile - Nomis - Official Labour Market Statistics (nomisweb.co.uk), (2021)

Employment in Levenmouth is significantly lower than for Fife as a whole, at 62.8% compared with 72.8%[193]. According to data collected by the Office of National Statistics (ONS) Business Register and Employment Survey, approximately 15.7% of the workers in Levenmouth are employed in manufacturing[194]. The Fife region has, however, seen a continuous shift from traditional manufacturing economy to a service based economy with majority employed in the public service sector. Between 2015 and 2019 there has been a 6.7% decline in the number of manufacturing employee jobs[195]. There is a recognised need to diversify the employment base for the area, this will be primarily achieved through inward investment from alternative sectors such as the renewable energy industry.

14.4.4. Local renewables economy: Fife Energy park

Fife Energy Park, a key project is a joint venture between Scottish Enterprise and Fife Council aimed to role in the development of Scotland's Renewable Energy Infrastructure and provide long term jobs.

Located on the east coast of Scotland, Fife Energy Park is 55 ha in size and is currently home to a number of businesses. These include Harland & Wolff, who have a steel manufacturing facility; Ferguson Transport and Shipping; and Hydrosphere UK, a supplier of maritime and navigation aids.

The ORE Catapult Levenmouth Wind Turbine also occupies part of the Energy Park. It is the world's most advanced, open-access offshore wind turbine dedicated to research and development. Since 2016, the facility has attracted 98 small or medium enterprises (SMEs) for technology development, testing or demonstration. It is also a key asset in ORE Catapults' core research and development programme with 45 projects completed or under contract at the facility. This indicates that while Levenmouth has been home to traditional manufacturing, it is becoming a hospitable location for renewables innovation.

The H100 Fife Project is also based at the Fife Energy Park. The Project is developing a world-first hydrogen network in Buckhaven that will bring renewable hydrogen into homes in 2023, providing zero-carbon fuel for heating and cooking. In the project's first phase, the network will heat around 300 local homes using clean gas produced by a dedicated electrolysis plant, powered by a nearby offshore wind turbine.

14.4.5. Scottish and UK renewables sector

There has been significant growth in the UK's Offshore Wind sector in recent years, with 50% of the UK's new renewable electric capacity coming from offshore wind in 2019[196]. The UK owns 25% of the global portfolio of offshore wind[197]. Scotland currently has 892 MW of operational offshore wind capacity[198], or 8.5% of the UK's offshore wind generating capacity[199]. Scotland's strong offshore winds provide the ideal conditions for technology which can harness this powerful resource and it has been identified that the east coast is of particular potential providing a very suitable location for the Proposed Development of offshore wind due to the gently shelving nature of the sea bed in this area[200].

The relevant policies and action plans from UK and the Scottish Government, implemented and led by both Crown Estate (CE) and Crown Estate Scotland (CES) to establish the offshore renewable industry, has created significant development opportunities within this sector.

A recent survey by Scottish Renewables observed that there were 22,660 jobs in the renewables industry in 2018 with 20% of this figure (4,700) associated with the offshore wind industry[201]. The Scottish Government's Sectoral Marine Plan for Offshore Wind[202] aims to increase jobs in the offshore wind sector to more than 6,000

[193] *Invest Fife, Levenmouth Economic Profile,* economic-profile-2021-levenmouth.pdf (investfife.co.uk)
[194] *Invest Fife, Levenmouth Economic Profile,* economic-profile-2021-levenmouth.pdf (investfife.co.uk)
[195] Labour Market Profile - Nomis - Official Labour Market Statistics (nomisweb.co.uk), (2021)
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[200] *Scottish Government Marine Energy – Offshore wind (online) http://www.scotland.gov.uk/Topics/marine/marineenergy/wind 2014*
[201] Renewable Energy Facts & Statistics | Scottish Renewables (2019)
[202] *Sectoral Marine Plan: Offshore Wind, Scottish Government (2021)* sectoral-marine-plan-offshore-wind-energy.pdf

jobs and the Socio Economic Impact Assessment for this plan, estimates that in the best case scenario, this could result in up to £2.1 billion gross value added (GVA) to the Scottish economy between 2020 and 2059[203].

14.4.6. Baseline content: Tourism and the natural environment

Fife is flanked by the River Tay to the north and to the south by the Firth of Forth. Fife is an important international tourist region that centres on its natural environment, particularly its coastline and golf centres, the majority of which are located in the eastern and northern parts of the region. Tourism is an important and growing sector in Fife. Tourism in Fife accounts for £566m annually, as well as 11,500 full-time equivalent jobs, or 9% of employee jobs in Fife[204]. The Fife Tourism and Events Strategy notes the importance of Fife's landscape to its tourism industry, as 75% of visitors undertook some kind of outdoor activity[205]; however the Strategy does not single out any areas for protection, and this document should be read alongside the Economic Strategy and the Climate Emergency Strategy.

There are no formal on-site public rights of way or recreational opportunities located within the Fife Energy Park where the substation and site office and store will be based. There are a number of local recreational and tourist attractions located in the vicinity of the Proposed Development, as listed in Box 14.. Several small islands are located within the Firth of Forth including Inchkeith, Craigleith, Isle of May and Bass Rock. A tourist ferry operates to the island Inchholm located 25km to the south west of the Proposed Development site and daily boat trips are available from Anstruther and North Berwick to the Isle of May, located 27.5km east of the Proposed Development site. Access to the remainder of the islands in the Firth of Forth is generally limited.

Box 14.1 - Examples of key attractions in the vicinity of the Proposed Development

- Methil Heritage Centre approximately 2.8 km north from the Proposed Development;
- Fife Heritage Railway approximately 3km north from the Proposed Development;
- Leven Beach located approximately 3.9 km north east from the Proposed Development;
- Leven Links Golf course located approximately 3.9 km north east from the Proposed Development;
- Largo Bay, located approximately 3.3 km north east from the Proposed Development;
- Macduff Castle located approximately 2.5 km south west from the Proposed Development;
- Wemyss Castle located approximately 5 km south west from the Proposed Development; and
- The Forth Railway Bridge located approximately 30 km south west from the Proposed Development.

Other potential landscape and cultural heritage designations such as National Parks, Area of Great Landscape Value, Historic Parks and Gardens is further discussed in *Chapter 5*: *Seascape, Landscape and Visual Impact Assessment* and Chapter 9: Cultural Heritage of this EIAR.

The recreational routes of regional and national importance in the vicinity of the Proposed Development are listed in Box 4.2 below.

Box 4.2 Recreational routes in the vicinity of the Proposed Development

- The Fife Coastal Driving Route follows the coastline in Fife and is 2km at its nearest point[206]
- The Fife Coastal Path, a part of the international North Sea Trail, stretches approximately 90 miles (150 km) from North Queensferry to Tay Bridge. The 11.2 km (7 miles) section from East Wemyss to Lower Largo is located approximately 2km from the Proposed Development[207];
- The section of the National Cycle route no. 1 (part of North Sea cycle route) that extends from Edinburgh to Aberdeen passes approximately 6.8 km (4.2 miles) from the Proposed Development at its closest point;
- The regional cycling route No.76 passes approximately 5.8km (3.6 miles) from the Proposed Development at its closest point; and

14.5. Strategic context

[206] Scotland Road Trip Itinerary Planner & Route Map | VisitScotland

The strategic context within which the Proposed Development is being progressed, comprises a range of strategies, policies, plans and initiatives which inform current and projected socio-economic development at the local, regional, Scottish and UK level. A selection of key strategies is listed below:

14.5.1. UK Strategy

In its Net Zero strategy[208], the UK Government made a commitment that all electricity in the UK will come from low carbon sources by 2035. To deliver this, the strategy sets out that the UK Government will deliver 40GW of electricity generated from offshore wind. In 2020, the UK only generated 10,383 MW from offshore wind, so this represents an ambitious increase of 285% of generating capacity. Whilst responsibility for policy and implementation on renewable energy, including offshore wind, is devolved to the Scottish Government, the Strategy reflects the ambitious UK wide plans for development for the industry.

14.5.2. Key Scottish strategies

The strategic framework within which the Proposed Development is being progressed, is strongly supportive of the development of the renewables and wind farm sector and the contribution this can make to a sustainable economic future for Scotland. Below is a selection of key strategies and the ambitions set out within these in relation to wind farms.

14.5.3. The Energy Strategy

The Energy Strategy[209] sets out the intention for 50% of Scotland's energy for transport, heat and electricity to come from renewable sources by 2030. The Strategy considers how Scotland's low carbon energy transition can deliver an energy sector which is competitive and delivers economic opportunity. The most recent Scottish Government Energy Statistics state that 97.3% of Scotland's electricity was produced from renewable sources in 2020[210]. The Energy Strategy also named Offshore Wind as a priority solution for low carbon electricity generation. This was followed by an Offshore Wind Policy Statement[211], which set out the Scottish Government's vision for the offshore wind sector which minimises impact on other marine users and maximises opportunities for economic development, investment and employment. Specifically, the Scottish Government intends to enable between 8 and 11 GW capacity in offshore wind by 2030.

14.5.4. Climate Change Strategy

The Scottish Government signalled a step change in their approach to carbon emissions by declaring a climate emergency in April 2019. The consideration of skills challenges has also become more prominent within the policy discourse in Scotland. For example, the establishment of the Just Transition Commission, with the remit of advising on a net-zero economy which is fair for all. The Commission reported in 2021[212], making recommendations grouped around four key messages:

1. Pursue an orderly, managed transition to net-zero that creates benefits and opportunities for people across Scotland.
2. To deliver maximum public benefit from public money, the public sector in Scotland must be more prescriptive and strategic in its use of funding streams to build strong and resilient local supply chains.
3. The Scottish Government must use all available levers to achieve increased local content and more competitive Scottish offshore wind projects.

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[204] *Fife Tourism Events Strategy, Fife Tourism Partnership (2019)* fife_tourism_events_strategy_2019_29_digital-1.pdf (fifetourismpartnership.org) accessed 29/09/2019, accessed 29/09/2021
[205]) *Fife Tourism Events Strategy, Fife Tourism Partnership (2019)* fife_tourism_events_strategy_2019_29_digital-1.pdf (fifetourismpartnership.org) accessed 29/09/2019, accessed 29/09/2021
[206] Scotland Road Trip Itinerary Planner & Route Map | VisitScotland
[207] *Fife Coastal Path, East Wemyss to Largo* Fife Coastal Path - Fife Coast & Countryside Trust (fifecoastandcountrysidetrust.co.uk), *accessed 29/09/2021*
[208] *Net Zero Strategy: Build Back Greener*, UK Government, 6 October 2021
[209] *The Future of Energy in Scotland, Scottish Government (2017),* The future of energy in Scotland: Scottish energy strategy - gov.scot (www.gov.scot)
[210] *Scottish Government Renewable electricity output and conversion calculators* Renewable electricity output and energy conversion calculators - gov.scot (www.gov.scot)
[211] *Offshore wind policy Statement, Scottish Government (2020),* Offshore wind policy statement - gov.scot (www.gov.scot)
[212] *Just Transition Commission: A National Mission for a fairer, greener Scotland, Just Transition Commission (2021)* Just Transition Commission: A National Mission for a fairer, greener Scotland - gov.scot (www.gov.scot)

4. To avoid a race to the bottom in our net-zero supply chain and embed quality work across the economy, all public funding for climate action must be conditional on Fair Work terms.

The Scottish Government's Climate Change Plan[213] sets out the targets of delivering a 75% reduction in greenhouse gas emissions, in comparison with 1990 emissions, by 2030, and of being net-zero by 2045.

14.5.5. Green Recovery

The Scottish Government have committed to an enhanced green new deal to support Covid recovery, which reconsiders every aspect of the Scottish economy through the lens of the low carbon energy transition and socioeconomic recovery from the pandemic. Within this context, the Scottish Government have set an ambition to increase offshore wind capacity to 11 GW by 2030, as well as looking to continue to significantly increase capacity in the longer term[214].

The pandemic has had a clear impact on the Scottish labour market. The number of people claiming jobseeker's allowance doubled from 3.5% of the population in March 2019, to 7% of the population share in July 2020.215 This has since decreased to 5.4%, indicating that there has been some improvement, but that the labour market in Scotland has not recovered to pre-pandemic levels.

14.5.6. Fife strategies, plans and policies

Fife's Economic Strategy for 2017-2027[216] highlights low carbon energy innovation as a key growth area. It also specifically highlights the Levenmouth Community Energy Project as a case study in how to deliver an innovative project which contributes to the fight against climate change, whilst delivering economic opportunities for Fife. The Strategy also highlights "responding to the continuing shift to a low carbon economy and opportunities for innovation in carbon reduction" as a key challenge which economic actors in Fife should seek to address over the lifetime of this plan.

The Climate Fife: Sustainable Energy and Climate Action Plan[217] sets out a vision for a low carbon energy transition in Fife, which is:

- climate friendly, transforming the economy, infrastructure, land use and energy system to decarbonise how we live;
- climate ready, with plans and projects to increase the resilience of Fife communities and the economy to help minimise the impacts from unavoidable climate change; and
- climate just, ensuring that all Fifers and the Fife environment can benefit from this transition.

The Plan also highlights low carbon energy generation, including from wind, as critical to the delivery of this vision.

14.5.7. Public Attitudes towards Wind farms

Informing the socio-economic context for the Proposed Development is the stakeholder environment within which renewables and wind farm projects in particular, have and will continue to be developed. A range of studies have been conducted since the emergence of the first wave of wind farm development proposals, which reflect upon evolving public perception of wind farms.

One of the key drivers for evolving public perception is the consent and operation of such projects across the UK and Scotland which have shifted the narrative from what was primarily a perception based discussion around

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[213] *Update to the Climate Change Plan 2018 – 2032 Securing a Green Recovery on a Path to Net Zero, Scottish Government (2020)* Update to the Climate Change Plan 2018 - 2032: Securing a Green Recovery on a Path to Net Zero (www.gov.scot). See also *Climate Change Plan: third report on proposals and policies 2018-2032, Scottish Government* Climate Change Plan: third report on proposals and policies 2018-2032 (RPP3) - gov.scot (www.gov.scot), *accessed 29/09/2021*
[214] Increased offshore wind ambition by 2030 - gov.scot (www.gov.scot)
[215] Claimant Count : S92000003 Scotland : People : NSA : Percentage (%) - Office for National Statistics (ons.gov.uk). To note, not all of this increase is a result of increased unemployment. Eligibility criteria for benefits has been widened, and some new claimants may still be working but have experienced a fall in income and therefore become eligible to claim benefits.
[216] fifes-economic-strategy-2017-27.pdf (investfife.co.uk)
[217] https://www.fife.gov.uk/__data/assets/pdf_file/0017/193121/ClimateActionPlan2020_summary.pdf

potential scenarios, to one informed by the operation of wind farms and the grounded experience of local communities.

Studies have been conducted across the past decade and beyond, to identify prevalent public attitudes towards wind farms. In 2015, a study undertaken on behalf of The Crown Estate[218] reported that the majority of the UK public continued to be in favour of more offshore wind farms, in this case 74% of the respondent base.

This was followed in 2017 by a Cardiff University and the UK Energy Research Centre report which considered Scottish attitudes to renewable energy. It reaffirmed previous research conducted which found that Renewable energy technologies were viewed favourably by a large majority of respondents: 78% report being very or mainly in favour of hydroelectric power, 85% for solar power, 74% for wind energy and 80% for marine power.

The most recent Public Attitude Tracker undertaken by the Department for Business Energy and Industrial Strategy (BEIS)[219] found that over three quarters of UK adults (79%) said they supported the use of renewable energy sources to generate the UK's electricity, fuel and heat. The tracker also highlighted that 76% of people were supportive of offshore wind as an energy source.

14.5.8. Public perception and evidence of the impacts of wind farms in regard to the tourism industry

Historical studies conducted in 2007[220], and in 2012[221],concluded that there was no evidence to suggest that wind farms would have a negative impact on Scottish tourism, with the 2012 report reporting that 80% of UK respondents, and 83% of Scottish respondents said their decision on where to visit or where to stay would not be affected by the presence of a wind farm.

A more recent study undertaken by Biggar Economics in 2020[222] examined the impacts of the construction phases of wind farm developments across the UK on the relevant local tourist industries. This study found that:

- The local tourism sectors did not underperform during the construction period compared to their long term average; and
- Local tourism-related employment followed the trends of the wider region during the construction period of offshore wind farms.
- These studies suggest that there is very limited risk to the tourist sector from wind farms in both the construction and operational phases.

These studies suggest that perceptions of the impacts of wind farms on local tourism and the tourist economy, including offshore wind farms in both Scotland and the whole of the UK, are positive and the evidence of recent operational impact of such developments, did not negatively impact the local tourist economy.

14.6. Assessment of Potential Effects

14.6.1. Construction phase

14.6.1.1. Community effects

Construction of the Proposed Development is anticipated to last six months and will be undertaken through the use of shipping vessels to facilitate offshore transportation of materials and components to the proposed location. This will serve to minimise disruption to local communities through avoiding onshore transportation and use of the local road network.

There are no landing facilities for recreational activities in the vicinity of the demonstration turbine. During construction the area surrounding the turbine will not be accessible to marine users for health and safety

[218] *Plymouth Marine Laboratory (PML), Public Perceptions of Offshore Wind Farms (2015)*public_perceptions_the_crown_estate.pdf (offshorewindindustry.com)
[219] BEIS Public Attitudes Tracker Wave 35 (publishing.service.gov.uk), (2021)
[220] Glasgow Caledonian University (2007) The Economic Impacts of Wind Farms on Scottish Tourism [online] Available at: Economic impacts of wind farms on Scottish tourism: report - gov.scot (www.gov.scot)
[221] The James Hutton Institute The Impact of Wind Farms on Scottish Tourism (climatexchange.org.uk), 2012
[222] Offshore Wind Farm Construction and Tourism - BiGGAR Economics (2020)

reasons. The construction area will be limited to that in the immediate vicinity of the turbine location and will not preclude recreational users from utilising the coastline around the Proposed Development.

Chapter 13: *Shipping and Navigation* of this ES provides further information on effects to marine recreational activities in the area surrounding the Methil Docks/ Fife Energy Park. Any potential visual effects of the Proposed Development will be discussed within Chapter 5: *Seascape, Landscape and Visual* of this EIAR.

Given the limited duration and scope of constructing the single turbine, and the undertaking of construction activity offshore, no significant effects on the cohesion and capital of local communities, is predicted.

14.6.1.2. Employment and local economic effects

It is estimated that the construction phase of the Proposed Development will create six local jobs in project management and development, in addition to generating opportunities for up to 60 local workers to establish site facilities and grid connection cabling during the six-month construction. Whilst of a defined scale, employment will nonetheless generate a positive effect which can be enhanced through proactive sourcing of this workforce within the local and regional area.

A review undertaken by BVG Associates, to assess the potential opportunity for the Scottish supply chain arising from the Proposed Development, concluded that there is a realistic opportunity for Scottish companies to supply a number of components and services to this project, equating to 44% of the total project costs[223]. This will have a potentially significant impact on the Scottish supply chain, both in terms of the delivery of the immediate project but also the potential replicability of services across wider wind farm developments.

Table 14.3 Potential local Scottish content delivery

	% cost	Scottish content	UK content
Development and project management	2%	38%	80%
Turbine	19%	1%	7%
Substations	3%	8%	19%
Foundations	9%	4%	7%
Cables	2%	0%	7%
Turbine and foundation installation	6%	4%	6%
Cable installation	4%	5%	8%
Installation Other	3%	42%	75%
Operations and maintenance	49%	43%	81%
Decommissioning	2%	17%	30%
Total	100%	25%	48%

Key areas where content has the potential to be delivered through the Scottish supply chain, include:

- Development and project management;
- Turbine assembly;
- Half of the possible value of the support structure could be added within Scotland;
- Wind farm transmission is designed and project managed in Scotland though recognising that large components will need to be imported;
- Installation contractors; and
- Operations and maintenance.

The remaining 55% of non-Scottish contribution relates to areas where there is no existing indigenous Scottish supply chain capacity or infrastructure. The BVG study recognises that, in the short term, the Forthwind development alone is not enough to trigger the major investment required by potential Scottish suppliers to meet this supplier gap, but adds to a wider investment case to the indigenous supply chain to add capability in these areas for the wider offshore wind sector. The successful and timely deployment of the Forthwind

[223] *UK and Scottish content baseline and roadmap A report for the Scottish Offshore Wind Energy Council* – BVG Associates (2021*)* bvga-local-content-roadmap.pdf (offshorewindscotland.org.uk), accessed 22/10/21

development will be a significant influence and positive signal to the turbine manufacturer to consider establishing turbine component manufacturing facilities within Scotland as an enabler for local content requirements of the UK Round 4 and 5 and ScotWind offshore wind leasing rounds.

The effects of construction activity on employment and the local supply chain economy will be positive with the scope to create even greater significance of effect through the successful future implementation of the prototype and for local suppliers, through the transference of skills and experience gained through the project, to wider developments.

14.6.1.3. Effects on commercial fisheries

The effects of the Proposed Development on navigational safety and commercial fisheries are discussed in *Chapter 13: Shipping and Navigation* and *Chapter 8*: *Commercial Fisheries* of this EIAR respectively. These include agreement on the level of survey undertaken to inform the assessments.

14.6.2. Operational Phase

14.6.2.1. Community effects

The location and operation of the Proposed Development is offshore, and will by design have negligible impacts on the functioning and cohesion of local communities. The public attitudinal studies summarised in section 14.5.5 also reflect evidence from currently operational wind farm developments, that public perception of offshore wind and wider renewables which would suggest that there is a reasonable assumption that there will be general public acceptance of the Proposed Development.

The land-based or sea-based recreational resources will not experience any direct effects during the operation of the Proposed Development. There is no significant visual effect on National Cycle Route 1 and 76 and Regional Cycle Route 63 due to no or limited intervisibility between these locations and the Proposed Development. More detailed assessment findings are set out in *Chapter 5 Seascape, Landscape and Visual Assessment*.

As detailed in *Chapter 11: Airborne Noise*, the assessment found that, as long as operational noise restrictions are imposed under specific conditions, there will be no significant noise impacts. The context of an offshore location, limited visual effects and mitigation to avoid significant noise effects arising from the operation of the Proposed Development, the cumulative effect of the Proposed Development on local communities is not predicted to be significant.

14.6.2.2. Effects on the local tourism economy

Chapter 5: Seascape, Landscape and Visual offers a detailed assessment of the Proposed Development's visual impact on the surrounding area. For the purposes of a socioeconomic assessment, this chapter has specifically considered the effect on key landmarks and tourist attractions, as outlined at section 14.4.6 above.

There are several operational wind farm developments within proximity of the location of the Proposed Development. The nearest cumulative wind farm developments to the Proposed Development site are the Levemouth turbine, located approximately 1.3 km to the north-west and the H100, located approximately 1.7 km to the north-east of the Proposed Development. Additional developments are located further afield including, Earlseat Wind Farm, located approximately 4.6 km to the west, Westfield Wind Farm, located approximately 15.4 km to the west, Little Raith Wind Farm 18.3 km south west and Lochel Bank Wind farm approximately 30.4 km northwest of the Proposed Development.

Turbines are, therefore, an established feature which both coastal communities and visitors to the area have become accustomed to viewing offshore. In the context that the Proposed Development comprises a single turbine, located along a coastline where there are multiple wind farm developments, it is not anticipated that there will be any significant negative effects on local tourism. This reflects the findings set out in studies such as that of Biggar Economics[222] which concluded that the evidence operational wind farms did not negatively impact tourism.

14.6.2.3. Employment and local economic effects

It is estimated that the Proposed Development will support the equivalent of up to 6 full-time maintenance and administrative staff. Whilst limited in scale, employment will generate a positive effect, particularly if sourced from within coastal communities and the region.

The skills development and experience derived from the construction and operation of the Proposed Development will generate both direct beneficial effect to employees and contractors but also support the further development of the Scottish supply chain. Enhancement opportunity exists to deliver wider skills development and training and the Proposed Development includes the commitment to working in partnership with national and local agencies to maximise the knowledge opportunity at all levels, from operational/installation training through to degree level and postgraduate research work. Future opportunities also exist for technician level training and industry skills development, which will support the region's objective in being an integral part of the growing Scottish renewables sector and the socio-economic benefits which this will generate.

14.6.2.4. Wider economic effects

The purpose of the Proposed Development is to demonstrate the feasibility of the prototype technology and achieve industry certification as a prelude to wider deployment. Whilst the Proposed Development can generate immediate economic benefit, the most significant scale of impact will arise from the future rollout of the prototype technology, development of the supply chain and generation of skills and experience within the region. This has the potential to enhance the level of content in future developments which can be sourced within the local/Scottish supply chain, with the direct and indirect economic development this can generate.

In the longer term, there is potential for the Forthwind technology to supply offshore wind farm developments including the Scottish Territorial Waters and the UK Government's offshore sites. The impact of achieving a <u>timely</u> and successful demonstration of the next generation offshore wind turbine sends a positive signal to the turbine manufacturer in its considerations of establishing component manufacturing facilities within Scotland, as an enabler for local content provision requirements.

14.6.3. Decommissioning Phase

It is intended that the life cycle of the Proposed Development will be 25 years. The Decommissioning Plan for the Proposed Development – Forthwind Decommissioning Plan B1 – sets out a strategy of offshore transportation of deconstructed turbine components avoiding impacts to local communities. Advance notification of the proposed lifespan coupled with proactive relocation of those employed on the project to the future deployment of the prototype technology and/or comparable wider developments, will mitigate against negative direct effect on relevant individuals and the supply chain supporting the Proposed Development.

There is no significant effect predicted to arise from decommissioning.

14.7. Summary of effects

Table 14.4 Summary of effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction			
Disruption to community social, recreational and everyday living	Negligible		Negligible
The construction phase of the Proposed Development will create six jobs in project management and development, in addition to generating opportunities for up to 60 local workers to establish site facilities and grid connection cabling during the six-month construction.	Minor (positive)	Emphasis upon local procurement of staff, goods and services	Minor (positive)
There is a realistic opportunity for Scottish companies to supply a number of components and services to this project, equating to 44% of the total project costs	Moderate (positive)	Emphasis upon local procurement of staff, goods and services	Moderate (positive)
Operation			

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
In the context of this development, the visual impact or airborne noise impact will not have significant secondary socioeconomic effects.	Minor (negative)	Reference to mitigation set out in Airborne Noise and SLVI chapters	Minor (negative)
A possibility that visual impacts could lead to an impact on the local tourism sector.	Negligible	None suggested	Negligible
The Proposed Development will support the equivalent of up to six full-time maintenance and administrative staff.	Minor (positive)	Emphasis upon local procurement of staff, goods and services	Negligible (positive)
The skills development and experience derived from the construction and operation of the Proposed Development will generate both direct beneficial effect to employees and contractors but also support the further development of the Scottish supply chain.	Moderate (positive)	Emphasis upon local procurement of staff, goods and services	Moderate (positive)
Enhancement opportunity exists to deliver wider skills development and training and the Proposed Development	Moderate (positive)	Embedded commitment to working with local agencies and technician level training	Moderate (positive)
The Proposed Development has the potential to enhance the level of content in future developments which can be sourced within the local/Scottish supply chain, with the direct and indirect economic development this can generate	Moderate (positive)	Emphasis upon local procurement of staff, goods and services	Moderate (positive)
There is potential for the Forthwind technology to supply offshore wind farm developments including the Scottish Territorial Waters and the UK Government's Round 4 offshore sites	Moderate (positive)	None suggested	Moderate (positive)

14.8. Statement of Significance

There are no significant negative socio-economic effects predicted to arise during the construction, operation or decommissioning phase of the Proposed Development. Positive effects are predicted to arise in relation to employment, skills and training, and the development of the regional and Scottish supply chain to support the continuing development of the renewables and offshore wind industry. These effects can be significantly enhanced with the future deployment of the prototype technology and the contribution it can make to the growth of the industry generally, influence on the establishment of future turbine component manufacturing facilities and specifically the consolidation of knowledge and expertise within the region which will position it to capitalise upon future commercial and development opportunities.

15. BENTHIC ECOLOGY

This chapter evaluates the potential effects of the Proposed Development on benthic ecology. This chapter contains the following sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Legislative Framework and Guidance
- Assessment Methods;
- Baseline Characterisation;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

15.1. Introduction

The benthic baseline are described at a local and wider regional scale in order to provide context to the environmental impact assessment (EIA). The chapter was principally informed by the benthic ecology survey technical report (Appendix A10.1).

The construction, operation and decommissioning of the Proposed Development has the potential to have a range of direct and indirect effects on benthic habitats and its associated species within the Study Area (as shown in Figure 14.1 Volume II of the EIAR). By describing the characteristics of the existing environment and the interactions with the proposed project activities, the potential effects of the Proposed Development on the benthic ecological receptors can be assessed.

The key sources of information used to inform the assessments of effects on benthic ecology include the following:

- Benthic ecology survey technical report (included in Volume III Technical Appendix 10a Benthic Ecology Survey Report of this EIAR.
- MeshAtlantic;
- Joint Nature Conservation Committee (JNCC) and Marine Nature Conservation Review (MNCR) database;
- The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) threatened and/or declining habitats in the north east Atlantic ocean;
- Scotland's National Marine Plan Interactive (NMPi) website; and
- Other reports and ESs from studies within the wider area.

15.2. Consultation

Table 15.1 describes the consultation that were undertaken in respect of the benthic ecology assessment for the original EIA, detailing how consultation responses have informed the assessment and have been considered within this chapter.

Table 15.1 Summary of Consultation Undertaken

Consultee	Consultation Method	Consultee Comments	Project Response
NatureScot	Letter	Intertidal habitats The ES will need to include habitat mapping of the intertidal area around the proposed turbine and the proposed bridging structure (see section 6.9.2 of the scoping report[224]). The mapping should clearly demarcate any natural habitats as well as 'man-made' and rock-armoured areas	The Project Description (Chapter 3) indicates that the turbine will be installed subtidally approximately, 1.5 km from mean high water springs (MHWS) and that the export cable will traverse the intertidal area by trenching. As the turbine locations are subtidal, no intertidal mapping around them was necessary.
NatureScot	Letter	Benthic survey, and mapping, will be required for turbine locations B&C [now named locations 1 and 2] and their associated cable routes. This information is necessary for EIA – to understand the potential impacts of this proposal on benthic ecology, as well as to target any mitigation / avoid any key sensitivities. NatureScot consider that Table 1 – Potential impacts matrix (page 11) needs to include consideration of the potential impacts to benthic ecology that may arise from piling, cable laying, and scour protection.	Benthic survey and mapping was undertaken and the technical report is available in Appendix A10.1. Key sensitivities such as protected habitats and species were detailed in this work.
MS-LOT Marine Scotland Licensing Operations Team	Email (26/09/2014) From David O'Sullivan to Scott Harper	MS-LOT are content with and approve the attached Benthic Survey Methodology clarification provided to us by Arcus on 8th September 2014. During discussions, MS-LOT requested a change to the scope to include beam trawls.	After a subsequent telephone conversation with David O'Sullivan at Marine Scotland it was agreed that the extra trawl would be completed and the survey carried out as agreed and submitted on the 8th September 2014.

[224] *Arup Scotland Ltd (2009). Methil Wind Turbine Demonstration Project Environmental Impact Assessment – Scoping Report. 2-B Energy. Job number 210528. (0015Final Issue-01.12.09-2-B Scoping Report.doc).*

Consultee	Consultation Method	Consultee Comments	Project Response
Marine Scotland	2021 Scoping Opinion	The Scottish Ministers advice that the Developer provides an explanation of the intended mitigation for, or amelioration of, anchor scars during installation of cables, within a Cable Plan which should accompany the EIA Report and application	Potential direct habitat disturbance impacts due to anchor scars are fully assessed within this Chapter. A Cable Plan has been produced and is contained within Volume 4: Compliance Plans of this EIAR.
Marine Scotland	2021 Scoping Opinion	The Scottish Ministers are content that Benthic Ecology is largely scoped out, however, the effects of EMF on benthic features must be assessed whether in a standalone assessment or as part of wider assessment or as part of wider assessment of EMF effects in the EIA Report for the receptors considered above in this Scoping Opinion	Potential effects of EMF for the operation of the subsea cabling has been scoped in and fully assessed in Section 15.8.3.4 of this Chapter.
Marine Scotland	2021 Scoping Opinion	Annex D states that, in order to mitigate and manage the risk of introducing invasive non-native species, a 'marine biosecurity plan requiring Marine Scotland approval prior to the commencement of offshore works will be produced as part of the post consent arrangement. And that the ‘biosecurity plan will address both the management of installation and maintenance vessels, but also the arrangements for managing the turbine foundation to prevent the establishment of non-native invasive species.	The potential introduction of non-native species have been fully assessed in Section 15.6.2.3 of this Chapter, and a draft biosecurity plan is contained within Volume 4: Compliance Plans of this EIAR.
Marine Scotland	2021 Scoping Opinion	For the avoidance of doubt, and to properly manage the risk of introduction of invasive non-native species, the Scottish Ministers advise that this should be presented in a binding biosecurity plan, perhaps as part of an Environmental Management Plan and that, in order for this to present mitigation and management measures for consideration, needs to be submitted alongside the EIA Report and applications.	As above

15.3. Scope of Assessment

The receptors that have been considered include seabed habitats and the communities of plant and animal species typically associated with each habitat type. Collectively, these are termed biotopes. A biotope is defined as the combination of an abiotic habitat and its associated community of species which can be defined at a variety of scales (with related corresponding degrees of similarity) and is a regularly occurring association hence its inclusion within the classification system[225].

The assessment has been based on information gathered during the baseline assessment and in response to consultation with statutory and non-statutory organisations. The assessment also draws upon specific guidance and best practice as outlined in section 6.4.1.

The effects scoped in are as laid out in section 6.7.1, which details worst case scenario design parameters relevant to the benthic ecology impact assessment identified within the Study Area from the baseline survey.

The Study Area, as shown in Figure 14.1 Volume II of the EIAR, was designed to cover a wider area than footprint of the Proposed Development to provide a broader scale context of the range of benthic communities in this area to aid the interpretation of impacts on the benthic communities within the Proposed Development.

15.3.1. Geographical Scope

The Proposed Development is located 1.5 km offshore of Methil, on the northern side of the Firth of Forth. Water depths in the Proposed Development range between 0 and 20 m, with depth increasing with distance offshore.

To support the development of the benthic ecology EIA chapter, two Study Areas are defined:

- Study Area: this is defined as the area encompassing the Proposed Development (Figure 14.1 Volume II of the EIA). This is the area within which site-specific benthic surveys have been undertaken, the results of which informs the baseline characterisation and identification of benthic receptors against which potential impacts associated with the Proposed Development will be assessed; and
- Regional Study Area: this is defined as the area encompassing the outer Firth of Forth region (Figure 14.2 Volume II of the EIA), characterised by desktop data to provide a wider context to the site-specific data collected within Study Area, including the Proposed Development.

As detailed in Table 15.1 Volume II the intertidal zone was scoped out in relation to the turbine and meteorological mast as both these installations will each be approximately 1.5 km from mean high water springs (MHWS). However, as the export cable will traverse the intertidal area by trenching, the intertidal zone has been scoped in.

15.4. Legislative Framework and Guidance

This section outlines the legislation, policy and guidance that are relevant to the assessment of the potential effects on benthic ecology associated with the Proposed Development.

International:

- United Nations Convention on Biological Diversity 1992 (the Rio Convention);
- The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the Bern Convention); and
- Convention for the Protection of the Marine Environment of the North-East Atlantic 1992 (the OSPAR Convention).

National:

- The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019;
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;

[225] Connor, D.W., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northen, K.O. and Reker, J.B. (2004). The Marine Habitat Classification for Britain and Ireland. Version 04.05, Peterborough: Joint Nature Conservation Committee (JNCC).

- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019;
- The Marine Environment (EU Exit) (Scotland) (Amendment) Regulations 2019;
- The Marine Environment (Amendment) (EU Exit) Regulations 2018;
- The Marine Environment (EU Exit) (Scotland) (Amendment) Regulations 2018;
- Scotland's National Marine Plan (2015);
- Scottish Energy Strategy: The future of energy in Scotland (2017);
- Nature Conservation (Scotland) Act 2004;
- Wildlife and Natural Environment (Scotland) Act 2011;
- Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (S.I. No. 572 of 2017);
- The Infrastructure Planning (Decisions) Regulations 2010 (Infrastructure Planning Regulations);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations);
- The Conservation of Habitats and Species Regulations 2017;
- UK Post-2010 Biodiversity Framework (the successor to, Biodiversity: UK Action Plan 1994);
- The identification of the main characteristics of stony reef habitats under the Habitats Directive[226];
- Guidance and publications from NatureScot and Marine Scotland on Priority Marine Features (PMF) and Marine Protected Area (MPA) search features;
- Interpretation Manual of European Union Habitats EUR 28 (European Commission, 2013);
- NatureScot Guidance on Habitats Regulation Appraisal of Plans (David Tyldesley and Associates, 2012);
- International Union for Conservation of Nature (IUCN) publication 'Greening Blue Energy: Identifying and managing the biodiversity risks and opportunities of offshore renewable energy'[227];
- Chartered Institute for Ecology and Environmental Management (IEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland (Terrestrial, Freshwater, Coastal and Marine) (CIEEM, 2018).

Further advice in relation to the Proposed Development specifically has been sought through consultation with statutory authorities, see section 6.2. The consultations outlined in Table 15.1 identified the need to focus on the effects on any protected habitats and species, which may be present.

15.5. Assessment Methods

The generic methodology for EIA is outlined in Chapter 2: Environmental Impact Assessment Methodology. The following describes the specific methodology adopted for the assessment of the potential effects of the Proposed Development on benthic ecology and follows IEEM guidelines[228.]

The magnitude of effect is quantified, where possible, based on the following characteristics (defined Table 15.2):

- Spatial extent (the geographical range of the effect);
- Duration (how long the effect would last); and
- Frequency (whether the effect is continuous or intermittent).

226 *Irving, R. 2009. The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop 26-27 March 2008. JNCC Report No. 432*

227 Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M., Patterson Edwards, J. K., Amir, O. and Dubi, A., eds., (2010). Greening Blue Energy: Identifying and managing the biodiversity risks and opportunities of offshore renewable energy. IUCN. Available online from: http://www.iucn.org/about/work/programmes/marine/marine_resources/?5713/Greeningblue-energy-identifying-and-managing-the-biodiversity-risks-and-opportunities-of-offshorerenewable-energy.

228 IEEM (Institute of Ecology and Environmental Management), 2018. Guidelines for Ecological Impact Assessment in Britain and Ireland. Marine and Coastal. Council of the Institute of Ecology and Environmental Management. Available online from: http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/EcIA_Guidelines/Final_EcIA_Marine_01_Dec_2010.pdf

Table 15.2 - Criteria used to Define the Magnitude of the Effect

Characteristics	Categories	Definition/Description
Spatial extent	High	The integrity of a biotope is predicted to be affected across much of its distribution. This is reflected by a significant shift in baseline conditions, including loss of characterising and keystone species and ecosystem function beyond the immediate Study Area.
	Medium	The integrity of a biotope is predicted to be affected and is reflected by a significant shift in baseline conditions, including change in the distribution and abundance of characterising and keystone species within the Study Area.
	Low	A change in baseline conditions is predicted but the distribution of characterising and keystone species will be unaffected.
	Negligible	Changes to baseline conditions are not expected to be detectable above natural variation beyond the footprint of activity.
Duration	High	The effect continues beyond ten years to permanent.
	Medium	The effect continues for five to ten years.
	Low	The effect lasts for one to five years.
	Negligible	The effect will last for less than one year.
Frequency	Intermittent	Occurs intermittently throughout the duration of the activity.
	Continuous	Occurs continuously throughout the duration of the activity.

These criteria are summarised by the following four categories for magnitude as a whole (Table 15.3).

Table 15.3. Categories used to define the magnitude of the effect

Magnitude of Effect	Definition
Large	Total loss or major alteration of the asset.
Medium	Loss of, or alteration to, one or more key elements of the asset.
Small	Slight alteration of the asset.
Negligible	Barely perceptible alteration of the asset.

In line with the overall assessment methodology, sensitivity assessment is broken down into three categories Low, Medium, and High and the defining criteria behind these terms are based on the Marine Life Information Network (MarLIN) assessment rationale[229].

Sensitivity is dependent on the intolerance of a species or habitat to damage from an external factor and the time taken for its subsequent recovery:

- Intolerance (the ability of a receptor to be either affected or unaffected); and
- Recoverability (how well a receptor recovers following exposure to an effect).

The categories and associated definitions used to inform the assessment of these characteristics are outlined in Table 15.4.

Table 15.4 - Criteria used to define the sensitivity of the effect

Characteristics	Categories	Definition/Description
Intolerance	High	The habitat may be destroyed and associated species lost. The habitat and associated species may partially recover but not within the lifetime of the project (25 years).
	Intermediate	The habitat may be severely damaged with many associated species lost. The viability of the species populations and ecological functioning of the

229 MarLIN (2015). Biodiversity and Conservation: Sensitivity assessment rationale - a summary. Available online at: http://www.marlin.ac.uk/sensitivityrationale.php

Characteristics	Categories	Definition/Description
		habitat may be impaired, but both are likely to recover within the lifetime of the project.
	Low	The habitat may either be damaged with a few associated species lost but, the species population and the ecological functioning of the habitat are not impaired; or, there is no detectable impact effect on the structure and/or function of a habitat or its characterising species.
Recoverability	Low	Species / habitat shows little or no recovery to change; or, partial recovery within the lifetime of the project.
	Moderate	Partial recovery within 5 years, full recovery within the lifetime of the project.
	High	Full recovery within five years, but may occur within months or days.

Value (the scale of ecological importance) is taken also into account where relevant in a minority of cases and is based on the definitions provided in Table 15.5

Table 15.5 - Criteria used to define judgements on value

Characteristics	Categories	Definition/Description
Value	Low	Widespread habitat/species, of little or no regional conservation importance.
	Medium	The habitat/species hold national conservation value and plays an important ecosystem role.
	High	The habitat/species hold international conservation status and plays a key ecosystem function.

Significance is then attributed through application of the matrix provided in Table 15.6. A significance rating of moderate or major is classed as a significant effect.

Table 15.6 - Significance Matrix used in the Impact Assessment

Sensitivity or Value of Resource or Receptor	Magnitude of effect			
	Negligible	Small	Medium	Large
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Major

15.5.1.1. Uncertainty

In broad terms, the uncertainty associated with the assessment is described as Low, Medium, or High. Low uncertainty indicates that receptor responses to specified effect are well studied, and interactions are well understood. Medium uncertainty indicates receptor responses to the specified effect are documented, and interactions are understood). High uncertainty indicates receptor responses to specified effect are not well studied, and interactions are poorly understood.

15.6. Baseline Characterisation

15.6.1. Introduction

The site-specific survey data and a review of the literature was used to provide a description of the benthic ecology within the Study Area and the wider Outer Firth of Forth region (Regional Study Area). Table 15.7 summarises the main literature sources used.

Table 15.7 - Summary of Major Data Sources Reviewed

Source	Area of research
MESH	Interactive map for habitats and marine features

Source	Area of research
JNCC	Overview of burrowed mud and PMF
NatureScot	Guide to Scottish species of interest
European Nature Information System (EUNIS)	Biotope classification
Comparison ES, including Neart Na Gaoithe (Fugro EMU, 2013) Seagreen ES (2012), Inch Cape (2013) Port of Leith ES (SKM, 2012)	Provide comparison survey data and biotope classifications.
Marine Scotland	Offshore renewable energy and general information on species found in Scottish waters.
Oslo and Paris (OSPAR) Commission for the Protection of the Marine Environment of the North-East Atlantic	Conservation features/habitats
Other	Journals, white papers, research articles.

15.6.2. Sensitive and Important benthic biotopes

The following sensitive and important benthic ecology biotopes are found within the Firth of Forth and wider area, and therefore were considered for assessment:

- SS.SSa.OSa Offshore circalittoral sand;
- SS.SMx.CMx Circalittoral mixed sediment;
- SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment;
- SS.SMu.CFiMu Circalittoral fine mud;
- SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud;
- SS.SSa.IMuSa.FfabMag *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand;
- SS.SSa.CMuSa Circalittoral muddy sand;
- SS.SSa.CMuSa.AbraAirr *Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand;
- SS.SMu.CSaMu Circalittoral sandy mud;
- SS.SMu.CSaMu.VirOphPmax.HAs Virgularia mirabilis and Ophiura spp. with Pecten maximus, hydroids and ascidians on circalittoral sandy or shelly mud with stones;
- CR.MCR.EcCr Echinoderms and crustose communities; and
- CR.HCR.XFa Mixed faunal turf communities.

Potential Annex I Reef habitats were included in the assessment. The JNCC has mapped the distribution of areas of potential Annex I Reef habitat and this was used to place the results from the site-specific survey (see Volume 3, Technical Appendix 10a) in a wider geographical context. The Scottish Priority Marine Feature (PMF) ‘burrowed mud’, which corresponds with the OSPAR threatened and declining habitat ‘seapen and burrowing megafauna communities’ was also identified as present and included in the assessment.

15.6.3. Overview of the subtidal area of the Firth of Forth

MESH habitat data, as shown in Figure 15.2, Volume 2 included within Volume 2 of this EIAR, provides a broad scale interpretation of the distribution of seabed habitats within the wider area surrounding the Proposed Development. In general, the area is dominated by circalittoral (i.e. deeper water) sandy mud with areas of infralittoral (shallow water) sandy mud and mixed sediments. The following broad biotopes have previously, been assigned to the Outer Firth of Forth area.

SS.SMu.CSaMu: Circalittoral sandy mud. Generally found in deeper areas with seapens (*Virgularia mirabilis*) and brittlestars, such as *Amphiura sp*, being characteristic of this habitat. Infaunal species can include the tube building polychaetes *Lagis koreni* and *Owenia fusiformis*, and deposit feeding bivalves such as *Mysella bidentata and Abra* spp.

SS.SMu.ISaMu: Infralittoral sandy mud. This biotope is found in more sheltered areas, toward the coast. Infaunal species include the polychaete *Melinna palmata* and deposit feeding bivalves such as *Macoma balthica* and *Mysella bidentata*. *V. mirabilis* and as *Amphiura* spp. may be present but not in the same abundances as found in deeper circalittoral waters.

SS.SSa.IFiSa: Infralittoral muddy sand. This biotope occurs in shallow coastal waters, characterised by the amphipods (*Bathyporeia*) and polychaetes such as *Lancie conchilega.*

SS.SMx.IMx: Infralittoral mixed sediments. This occurs in patches throughout the Study Area. It consists of mixed sediments of gravelly sands or mosaics of shell, cobbles and pebbles embedded in mud, sand or gravel. It can support a variety of species and communities and can therefore be difficult to categorize.

These biotope classifications coincide with surveys undertaken in the Firth of Forth area for previous projects such as indicated in Figure 15.2.

Records (of both certain and uncertain origin) of OSPAR threatened and or declining habitats available at the MESH Atlantic website[230] indicate that the 'seapen and burrowing megafauna communities' habitat is widely distributed across the deeper offshore area of the Firth of Forth. JNCC[231] have identified areas across the wider region, particularly in the nearshore environment where potential Annex I habitat may be found. NNG (Fugro EMU, 2012)[232] and Inch Cape (2013)[233] ES indicated that boulder and rocky reef type habitat were also common throughout the wider Firth of Forth.

There are no sites within the Proposed Development designated for their benthic ecology. Sites designated for other species, e.g. seabirds, marine mammals and fish and shellfish relevant to the Proposed Development are dealt with in Chapter 6 - Ornithology, Chapter 7- Marine Mammals and Chapter 10 - Fish and Shellfish Ecology of this EIAR respectively.

15.6.4. Overview of the intertidal area in the region of the Proposed Development

The coast in the Methil-Buckhaven area consists of reclaimed land made of colliery waste and the littoral zone is consequently relatively narrow in comparison to other areas of the Firth of Forth and is typically about 30 m in width[234]. The section of coast between Methil and Kirkcaldy is considered more industrialised than that to the east and is broadly described as being made up of mobile cobbles and pebbles with occasional outcrops of sandstone bedrock or patches of boulders[234]. Biotopes are therefore relatively limited and in the area of Buckhaven Posford Haskoning[234] indicate that the, '*upper shore is barren and the mid shore comprises LR.Ver.Ver on the boulders, followed by a band of ELR.BPat.Fvesl*''. Note that the 1997 *LR.Ver.Ver* biotope code has now changed to *LR.FLR.Lic.Ver.Ver Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock; and *ELR.BPat.Fvesl*' is *LR.HLR.MusB.Sem.FvesR Semibalanus balanoides, Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock[235]. Posford Haskoning[234] did not survey the lower shore at Buckhaven.

230 MESH Atlantic (2015). Mapping European Seabed Habitats (MESH). Available online at: http://www.emodnet-seabedhabitats.eu/default.aspx?page=1974.
231 JNCC (2015). Marine Protected Areas in the UK [WebGIS]. Available online at: http://jncc.defra.gov.uk/page-5201.
232 NNG Offhore Winf Environmental Statement. Available online from: https://nngoffshorewind.com/resources-old/offshore-environmental-statement/ Accessed
233 Inch Cape Offshore Wind Farm Environmental Statement. Available from: Inch Cape Offshore Wind Farm Environmental Statement | Tethys (pnnl.gov)
234 Posford Haskoning (2002). Broad scale intertidal survey of the Firth of Forth. Scottish Natural Heritage Commissioned Report F01AA407.
235 Connor, D.W., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northen, K.O. and Reker, J.B. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8 (internet version) jncc.defra.gov.uk/MarineHabitatClassification

The 2009 scoping report[236] states that the intertidal zone consists of, '*artificial rock armour or rip-rap, put in place to prevent further erosion of the coastline and colliery spoil*''. Fowler and Everett[237] indicate that 'rip-rap' (rocks on top of fabric) was the coastal defence works used at Buckhaven to protect housing.

The intertidal area at the proposed cable landfall location is part of the Firth of Forth SSSI, SPA and Ramsar sites.

15.6.1. Overview of the sediment and seabed types in the Proposed Development

The predominant sediment in the Proposed Development is characterised in part by coarse substrates (including areas of mixed gravelly muddy sands and sandy gravels / gravelly sands) interspersed by rocky outcrops. The seabed within the Proposed Development is mostly featureless, except for the previously mentioned rocky outcrops.

15.6.2. Site survey results

The site-specific survey data presented in this chapter was collected during a survey conducted in 2014. The results from this survey provide the basis for the detailed description of the existing benthic habitat in the Proposed Development. Although changes in individual species' assemblage and composition can occur within a biotope over time, it is considered any such changes will not have occurred at a sufficiently high level to change the biotope type present within the Study Area since the survey data was collected.

The technical survey report is provided in Environmental Statement – Volume 3 Technical Appendix 10a Benthic Ecology Survey Report, including the survey methodology and full results.

A total of 19 sites were selected within and around the site boundary in the Firth of Forth with drop down videos and faunal grab samples taken at each. Five trawl sites were selected across the survey area for 2 m scientific beam trawling.

15.6.2.1. Biotope assignment

Using a combination of the video, grab and Particle Size Analysis (PSA) data, six biotopes were assigned to the area surveyed. Based on the biotopes described, the Study Area can be divided in four blocks following the sediment gradient from the offshore sites to the inshore ones.

Biotopes such as, *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment (SS.SMx.CMx.OphMx) indicating the presence of Ophiothrix beds; and the biotope complex circalittoral mixed sediments (SS.SMx.CMx) indicating mixed coarse substrate were confirmed by the video analysis and were located in the inshore part of the Study Area. The biotope *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand (SS.SSA.IMuSa.FfabMag) was also found at two locations close to shore. The bivalve mollusc, *Tellina fabula* (the currently accepted name for *Fabulina fabula*, commonly known as the bean-like tellin) and two species of *Magelona* were abundant and the sediment observed as muddy sand matches the one characteristic for this biotope.

The central part of the Study Area was dominated by the Level 4 biotope deep circalittoral sand (SS.SSA.OSa). Level 5 biotopes currently available from the JNCC marine habitat classification within this Level 4 biotope complex are limited and do not satisfactorily described those communities sampled in the offshore sand encountered in the Study Area. The species identified at these locations have been widely recorded and are typical for such habitats.

For the offshore area, two biotope complexes were identified: Circalittoral sandy mud (SS.SMu.CSaMu) and circalittoral fine mud (SS.SMU.CFiMu). Species assemblages were reasonably sparse in this area so classification was derived largely from sediment composition and depth.

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236 Connor, D.W., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northen, K.O. and Reker, J.B. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8 (internet version) jncc.defra.gov.uk/MarineHabitatClassification
237 Fowler, S.L. and Everett, S.J. (1997). Chapter 8.4 Coastal defence In: Coasts and seas of the United Kingdom. Region 4 South-east Scotland: Montrose to Eyemouth, ed. by J.H. Barne, C.F. Robson, S.S. Kaznowska, J.P. Doody, N.C. Davidson & A.L. Buck, 61-64. Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series.).

These biotopes broadly correspond with the wider Firth of Forth area and are typical for the region.

15.6.2.2. Subtidal Epibenthic Species

Scientific 2 m beam trawls and grabs gave information on larger, more mobile epibenthic assemblages and colonial sessile communities. The most common epibenthic group sampled was that of bony fish in the Class Actinopterygii (21%), followed by Crustacea and Mollusca (19%), Echinodermata (14%) and Annelida (11%). All the other major groups accounted for less than 10% each. Of the non-enumerated taxa, Echinodermata were the most abundant group (36%), due mainly to the very high abundance of the sand star *Astropecten irregularis* and the high abundance of common starfish *Asterias rubens*. Other major taxa contributing to the total abundance included Tunicata (24%), Crustacea (14%), Mollusca (13%) and Actinopterygii (12%). Annelida counted for 1% of the total abundance with Cnidaria counting for less than 1%. The sea squirt *Ascidiella* was the most numerous species overall, with the sand star the second most abundant species overall, with only nine fewer individuals than *Ascidiella*. Amongst the non–enumerated colonial sessile taxa the Bryozoan *Alcyonidium parasiticum* was the most frequently recorded species with the hydroid *Hydrallmania falcata* and the soft coral (dead man's fingers) *Alcyonium digitatum* also common.

15.6.2.3. Subtidal Benthic Habitats of Ecological and Conservation Interest

The Study Area does not overlap with any sites currently designated for their conservation importance. However, there are certain benthic habitats and species found in the offshore Study Area that are of conservation and wider ecological importance or interest. These habitats are discussed further below.

Burrowed Mud

Burrowed mud is a PMF in Scotland's seas. One of the component biotopes identified for this PMF is SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud'. This biotope was observed within the Study Area and is also on the OSPAR list of threatened and declining habitats as 'Sea-Pen and burrowing megafauna communities'[238] (OSPAR, 2021).

Stony reef

There are small areas within the site that have characteristics similar to those of 'stony reef' as listed in the European Commission (EC) Habitats Directive Annex I.

These sites were identified according to definitions as discussed by Irving[226] and concluded that although a few of these areas met some of the assessment criteria (e.g., elevation, extent and biota present); none of these satisfied the criteria in full. However, two sites in the inshore area were identified as having 'medium reefiness' due to the coverage of cobbles, boulders and fauna, with another two sites classified as 'low reefiness'.

Peat and Clay Exposures with Piddocks

Areas of mud/sandstone with large holes bored into the surface were observed at two sites in the inshore area. This appears to be consistent with the biotope CR.MCR.SfR soft rock communities which is illustrative of the UK BAP habitat 'Peat and Clay Exposures with Piddocks'.

Benthic species of conservation interest

The site-specific survey recorded some occurrences of species of conservation importance within the Study Area; Sandeel Ammodytes, Sand goby Pomatoschitus minutus and Cod Gadus morhua. Sand goby were found at all three trawl sites and were the second most abundant fish species caught and the Firth of Forth is a known nursery ground of Cod[239]. All three of these species are listed on the PMF list for Scotland.

15.6.3. Data gaps

238 OSPAR (2015). OSPAR list of threatened and/or declining species and habitats. Available online at: List of Threatened and/or Declining Species & Habitats | OSPAR Commission
239 Ellis, J. R., Milligan, S. P., Readdy, L., Taylor, N. and Brown, M. J. (2012) Spawning and nursery grounds of selected fish species in UK waters. Scientific Series Technical Report, Lowestoft: Cefas, No. 147.

Sufficient data was available to describe and assess the subtidal benthic environment for the Proposed Development. In this context, no data gaps have therefore been identified.

No site-specific intertidal survey was undertaken. The intertidal area is limited and relatively impoverished and data on the biological communities present is available from previous reports (i.e. the NatureScot report from Posford Haskoning[234]).

15.7. Development Design Mitigation

This chapter takes into account measures that have been incorporated in the Proposed Development as standard industry practice and as part of the design process. Together these measures are termed "Proposed Development Design Mitigation", which is distinct from additional mitigation which is applied where a significant effect is predicted. Measures that are directly relevant to benthic ecology include the following.

- Spoil from the ground preparation works will either be re-used as in-fill/ballast material or removed and disposed off-site. This will reduce the amount of sediment available to cause effects relating to increased suspended sediment concentrations and smothering from sediment deposition;
- Space frame foundation piles will be drilled into the seabed and not pile driven using a pneumatic hammer. This will significantly reduce the level of underwater noise and vibration generated during the construction phase. Benthic ecology receptors will not therefore incur the same level of disturbance generated by underwater piling activities;
- The Proposed Development will operate a pollution / spill prevention plan. This will limit the risk of accidental spillages or releases occurring and ensure that adequate contingency is in place (i.e. through a Marine Pollution Contingency Plan (MPCP)) to resolve any incidents quickly; and
- All subsea electricity cables will be buried, subject to ground conditions, or covered with cable protection material. As such, any heating or electromagnetic field (EMF) effects, which might have directly influenced sensitive habitats or species, will be limited.

15.8. Assessment of Potential Effects

15.8.1. Worst Case Scenario

Table 15.8 details the aspects of the Proposed Development that represent the worst case scenario for each of the potential effects on the benthic ecology.

To consider the potential effects from the Proposed Development, a worst case scenario of x 3.5 m pin piles for the turbine, one ≥10 m monopile for the Met Mast and that the export and inter array cables will be buried utilising jetting (trench dimensions being 2 x 1.5 m).

The effects of decommissioning activities on the benthic ecology are considered comparable to construction but in a reverse order and of a reduced magnitude, as it is anticipated that all infrastructure beneath the seabed will be left in situ. This will, for example, reduce the potential to generate increased suspended sediment concentrations when removing infrastructure. It will also preserve the habitats that have recovered over the operational life span of the turbine. Therefore, the effects from decommissioning have been grouped together with construction activities.

Table 15.8 - Worst Case Scenario Design Parameters Relevant to Benthic Ecology

Potential Effect	Worst Case Scenario	Justification
Construction and Decommissioning		
Temporary direct seabed habitat disturbance	Foundation: One 10 m diameter monopile for the turbine, w and 78.55 m^2 of seabed disturbance (excluding scour protection). One 3.5 m diameter monopole for the meteorological mast totalling 9.6 m^2 of	The monopile foundation options disturb the greatest area of seabed due to the ground preparation/levelling works (e.g., dredging).

Potential Effect	Worst Case Scenario	Justification
	seabed disturbance (plus scour protection).	
	Turbine and meteorological mast: Installed by a single jack-up vessel with six feet, each with a surface area of 12 m^2, totalling 72 m^2 of seabed disturbance.	Installation is anticipated to take two days and is anticipated to be finished after four allowing for de-rigging and transit.
	Cables: Complete burial of the export cable via jetting. This will disturb a jetting 4545.75 m^2 for the electrical export cable and 1,875 m^2 for the meteorological mast utility cable i.e., a total of 6,420.75 m^2.	Trenching assessed as disturbing more sediment than other installation techniques. It should also be noted that the sediment from the trench will be piled either side. The spoil will erode and naturalise over time becoming part of the natural seabed landscape.
	Cables: Maximum extent of protection if burial of the export cable is not possible. This will disturb a maximum volume of 7576.25 m^2 for the electrical export cable (1515.25 m (length) x 5 m (width)) and 3,132 m^2 for the meteorological mast utility cable (626.5 m (length) x 5 m width) i.e., a total of 10,708.25 m^2.	Anchor 'scars' will be left on the seabed following deployment. These will be similar to the size of the anchor. The total areas are precautionary as complete burial is unlikely.
	Cable laying vessels will deploy anchor along the export cable route. There may be up to eight 12 tonne anchors with a footprint of 193 m^2 per deployment (BERR, 2008)[240]. This will disturb a maximum area of 1,544 m^2.	
Temporary increased suspended solid concentrations	Foundation: One 10 m diameter monopile for the turbine, and 78.55 m^2 of seabed disturbance (excluding scour protection). One 3.5 m diameter monopole for the meteorological mast totalling 9.6 m^2 of seabed disturbance (excluding scour protection).	The monopole foundation options disturb the greatest area of seabed due to the ground preparation/levelling works (e.g., dredging).
	Cables: Complete burial of the export cable via jetting. This will disturb a maximum volume of 4545 m^2 for the electrical export cable and 1,875 m^2 for the meteorological mast utility cable i.e., a total of 6,420.75 m^2. Cables: Maximum extent of protection if burial of the export cable is not possible.	Jetting assessed as releasing more sediment than other installation techniques. The total volumes are precautionary as complete burial is unlikely and the volume of disturbed sediment will be less.

240 BERR (2008). Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Technical report. January 2008.

Potential Effect	Worst Case Scenario	Justification
	This will disturb a maximum volume of 7576.25 m^2 for the electrical export cable (1515.25 m (length) x 5 m (width)) and 3,132 m^2 for the meteorological mast utility cable (626.5 m (length) x 5 m width) i.e., a total of 10,708.25 m^2.	
Temporary increases in sediment deposition	Foundation: One 10 m diameter monopile for the turbine, and 78.55 m^2 of seabed disturbance (excluding scour protection). One 3.5 m diameter monopole for the meteorological mast totalling 9.6 m^2 of seabed disturbance (excluding scour protection).	The monopole foundation options disturb the greatest area of seabed due to the ground preparation/levelling works (e.g., dredging).
	Cables: Complete burial of the export cable via jetting. This will disturb a maximum volume of 4545 m^2 for the electrical export cable and 1,875 m^2 for the meteorological mast utility cable i.e., a total of 6,420.75 m^2. Cables: Maximum extent of protection if burial of the export cable is not possible. This will disturb a maximum volume of 7576.25 m^2 for the electrical export cable (1515.25 m (length) x 5 m (width)) and 3,132 m^2 for the meteorological mast utility cable (626.5 m (length) x 5 m width) i.e., a total of 10,708.25 m^2.	Jetting assessed as being worst case. The total volumes are likely to be less for the reasons explained above.
Temporary release of sediment contaminants from seabed disturbance.	Foundation: One 10 m diameter monopile for the turbine, and 78.55 m^2 of seabed disturbance (excluding scour protection). One 3.5 m diameter monopole for the meteorological mast totalling 9.6 m^2 of seabed disturbance (plus scour protection).	The monopole foundation options disturb the greatest area of seabed due to the ground preparation/levelling works (e.g., dredging).
	Cables: Complete burial of the export cable via jetting. This will disturb a maximum volume of 4545m^2 for the electrical export cable and 1,875 m^2 for the meteorological mast utility cable i.e., a total of 6,420.75 m^2. Cables: Maximum extent of protection if burial of the export cable is not possible. This will disturb a maximum volume of 7576.25 m^2 for the electrical export cable	Jetting assessed as releasing more sediment than other installation techniques. The total volumes are precautionary as complete burial is unlikely and the volume of disturbed sediment will be less.

Potential Effect	Worst Case Scenario	Justification
	(1515.25 m (length) x 5 m (width)) and 3,132 m^2 for the meteorological mast utility cable (626.5 m (length) x 5 m width) i.e., a total of 10,708.25 m^2.	
Noise	Foundations: One turbine with maximum of four x 3.5 m diameter pin piles each drilled to a target depth of approximately 50 m and one meteorological mast monopile with 3.5 m diameter up to 50 m.	Pin piles foundations represent the noisiest means of foundations installation (NB: ground conditions are not suitable for hammering).
	Cables: One 1515.25 m of electrical export cable and one 622 m meteorological mast utility cable i.e., a total distance of 2,137.25 m (for both cables) with complete burial via jetting.	Jetting represents the noisiest means of cable installation.
Intertidal temporary direct seabed habitat disturbance	One cable installed over the intertidal area (assumed to be no more than 30 m) by trenching. Trenches will be dug by a JCB or similar and the dimension will be 3 m wide. Total surface area affected is therefore 90 m^2.	Trenching will be used for crossing the intertidal area with potential effects on the benthic ecology.
Intertidal temporary increased suspended solid concentrations, sediment deposition and release of contaminants	One cable installed over the intertidal area by trenching. Trenches will be dug by a JCB or similar and the dimension will be 3 m wide by up to 1.5 m deep. Total volume of area affected is therefore 135 m^3.	Trenching will be used for crossing the intertidal area with potential effects on the benthic ecology.
Accidental spillages of chemicals.	Accidental uncontrolled release of chemicals.	
Operation		
Net loss of original habitat	Foundation: One 10 m diameter monopile for the turbine, and 78.55 m^2 of seabed disturbance (plus scour protection). One 3.5 m diameter monopole for the meteorological mast totalling 9.6 m^2 of seabed disturbance (plus scour protection).	The monopole foundation options for the meteorological mast will disturb the greatest area of seabed due to the ground preparation/levelling works (e.g., levelling). It is acknowledged that the loss of seabed habitat through the construction phase (three to six months) would be incremental as a result of successive placement of turbine foundations and scour protection materials.
	Cables: Complete surface lay of electricity and meteorological mast utility cables with associated protection materials (dimensions 5 m x 1500 m).	Maximum cable requiring protection would result in maximum area of seabed habitat removal. However, this is

Potential Effect	Worst Case Scenario	Justification
	This will result in a maximum seabed loss of 7,500 m^2 for both cables.	precautionary as the preferred option would be to bury the cables.
Introduction of new hard substrate for colonisation including non-native species	Foundations: five x 3.5 m^2 (one for the turbine, one for the meteorological mast) diameter pile foundations.	New vertical surfaces would be provided associated with the turbines and foundations within the water column, scour protection and rock placement material. This increases habitat complexity.
	Cables: Complete surface lay of electricity and meteorological mast utility cables with associated protection materials (dimensions 5 m x 1500 m). This will result in a maximum seabed loss of 7,500 m^2 for both cables.	New vertical surfaces associated with cable protection material. It increases habitat complexity. Maximum new habitat would be introduced by assuming complete surface laid cabling.
Changes to the hydrodynamic regime	Foundations: five x 3.5 m (four for the turbine, one for the meteorological mast) diameter pile foundations (plus scour protection).	The Piles represent a potential effect on tidal, wave and sediment regimes and associated scour effects.
Temporary habitat disturbance	The maintenance of the wind turbine may involve the use of jack up vessels for intermittent maintenance.	It is estimated that the turbine might be visited once every ten years for a significant maintenance visit involving a jack up vessel. Other maintenance vessels may also be used but it is anticipated that these will be small vessels (<15 m) which would anchor to the structure.
Electromagnetic field generation / Heat effects	The export cable will be 66 kV and installed in a single trench to a target burial depth of 1 m. The total length of the export cable will be 1,500 m.	The scenario represents the maximum anticipated length of the cable.
Accidental spillages of chemicals.	Accidental uncontrolled release of chemicals.	

15.8.2. Construction Effects

The project activities that could affect benthic ecological receptors during construction in the offshore and intertidal zone include the following:

- Direct habitat disturbance;
- Increase in sediment deposition and smothering;
- Releases of sediment contaminants;
- Noise and vibration;
- Intertidal temporary direct seabed habitat disturbance;
- Intertidal temporary increased suspended solid concentrations, sediment deposition and release of contaminants;
- Accidental spillages of chemicals.

15.8.2.1. Direct habitat disturbance

The sources of temporary physical disturbance to benthic habitats during the construction phase derive from the jacking up and anchoring of construction vessels, the placement of jacket foundations for the turbine, the installation of one pile foundation for the meteorological mast and the installation of the turbine export cable and inter array cable connecting the turbine and the meteorological mast. The pre-installation site preparation works, placement of jacket and monopile based foundations will result in a permanent loss of benthic habitats and this effect is assessed within the operational section.

Direct mortality and localised declines in species abundance, biomass and diversity as a consequence of physical disturbance are inevitable. Evidence from the aggregates industry with respect to both maintenance dredging and marine aggregates dredging suggests reductions of 30-70% for species diversity and 40-95% for numbers of individuals as well as biomass[241]. Although the percentage losses per unit will be the same, this over-estimates losses for the current purposes as the data from Newell *et al* [241] is not restricted to such discrete events a being considered here.

Sedimentary conditions will also be modified in affected areas, for example underlying sediment strata in dredged areas are unlikely to be the same as the surficial material previously in place. Jack-up legs will compact the sediment, destroy any associated faunal communities and leave pitted areas on the seabed.

Estimated recovery times depend on the nature of the habitat, the scale and duration of disturbance, hydrodynamics and associated bed-load transport processes and the topography of the area. Infilling of areas where depressions / scars have been created will begin with sides slumping in and in the subsequent days the natural current / wave driven transport of material into the affected area. Initially, these recovering sedimentary environments are likely to be unstable and the associated fauna impoverished but in time full recovery to baseline conditions is anticipated. The speed with which this might occur will be aided by the limited nature of the impact event and the small area affected but would be expected within less than four years[241,242]. Although Boyd *et al*.[243] note that erosion of dredge tracks in areas of moderate wave exposure and tidal currents have been observed to take between three to more than seven years (with the longer time periods being for coarser sandy gravel substrates). Re-colonisation will occur by adult and larval immigration with more opportunistic species likely to be the first species to recolonise the area. Generally, biomass dominants and age structures will take longer to return to pre-disturbance levels than other community attributes[243].

The level of disturbance generated by the installation of the turbine export cable and meteorological mast inter array cable will depend on the technique employed, with trenching considered to be the worst case scenario for physical disturbance (because substrate from the trench will be placed to the side of the trench and then backfilled) compared with ploughing (where the cable trench is cut and backfilled in one operation). Defra[244] suggests that given the localised nature of cable installation with the area affected generally restricted to a 2-3 m width of substrate, then the overall effect on the benthic ecology is unlikely to be significant if the habitat distribution throughout the wider area is homogenous. It is likely that mobile epibenthic species such as crabs are able to avoid much of the disturbance whereas sessile epifauna (e.g. tubeworms) and infauna (e.g. bivalves) and sensitive species (such as slower growing or fragile species) will be more affected[245].

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[241] Newell, R. C., Seiderer, L. J., and Hitchcock, D. R. 1998. The impact of dredging works in coastal waters: a review of the sensitivity to disturbance and subsequent recovery of biological resources on the sea bed. Oceanography and Marine Biology: an Annual Review, 36: 127–178.
[242] Foden, J., Rogers, S.I., Jones, A.P., (2009). Recovery rates of UK seabed habitats after cessation of aggregate extraction. Marine Ecology Progress Series, 390, 15-26.
[243] Boyd, S. E., Cooper, K. M., Limpenny, D. S., Kilbride, R., Rees, H. L., Dearnaley, M. P., Stevenson, J., et al. (2004). Assessment of the rehabilitation of the seabed following marine aggregate dredging. CEFAS Science Series Technical Report 121. 156 pp.
[244] Defra (2008). Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. 164pp.
245 OSPAR (2012). Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation (Agreement 2012-2). OSPAR 12/22/1, Annex 14.

Based on the findings of the site-specific technical report (Appendix A10.1), the receptors most likely to be directly affected are the biotopes SS.SMx.CMx.OphMx, SS.SMx.CMx, SS.SSA.OSa, SS.SSa.CMuSa.AbraAirr, SS.SSa.CMuSa, SS.SSA.IMuSa.FfabMag, CR.MCR.EcCr and CR.HCR.XFa. The final four, while not recorded specifically from areas likely to be affected may occur as part of the mosaic of habitats across the area. The SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud biotope was only recorded by the site-specific video survey further offshore and is therefore unlikely to be directly affected by the physical disturbance events and is not considered further here (Appendix A10.1).

SS.SMx.CMx.OphMx *Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment* has an intermediate intolerance but high recoverability (1-5 years) and therefore low sensitivity to physical disturbance[246]. The key characterizing species of this biotope, *Ophiothrix fragilis*, the common brittlestar, has a similarly, low sensitivity to abrasion and physical disturbance[247]. Many other species characteristic of the biotope also have a low sensitivity to this factor including *Asterias rubens*, the common starfish, *Pomatoceros triqueter*, the keelworm, *Pecten maximus*, great scallop, and *Echinus esculentus*, the edible sea urchin[248, 249, 250, 251].

SS.SMx.CMx is considered to have an intermediate intolerance and moderate recoverability (>5-10 years) and therefore a moderate sensitivity to physical disturbance[246].

The biotope SS.SSa.CMuSa.AbraAirr *Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand is present as an epifaunal overlay in the area likely to be affected by temporary, direct, physical disturbance. Some direct mortality will occur locally but this will be limited in extent and where not killed the characterising echinoderms are both burrowing species capable of re-burrowing after the disturbance has ceased. Some specimens may be damaged (e.g. loss of arms) and will undergo limb regeneration which has an associated debilitating energetic cost (e.g. some energy which might be used for growth more generally, and reproduction, will be diverted). Depending on the extent of the damage and the species, in question starfish arm regeneration can take between 6-24 months[252]. The biotope complex SS.SSa.CMuSa within which this biotope occurs is also found across the Study Area. CMuSa does not have a sensitivity assessment but species which characterized this habitat locally were, for example, the common starfish, *Ophiura* brittlestars and *Liocarcinus* swimming crabs. It is therefore expected that sensitivity may be similarly low.

Amphiura filiformis (a brittlestar) and *Owenia fusiformis* (a tubeworm) are characteristic of the SS.SSA.OSa Offshore circalittoral sand identified in the Study Area. The biotope complex does not have a sensitivity

246 Tyler-Walters, H. & Hiscock, K., (2005). Impact of human activities on benthic biotopes and species. Report to Department for Environment, Food and Rural Affairs from the Marine Life Information Network (MarLIN). Plymouth: Marine Biological Association of the UK. [Contract no. CDEP 84/5/244].
247 Jackson, A. and Hiscock, K. (2008). Urticina felina. Dahlia anemone. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=4556
248 Budd, G. (2008a). Asterias rubens. Common starfish. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=2657
249 Riley, K. and Ballerstedt, S. (2005). Pomatoceros triqueter. A tubeworm. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=4179
250 Marshall, C. and Wilson, E. (2009). Pecten maximus. Great scallop. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 05/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=4056
251 Tyler-Walters, H. (2008). Echinus esculentus. Edible sea urchin. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=3237
252 Jennings, S., Kaiser, M.J. & Reynolds,J.D. (2001) Marine Fisheries Ecology. Blackwell Science, Oxford.

assessment at the MarLIN website; however, the sensitivity of these two species to physical disturbance is, respectively, very low and low[253,254].

Species noted as present in the CR.MCR.EcCr Echinoderms and crustose communities biotope in the Study Area included the edible sea urchin, the common starfish, keelworms and the common brittlestar all of which are assessed as having low sensitivity to physical disturbance[251],[248],[249],[255]. The other circalittoral rock biotope present was CR.HCR.XFa. As with the previous biotope complex no sensitivity assessment from MarLIN is available however, five of the conspicuous species recorded representing the expression of this biotope locally have low sensitivity to physical disturbance including common starfish, *Nemertesia* (a hydroid), *Alcyonium digitatum*, dead man's fingers, *Cancer pagurus*, edible crab and the edible sea urchin[248],[256],[257],[258],[251]. The effect on potential Annex I Reef habitat is discussed in the context of net habitat loss in the operational phase of the Proposed Development.

SS.SSA.IMuSa.FfabMag *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand has an intermediate intolerance, high recoverability and therefore low sensitivity to physical disturbance[246].

The magnitude of effect of temporary direct seabed habitat disturbance is considered to be small as it will be limited both spatially and temporally, occurring intermittently during the construction phase. As the above assessment indicates, receptor sensitivity is, with the exception of SS.SMx.CMx, considered to be low. The CMx biotope complex was largely recorded from video evidence. As the more detailed grab results indicate SS.SMx.CMx.OphMx and SS.SSA.OSa at sites within / or close to physical effect corridors, the relevance of SS.SMx.CMx has been down-weighted in this assessment and a rating of low sensitivity considered most appropriate. The two locations where SS.SMx.CMx was recorded from the grab results were coarser sediment locations on the east and west boundary of the Proposed Development over 1 km from any area likely to be physically disturbed during the construction process. Low sensitivity indicates that the benthic receptors affected largely have a low intolerance and high recoverability. The significance of the effect is therefore, negligible.

The effect is **not significant** and the assessment carries a moderate to low uncertainty as the magnitude of the effect can be quantified and the sensitivity of receptors is relatively well understood.

15.8.2.2. Increase in sediment deposition and smothering

Increases in suspended sediment concentrations (SSCs), and the associated increase in the turbidity of the water column, will occur as a result of seabed preparation activities prior to the installation of the turbine four pin pile foundations, meteorological monopile foundation and export and inter array cables, as outlined in Table 14.8.

These activities will occur intermittently during the three to six month construction phase. The spoil generated by the ground preparation works for the pile foundations will cause a short-term localised increase in SSC which,

253 Hill, J. and Wilson, E. (2008). Amphiura filiformis. A brittlestar. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=2503
254 Neal, K. and Avant, P. (2008). Owenia fusiformis. A tubeworm. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=4001
255 Jackson, A. (2008). Ophiothrix fragilis. Common brittlestar. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=3976
256 Jackson, A. (2004). Nemertesia ramosa. A hydroid. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 06/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=3864
257 Budd, G. (2008b). Alcyonium digitatum. Dead man's fingers. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 06/03/2015]. Available from: http://www.marlin.ac.uk/speciesfullreview.php?speciesID=2442
258 Neal, K. and Wilson, E. (2008). Cancer pagurus. Edible crab. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 06/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=2872

in close proximity to the activity, is likely to be well above natural background levels. The extent and duration of the SSC increase within the Study Area will vary with substrate type. Coarse sediments like sand and gravels will settle out relatively rapidly (within seconds to a few minutes) and in close proximity to the original disturbance. Finer sediment particles like silts are likely to stay in suspension for longer periods and will be subject to gradual dilution and dispersion within the area with some very fine fractions potentially leaving the area due to tidal action[259] and storm events. Deposition of re-suspended sediments onto the seafloor may result in a degree of fining of the surface sediments in localised areas. This deposition footprint is likely to vary in thickness across the affected area but will be limited by the transient nature of the activity and, in the case of the pile foundations, ground preparation. Any build-up of sediment fines will only be temporary, as it will be re-mobilised on subsequent tides. In this fashion, the natural process of settlement and re-suspension will gradually dilute and disperse this fine sediment material away from the release location over the following hours and days to a point where natural SSC levels are achieved.

The subtidal biotopes within the influence of any sediment plumes would be potentially affected by increased suspended sediment loadings. Re-suspended sediments will, subject to the hydrodynamic forces acting on them, settle out and in doing so have the potential to scour and smother benthic habitats and the associated species. Specific effects on individual organisms include the possible clogging of sensitive feeding and respiratory apparatus, particularly of sessile epifaunal species and suspension feeding animals[260]. This could lead to a loss of species diversity, abundance and biomass where effects are significant. More mobile species such as crabs, shrimps and prawns are expected to be able to avoid any more adverse conditions, which might occur close to activities generating such plumes. Effects will be temporary and will cease on completion of the construction activity.

As detailed in Chapter 6: Physical Processes and Water Quality of the Forthwind Offshore Wind Demonstration Project Environment Statement, Methil Fife, July 2015, tidal currents along the Kirkcaldy shorefront in the vicinity of the Proposed Development flow in a northeast to southwest direction during flood tides, reversing direction after high water. Re-suspended material is most likely to follow a similar pattern of dispersal. The biotopes in the immediate vicinity most directly affected are SS.SMx.CMx.OphMx, SS.SSa.CMuSa.AbraAirr, SS.SSA.OSa, CR.MCR.EcCr, CR.HCR.XFa, SS.SMx.CMx, SS.SSa.CMuSa and SS.SSA.IMuSa.FfabMag. The SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud biotope is further offshore and therefore likely to be less affected by increases in SSC.

SS.SMx.CMx.OphMx *Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment* does not have a sensitivity assessment at the MarLIN website. However, the key characterizing species of this biotope, *Ophiothrix fragilis*, the common brittlestar, has a low intolerance and very high recoverability and consequently a very low sensitivity to increases in SSC (Jackson, 2008). Many other species characteristic of the biotope also have a low or very low sensitivity to this factor including *Asterias rubens*, the common starfish, *Pomatoceros triqueter*, the keelworm, *Alcyonium digitatum*, dead man's fingers, *Urticina felina*, the dahlia anemone and *Echinus esculentus*, the edible sea urchin[248,249,257,247,251].

SS.SSa.CMuSa.AbraAirr *Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand currently do not have a direct sensitivity assessment at the MarLIN website. Another Level 5 biotope within the same complex (SS.SSa.CMuSa) does have an assessment and this indicates a low sensitivity to increases in SSC[261]. Sensitivities of biotopes within a complex can vary, therefore because one has a low sensitivity it cannot be assumed that others will. Breen *et al*.[262] indicate that the SS.SSa.CMuSa.AbraAirr biotope

259 Guillou, N. and Chapalain, G. (2010) Numerical simulation of time-induced transport of heterogeneous sediments in the English Channel Continental Shelf Research, 30, 806–819.
260 Holme, N. A. (1961). The Bottom Fauna of the English Channel. Journal of the Marine Biological Association of the United Kingdom, 41, pp 397-461. doi:10.1017/S0025315400023997.
261 Budd, G.C. (2006). Abra alba, Nucula nitida and Corbula gibba in circalittoral muddy sand or slightly mixed sediment. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/habitatsbasicinfo.php?habitatid=62&code=2004
262 Breen, P., Allcock, L.A. and Johnson, M.P. (2010). Quantification of habitat sensitivity to potential threats as part of Marine Protected Area planning and evaluation. GIS/Spatial Analyses in Fishery and Aquatic Sciences (4) 17, 291-306

is intolerant of threats that might deprive it of oxygen or light. The former is not relevant or suggested here and the latter is likely to be marginal and short term at worst. This biotope was present as an epifaunal overlay in the Study Area and the characteristic echinoderms are both burrowing species likely to be able to re-burrow if necessary. Burrowing infauna more generally are unlikely to be affected by an increase in suspended sediment and subsequent smothering as most animals will be able to re-burrow or move up through the sediment within hours or days. Other species associated with the biotope such as *Asterias rubens*, the common starfish and the *Lanice conchilega*, the sand mason worm are known to have a low sensitivity to increase in SSC or to be not sensitive to this factor, respectively[248], [263]. *Astropecten irregularis*, the sand star is a predator of infaunal shellfish, crustaceans and worms and *Acrocnida brachiata* (formerly *Amphiura brachiata*) is a suspension feeder. Any increase in SSC will be highly limited both spatially and temporally and sensitivity is therefore likely to be low.

SS.SSA.OSa Offshore circalittoral sand does not have a sensitivity assessment at the MarLIN website, however species characteristic of this community in the Study Area include *Amphiura filiformis* (a brittlestar) and *Owenia fusiformis* (a tubeworm). The sensitivity of these two species to increases in SSC is, respectively, very low and not sensitive[253,254]. Furthermore, it is likely that another of the abundant characterizing species, *Phoronis* sp., the horseshoe worm, which is understood to be a suspension feeder, can essentially engage in deposit feeding at the sediment-water interface[264,265] and thus, it is suggested, may be tolerant of raised levels of SSC. Other species such as *Kurtiella bidentata* (formerly *Mysella bidentata*) are able to switch between deposit and suspension feeding depending on local environmental conditions and as such would also be tolerant of raised SSCs[266].

Sessile epifauna (e.g., hydroids and bryozoans within the biotope CR.MCR.EcCr) are likely to be susceptible to an increase of SSC and subsequent sediment settlement leading to possible smothering, which may cause individual mortality leading to temporary and localised decline of species richness within the biotope, at the MarLIN benchmark. The benchmark is an arbitrary short term, acute change in background suspended sediment concentration e.g., a change of 100 mg/l for 1 month. This is far higher than those suggested to occur during the construction phase (Chapter 6: Physical Processes and Water Quality of the Forthwind Offshore Wind Demonstration Project Environment Statement, Methil Fife, July 2015). CR.HCR.XFa, like CR.MCR.EcCr, lacks a direct sensitivity assessment at MarLIN but five of the species recorded from the video survey including the common starfish, edible crab, edible sea urchin, dead man’s fingers and the hydroid, *Nemertesia* have either low or, for the latter three, very low sensitivity to increases in SSC[248,251,256, 257,258].

SS.SMx.CMx, as with all previous biotopes, does not have a sensitivity assessment at the MarLIN website, although again, some of the characterising species give an indication of the possible effect of increases in SSC. *Pisidia longicornis*, the long-clawed porcelain crab is not sensitive to this factor and *A. filiformis* has a very low sensitivity[267,253]. The keelworm *Spirobranchus lamarcki* (formerly *Pomatoceros lamarcki*) also lacks an assessment, however the related species *Spirobranchus triqueter* (formerly *Pomatoceros triqueter*) does not and indicates that *S. lamarcki* is likely to have a low sensitivity to increases in SSC (both species can occur at the same

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263 Ager, O. (2008). Lanice conchilega. Sand mason. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=3633
264 Keegan, B.F.; Ceidigh, P.O.; Boaden, P.J.S. (Ed.) (1977). Biology of Benthic Organisms: 11th European Symposium on Marine Biology, Galway, October 1976. Pergamon Press: Oxford. ISBN 0-08-021378-2. XXXIII, 630 pp.
265 Dauwe B., Herman, P. M. J. and Heip, C. H. R. (1998). Community structure and bioturbation potential of macrofauna at four North Sea stations with contrasting food supply. Mar. Ecol. Prog. Ser. Vol. 173: 67-83.
266 Rayment, W.J. (2002). Semi-permanent tube-building amphipods and polychaetes in sublittoral mud or muddy sand. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 05/03/2015]. Available from: http://www.marlin.ac.uk/habitatecology.php?habitatid=136&code=
267 Hiscock, K. (2008). Pisidia longicornis. Long clawed porcelain crab. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 05/03/2015]. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=4134

location). *Kurtiella bidentata* is also found in this habitat within the Study Area and as mentioned previously is likely to be tolerant of raised SSCs.

SS.SSa.CMuSa was characterized by species such as the common starfish and *Ophiura* brittlestars. This latter species is a predator, but will also fairly frequently scavenge and surface deposit feed[268] and will therefore be tolerant of increases in SSC. Finally, SS.SSA.IMuSa.FfabMag has a very low sensitivity to increases in SSC[269].

SS.SMu.CFiMu.SpnMeg has a low intolerance and immediate recoverability from raised levels of SSCs and is therefore considered not sensitive to this effect[270].

The magnitude of effect of increased SSC is considered to be small as it will be limited in space and time, occurring intermittently during the construction phase. As the above assessment indicates, receptor sensitivity is low. Low sensitivity indicates that the benthic receptors affected largely have a low intolerance and high recoverability (1-5 years). The significance of the effect is therefore, negligible.

The effect is **not significant** and the assessment carries moderate to low uncertainty as the sensitivity of receptors is relatively well understood.

15.8.2.3. Deposition of sediment plumes

Sands and gravels will settle back to the seabed very rapidly with mud fractions (silt and clay particles) remaining in suspension considerably longer and being dispersed over much greater distances and wider areas depending on local hydrodynamic conditions[17].

As indicated in the Physical Processes assessment (Chapter 6: Physical Processes and Water Quality of the Forthwind Offshore Wind Demonstration Project Environment Statement, Methil Fife, July 2015), sediment deposition from any sediment plume associated with construction work is expected to be small in magnitude with only thin veneers of fine material over a wider area expected and well within natural variation.

The biotope receptors affected are the same as for the previous effect as the two are clearly linked. Those in the immediate vicinity most directly affected are SS.SMx.CMx.OphMx, SS.SSa.CMuSa.AbraAirr, SS.SSA.OSa, CR.MCR.EcCr, CR.HCR.XFa, SS.SMx.CMx, SS.SSa.CMuSa and SS.SSA.IMuSa.FfabMag.

The SS.SMu.CFiMu.SpnMeg biotope is further offshore and therefore likely to be less affected by the limited deposition expected. Furthermore, the seapen and burrowing megafauna habitat is considered to be insensitive to smothering[43]. SS.SMu.CFiMu Circalittoral fine mud is also present in the offshore environment of the Regional Study Area and although it lacks a MarLIN assessment is considered to be similarly insensitive to smothering as the suite of species are broadly similar to those found in nearby SpnMeg locations.

Ophiothrix fragilis is moderately sensitive to smothering[28]. However, the MarLIN benchmark used to make the assessment is as follows, ‘all of the population of a species or an area of a biotope is smothered by sediment to a depth of 5 cm above the substratum for one month’. No such magnitude of effect is predicted from the Proposed Development. It is possible that burial will occur highly locally to any dredging activity or during trenching when material is placed to the side of the trench.

SS.SMx.CMx.OphMx in the current context is not considered to be sensitive to this effect. The same is considered true for other biotopes which lack a formal assessment from MarLIN with the exception of the circalittoral rock biotopes some component fauna of which, such as sessile species (e.g. bryozoans) may have low sensitivity.

268 Stöhr, S. (2014). Ophiura albida Forbes, 1839. In: Stöhr, S.; O'Hara, T. & Thuy, B. (Eds) (2014) World Ophiuroidea database. Accessed through: World Register of Marine Species at http://www.marinespecies.org/aphia.php?p=taxdetails&id=124913 on 2015-03-05
269 Rayment, W.J. (2006). Fabulina fabula and Magelona mirabilis with venerid bivalves in infralittoral compacted fine sand. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 05/03/2015]. Available from: http://www.marlin.ac.uk/habitatsensitivity.php?habitatid=142&code=2004
270 Hill, J.M. (2004). Sea pens and burrowing megafauna in circalittoral soft mud. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 06/03/2015]. Available from: http://www.marlin.ac.uk/habitatsensitivity.php?habitatid=131&code=2004

SS.SSA.IMuSa.FfabMag does have a smothering sensitivity assessment, which even in the context of the benchmark is considered to be very low.

The magnitude of effect of sediment deposition is considered to be small as it will be limited in space and time, occurring intermittently during the construction phase. As the above assessment indicates, receptor sensitivity is, at worst, low. The significance of the effect is therefore, negligible.

The effect is **not significant** and the assessment carries low uncertainty as the sensitivity of receptors and the nature of the effect is well understood.

15.8.2.4. Release of sediment contaminants

OSPAR[245] notes that, '*contamination arising from seabed disturbance is only a risk in heavily contaminated locations*'. With the exception of total petroleum hydrocarbon (TPH) concentration and arsenic concentration, all other contaminant values measured were below guideline values indicating that at the site sampled there was no evidence for heavily contaminated conditions. The concentration of arsenic was only marginally outside the guideline value, however the recorded concentrations of TPH were from a single grab sample and the reason for the relatively high concentrations are unknown.

Benthic communities in this part of the Firth of Forth will have existed in the context of high levels of total petroleum hydrocarbons with periodic releases of sediments containing concentrations in excess of guideline values from storm events. As such, a high tolerance to temporary releases of sediment contaminants is expected with assemblages showing good adaptation to local conditions. It was noted in the technical report that at the sample location the brittlestar *A. filiformis*, a species known to be highly intolerant of oil pollution, was present in high numbers. In addition, the site also had the highest Shannon-Wiener diversity index reported from the survey. On this basis, the high value of TPH reported would seem not to be having a negative effect on the biological community sampled.

The biotope receptors affected are the same as for those reported for the increase in suspended sediment effect as the two are clearly linked. Those in the immediate vicinity most directly affected are SS.SMx.CMx.OphMx, SS.SSa.CMuSa.AbraAirr, SS.SSA.OSa, CR.MCR.EcCr, CR.HCR.XFa, SS.SMx.CMx, SS.SSa.CMuSa and SS.SSA.IMuSa.FfabMag.

The common brittlestar, *O. fragilis* is assessed as being moderately sensitive to hydrocarbon contamination. However, the site-specific survey provided clear evidence of extensive beds (SS.SMx.CMx.OphMx) composed of this species. Such populations are understood to be stable through time and space and as such would have been exposed to storm driven contaminant remobilization events in the past and have clearly persisted despite this exposure[271].

SS.SSA.IMuSa.FfabMag has a low sensitivity to hydrocarbon contamination[269]. However, given the presence and probable persistence of communities and species with greater sensitivity to the effects of, in particular, hydrocarbon contamination, the sensitivity of benthic receptors more broadly is assessed as low.

The scale of the effects would be related to the extent of any sediment plumes and as indicated in Chapter 6: Physical Processes and Water Quality of the Forthwind Offshore Wind Demonstration Project Environment Statement, Methil Fife, July 2015 these are considered to be localised and temporary. The magnitude of the effect of the temporary release of sediment contaminants from seabed disturbance is assessed to be small. The evident lack of contamination with the exception of TPH coupled with the established presence of communities with components sensitive to hydrocarbon pollution indicates that receptor sensitivity is, low. The significance of the effect is therefore, negligible.

The effect is **not significant** and the assessment carries low uncertainty as the sensitivity of receptors and the nature of the effect is well understood.

271 Morgan, R. and Jangoux, M. (2005). Larval morphometrics and influence of adults on settlement in the gregarious ophiuroid Ophiothrix fragilis (Echinodermata). Biol Bull 208:92–99.

15.8.2.5. Noise and vibration

Potential effects of noise on fish and shellfish (including crustaceans and cephalopods) have been addressed in Chapter 10: *Fish and Shellfish Ecology* of this EIAR. Based on evidence at the time (which was noted to be limited) the potential effect of noise on benthic ecology was considered to be of little consequence according to Cefas[272]. The Marine Management Organisation (MMO)[273] reported that the effect of seabed vibration on seabed dwelling marine fauna is unknown and noted that understanding the absolute level of vibration would be of limited value without improved understanding of its effect on the relevant marine receptors. Within this context the following therefore seeks to assess the potential effects of noise on sediment dwelling species (infauna) such as worms, bivalves, urchins and small shrimp like amphipods and sessile epifauna, such as sponges, sea firs and sea mats.

Noise and vibration effects may arise in the construction phase as a result of drilling, cable installation and associated vessel traffic and anchoring. Piling activities will be limited to drill piling which is a less impactful activity than hammer piling, which is normally considered to be the most noisy construction activity. Effects would be highly localised and temporary and may include avoidance of adversely affected areas or mortality if sufficiently close to a noise source. Because of their limited mobility, sessile species may be more susceptible to noise effects than mobile animals that are likely to move away from the immediate proximity in the short term[274].

Sounders et al [274] state that noise, 'must be placed in the context of the existing receiving environment, as commercial shipping, sites of industry or other sources of marine noise may already be present in the area'. The Scottish Executive[275] defined ambient or background noise as being composed of both natural (e.g. wind) and anthropogenic sources (e.g. shipping) and that these sounds combine to give a 'continuum of noise' against which may impact the functionality of bioacoustics receivers. In shallow coastal waters (tens of metres), the long-range propagation of the very low frequencies is not supported. Propagation of sound in water will vary due to a number of factors including salinity, temperature, pressure and seabed type[275]. Hard seabeds are effective at reflecting noise compared to muddy sea beds which will absorb noise whilst waves on the surface can scatter sound, rather than simply reflecting it, which will affect propagation loss[275]. In addition, suspended sediments or bubbles can cause additional propagation loss[275].

Although invertebrate benthic species do not hear in the same way that vertebrates do, some are able to sense vibrations and movements associated with sound production. This ability assists them in survival by allowing them to detect potential predators, prey, and even sense the activity of tides and currents. The lack of a swim bladder or similar gas filled cavities (such those possessed in fish) means that benthic infauna and sessile epifaunal species may be less susceptible to the injurious or mortal effects from noise[276].

There has been little work on the sensitivity of invertebrates to underwater sound. However, Normandeau Associates[277] indicate that a range of invertebrates are sensitive to low frequency sounds. Reynault and Lagardere[278] suggest that the shrimp *Crangon crangon* can sense variations in environmental sound pressure at low frequencies (below 1000 Hz) and that acoustic sensitivity of *C. crangon* could vary as a function of age and

272 Cefas (2009). Strategic Review of Offshore Wind Farm Monitoring Data Associated with FEPA Licence Conditions. Benthic Ecology. Contract ME1117. 19pp.

273 MMO (2014). Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation, pp 194. MMO Project No: 1031. ISBN: 978-1-909452-24-4.

274 Saunders, G., Bedford, G.S., Trendall, J.R., and Sotheran, I. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.

275 Scottish Executive (2007). Scottish Marine Renewables SEA. Environmental Report Section C SEA Assessment: Chapter C17 Noise. 35pp.

276 Moriyasu, M., Allain, K., Benhalima, R. and Claytor, R. (2004). Effects of seismic and marine noise on invertebrates: A literature review. Dept of Fisheries and Oceans, Canada. 50pp.

277 Normandeau (Normandeau Associates, Inc.) (2012) Effects of Noise on Fish, Fisheries, and Invertebrates in the U.S. Atlantic and Arctic from Energy Industry Sound-Generating Activities A Literature Synthesis for the U.S. Dept. of the Interior, Bureau of Ocean Energy Management. Contract M11PC00031. 153 pp.

278 Reynault, M. and Lagardere, J.P., (1983). Effects of ambient noise on the metabolic level of Crangon crangon (Decapoda, Natantia). Mar. Ecol. Prog. Ser. Vol. 11: 71-78.

size. Reynault and Lagardere[278] also note that when increased sound levels are permanently imposed on brown shrimp it stimulates mechanoreceptors and is liable to induce a stress-state. These authors also indicate that high sound levels cause some modifications in behaviour such as increased cannibalism as well as delays in growth.

In general however, because of the relative paucity of studies, very little is known about sound detection in invertebrates. The Baltic tellin (bivalve shell) *Macoma balthica*, is sensitive to frequencies in the minimum range of 50-200 Hz, which corresponds to shear wave vibrations at the sediment-water interface. The prawn *Palaemon serratus* is responsive to sounds ranging in frequency from 100 to 3000 Hz[279].

It is worth noting that the total noise level from all sources for a particular location may be significantly higher than the level due to a dominant source alone. Different sources may dominate in different parts of the spectrum and bio-receptors may be more sensitive to a less dominant noise source in a different frequency range[275].

Sensitivity assessments for noise, available for both biotopes and individual species, indicate that benthic receptors are not sensitive (e.g. SS.SMu.CFiMu.SpnMeg and SS.SSA.IMuSa.FfabMag) or that sensitivity is considered to be very low (*O.fragilis*)[255,269270]).

Effects are expected to be highly localised and short-lived, lasting for the duration of each individual noise event only. Magnitude of effect is thus considered to be small. No significant effects on benthic ecology have been recorded as part of license monitoring of offshore wind farms. Consequently, receptor sensitivity is judged to be low. The significance of the effect is therefore, negligible.

The effect is **not significant** and the uncertainty associated with this assessment is judged to be moderate-low.

15.8.2.6. Intertidal temporary direct seabed habitat disturbance

Disturbance of the intertidal area will include temporary breaching of sea defences and excavation of the necessary trench. As part of the Construction Plan , one trench is considered for this assessment (Table 14.8). Disruption will usually occur within the construction corridor but will be limited to the width of the trench created i.e. 3 m[17].

The two biotopes previously recorded in the area are LR.FLR.Lic.Ver.Ver *Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock and LR.HLR.MusB.Sem.FvesR *Semibalanus balanoides, Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock[7].

LR.FLR.Lic.Ver.Ver is generally a species poor community consisting mainly of the tar lichen *V. maura* and the rough periwinkle *L. saxatilis*. It is found in the upper littoral fringe on bedrock, boulders and stable cobbles in a range of conditions from very exposed to very sheltered[2]. Hiscock indicates the closely related biotope LR.FLR.Lic.Ver *Verrucaria maura* on littoral fringe rock has a low intolerance and very high recoverability to physical disturbance. LR.FLR.Lic.Ver.Ver sensitivity to this effect is also assessed as being very low.

LR.HLR.MusB.Sem.FvesR is characterised by the barnacle *S. balanoides*, the common limpet *Patella vulgata* and the dog whelk *Nucella lapillus* with a sparse community of seaweeds . It occurs on exposed and moderately exposed upper and mid eulittoral rock. As such, the algal community is generally restricted to fissures and cracks in the surface of the rock. These damp cracks and crevices may also provide a refuge for small individuals of the mussel *Mytilus edulis* and the winkles *Littorina saxatilis* and *Littorina littorea* as well as the anemone *Actinia equina* encrusting coralline algae[2]. There is no direct habitat sensitivity assessment for LR.HLR.MusB.Sem.FvesR at the MarLIN website however, the three top characterising species in terms of abundance (the barnacle *S. balanoides*, the common limpet and the dog whelk) either have a low sensitivity (the barnacle and the common limpet) or are not sensitive (dog whelk) to physical disturbance.

The site itself is relatively exposed with previous survey work in the area describing the intertidal area as being made up of mobile cobbles and pebbles with occasional outcrops of sandstone bedrock or patches of boulders[7].

279 Lovell, J.M. Findlay, M.M., Moate, R.M. & Yam, H.Y. (2005). The hearing abilities if the prawn Palaemon serratus. Comparative Biochemistry and Physiology, Part A 140, 89-100.

This indicates that the habitats and species here will be exposed to a degree of natural perturbation and as such be more adapted to, and tolerant of, such events and, because of this, better able to recover from them.

The intertidal area falls within the Firth of Forth Site of Special Scientific Interest (SSSI), Special Protected Area (SPA) and Ramsar site. However, the benthic habitats and species are widespread throughout the region.

The magnitude is assessed as negligible as the extent is highly limited both spatially and temporally. As the above assessment indicates, receptor sensitivity is considered to be low due to the low intolerance and high recoverability. In addition, the value associated with the area is very unlikely to be effected by the proposed works and the significance of the effect is therefore, negligible.

The effect is **not significant** and the assessment carries a moderate to high uncertainty as although the magnitude of the effect can be quantified and the sensitivity of receptors is reasonably well understood the assessment is not based on recent survey data and the lower shore was not surveyed in the information available.

15.8.2.7. Intertidal temporary increased suspended solid concentrations, sediment deposition and release of contaminants

Cable installation in the intertidal area will be undertaken by JCB (or similar) at low tide and therefore potential for resuspension of material and its subsequent deposition is much reduced. As such, any release of associated contaminants will also be reduced. Any re-suspension which may occur during the flood-tide is expected to be low given the exposed nature of the site and the consequently coarse nature of the sediments as indicated by the identified biotopes with any re-suspended sediment settling back very quickly. As such, the spatial extent of any re-settled sediment is expected to be highly limited and localised. In addition, the naturally dynamic nature of the exposed site suggests any smothering would be short term in nature. The magnitude of the effects is therefore assessed as being negligible.

LR.FLR.Lic.Ver has a very low sensitivity to the effects of sediment resuspension and smothering and LR.FLR.Lic.Ver.Ver is similarly assessed here as having low intolerance, very high recoverability and therefore very low sensitivity[280]. Similarly, the three top characterising species in terms of abundance (the barnacle *S. balanoides*, the common limpet and the dog whelk) for LR.HLR.MusB.Sem.FvesR have a low / very low sensitivity to the effects of sediment resuspension and smothering or are not sensitive. The common limpet is moderately sensitive to smothering but the benchmark indicates this is in relation to all of the population of a species or an area of a biotope being smothered by sediment to a depth of 5 cm above the substratum for one month. No such effect is expected in the context of the project proposed here.

For LR.HLR.MusB.Sem.FvesR the three top characterising species in terms of abundance (the barnacle *S. balanoides*, the common limpet and the dog whelk) all have low or very low sensitivity to heavy metal contamination and moderate to low sensitivity to hydrocarbon contamination. In addition, the natural conditions of the site will have re-suspended sediments here from both wave and tide activity as well as storm events. Species present will therefore be, to a degree, adapted to such effects. Intolerance is likely to be low and recoverability high. LR.FLR.Lic.Ver.Ver is therefore similarly assessed as having low sensitivity to the release of contaminants.

Given the negligible magnitude of the effects and the low sensitivity, the significance is assessed as, negligible.

The effects are **not significant** and the assessment carries a high to moderate uncertainty as although the effects are reasonably well understood the magnitude is not quantified and no data is available to indicate the extent to which sediments may be contaminated.

15.8.2.8. Accidental spillages of chemicals

Accidental spillages or release of chemicals into the environment such as grouting, fuel and oil during the construction phase, could potentially contaminate the marine environment and harm benthic ecology receptors. The severity of this effect on the biotope receptors depends upon the quantities and nature of the spillage /

280 Hiscock, K. (2014). Marine Biodiversity Conservation: A Practical Approach. Earthscan Oceans. Routledge. 289 pp.

release, the dilution and dispersal properties of the receiving waters and the bio-availability of the contaminant to species. It is likely that any accidental spillage or release would be dispersed by tidal currents and wave action. As a result any potential effect may be very limited. However, static receptors and less mobile species unable to avoid accidental pollution events could experience significant effects. Sounders et al.[47], reinforce this view noting that in high energy environments, 'a spillage would be expected to disperse rapidly and have minimal impact on the benthic environment. Where devices are positioned close to the shore, the intertidal zone and nearshore areas will be more vulnerable to such a spillage than benthic habitats at offshore sites'.

At this stage, the quantities and types of material that might conceivably enter the marine environment in this way are not known and so scale and magnitude of effects are unquantifiable at present. In the worst case scenario, the potential significance of an accidental spillage would be high, although the likelihood of this occurring would be very low. The effects on benthic ecology from accidental events are, by definition, unknown and the uncertainty associated with this effect is, therefore, high.

Primary mitigation includes best practice construction site management. A pollution / spill prevention plan will be produced for the Proposed Development to control the use and storage of materials during the construction of the wind farms and will mitigate for accidental spillages or releases of chemicals, such as fuels, lubricants and grouting materials, into the marine environment and prevent harm to the benthic ecology.

Adherence to pollution/spill prevention plan will reduce the magnitude of an accidental spill and mitigate the scenario by minimising the potential for accidental pollution events to occur. The magnitude of effect is therefore considered to be negligible. Depending on biotope and species specific sensitivities to particular contaminants and degree of mobility of the latter, receptor sensitivity is considered to be low to high. Therefore, it is predicted that the significance of an accidental spill or release would be of negligible.

The effect is **not significant** and the uncertainty remains high for the reasons outlined.

15.8.3. Operational Effects

15.8.3.1. Loss of original habitat

As Table 15.8 indicates, a maximum of four pin piles for the turbine foundation and one monopile for the meteorological mast foundation will be installed, totalling 0.000048 km² of seabed disturbance, plus associated scour protection. There will be a temporary loss of seabed habitat as the turbine and meteorological mast are installed by a single jack-up vessel with six feet, totalling 0.000072 km^2 of seabed disturbance. Complete surface lay of export and inter array cables with associated protection materials will result in a maximum seabed loss of 0.01070825 km^2 for both cables. In reality, this apparent maximum loss associated with cable installation will not be realised as the preferred option for all cabling is burial to a depth of 1.5 m, where seabed conditions allow, avoiding the necessity of applying protection and the consequent habitat alteration. There will also be a temporary loss of habitat of up to 0.001544 km^2 associated with cable laying vessel anchors.

The small spatial scale is therefore evident and as the MESH data illustrates (Figure 15.2) there is clearly a wider availability of comparative habitats throughout the outer Firth of Forth. None of the biotopes within the footprint of the turbine and meteorological mast foundations or cabling area are considered rare, geographically restricted or of specific conservation importance. Effects on biotope diversity or designated nature conservation features are not therefore forecast and any effect on a biodiversity or the functional role of the habitats in question is highly unlikely.

Both CR.MCR.EcCr and CR.HCR.XFa can be found in Annex I Reef habitats. The area of the Proposed Development is not within or near to an SAC. The nearest SAC with Reef identified as a qualifying feature is the Isle of May, approximately 28 km to the east of the Proposed Development. The JNCC[231] has noted that potential Annex I reef may be present in many locations in the surrounding region including immediately northeast of the turbine and meteorological mast and in the nearshore area likely to be crossed by the proposed export cable route corridor. The site-specific survey (see Technical Appendix 10A, Methil Benthic Survey Report, Volume III) identified CR.MCR.EcCr and CR.HCR.XFa as present. The assessment of 'reefiness' indicated four nearshore sites with a resemblance to Reef. Two of these sites (3 and 6) have medium resemblance to Annex I Reef. The other two sites (15 and 17) were just over one kilometre southwest and northeast of this and had low resemblance to

Annex I Reef. These rocky nearshore areas may be unsuitable for cable burial and consequently the cable would be laid on the surface of the seabed and protected by either concrete mattressing or rock placement. The mattressing / rock placement would cover any potential Annex I Reef which may be present but is highly likely to be quickly colonised by fauna and flora that are representative of local populations. However, given that it will be made from a different material (artificial or non-local rock), possibly with reduced / different habitat complexity, relative to the ambient rocky habitat, the colonising community may not exactly match that of the surrounding communities. This would constitute a negative effect, although its spatial extent would be localised around the area of the mattressing / rock placement. Consequently, effect magnitude would be small and receptor sensitivity is considered low.

More broadly, any loss that may occur is considered of small magnitude within the wider geographical context. However, long term habitat loss will occur locally with all biotopes and associated fauna and flora having a low tolerance to removal or burial of the natural environment, where directly affected. Effects associated with the meteorological masts will be short term, lasting the duration of its operational phase of the Proposed Development (5 years), but will be reversible upon decommissioning with removal of the mast and scour protection material. Effects associated with the turbine will last for the duration of its operational phase (25 years) but will be reversed upon decommissioning with removal of the turbine and scour protection material. Following decommissioning the subsequent recoverability of affected areas will be high. Receptor sensitivity is therefore considered to be low. The significance of the effect is therefore, negligible.

The effect is **not significant** and the extent is quantifiable and the evidence for wider availability of similar habitat reliable so the uncertainty associated with this significance level is low.

15.8.3.2. Introduction of new hard substrate for colonisation including non-native species

As assessed above, a total of 0.01879625 km^2 of original seabed habitat will be lost and a substantial proportion of this will become new habitat, including all scour and cable protection material and engineering infrastructure, such as the framework and turbine column. Over time, this material will become colonized by many different species, for example, barnacles, bryozoans, hydroids and keelworms, with the new spaces and surfaces exploited by crabs and echinoderms etc. The source of much of this colonization will be from the natural hard substrate already present in the wider area examples of which can be seen from the video survey undertaken as part of the site-specific technical report (see Technical Appendix 10A, Methil Benthic Survey Report, Volume III). Some of those species which occupy parts of the newly available hard substrate may be non-native and a proportion of those may also be considered invasive. Such species are equally liable to colonise other hard structures elsewhere in this part of the Firth of Forth.

These communities will be very different to those associated with the soft sediment habitats they replace. In some areas where the cable crosses rock biotopes the difference will be less. The effects will be long term, lasting for the operational lifetime of the Proposed Development until decommissioning. The increase in the availability of hard substrata is of further potential interest as it increases the risk of enhancing the spread of invasive non-native species; a consequence which may last beyond decommissioning, although within the context of existing artificial hard structures locally, any increase in this risk is expected to be very small.

Biological succession can result in the establishment of communities similar to those already naturally present in the region; the rate that this biological succession from colonisation to climax community occurs is influenced by the local physical (e.g., hydrographic regime) and biological conditions (e.g., larval supply) .

The colonisation of the turbine and meteorological mast foundations by the epibenthic macrofauna is influenced by physical and biological factors, as well as by the position and orientation of the substrate in the water column. Therefore, the assemblages on the vertical turbine foundations may differ from those on the scour protection around them. Post construction studies of offshore wind farms show that turbine foundations support dense populations of filter feeders, typically blue mussels *Mytilus edulis*, which has also been recorded on other structures projecting from the sea floor, such as oil platforms and pier piles. Surveys of operational wind turbines on the Danish coast have recorded two principal assemblages, i.e., mussels, dominating the upper zone, and tubeworms, anemones, hydroids and solitary sea squirts on the lower zone.

In the context of the Proposed Development, the abundance of epibenthic assemblages, e.g., those associated with the biotopes CR.MCR.EcCr and CR.HCR.XFa and to some extent hard substrata in areas of mixed substrates is likely to increase, as more hard substrate will be available. Leaving aside the question of non-native species for a moment, the spatial scale of the change is very limited with the duration of the foundations being installed being short term regarding the meteorological mast and long term regarding the turbine foundation, the species colonizing the newly available surfaces and niches will be the same as those already present within the wider Firth of Forth area; therefore the magnitude of the effect for both foundations is assessed as small. Receptor sensitivity is low, as some receptors will benefit from extended coverage, while others lose out for the duration of the operational phase. With the removal of all structures and protection above the seabed during decommissioning, subsequent recoverability will be high. In the extended interim, the effect of the localised shift in the balance of substrates is unlikely to disrupt the broader functional role of the habitats regionally. The significance of the effect is therefore, negligible.

The effect is **not significant** and the uncertainty associated with this assessment is moderate to low as the processes involved are well understood, while the details of the successional changes will be subject to the potential vagaries inherent in dynamic systems and stochastic effects.

The addition of turbine and meteorological foundations may act as a stepping stone for non-native species brought in as larvae by ballast waters or biofouling on ships hulls[4]. Artificial structures are reported to be more suitable for non-native species than natural reefs by changing the competitive interactions[4]. The potential introduction of invasive non-native species could impair the ecosystem equilibrium. However, no specific information is available to suggest that reefs associated with offshore wind farms will provide uniquely beneficial opportunities not currently available to alien species to assist their invasion in UK waters. The Proposed Development will only represent a very small contribution to any increased risk of spreading non-native species as there are already other artificial hard structures present in the area, which may be equally suitable for colonisation. The Proposed Development and implementation of ballast water and anti-fouling management plans for construction and maintenance vessels will reduce the risk of introducing marine non-native species during the life of the Proposed Development.

The site-specific survey (see Technical Appendix 10A, Methil Benthic Survey Report, Volume III) did not identify the presence of any invasive non-native species in the Study Area. While the magnitude remains small as already assessed, receptor sensitivity is conservatively assessed as medium with regard to possible colonisation by non-native species. The significance of the effect is therefore, minor and as such is considered to be **not significant** but, the uncertainty associated with the assessment is very high given the preponderance of unknowns.

15.8.3.3. Changes to the Hydrodynamic regime

The main aspect that could arise as a result of the Proposed Development during operation relates to the how water flows around the installed wind turbine and meteorological mast foundations resulting in changes to currents, water levels and wave heights in the area. However, as the Proposed Development is smaller in scale (only one turbine) that the development described in the original 2015 ES, no significant effects on tidal levels or current speeds are expected. Any secondary scour around the edges of the scour protection material from locally accelerated near bottoms currents would last for the operational lifespan of the project (approximately 25 years) and would be cease on decommissioning

Benthic receptors would experience some very localised modification but little different to that which might occur around boulders scattered naturally in the wider area. The magnitude of the effect is therefore negligible even given the extended period of time over which it would operate. Receptor sensitivity is low as the habitats are widely distributed throughout the Study Area and beyond. The significance of the effect is assessed as negligible and **not significant** and the uncertainty is low.

15.8.3.4. EMF / Heat effects

15.8.3.4.1. EMF

EMF and heat emissions from the turbine export y cable will be generated during the operation of the scheme. The Proposed Development will require a maximum of approximately 1.5 km (0.8 nautical miles), 66 kV export cable. There will be no inter array export cable between the meteorological mast and the turbine, only a backup power line. The EMF created by the electric current passing through the cables is composed of both an induced electric field (E field) and a magnetic field (B field).

Sensitivity to EMF in benthic organisms, where present, is thought to be related to orientation and direction finding[244]. However, studies on the effects of EMF on benthic invertebrate fauna are limited and those that are available indicate that geomagnetic orientation, for example, is not a unique characteristic of fish and marine mammals, but also occurs in molluscs[281]. Therefore, effects of EMFs are of potential interest as these may cause changes in a range of behaviours from local foraging to migration of benthic species depending upon the scale and magnitude of the influence.

The survival and physiology of selected species of prawns, crabs, starfish, marine worms and blue mussels have been studied in relation to EMF levels corresponding to the intensity on the surface of ordinary submarine direct current cables in the Baltic Sea. Results showed no significant effects for any of the species under consideration after three months of exposure[282]. In addition, a visual survey of benthic communities on wind power cables and the peripheral areas, showed no differences in assemblage structure[227].

In general, the occurrence of apparently healthy and diverse communities on existing offshore wind farm structures provides evidence that EMF is unlikely to pose a significant threat to the colonising communities on turbine bases in the longer term[283]. This suggests that receptor sensitivity is low or negligible although, in the absence of more comprehensive evidence, uncertainty remains when predicting potential effects of EMF on benthic invertebrate communities.

As part of the current design of the Proposed Development, cables will be buried to a target depth of between 1 m to 1.5 m, and where burial cannot be achieved, the cable will be protected using rock or concreting mattressing creating a distance separation between the EMF source and benthic species (see Chapter 3: Project Description of this EIAR). This is likely to provide some mitigation for possible effects associated with EMFs, as a result of the dampening effects of the substrate and the physical separation of the receptors from the EMF source. However, as pointed out by Gill *et al.*[284], EMFs may still remain detectable to the most sensitive of species even if the cable was buried to several metres below the seabed.

The overall effect of EMFs from the electricity export cable is thought to be highly localised around the cable[244]. Effects associated with the electricity export cable will be long term, lasting for the duration of the operational phase of the Proposed Development (25 years), but will equally be reversible upon decommissioning. The magnitude of the effect of EMF is considered to be small based on the small footprint of the cables within the offshore site. The sensitivity of the invertebrate species associated with the biotopes recorded within the Proposed Development is considered to be low (based on current knowledge). The significance of the effect is therefore assessed as negligible.

The effect is **not significant** and the assessment carries medium uncertainty as the number of experimental field studies addressing invertebrate tolerance/sensitivity to EMF is currently limited.

15.8.3.4.2. <u>Heat effects</u>

All electrical cables have resistance which produces heat in the cable. The amount of heat is proportional to the power transmitted. Thermal radiation will be emitted from the export cable during its lifespan associated with

281 Bochert, R. and Zettler, M. L., (2006). Chapter 14 Effects of Electromagnetic Fields on Marine Organisms. IN: Koller, J., Köppel, J. and Wolfang, P., eds. Offshore Wind Energy -Research on Environmental Impacts, Springer, Germany.
282 Bochert, R. & Zettler, M.L. (2004). Long-term exposure of several marine benthic animals to static magnetic fields. Bioelectromagnetics. 25:498–502.
283 Linley, E. A. S., Wilding, T. A., Black, K., Hawkins, A. J. S. and Mangi, S., (2007). Review of the reef effects of offshore wind farm structures and their potential for enhancement and mitigation. Report from PML Applications Ltd and the Scottish Association from Marine Science to the Department for Business, Enterprise and Regulatory Reform. Available online from: http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file43528.pdf
284 Gill, A.B., Gloyne-Phillips, I., Neal, K. J. and Kimber, J. A., (2005). The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm Proposed Developments on electrically and magnetically sensitive marine organisms - a review COWRIE 1.5 Electromagnetic Fields Review. Available online from: http://www.offshorewindfarms.co.uk/Assets/1351_emf_phase_one_half_report.pdf

the Proposed Development. This has the potential to increase the temperature of the surrounding environment. The amount of heat dissipation depends on the type of cable, the power being transmitted and the way in which the power is being transmitted, i.e. via alternating current (AC) or direct current (DC). In general, it is thought that AC cables transmit significantly more heat than DC cables[285].

It is currently assumed that a permanent increase in the seabed temperature will lead to changes of seabed characteristics (e.g., alteration of redox, oxygen, sulphide profiles, changes of nutrient profiles and increase in bacterial activity)[286]. These in turn may affect the physiology, reproduction or even mortality of certain benthic species, but also alter benthic communities because of changes in emigration/immigration patterns[285]. Effects of heat from cables laid on the surface of the seabed are considered to be of less concern, as the heat will be rapidly dissipated within the overlying water column.

Theoretical calculations of the temperature effects of operational buried cables currently reported in the literature predict significant temperature rise of the surrounding sediment[285]. However, in the absence of robust field data, the assessment of effects of increased temperature associated with subsea cables on marine habitats and species remain highly uncertain[285]. For example: seabed temperature rise has been considered during a project to bury a submarine HVDC cable between New England and Long Island, New York. It was estimated that the rise in temperature at the seabed immediately above the buried cable would be just 0.19°C and thus well within the natural variation[244]. A further study for a wind farm Proposed Development in the German EEZ predicted a rise of 5.6°C at a point 0.5 m above a buried cable and assumed that the cable was connecting five consecutive 4.5 MW turbines with the transformer station[286].

German Federal Agency for Nature Conservation guidelines suggest that seabed temperature rises within the uppermost sediment layer above buried cables, within which the majority of benthic organisms reside, should not exceed 2°C to which species are expected to be tolerant. Based upon model outputs, this guideline will be achieved if the cable burial depth is one metre[286], although temperature rises very close to the cable (within a few cms) may increase by 10°C.

Given the highly localised effect predicted (within a few centimetres of the cable) the magnitude of this potential effect is assessed as being negligible. The effect will be of long duration, lasting throughout the operational phase of the Proposed Development but will be reversible upon decommissioning. Receptor sensitivity is low given that cables will either be buried to a depth of between 1 to 1.5 m, or covered by protective material. The significance of the effect is negligible and **not significant** and the uncertainty is medium due to the very limited amount of data from field studies.

15.8.4. Decommissioning Effects

The Proposed Development will be decommissioned in accordance with an approved decommissioning plan at the end of its operational life. The meteorological mast will be removed, with foundations removed to the surface of the seabed. It is likely that the turbine will be removed and foundations removed to the surface of the seabed, with infrastructure beneath the seabed and cables being left in place. The activities involved in decommissioning are likely to be similar, but of smaller environmental impact, to those during construction. As all effects identified for the construction phase were assessed as being of negligible significance, the same will be true for the decommissioning activities. As there will be limited or no disruption of the seabed, the new habitats that have been formed over the operational life span of the windfarm will be preserved.

Activities would be undertaken in accordance with the relevant guidelines, legislation and good practice at the time, in order to minimise potential environmental impacts. A decommissioning plan for the turbine and the

285 OSPAR, (2009). Assessment of the environmental impacts of cables. Biodiversity Series Publication Number: 437/2009. Available online from: http://qsr2010.ospar.org/media/assessments/p00437_Cables.pdf
286 Meißner, K. and Sordyl, H., (2006). Literature Review of Offshore Wind Farms with Regard to Benthic Communities and Habitats. IN: Zucco, C., Wende, W., Merck, T., Köchling, I. and Köppel, J., eds. Ecological Research on Offshore Wind Farms: International Exchange of Experiences. art B: Literature Review of Ecological Impacts. Available online from: http://www.bfn.de/habitatmare/de/downloads/berichte/Ecological_Research_Offshor-Wind_Part_B_Skripten_186.pdf

meteorological mast will be developed for approval by the relevant authorities (currently DECC and Marine Scotland) prior to construction and will be updated on a regular basis up to the point of decommissioning.

15.8.4.1. Temporary direct seabed habitat disturbance

The temporary direct seabed habitat disturbance during the construction phase is considered to be small and not significant as it will be limited both spatially and temporally and will occur intermittently. Therefore, the effects from decommissioning are considered to be less than those described for the construction phase and are deemed to be negligible and therefore assessed as **not significant**.

15.8.4.2. Temporary increased suspended solid concentrations

Buried export and inter array cables will be cut and left in situ except where they have been laid at the surface and covered in protective material, in which case both cable and protection material will be removed. The removal process is unlikely to generate any level of SSC that exceeds that already assessed during construction. Therefore, the effects from decommissioning are considered to be less than those described for the construction phase and are deemed to be negligible and therefore assessed as **not significant**.

15.8.4.3. Temporary increases in sediment deposition

Ground preparation works and trenching activities will not be undertaken during decommissioning so there will be little sediment disturbance. Where the sediment is disturbed i.e. during the removal of certain infrastructure it is highly unlikely to generate any depositional effect greater than that already assessed. Therefore, the effects from decommissioning are considered to be less than those described for the construction phase and are deemed to be negligible and therefore assessed as **not significant**.

15.8.4.4. Temporary release of sediment contaminants from seabed disturbance.

With limited increases in SSC from re-mobilisation of sediments the effects from decommissioning are considered to be less than those described for the construction phase and are deemed to be negligible and therefore assessed as **not significant**.

15.8.4.5. Noise and vibration

The turbine and meteorological mast will be removed to the level of the seabed. This will generate some underwater noise but it is highly unlikely to exceed levels that are already assessed under the construction process. Therefore, the effects of decommissioning noise are considered to be less than those described for the construction phase of the Proposed Development and are deemed to be negligible and therefore assessed as **not significant**.

15.9. Mitigation Measures and Residual Effects

The effects of the construction, operation and decommissioning of the project have been assessed to be minor or less and are considered to be **not significant**. Consequently, no additional mitigation measures for the Proposed Development are proposed in addition to those already adopted in the design of the Proposed Development.

15.10. Cumulative Effect Assessment

The following section describes the existing and other proposed developments that may give rise to cumulative effects in the context of the Proposed Development, and the likely potential effect as a result of these effects. This assessment follows the approach used for the assessment of potential effects outlined in section 6.4.1.

15.10.1. Scope of Cumulative Assessment

Projects were considered where potential overlap between activities and receptors might take place with the Proposed Development. Consideration was given to spatial and temporal influences at a cumulative scale for benthic ecology receptors. Those projects identified for the assessment are discussed further within the following sections.

Potential cumulative effects were identified as:

- Habitat disturbance;

- Increase in SSC;
- Increase in sediment deposition;
- Release of sediment contaminants
- Effects of underwater noise and vibration
- Loss of habitat;
- Effects of introduction of new habitat; and
- EMF / heat effects.

A list of the projects and plans considered in the benthic ecology assessment are outlined in Table 15.9. Note that Inch Cape did not get an allocation under the Contracts for Difference (CfD) round and therefore is unlikely to overlap with Methil with respect to the construction period.

Table 15.9 -. Cumulative Effects Projects Considered

Project	Distance (km)	Status	Effects identified
Neart na Gaoithe Windfarm	40	Under construction	Habitat disturbance, increase in suspended solids concentrations, Increase in sediment deposition, release of sediment contaminants, effects of underwater noise and vibration, loss of Habitat, effects of the introduction of new habitat; and EMF/ Heat effects
Inch Cape Windfarm	65	Consented – Site Investigation Works Underway	
Seagreen Windfarms	60	Consented – Optimised Design Under review	

15.10.2. Assessment of Cumulative Effects

Should the construction of one or more of the windfarm projects identified in Table 15.9 with the Proposed Development, there is potential for cumulative effects to arise as a result of the installation of the turbine and meteorological mast foundations and inter array and export cables.

Cumulative effects may occur where the plumes of suspended sediments resulting from trenching, dredging and disposal activities interact with neighbouring dredging or sea disposal activities, producing a greater spatial extent of sediment plume than individual activities in isolation. This would have effects on the seabed and water quality.

The projects identified in Table 15.9 may require dredging for seabed preparation works and cable trenching however, the associated plumes are not likely to extend as far as the Proposed Development, given the large distances between these projects and the Proposed Development.

Further cumulative effects might occur once operational as a result of EMF, operational noise, introduction of new habitat and loss of baseline habitat.

However, it is unlikely that any of these cumulative effects will have a significant effect on the benthic ecology of the Study Area, as the magnitude of effect will be small and the sensitivity low. Cumulative effects as a result of the Proposed Development are therefore predicted to be **not significant**.

15.11. Summary of Effects

Table 15.10provides a summary of effects relating to the benthic environment from the Proposed Development.

Table 15.10 - Summary of Effects

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction			
Seabed habitat disturbance	Short-term and reversible loss of available habitat. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Increased suspended sediment concentration	Short-term and reversible clogging of gills and feeding apparatus. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Deposition of sediment plumes	Short-term and reversible loss of available habitat and burial of communities through fining. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Underwater noise and vibration	Short-term and reversible. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Re-release of sediment bound contaminants	Short-term and reversible increase bioavailability of sediment bound toxic substances to benthic species. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Unplanned accidental spill and release of environmentally harmful substances	Short-term and reversible increase bioavailability of toxic substances to benthic species. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Intertidal temporary direct seabed habitat disturbance	Short-term and reversible loss of available habitat. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Intertidal temporary increased suspended solid concentrations, sediment deposition and release of contaminants	All short term and reversible and assessed as being of negligible significance.	No mitigation proposed	Not significant
Operation			
Net loss of seabed habitat	Long-term permanent loss of baseline habitat, species diversity, abundance and biomass. Assessed as being of negligible / minor significance.	No mitigation proposed	Not significant
Introduction of new habitat	Long-term permanent community shift to hard habitat preference species.	No mitigation proposed	Not significant

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
	Assessed as being of negligible significance.		
Changes in hydrodynamic regimes	Long-term reversible changes to physical attributes of habitats. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Seabed habitat disturbance	Short-term and reversible loss of available habitat. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Electromagnetic field emissions	Long-term reversible potential behavioural alterations such as increased foraging effort or area avoidance electro-sensitive species. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Heat emissions	Long-term reversible alteration to the benthos through sediment heating. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Unplanned accidental spill and release of environmentally harmful substances	Short-term and reversible increase bioavailability of toxic substances to fish and shellfish species. Assessed as being of negligible significance.	No mitigation proposed	Not significant
Decommissioning			
Seabed habitat disturbance	As those describes for construction. Negligible significance.	No mitigation proposed	Not significant
Increased suspended sediment concentration	As those describes for construction. Negligible significance.	No mitigation proposed	Not significant
Deposition of sediment plumes	As those describes for construction. Negligible significance.	No mitigation proposed	Not significant
Re-release of sediment bound contaminants	As those describes for construction. Negligible significance.	No mitigation proposed	Not significant
Underwater noise and vibration	As those describes for construction. Negligible significance.	No mitigation proposed	Not significant
Unplanned accidental spill and release of environmentally harmful substances	As those describes for construction. Negligible significance.	No mitigation proposed	Not significant

15.12. Statement of Significance

The Study Area was identified as having, in the nearshore environment, habitats with medium and low resemblance to Annex I Reef. In the offshore environment, the biotope SS.SMu.CFiMu.SpnMeg confirmed the presence of the PMF habitat 'burrowed mud' and the OSPAR habitat 'seapens and burrowing megafauna communities'.

Potential effects were identified for the construction, operational and decommissioning phases. These included: habitat disturbance, increased suspended sediment, sediment deposition and smothering, underwater noise and vibration, release of environmentally harmful substances, introduction of new habitats, EMF and heat effects and a change to the local hydrodynamic regime. Each of these effects was assessed in terms of their likely effects on benthic ecological receptors.

No specific mitigation measures are suggested for construction, operational or decommissioning effects as all effects and cumulative effects assessed are considered to be of negligible or minor significance. Therefore, it is considered that any changes to the local and regional benthic habitats / species of the Study Area within the Firth of Forth will be within naturally occurring population fluctuations and as such, they will not be adversely affected by the Proposed Development.

16. MISCELLANEOUS ISSUES

This chapter of the EIAR evaluates the potential effects of the Forthwind Demonstration Project (hereafter referred to as the “Proposed Development”) on the following miscellaneous issues:

- Health and Safety Considerations; and
- Radio Links
- Major Accidents and/or Disasters
- Climate Change and Greenhouse Gases

16.1. Health and Safety Considerations

This section considers health and safety considerations that are considered relevant to the construction and operation of the Proposed Development.

As set out in Chapter 3 – Project Description of this EIAR, the Principal Contractor would be responsible for producing a health and safety plan to be implemented during the construction of the Proposed Development.

The site would be operated to Renewable UK ‘Offshore Wind and Marine Energy Health and Safety Guidelines’ (Renewable UK, 2014), and Guidelines for Health and Safety in the Wind Energy Industry’ and “Guidelines for Health and Safety in the Marine Energy Industry”.

Further information relating to the site safety and emergency procedures and navigation is provided in Chapter 3 – Project Description and Chapter 13 – Shipping and Navigation.

16.2. Radio Links

An application to the Joint Radio Company Ltd (JRC) was submitted on 28th July 2021 to assess the potential of the Proposed Development to interfere with radio systems operated by utility companies in support of their regulatory operations. As stated in the JRC response on 24th August 2021:

“In the case of this wind energy development, JRC does not foresee any potential problems based on known interference scenarios and the data you have provided.”

16.3. Major Accidents and/or Disasters

16.3.1. Assessment methodology

In identifying relevant major accidents or disasters, the following key terminology is used to guide this assessment which has been informed by the ‘Institute of Environmental Management and Assessment (IEMA) Major Accidents and Disasters in EIA: A Primer’:

- Disaster – May be a natural hazard (e.g. earthquake) or a man-made/external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident.
- Major Accident – Events that threaten immediate or delayed serious effects to human health, welfare and/or the environment and require the use of resources beyond those of the client or it’s appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events.
- Man-made hazards – for example (but not limited to):
    - Structural collapse
    - Human error/management failure
    - Design error
    - Sabotage/arson
    - Terrorism
    - Fire
- Natural hazards – for example (but not limited to):
    - Earthquake

- Volcanic eruption
- Extreme temperate (cold snap)
- Fire
- Storm surge
- High winds/storm
- Tsunami/tidal wave

16.3.2. Vulnerability of the Proposed Development to Disasters

The Proposed Development is not located within an area known for natural disasters such as hurricanes, tornadoes, volcanic eruptions, earthquakes or tsunamis. Severe weather and high wind speeds is likely to be the only relevant and most probable natural disaster that could affect the Proposed Development. Wind turbines are designed to withstand extreme weather conditions due to exposed locations wind farms are often installed on. Brake mechanisms installed on turbines allow the turbine to be operated only under specific wind speeds and, should severe wind speeds be experienced, the turbine would be shut down.

No other natural or man-made disasters are considered to have the realistic potential to occur and therefore are not considered further within this Chapter.

16.3.3. Potential for the Proposed Development to cause major accidents

No major accidents are considered likely to occur as a result of the Proposed Development.

Resilience in the event of severe weather and fire is a core component to the test and demonstration site design. A remote operational control system (controller and SCADA systems) will be used during the operational phase. This system allows both automated and remote user shutdown in order to protect assets in the event of extreme weather conditions including extreme high wind or ice loading.

In the event of fire, the turbine is located a sufficient distance from settlements such that there would be no significant risk to human health. The turbine is fitted with a comprehensive fire detection and warning system that are integrated to the control SCADA systems to generate alarms, alert the operator and control the shutdown of the turbine.

With the implementation of mitigation measures discussed above, no significant effects associated with accidents and disasters are anticipated.

16.4. Climate Change and Greenhouse Gases

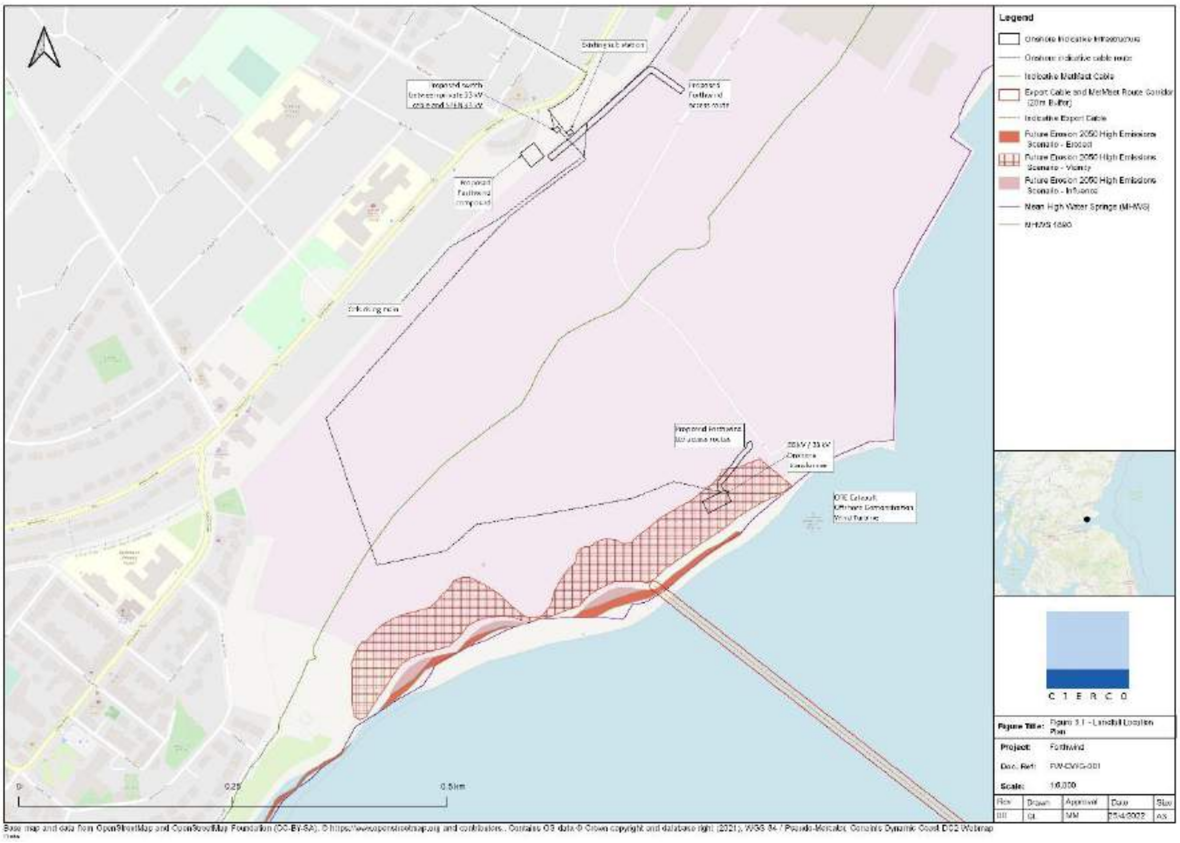
The Forthwind project design ensures that the cable landfall and duct is designed to address potential impacts from localised erosion due to climate change impacts over its 25 year operational life. Figure 16.4 considers the outputs from the Dynamic Coast project[287] (i.e., considering the impacts of coastal climate change).

As can be seen from the figure, the Fife Energy Park has been reclaimed from the sea (the green line inshore) shows the Mean High Water Spring line in 1890. This area is under a continued management arrangement with appropriate sea defences.

The onshore cabling avoids any areas of influence from sea level rise and the development site avoids the predicted erosion zone under a 2050 high emission scenario. The location of the transformer station indicates it may be in a vicinity of influence under a high emission scenario by 2050, the date by which the turbine is due to be decommissioned. However, the area will be under long term shoreline management to protect other important existing industrial assets and it is assessed that the presence of the transformer station should not be affected negatively by coastal erosion, even under a high emission scenario.

[287] https://www.dynamiccoast.com/webmaps

Figure 16.4 – Landfall Location and Proposed Onshore Infrastructure



The remainder of this section assesses the potential impacts of greenhouse gases (GHGs) emitted during the pre-construction, construction, operation and maintenance, and decommissioning of the Proposed Development as a whole (onshore and offshore infrastructure). The approach aims to deliver a robust, proportionate and appropriate assessment based on a Life Cycle Assessment (LCA) approach and considers the impacts on the supply chain and benefits beyond the life cycle of the Proposed Development.

The Proposed Development is situated off the coast of Fife 1.5 km offshore, with a total development area less than 0.5 square kilometres. It is a single offshore wind demonstration turbine to produce low carbon energy, supporting the Scottish Government to fulfil its commitments in meeting its reduction goals under the Climate Change (Scotland) Act of 2008, as amended in 2019 (Climate Change (Emission Reductions Targets) (Scotland) Act 2019). In addition, it will support the UK-wide Climate Change Act of 2008, amended in 2019. As agreed within the scoping opinion, the effects (positive and negative) on climate change need not be considered due to the scale of the development.

16.4.1. Scope of the Assessment

The scope of the study area is Scotland. The UK has committed to meeting a legally binding target to cut GHG emissions by at least 100% from the 1990 baseline by 2050, which would result in 'Net Zero' GHG emissions[288]. Scotland has recognised the importance of transitioning to a net zero emissions for the benefit of its environment, people, and prosperity – resulting in the setting of a an even more ambitious 'Net Zero' target, legislating for a world-leading net zero GHG emission target date by 2045[289].

[288] UK Government (2019) *The Climate Change Act 2008 (2050 Target Amendment) Order 2019* [Online] Available at: https://www.legislation.gov.uk/uksi/2019/1056/made?view=plain (Accessed 05/10/2021)
[289] https://www.gov.scot/policies/climate-change/ (Accessed 05/10/2021)

Meeting this target requires major investment in new technologies, the electrification of heating, industry and transport, prioritisation of sustainable energy and cleaner power generation including the development of offshore wind capacity.

The Scottish Government intends to facilitate investment in new infrastructure projects, with particular focus on electrification[290]. Within a market-based system and with significant constraints on public expenditure, both the UK and Scottish Governments recognise the important role the private sector has to play in the delivery of renewable energy schemes[291].

In line with its Climate Change Plan 2018-2032 update in December 2020[292], the Scottish Government stated that it "*will continue to support the development of technologies that can support sustainable security of supply, with renewable generation delivering technical services that currently depend on fossil fuel power statio*ns" and "*aims to take full advantage of new and developing technologies….Scotland has the opportunity to be at the forefront of global change, developing and exporting expertise and support new skilled jobs*."

The Climate Change Plan also specifies that Scotland will "*continue to do all that we can to maximise the opportunities for Scottish businesses in our green recovery and longer term transition, supporting jobs, skills and enterprise, ensuring that the correct support is in place to strengthen Scotland's renewable electricity supply chains, and supporting investment in the necessary infrastructure*."

In response to the growing international concern regarding the effects of climate change and the advice provided by the Climate Change Committee in its Progress reports, in April 2019 the Scottish Government declared a Climate Emergency[293]. The Scottish First Minister in her address to the SNP Party conference, announced:

"*Our obligations to the next generation are the most important that we carry. A few weeks ago, I met some of the young climate change campaigners who've gone on strike from school to raise awareness of their cause. They want governments around the world to declare a climate emergency. They say that's what the science tells us. And they are right. So today, as First Minister of Scotland, I am declaring that there is a climate emergency. And Scotland will live up to our responsibility to tackle it*."

If consented, the Proposed Development would contribute to the delivery of international and national policy objectives, diversify the energy mix and facilitate the transition to low carbon energy, whilst decreasing the dependency on fossil fuels.

In the past several years wind power development has increased rapidly worldwide. In general, it is an established technology that requires little installation time. In addition, it is environmentally friendly during the operation, as no direct emissions occur. Hence, wind power plays a vital role in the global electricity market to adequately meet energy demands and to reduce our dependency on conventional fuels.

16.4.2. Baseline GHG Emissions

The Proposed Development comprises of the construction of a new single offshore wind demonstration turbine prototype, as a result there is no baseline data to review. In this scenario, it is reasonable to represent the GHG emission that would occur in the absence of the Forthwind Demonstration site – in other words the baseline scenario is the "without project" scenario.

[290] For example, the Scottish Government Infrastructure Plan for Scotland 2021-22 to 2025- 26 includes specific electrification projects and has a key Them of enabling the transition to Net Zero [Online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2021/02/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26/documents/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26/govscot%3Adocument/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26.pdf

[291] For example, the Scottish Energy Strategy 2017 notes the need for collaboration between the public, community, and private sectors [Online] Available at: https://www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/ (Accessed 04/10/2021)

[292] https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/pages/7/ (accessed 07/04/2022)

[293] Speech by Nicola Sturgeon [online] available at: https://climateemergencydeclaration.org/scotland-worlds-first-government-to-declare-a-climate-emergency/ (Accessed 04/10/2021)

In 2019, Scotland's GHG Emissions were estimated to be 47.8 million tonnes carbon dioxide equivalent (MtCO2e) having fallen by 51.5 % since 1990[294]. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 specifies a 55 % reduction over the same period meaning that the 2019 target was not met.

From a GB perspective, the average carbon intensity for electricity was 232 g/kWh[295] The Scottish Pollution Release Inventory reported that 10,645 kt of CO^2 was released into the air from Scottish Industry in 2020 from a number of industrial sectors, with nearly half of those emissions coming from the Energy Sector (5,107 kt)[296]. Scotland has an ambitious climate target to cut emissions by 75% by 2030[297], one that the Committee on Climate Change (CCC) recognise as a "*huge challenge*", which "*rests ultimately on Scotland doing more and earlier than the rest of the UK on cutting emissions.*"[298].

16.4.3. Assessment Methodology

The GHG assessment utilises the approach of the Institute of Environmental Management & Assessment (IEMA) Guide: Assessing GHG Emissions and Evaluating their Significance, 2nd Edition, February 2022. The second edition provides five relative significance descriptions/criteria to assist assessments. These are:

Major adverse: the project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.

Moderate adverse: the project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.

Minor adverse: the project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.

Negligible: the project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.

Beneficial: the project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

Within this definition of significance, the IEMA approach considers major or moderate adverse effects and beneficial effects are **significant**, whereas minor adverse and negligible effects are **not significant**.

16.4.4. System boundary and data utilised

This section sets out the rational for GHG assessment and its scope. The core elements of the GHG assessment consist of consideration of things that have not yet happened – i.e. the manufacture, transport, installation and decommissioning of the turbine, tower, cabling and met-mast. The pre-construction activities, such as the geotechnical investigations and environmental surveys had mostly been undertaken for the previous Forthwind proposal, and so already form the baseline within the assessment. Figure 16.1 below identifies the different stages of the Forthwind asset lifecycle and how it is assessed.

294 https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-1990-2019/ (accessed 07/04/2022)
295 https://electricityinfo.org/region-archive/#data (accessed 07/04/2022)
296 https://informatics.sepa.org.uk/SPRI/ (accessed 07/04/2022)
297 https://www.gov.scot/policies/climate-change/reducing-emissions/ (accessed 07/04/2022)
298 https://www.bbc.co.uk/news/uk-scotland-59110798 (accessed 07/04/2022)

Figure 16.1 Asset Life Cycle

Asset Life Cycle

Project Phase	Project Component and activities	Baseline	Data Used
Pre-Construction (before use stage)	• Design • Consent baseline monitoring activities	Undertaken as part of the previous 2B Energy assessment – forms part of the baseline	n/a
Construction / Installation (before use stage)	Fabrication and installation of: • Blades • Nacelle (generator, converter and transformer) • Tower • Cabling • Met-Mast	Will not take place without the project - additional to the baseline	Turbine - scaling up of SimaProc LCA output 33kV cable value taken from Birkeland (2011) NTNU* Met Mast assumption of 10% uplift of total value
Operation (use stage)	• Energy Production	Will not take place without the project - additional to the baseline	Scaling up of SimaProc LCA output
Decommissioning (end of life stage)	• Dismantling and disposal of blades, nacelle and tower	Will not take place without the project - additional to the baseline	Scaling up of SimaProc LCA output
Beyond Asset Lifecycle	• Wider impact of development of supply chain, offshore wind industry and energy production.	Additional to the baseline as potentially will not take place without the project	Quantitative assessment

Beyond Asset Life Cycle

A carbon footprint is a measure of the estimated GHG emissions produced directly and indirectly by a product. Due to the size, scale and novelty of the proposed project, the assessment will be based on a proportionate qualitative assessment rather than quantitative. As the turbine is a prototype that has not been fabricated before, the calculation of the carbon footprint of the manufacturing, delivery, installation, Operations and Maintenance (O&M) and end of life decommissioning has been based on an assessment of an existing 220m diameter rotor turbine and then scaled up to a 255m diameter rotor based on the increased mass to deliver a worst case assessment. This can be done as turbine mass is approximately proportional to the cube of its blade-length[299]. Based on this worst case approach a percentage increase of 55% on the original values was used as a basis for scaling up the GHG emission factors (based on increase from 110^3 to 127.5^3).

- Reference turbine radius = 110m; total mass of turbine = 1,581.6 tons
- Forthwind turbine radius = 127.5m; total mass of turbine = 2,451.48 tons
- Percentage increase of mass from 1581.6 tons to 2320.9 tons = 55%

GHG Calculation Methodology

The analysis methodology for the 220m diameter rotor turbine was provided by the turbine OEM, performed with SimaPro LCA software version 9.0.0.40 and a set of impact assessment methods (CML-IA Baselines and cumulative Energy Demand for energy). The Life Cycle Assessment (LCA) was undertaken in accordance with ISO standards 14040 and 14044. For the purposes of the assessment, the worst case scenario for a GHG calculation considers all turbine components are sourced from Europe and shipped across to the Methil site.

<u>Manufacturing</u>

The manufacturing elements of the turbine included extraction and refinement of the raw materials, the manufacturing of the wind turbine components and assembly of the nacelle. The OEM engineers complied a bill

[299] Ashwill, T; Laird D (January 2007). Concepts to Facilitate Very Large Blades. 45th AIAA Aerospace Sciences Meeting and Exhibit. AIAA-2007-0817 – Accessed from https://arc.aiaa.org/doi/abs/10.2514/6.2007-817

of material inventory data for the materials and components of the wind turbine. The wind turbine materials were grouped into six major components:

- Tower: 3 tower sections, elevator and hydraulic kits
- Central frame and yaw system
- Hub and pitch system
- Rear frame, with power system: transformer, converter, switchgear
- Generator: stator, rotor, bearing, magnet, pole shoes
- Blades x 3

The data for the manufacturing of the blades and nacelle were provided by the OEM facility managers, while the data for manufacturing of other components were estimated based on industry-average data for difference material types (Econinvent 3.5 life cycle inventory database[300])

To calculate the GHG kg CO^2 eq for the cable infrastructure, a figure calculated for a 33kV cable of 229 kg CO^2 eq/MW/km is used[301]. As GHG data for the production and installation of the met mast is not available a worst case scenario of assessing its contribution as being 10% of the total for the turbine.

<u>Transport and Installation</u>

A European manufacturing site is used for the 220m diameter rotor based on a transport distance of circa 130 km to an eastern England installation site. Transport impacts were estimated based on road and ocean transport of components to the installation site. Installation impacts were estimated based on vessel activity related to installation of the wind turbine, along with consumables (and associated wastes) needed during installation.

<u>Operation</u>

Operation and maintenance of the wind turbine has been assessed for 25 years. Maintenance impacts are based on fuel consumption related to planned and unplanned maintenance activities for 25 years, along with replacement consumables (greases, oils, fluids and coolants) and associated wastes.

<u>Decommissioning</u>

Decommissioning and transport of components to end-of-life treatment either landfill disposal, incineration or recycling. Decommissioning was assumed to be the reverse of installation. Components are then transported by road to a processing facility. Table 16.4 contains components and material disposal scenarios that were assumed based on available data for wind turbines:

300 https://ecoinvent.org/?msclkid=34ff4695bb4b11ecaf1d6fb4882bcdbd

301 Birkeland. C "Assessing the Life Cycle Environmental Impacts of Offshore Wind Power Generation and Power Transmission in the North Sea" (2011), Norwegian University of Science and Technology; accessed from: https://ntnuopen.ntnu.no/ntnu-xmlui/bitstream/handle/11250/257062/440527_FULLTEXT01.pdf?sequence=1

Table 16.4 - Assumed Components and Material disposal

Materials	End of Life Scenario
Large mono-material metal parts	98% recycled, 2% landfilled
Steel	92% recycled, 8% landfilled
Aluminium	92% recycled, 8% landfilled
Copper	92% recycled, 8% landfilled
Composites	10% recycled, 90% landfilled
Polymers	50% incinerated, 50% landfilled

The study considered the impact of the material disposal processes (incineration and landfilling) as well as the environmental benefits and loads of recycling.

16.4.5. Assessment of Potential Effect – Direct Effects

The functional unit of the study is the production of one kWh of electricity. The analysis considers the entire lifecycle of the turbine including materials extraction, processing, transport, product manufacturing, installation, operation and maintenance and end-of-life disposal. The assessment assumes a capacity factor or 0.608, and availability of 0.975 and wind turbine lifetime of 25 years. The majority of GHG emission production comes from the manufacturing phase over the lifetime of the turbine.

Turbine	Factor	Unit (per kWh)	Manufacturing	Transport	Installation	Operation	Decommissioning	Turbine Total	Met-Mast	Cabling	Total
Reference Turbine	Greenhouse Gas Emission	Kg CO_2 eq	4.43E-03	2.75E-04	5.83E-04	2.17E-03	-4.23E-04	7.03E-03			
Forthwind Turbine (+ 55%)	Greenhouse Gas Emission	Kg CO_2 eq	6.87E-03	4.26E-04	9.04E-04	3.36E-03	-6.56E-04	1.09E-02	1.20E-02	9.16E-03	3.20E-02

It is estimated that the Forthwind turbine, based on the mass scaling up factor, would produce 0.032 Kg CO_2 eq per kWh over its lifetime.

Based on the following lower case assumptions for the Forthwind Turbine:

- Installed Capacity = 16MW (or 16,000 kW)
- Capacity Factor = 0.608
- Availability Factor = 0.975
- Number of hours in one year = 8760

The annual production of the Forthwind turbine would be 83,086,848 kWh/year or 83.086 GWh/year (Annual production = 16,000 x 0.608 x 0.975 x 8760).

Over a one year of operation that provides a total of:

- 2,685,779 Kg CO_2 eq per year; or alternatively
- 2,643 tonnes CO_2 eq per year

According to the IPPC Annex 3 report[302] a Combined Cycle Gas Turbine (CCGT) produces a median value of 490 tonnes CO_2 eq per GWh (497862.985 Kg CO_2 eq per GWh or 497,862,985,000 Kg CO_2 eq per kWh) – although it should be noted that this accounts only for energy production and does not include the GHG equivalent over the CCGT lifecycle.

For a CCGT unit to produce an equivalent annual power production to the Forthwind turbine (i.e. 83.086 GWh/year), it would produce 40,712.14 tonnes CO_2 eq per year. Producing power with the Forthwind

[302] https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-iii.pdf#page=7

demonstration turbine instead of a CCGT unit would equate to an elimination (or avoided emissions) of 38,069.14 tonnes of CO_2 eq every year (or an avoidance of 952,728.5 tonnes of CO_2 eq over the 25 year period). To put this into context this would be the equivalent of the removal of approximately 22,000 cars from Scotland's roads every year[303].

16.4.6. Assessment of Potential Effect – Indirect Effects

A key aspect of the Forthwind Demonstration turbine goes beyond its direct physical reduction of CO_2 emissions for energy production from a single turbine. The purpose of the offshore demonstration is to prove the full turbine design in an offshore environment and to obtain certification and validation of the turbine design and technology – creating an ability for greater clean energy production.

The turbine model will be the next generation offshore wind turbine and will potentially become the most powerful offshore wind turbine in the world developed to date. The turbine size allows a significant step change in production efficiencies providing a five to seven point improvements in capacity factor, well above industry standard. The combination of a bigger rotor, longer blades and higher capacity factor makes the turbine less sensitive to wind speed variations, increasing predictability and the ability to generate more power at low wind speeds. It will capture more Annual Energy Production (AEP) than any other offshore wind turbine even in low wind conditions. This means that future offshore wind installations can provide significantly increased energy production with significantly less lifetime CO_2 emissions.

The establishment of the demonstration turbine will have a positive effect on the local Scottish supply chain and has a significant potential to feed into the 17 offshore wind projects agreed by the Crown Estate Scotland in their recent ScotWind leasing round. The development of larger offshore wind turbines will allow these developments to provide more efficient use of the seabed, potentially increasing the available capacity over the longer term. Table 16.5 shows a summary of the level of assessed significance.

Establishing the next generation offshore wind demonstration turbine in an area affected by extreme deprivation, (identified as amongst the impoverished in Scotland (according to the Scottish Index of Multiple Deprivation (SIMD)[304]), provides an opportunity to develop local skills and a supply chain base to meet the recommendations set out by the Scottish Governments Just Transition Commission (as discussed in section 16.11). The development of the project also supports the Scottish Governments aim of achieving a green the low carbon energy transition and socioeconomic recovery from the pandemic.

Table 16.5 – Summary of level of significance

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction			
The GHG produced during construction of the turbine is relatively consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type and is fully in line with measures necessary to achieve the UK's trajectory towards net zero	Minor adverse	none	Minor adverse
Operation			
As per the IEMA guidance the project's GHG impacts are reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type – potentially reducing total CO_2 emissions by 40,000 tonnes/year or almost 1	Negligible	none	Negligible

[303] https://www.gov.uk/government/news/uks-largest-carbon-capture-project-to-prevent-equivalent-of-22000-cars-emissions-from-polluting-the-atmosphere-from-2021?msclkid=cb776eddbb6e11ecade929915eb8d9b8
[304] https://www.thecourier.co.uk/fp/news/fife/1980262/fife-facing-poverty-crisis-region-falling-behind-both-scotland-and-the-uk/?msclkid=180ec1eebb7511ecaf6c89c9b53f5ab9

Effect	Significance of Effect	Mitigation Proposed	Residual Effect
million tonnes over its lifetime. The turbine will provide a valuable contribution to ensuring decarbonisation is achieved well before 2050. The Forthwind project provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.			
Beyond Asset Lifecycle			
The establishment of the Forthwind Offshore Wind Demonstration has the potential to significantly enhance future more efficient low carbon deployment of technology providing a significant contribution to the growth of the offshore wind industry– both in Scotland and globally	Significant Beneficial	none	Significant Beneficial

16.4.7. Statement of Significance

There is a minor adverse effect predicted to arise during the construction and installation of the turbine and its component parts. This is relatively consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type

There are no negative significant GHG emissions predicted to arise during the operational phase of the Proposed Development. Positive effects are predicted to arise in relation to a significant reduction in GHG emissions should energy production replace an equivalent CCGT unit.

These effects can be significantly enhanced with the future deployment of the prototype technology and the contribution it can make to the growth of the offshore wind industry generally and specifically the consolidation of knowledge and expertise within the region which will position it to capitalise upon future commercial and development opportunities.

17. OTHER MARINE USERS

This chapter of the EIAR evaluates the effects of the proposed Forthwind demonstration project (hereafter referred to as "the Proposed Development") on other marine users. This chapter contains the following sections:

- Introduction;
- Consultation;
- Scope of Assessment;
- Methodology and Significance Criteria;
- Baseline Description;
- Development Design Mitigation;
- Assessment of Potential Effects;
- Statement of Significance.

17.1. Introduction

The potential effects arising from the Proposed Development on other marine users are described at local and regional scale in order to provide context to the environmental impact assessment (EIA).

The construction, operation and decommissioning of the Proposed Development have potential for a variety of direct and indirect effects, particularly on those other marine users within the immediate study area. The receptors that have been considered within this chapter include disposal sites, recreation and tourism (principally sailing), military activities and other renewable energy activity.

By characterising the existing environment in the baseline, the potential effects on Other Marine Users arising from the Proposed Development can be identified. Where potential effects are considered to interact with receptors, these effects are discussed.

As part of this desk-based assessment, a range of data sources from existing literature have been consulted including, but not limited to, the following:

- Crown Estate Scotland;
- Marine Scotland;
- Department for Energy and Climate Change (DECC);
- RYA Atlas of Recreational Boating;
- Strategic Environmental Assessment 5 (SEA 5, (DTI, 2004);
- Fife and East Lothian Councils;
- SEPA
- Kingfisher Information Service – Cable Awareness (KIS-CA);
- Seasearch;
- Relevant publicly available data and information from website literature;
- Relevant publicly available data from Neart na Gaoithe offshore wind farm;
- UKdeal;
- MOD Aircraft trials describing and illustrating the effects of wind turbines on air defence (AD), air traffic control (ATC) radars, and precision approach radar (PAR) (MOD, 2005a; MOD, 2005b; ADATS, 2009;
- Trials reports describing and illustrating the impacts of offshore wind turbines on marine radar and telecommunications systems (QinetiQ and MCA, 2004; MCA, 2005; Marico Marine, 2007);
- Environmental Statement and related document with regard to the existing turbine in Methil Docks (Fife Energy Park); and
- UK Admiralty Charts.

17.2. Consultation

Table 17.1 details the consultation that has been undertaken in respect of the other marine users assessment, detailing how consultation responses have informed the assessment and have been considered within this chapter.

Table 17.1- Consultation regarding Other Marine Users

Consultee	Consultation Method	Consultee Comments	Project Response
Consultation regarding the current Environmental Statement			
Marine Scotland			
Defence Infrastructure Organisation	Scoping Opinion	Impact on military activity has been recognised in Section 15.1 Military Activities of the Scoping Report, with the offshore array being located within Firth of Forth an area used by the Navy. The proposed area does not overlap with any Practice Exercise Areas (PEXA). We therefore do not anticipate there will be any concerns relating to military maritime activities.	The potential impact of the Proposed Development on the MOD infrastructure has been scoped out of this assessment.
		The use of airspace for defence purposes in the vicinity of the proposed development have been appropriately identified and considered. The Scoping Report considers some of the aviation and radar systems that may be affected by the proposed wind farm. The MOD is correctly identified as a relevant receptor in Section 15.1 Military Activities of the Scoping Report. I can confirm that the MOD has no concerns in respect of airfields or radar for this development.	The potential impact of the proposed development on the MOD infrastructure has been scoped out of this assessment.
		Impact on military low flying has been scoped in and the applicant states in the Scoping Report that they are committed to lighting and charting the turbine and Mast. In the interests of air safety, the MOD would request that the development be fitted with MOD accredited aviation safety lighting in accordance with the Civil Aviation Authority, Air Navigation Order 2016.	Further consideration of the impact of military low flying has been included in Section 17.5.1 Military and Civil Aviation Activities of this Chapter. The development will be fitted with MOD accredited aviation safety lighting as detailed in Chapter 5 – Seascape, Landscape and Visual.
		In summary, I can confirm that the MOD has no concerns with this proposal.	The potential impact of the proposed development on the MOD infrastructure has been scoped out of this assessment.

Telecommunications			
British Telecoms	Scoping Opinion	The conclusion is that, Turbine 1 located at 337812E; 697333N is detailed in the 'Scoping Request' document should not cause interference to BT's current and presently planned radio network.	Further assessment regarding the impact on BT's current and planned radio network has been **scoped out.**
NATS			
NATS	Scoping Opinion	The proposed development has been examined from a technical safeguarding aspect and does not conflict with our safeguarding criteria. Accordingly, NATS (En Route) Public Limited Company ("NERL") has no safeguarding objection to the proposal.	No further assessment has been undertaken regarding the potential impact of the Proposed Development on the NATS safeguarding criteria.
NLB	Scoping Opinion	Northern Lighthouse Board are satisfied with the content of the Scoping Report, and note the proposal by the applicant to engage in consultation with NLB with regard to navigational lighting and marking of the WTG and Met Mast	No further assessment has been undertaken. A Lighting and Marking Plan has been drafted and included in Volume 4: Compliance Plans – Lighting and Marking Plan. Consultation with NLB will be undertaken regarding the WTG and MetMast.
Royal Yachting Association Scotland (RYA)			
RYA	Scoping Opinion	I agree that recreation and tourism can be scoped out as the navigational safety aspects are included within shipping and navigation.	Further assessment regarding tourism and recreation has been **scoped out.**
Consultation regarding 2017 Scoping Opinion			
Telecommunications			
British Telecoms	Scoping Opinion	BT have studied this proposal with respect to EMC and related problems to BT point-to-point microwave radio links. The conclusion is that the project should not cause interference to BT's current and presently planned radio networks.	Further assessment regarding the impact on BT's current and planned radio network has been **scoped out.**

17.3. Scope of Assessment

This chapter presents an assessment of the predicted effects of the Proposed Development on other marine users (please see section 17.5).

Commercial fishing has been considered within Chapter 8: Commercial Fisheries of this EIAR and shipping and navigation within Chapter 13: Shipping and Navigation of this EIAR.

- For military activities, due to the nature of activities which can take place within military exercise areas such as large aviation and submarine areas, the consideration of these areas extends to the limits of an exercise area.

17.4. Methodology and Significance

Whilst these is no specific legislation, policy and guidance relating to the assessment of other users, this section outlines those that are most relevant to the assessment:

- OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR, 2003);
- EIA Directive (2014/52/EU);
- Marine (Scotland) Act, 2010;
- British Wind Energy Association (BWEA). 'Wind Energy and Aviation Interests – Interim Guidelines' which outline some legislative processes and provide indicative safeguarding criteria (BWEA et al., 2002);
- Civil Aviation Authority (CAA), cap 168, Licensing of Aerodromes' (CAA, 2010a), which defines runway obstacle limitation surfaces (OLS) in Chapter 4, 'The Assessment and Treatment of Obstacles';
- CAA, CAP 764, 'CAA Policy and Guidelines on Wind Turbines', which state a number of safeguarding criteria (CAA, 2009);
- Meteorological Office online self assessment map showing safeguarding zones around United Kingdom;
- (UK) Meteorological radars (MOD, 2011a);
- Ministry of Defence (MOD) low flying self assessment map, showing areas of low, medium and high priority for MOD low flying activities (MOD, 2011b); and
- National Air Traffic Service (NATS) self assessment website, an online resource with access to maps generated by NATS for the purpose of safeguarding their assets (NATS, 2022).

17.4.1. Baseline Characterisation

A detailed review of existing literature was used to give an overview of the general use of the core study area and the wider Firth of Forth region. The major data sources reviewed are summaries Table 17.2. Further data sources used in the preparation of this chapter are credited within the text and full references are provided in the reference list at the end of the chapter.

Table 17.2 - Other Marine Users Datasources

Source	Area of Research
Crown Estate Scotland	Crown Estate Scotland website and publication were reviewed and assessed in order to gather and reinforce information regarding baseline other users activities in general.
Marine Scotland	Marine Scotland website and publications were reviewed and assessed in order to gather and reinforce information regarding baseline other users activities in general.
Relevant publicly available data and information from website literature.	A general data and literature search was undertaken to ensure the latest, local and specialist information has been gathered to support the baseline for other users.
Relevant publicly available data from the Neart na Gaoithe offshore wind farm	These documents were assessed against other literature to gain an accurate baseline for other users.

17.4.2. Assessment Methods

The outline methodology for the EIA is outlined in Chapter 2: EIA Methodology of this EIAR.

The significance of the potential effects of the Proposed Development has been assessed by taking into account the sensitivity of the receptor and the magnitude of the effect.

The following tables (Table 17.3 to Table 17.5) have been used in the assessment to classify the sensitivity of the receptors and the magnitude and significance of a potential effect on them.

Table 17.3 Categories of sensitivity of receptor and associated criteria

Sensitivity of receptor	Definition
High	Permanent fixed infrastructure / high use activity
Medium	Medium use activity, able to adapt to change.
Low	Minimal / Infrequent activity, adaptable to change location.

Table 17.4- Categories of magnitude of effect and associated criteria

Magnitude of effect	Definition
Large	Complete loss / damage / disturbance / exclusion of / to existing infrastructure / activities
Medium	Partial loss / damage / disturbance / exclusion of/ to existing infrastructure / activities.
Small	Minimal loss / damage / disturbance / exclusion of / to existing infrastructure / activities.
Negligible	No loss / damage/ disturbance / exclusion of / to existing infrastructure / activities

Table 17.5- Categories of significance of effect

Sensitivity of receptor	Magnitude of effect			
	Large	Medium	Small	Negligible
High	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

17.5. Baseline Description

The existing baseline environment has been established through a desk-based literature review. A description is given below of the type and level of activity in the Firth of Forth and around the Proposed Development Site.

This section describes those other marine users (and uses) with the potential to be affected by the Proposed Development not covered in other chapters in this EIAR including:

- Military activities;
- Other Marine Renewable Energy Activities.

17.5.1. Military and Civilian Aviation Activities

This section discusses the military and civilian aviation activity within the vicinity of the Proposed Development. This topic was discussed in the Environmental Statement (Arcus, 2012) for the previous development (Levenmouth Demonstration turbine (LDT) located approximately 1.4 km south-east to the current Proposed Development location.

17.5.1.1. Military Activities

Areas in and around the Firth of Forth are predominantly used by the Navy for submarine exercises, mine countermeasures and minesweeping, and explosive trials (DTI, 2004). The Proposed Development does not overlap with any Practice and Exercise Areas (PEXA). It is not anticipated that there will be any impacts on military maritime activities. Consultation with the MOD and the DIO stated that there were no issues expected to arise from the Proposed Development on their facilities.

The Royal Air Force (RAF) base Leuchars is the nearest military airfield to the already consented development, located approximately 23.4 km north east of the site (Arcus, 2012). However on the 1st April 2015 it transitioned to Army control. The consented development does not lie within a safeguarding zone which, are zones that safeguard the airspace surrounding airfields (Arcus, 2012).

In the interests of air safety, the Proposed Development be fitted with MOD accredited aviation safety lighting in accordance with the Civil Aviation Authority, Air Navigation Order 2016.

17.5.1.2. Civilian Aviation Activities

Arcus (2012), states that the closest civilian airport with radar is approximately 33 km to the southwest of the FEPOWDT. Concerns regarding aviation can include whether the turbine can affect the primary surveillance radar, which is used by numerous civil and military aerodromes and by NERL (Navigational Air Traffic Services En Route Plc) (Arcus 2012). BAA confirmed that they had no aerodrome safeguarding objections in relation to the consented development. CAA highlighted that although they had no objections or observations to the consented development, aviation lights would be required and that they are visible at night from all directions and that it would also be necessary to chart the Proposed Development on Civil Aviation Maps, as it is a requirement. for all structures taller than 300 feet (91 m) to be chartered. During the scoping period, for the consented development NATS highlighted that they do not expect the Development to have any adverse effects on their operations, therefore they have no obligations (Arcus, 2012). The consented development does not lie within the line of sight of any radar facilities and no further issues are anticipated. Consultation with NATS regarding the current application confirmed that there are no concerns in respect of airfields or radar for the Proposed Development.

An assessment of the potential impact of the Proposed Development on published flight procedures has been carried out by Edinburgh Airport. No impact on the published flight procedures was identified.

The military and aviation sections have been based on that within the EIAR for the consented development is from 2012 and as that EIAR had no objections, and no objection have been raised from consultation for this EIAR, military and aviation activity has been scoped out of further assessment from this current EIAR.

As no effects have been predicted on aviation or defence receptors, no mitigation is considered necessary.

17.6. Development Design Mitigation

As no anticipated impacts on military maritime activities are expected to arise, and no concerns in respect of airfields or radar have been identified as a result of the Proposed Development, no development design mitigation has been proposed.

17.7. Assessment of Potential Effects

No potential effects resulting from the Proposed Development on military and civilian aviation activities have been identified in within this assessment.

17.7.1. Assessment of Cumulative Effects

Should the operation of the LDT as identified in section 17.5.1 overlap with the Proposed Development, there is potential for cumulative effects to arise as a result of vessel displacement, loss of area or resource (including indirectly) due to the placement of the seabed foundation and the export cable.

Cumulative effects may occur where the Proposed Development overlaps with the vessel displacement that may already be occurring due to the LDT, however this potential overlap is unlikely due to the turbine location on the shoreline and access can be gained from onshore. Similarly the loss of seabed area will be minimal in comparison to the wider area.

Therefore, this potential cumulative effect has been scoped out of this assessment.

17.8. Statement of Significance

The study area of the Proposed Development is located on the Methil coastline, in water depths up to 14 m, on a seabed of gravelly sands and rock outcrops. No potential effects have been identified during the construction, operational and decommissioning phases. No effects were predicted on other marine user receptors and therefore no further assessment was undertaken.

18. SCHEDULE OF MITIGATION

18.1. Introduction

Forthwind Ltd is committed to being a good neighbour and creating and maintaining a harmonious relationship with other sea users. Engaging and consulting with stakeholders during the assessment process has allowed the development of mitigation measures which will be applied at key points in the construction, operation or maintenance phases in order to minimise potential impacts.

For each scoped in receptor, a full environmental impact assessment (EIA) has been undertaken and is presented in individual chapters in this Environmental Impact Assessment Report (EIAR)). For further information on each of the impact assessments and additional detail on the suggested mitigation measures please refer to the relevant chapter.

Mitigation has been suggested for those impacts considered to be of moderate or major significance. A summary of the mitigation is detailed in this chapter, for additional information on the impact assessment criteria and conclusions refer to the appropriate chapter within this EIAR.

Additionally certain potential impacts have been minimised through adopted of embedded mitigation measures for a number of topics. These include use of scour protection to minimise potential impacts on physical process. Further information on embedded mitigation is provided below and in individual chapters within this EIAR. Where appropriate, monitoring recommendations are also described below.

18.2. General Mitigation Measures

Should the Proposed Development be granted consent, a Marine Licence will be issued by Marine Scotland. This Marine Licence is likely to contain a number of conditions to which the developer of the offshore wind farm must adhere. Conditions are likely to include preparation of a number of plans that must be agreed with Marine Scotland. Statutory Bodies and stakeholders prior to construction commencing (refer to Table 18.1**Table**).

Table 18.1 - Pre-commencement Plans

Plan	Indicative content
The Project Environmental Management Plan (EMP) and the Construction Environmental Management Plan (CEMP) will include: • Waste management; • Procedure to manage European Protected Species interactions; • Environmental Risk Assessment; and • Corrective actions and auditing procedures.	Forthwind will adhere to measures identified in the PEMP and CEMP during construction and operation, contained within Volume 4: Compliance Plans. The PEMP and CEMP will be agreed with Marine Scotland, Statutory Bodies and Stakeholders in advance of any works commencing. The CEMP will provide a description of works and construction processes, description of vessel routes and safety procedures, plant service procedures, communication and reporting structures and timeline of work. It will detail the final design selected and take into account Marine Licence Conditions and commitments within the PEMP.
Pollution Control Plan (PCP)	The PCP will contain pollution risk assessment and mitigation measures and will outline procedures required to be implemented prior to construction and which are to be followed in the event of a pollution incident, including a response plan and communications procedure.
Navigational Safety Plan (NSP)	The NSP will address safety management procedures on operation and maintenance (O&M) vessels.
Project Environmental Monitoring Programme (PEMP)	Through the environmental impact assessment (EIA) process, conclusions have been drawn on the potential environmental impact of developing the Forthwind offshore wind farm. Where required, a monitoring programme will be put in place to provide further evidence to support these conclusions and provide information for future offshore wind farm developments. Pre, during and post construction and operation

Plan	Indicative content
	surveys on aspects such as, shipping, will be considered as part of the monitoring plan.

18.3. Seascape, Landscape and Visual

18.3.1. Embedded Mitigation

The Proposed Development will see a reduction in the number of turbines at the site when compared to the original consent; from two turbines to one.

18.3.2. Potential Impacts Assessed

The potential SVLIA identified included:

- Construction Phase - Short-term and reversible effects of vessels, cranes, cable trenching, construction plant and materials
- Operational Phase – Long-term and reversible effects on aesthetic and perceptual aspects of landscape resources, and visual resources;
- Decommissioning Phase – Short-term and reversible effects of vessels, cranes, construction plant and materials at the sub-station and control building.

18.3.3. Additional Mitigation Measures

Mitigation for wind farms is generally limited to the reduction of potential direct effects through detailed siting, and the reduction in adverse aesthetic effects through wind farm design, however this is applicable only for onshore developments. A range of standard mitigation measures have already been applied to the Proposed Development as part of the over-arching site selection and iterative design process. No additional mitigation measures are proposed.

18.3.4. Statement of Significance

The seascape, landscape and visual assessment concluded whilst the Proposed Development will result in significant effects on landscape and visual resources within a limited area, such effects are not unacceptable due to the heavily modified context of the receiving environment and the reversibility of the effects.

18.4. Ornithology

18.4.1. Embedded mitigation

The Proposed Development will comprise of a turbine with a tubular tower structure rather than a lattice tower structure.

The use of soft-start during construction will be undertaken as a routine mitigation measure. By doing so, this might reduce the impacts on prey species upon which seabirds rely.

By minimising vessel numbers on site, or ensuring vessels using the site are travelling at reasonable speeds, displacement of birds due to vessel movements will be minimised. This will be agreed with NatureScot and Marine Scotland and included as part of the CEMP.

18.4.2. Potential impacts assessed

Possible impacts to ornithological receptors as a result of the Proposed Development include collision with turbines, displacement of birds from the site, displacement of prey from the site as well as barrier effects.

18.4.3. Additional mitigation measures

No additional mitigation measures are proposed.

18.4.4. Statement of residual significance

The effects of the construction, operation and decommissioning of the Proposed Development were found to be not significant, and the Proposed Development will not significantly increase the levels of cumulative impact on any of the SPA bird populations assessed.

18.5. Marine Mammals

18.5.1. Embedded Mitigation

The design of the Proposed Development includes drilled pin-pile/monopile foundations ensuring that no impact piling is undertaken during the construction phase. Construction of the Proposed Development will utilise embedded mitigation techniques including soft start, vessel management plans (as part of the CEMP), burial of subsea cables to reduce the EMF effects.

18.5.2. Potential impacts assessed

There is potential for noise arising from the construction, operation and decommissioning of the Proposed Development to cause either behavioural responses to, or displacement of marine mammals in the area of affect. There are also possible physical impacts to marine mammals from either collisions with vessels or impacts with vessel’s thrusters.

18.5.3. Additional mitigation measures

The design of the Proposed Development has seen a reduction in the locations of piling required due to the reduction in wind turbine numbers from two to one. The foundations will be drilled only, with no impact piling being undertaken.

Any disturbance of individual marine mammals arising from construction and decommissioning noise can be further mitigated through implementation of an environmental management plan and decommissioning plan, respectively.

18.5.4. Statement of residual significance

The Proposed Development has no impact on the population viability of any SAC marine mammal interests, and no impact on the favourable conservation status of any EPS cetaceans.

18.6. Commercial Fisheries

18.6.1. Embedded Mitigation

Mitigation Measures which increase navigational safety, reducing the impact on commercial fishing vessels are included within Section 18.11. Mitigation measures are incorporated into the design of the Proposed Development and are intended to prevent, reduce and where possible offset any significant adverse impacts on commercial fisheries, including:

- Where possible all array cables will be buried to sufficient depth to protect from fishing activity.
- Cables will be buried or be protected by other means.

18.6.2. Potential Impacts assessed

The potential impacts on commercial fisheries identified during the assessment include:

- During the construction phase, fishing vessels and gear displacement may occur and disruption to nearby fishing activities.
- Complete loss or restricted access to traditional fishing grounds.
- Safety issues for fishing vessels (considered within Section 18.11.
- During the decommissioning phase, the effects are likely to be the same as those from construction although the duration is likely to be shorter.

18.6.3. Additional Mitigation Measures

Dialogue will be ongoing throughout all stages of the Proposed Development following best industry practice.

A Construction Environmental Management Plan (CEMP) will be developed and will address the following aspects:

- Dissemination of project information
- Application of safety zones and implications for fisheries

- Incorporation of fishing activities into risk assessments and identification of Emergency Response Procedures (ERP)
- Procedures in the event of interactions between wind farm construction and fishing activities
- Burial and protection of electricity export cabling
- Removal of seabed obstacles during and post construction
- Post-construction surveys and seabed rectification procedures.

All infrastructure installed during the construction phase will be marked on charts with the above sea-level infrastructure lit. Relevant information will be distributed to fishermen through the agreed channels to be defined in the CEM in line with good industry practice.

Safety zones may be implemented at the discretion of Forth Ports during construction and maintenance activities.

Over-trawl surveys will be carried out on the export cables.

An FIR and FLO will be appointed post consent.

18.6.4. Statement of Significance

The Proposed Development area is of importance to local fishing vessels, especially those targeting lobster, crabs, Nephrops and to a lesser extent scallops; confirmed by landings, tracking data and consultation. Effects could occur during construction and decommissioning when fishing vessels may be excluded completely from the area, however, the duration will be relatively short and mitigation through application of safety zones and proper provision of information should keep disruption to as low as possible reducing the significance to minor.

During the operational phase of the Proposed Development, much of the potting activity will be able to resume operation in close proximity to the Proposed Development, however, if cables cannot be buried a minor impact will occur for fishing methods which are susceptible to snagging.

18.7. Cultural Heritage

18.7.1. Embedded Mitigation

No mitigation is proposed or considered necessary in respect of any direct impacts.

No mitigation is proposed or considered necessary or practicable in respect of the “minor” effects upon the settings of any cultural heritage assets. The Proposed Development lifespan is of limited duration and is considered temporary and fully reversible.

18.7.2. Potential Impacts Assessed

The seabed impacts as a result of the Proposed Development do not materially change as a result of the Project Design Envelope. There are potential indirect, visual effects upon the setting of some cultural heritage features within 7.5 km of the Proposed Development.

No direct effects are anticipated from the decommissioning of the Proposed Development. Any residual “minor” indirect effects on settings of some heritage assets will be removed. No significant indirect effects are anticipated from the short-term presence of plant required during the decommissioning phase.

18.7.3. Additional Mitigation Measures

No mitigation measures is proposed or considered necessary in respect of any direct impacts.

No mitigation is proposed or considered necessary or practicable in respect of the “minor” effects upon the settings of any cultural heritage assets. The Proposed Development lifespan is of limited duration and is considered temporary and fully reversible.

Forthwind will produce, consult on and implement a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) prior to construction activities being undertaken and that HES will be consulted on both the WSI and PAD. Draft copies of the WSI and PAD are included within Volume 4: Compliance Plans of this EIAR. These will mitigate the potential impact on any known or unknown archaeological remains discovered during construction.

This protocol will also include appropriate archaeological briefings for all personnel involved in the construction, operation and decommissioning activities associated with the Proposed Development. The PAD will be in place for the life of the Proposed Development and will be updated when required should details within the document change, for example contact details for key stakeholders.

18.7.4. Statement of Significance

No significant effects are anticipated to occur as a result of impact to the settings of any cultural heritage assets arising from the construction, operation or decommissioning of the Proposed Development. Although a number of non-significant (i.e. effects of “minor” or lower significance) have been identified, these are considered temporary (albeit long term) and fully reversible upon the decommissioning of the Proposed Development.

18.8. Fish and Shellfish Ecology

18.8.1. Embedded Mitigation

The key embedded mitigation measures for fish and shellfish include:

- Use of drilled pile foundations for the turbine and metmast (no impact piling)
- Agreement and implementation of a CEMP.

18.8.2. Potential Impacts Assessed

The impacts identified during this assessment included underwater noise and EMF,

18.8.3. Additional Mitigation Measures

No additional mitigation measures are proposed.

18.8.4. Statement of Significance

The Proposed Development has no significant impacts on any fish or shellfish species and no likely significant effect on Atlantic salmon or sea lamprey as qualifying interests of any freshwater SACs. Monitoring

18.9. Airborne Noise

18.9.1. Embedded Mitigation

The design of the Proposed Development has ensure that the distance between the turbine and neighbouring properties was maximised where possible in order to minimise the effects of noise.

18.9.2. Potential Impacts assessed

The impacts identified during this assessment include the potential effect of noise during operation of the Proposed Development including cumulative effects.

18.9.3. Additional Mitigation Measures

The selection of the final turbine to be installed for the Proposed Development would be made on the basis of enabling the relevant ETSU-R-97 noise limits to be achieved

18.9.4. Statement of Significance

The assessment of the operational noise associated with the Proposed Development has been shown to comply with criteria derived in accordance with ETSU-R-97 which is recommended in Scottish Planning Policy. Therefore, operational noise effects are considered acceptable and not significant in the context of the EIA Regulations.

When considering the potential cumulative effect of the LDT scheme, based on the available information, it was concluded that these effects would either be negligible or such that cumulative operational noise would remain below the derived noise limits in most cases. Although some limited exceptions were identified for properties closest to the LDT, the operators of both schemes can operate their turbines such that suitable noise levels can be achieved in practice, and this can be secured by conditions similar to those applicable to the extant consents. Therefore, cumulative operational noise levels would remain acceptable and not significant

18.10. Shadow Flicker

18.10.1. Embedded Mitigation

It is not possible to include any embedded mitigation measures to reduce shadow flicker effects within the Proposed Development

18.10.2. Potential Impacts Assessed

No impacts will occur during construction as for shadow flicker to occur, the turbine must be operational. The operational impact includes shadow flicker occurring. Decommissioning impacts will not occur as shadow flicker requires the turbine to be operational.

18.10.3. Additional Mitigation Measures

No mitigation measures are suggested.

In the event that complaints are made regarding shadow flicker effects and that these complaints are proven to constitute a Statutory Nuisance, then measures can be taken which would allow for shadow flicker to be reduced. A control system could be employed for those circumstances where shadow flicker could be attributed specifically to the Proposed Development.

18.10.4. Statement of Significance

During the operational phase, it has been calculated that 28 of the 32 assessed properties are expected to experience shadow flicker effects from the Proposed Development; no likely effects are predicted to exceed the threshold of 30 hours per annum in line with recommended guidance. Therefore, the effects are **not significant** in terms of the EIA Regulations. No shadow flicker effects will occur during construction or decommissioning.

Cumulative shadow flicker effects are expected to surpass the 30 hour per annum threshold at 11 receptors. However, cumulative shadow flicker exceedances have been proven to be attributed to the Levenmouth Demonstration Turbine. No likely cumulative effects are predicted to exceed the shadow flicker thresholds from the Proposed Development. As such, cumulative shadow flicker effects from the Proposed Development are **not significant** in terms of the EIA Regulations.

With the implementation of micro-siting, shadow flicker due to the Proposed Development is considered to remain **not significant** at the identified properties.

18.11. Shipping and Navigation

18.11.1. Embedded Mitigation

The following development design mitigation has been adopted to reduce the potential for effects on shipping and navigation receptors:

- Cable burial risk assessment – cable protection will be suitably implemented and monitored where adequate burial depth as identified via risk assessment is not feasible, with any damage, destruction or decay of cables notified to MCA, NLB, Kingfisher and UKHO no later than 24 hours after discovered.
- Charting of infrastructure – infrastructure associated with the Proposed Development (both surface and subsea) will be appropriately marked on UKHO Admiralty Charts.
- Compliance with MGN 654 – compliance with the requirements of MGN 654 and its annexes, including SAR Annex 5 (MCA, 2021), will ensured, where applicable.
- Development within a VTS area – will allow Forth Ports as the competent harbour authority to control the movement of vessels including project vessels.
- Guard vessel – use of a guard vessel as required by risk assessment.
- Lighting and marking – lighting and marking of the Proposed Development will be in agreement with NLB and in accordance with IALA Recommendation O-139 (IALA, 2013).
- Marine licence conditions – the marine licence may specify additional documentation post consent to further manage vessel traffic.
- Minimum blade tip clearance – the minimum blade tip clearance of the WTG will be at least 25 m above Highest Astronomical Tide (HAT).

- Promulgation of information – information relating to the Proposed Development including project vessel routes, timings and locations will be promulgated via Kingfisher Bulletins

18.11.2. Potential Impacts Assessed

The following impacts have been identified during the assessment:

- Construction phase - vessel displacement, collision risk, restrictions on port access for third-party vessels, disruption to pilotage services.
- Operational phase – vessel displacement, collision risk, restrictions on port access for third-party vessels, allision risk for third-party vessels, increased grounding risk for third-party vessels, disruption to emergency response and SAR operations, disruption to pilotage services, prevention of use of existing aids to navigation.
- Decommissioning phase – vessel displacement, collision risk and restrictions on port access for third-party vessels, disruption to pilotage services.

18.11.3. Additional Mitigation Measures

The following mitigation measure is suggested to further reduce the potential for effects on shipping and navigation receptors:

- Ongoing consultation with Forth Prots

18.11.4. Statement of Significance

The effects of the Proposed Development on shipping and navigation have been considered for all phases of the Proposed Development, with numerous effects identified involving a number of receptors. The significance of effect has been determined as either **Extremely Remote** or **Remote** in terms of frequency of occurrence and **Minor** in terms of severity of consequence, with the significance of effect either **Broadly Acceptable** or **Tolerable with Monitoring**, which are both not significant in EIA terms. A mitigation measure involving ongoing consultation with Forth Ports, as the competent harbour authority for the area where the Proposed Development will be installed, is suggested and will result in the residual effect of all effects being **Broadly Acceptable**. Since no future developments are considered to have the potential to result in cumulative effects on shipping and navigation, no cumulative effects have been considered.

18.12. Socio-economics

18.12.1.1. Potential Impacts Assessed

The following effects were identified within the assessment; community effects, employment and local economic effects; effects on commercial fisheries; effects on local tourism economy and the wider economic effects.

18.12.2. Additional Mitigation Measures

No mitigation measures are proposed.

18.12.3. Statement of Significance

There are no significant negative socio-economic effects predicted to arise during the construction, operation or decommissioning phase of the Proposed Development. Positive effects are predicted to arise in relation to employment, skills and training, and the development of the regional and Scottish supply chain to support the continuing development of the renewables and offshore wind industry.

18.13. Benthic Ecology

18.13.1. Embedded Mitigation

Embedded mitigation measures that are directly relevant to benthic ecology include the following.

- Spoil from the ground preparation works will either be re-used as in-fill material/ballast or removed and disposed off-site.

- Space frame foundation piles will be drilled into the seabed and not pile driven using a pneumatic hammer. This will significantly reduce the level of underwater noise and vibration generated during the construction phase.
- The Proposed Development will operate a pollution / spill prevention plan.
- All subsea electricity cables will be buried, subject to ground conditions, or covered with cable protection material. As such, any heating or electromagnetic field (EMF) effects, which might have directly influenced sensitive habitats or species, will be limited.

18.13.2. Potential Impacts Assessed

Potential impacts identified during the assessment include direct habitat disturbance, increase in sediment deposition and smothering, releases of sediment contaminants, noise and vibration and intertidal temporary direct seabed habitat disturbance, intertidal temporary increased suspended solid concentrations, sediment deposition and release of contaminants, and accidental spillage of chemicals.

18.13.3. Additional Mitigation Measures

No additional mitigation measures are proposed.

18.13.4. Statement of Significance

Potential effects were identified for the construction, operational and decommissioning phases. These included: habitat disturbance, increased suspended sediment, sediment deposition and smothering, underwater noise and vibration, release of environmentally harmful substances, introduction of new habitats, EMF and heat effects and a change to the local hydrodynamic regime. Each of these effects was assessed in terms of their likely effects on benthic ecological receptors.

18.14. Military And Aviation

18.14.1. Embedded Mitigation

As no anticipated impacts on military maritime activities are expected to arise, and no concerns in respect of airfields or radar have been identified as a result of the Proposed Development, no development design mitigation has been proposed.

18.14.2. Potential Impacts Assessed

The following impacts were identified during this assessment:

- Military Maritime Activities;
- Civilian Aviation Activities

18.14.3. Additional Mitigation Measures

No mitigation measures have been proposed

18.14.4. Statement of Significance

No potential effects have been identified during the construction, operational and decommissioning phases. No effects were predicted on other marine user receptors and therefore no further assessment was undertaken

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Table 18.2– Summary of Mitigation

Receptor	Mitigation	Monitoring
Seascape, Landscape and Visual impacts	Detailed siting, and reduction in the turbine numbers from two to one.	None
Ornithology	Reduction in the number of turbines. Tubular tower structure rather than a lattice structure. Use of soft-start during construction. Minimisation of vessel numbers on site, or ensuring vessels travel at reasonable speeds.	Pre/Post construction surveys.
Marine Mammals	Installation using drilled methods. Soft-start techniques, vessel management plans (as part of CEMP), burial of subsea cables, environmental management plan.	Pre/Post construction surveys.
Commercial Fisheries	Burial of cables or protected by other means. CEMP Infrastructure marked on charts Safety zones FIR and FLO appointed post consent	None proposed. Will follow best practice and Fisheries Working Group / MS advice / requirements.
Cultural heritage	Written Scheme of Investigation (WSI) Protocol for Archaeological Discoveries	None.
Fish & Shellfish Ecology	Installation using drilled pile techniques CEMP	None.
Airborne Noise	Selection of final turbine will be made o ensure relevant ETSU-R-97 noise limits are achieved.	None.
Shadow Flicker	None.	None.
Shipping and Navigation	Cable burial risk Charting of infrastructure Compliance with MGN. Development within a VTS area Guard vessel Lighting and marking Marine licence conditions Minimum blade tip clearance Promulgation of information	A Marine Control Centre Monitoring AIS CCTV monitoring of vessel activity Periodic AIS and radar monitoring by operation and maintenance vessels
Socioeconomics	None.	None.
Benthic Ecology	Re-use of ground preparation works if possible Foundation piles drilled not piled Pollution / Spill prevention plan Burial of subsea cables	Pre-construction benthic survey to inform the micrositing of the turbine, metmast and cable.
Military and aviation	None.	None.