PROJECT BANDIBULI/FIREFLY

Environmental and Social Impact Assessment Scoping Report

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GLOSSARY

Term	Meaning
Anthropogenic	Pollution or environmental change originating from human activity.
Area	The Project area in which the wind turbines, foundations, inter-array cables, export cables and offshore substations will be located.
Bathymetry	The measurement of water depth in oceans, seas, and lakes.
Benthic Ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.
Cetaceans	A marine mammal of the order Cetacea; a whale, dolphin, or porpoise.
Cretaceous Age	Geological period that lasted from about 145 to 66 million years ago.
Crustaceans	Represent a large, diverse arthropod taxon which includes crabs, lobsters, crayfish, shrimp, prawns, krill, woodlice and barnacles.
Cumulative Impacts	'The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects' (EPA, 2017).
Designated Landscape	Areas of landscape identified as being of importance at international, national or local levels, either defined by statute of identified in local development plans.
Ensonification Field	The area of the seafloor that is acoustically imaged during a sonar survey.
Environmental and Social Impact Assessment (ESIA)	A statutory process to identify, predict and assess the type and scale of potential biodiversity impacts, and opportunities to benefit conservation, associated with any business activities or projects as according to the IFC.
Fauna	Animals of a particular region, habitat, or geological period.
Flora	Pertaining to plant, bacterial and fungal life.
Gross Value Added (GVA)	An economic productivity metric that measures the contribution of a corporate subsidiary or company to an economy, producer or sector.
Hydrogeology	The branch of geology concerned with water occurring underground.
Hydrology	The branch of science concerned with the properties of earth's water and its relation to land.
Incidental Catch	Refers to the retained catch of non-targeted species.
Indigenous	Originating or occurring naturally in a particular place.
Indirect Impacts	'Impacts on the environment, which are not a direct result of the project, often produced away from (the site) or as a result of a complex pathway' (EPA, 2017).
Intertidal	Referring to the area of seashore which is covered during high tide and uncovered during low tide.
Land Use	The use and management of the natural, semi-natural and built environment.
Landfall	The area in which the offshore export cables make landfall and is the transitional area between the offshore cabling and the onshore cabling.
Landscape Character Area	Distinct types of landscape which are generic in character in that they may occur in different parts of the country, but wherever they are they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern.
Macrobenthic	Relatively large organisms living on or in the substrate of bodies of water.
Macrozoobenthic	Benthic organisms that are large enough to be seen with the naked eye.
Magnitude	Size, extent and duration of an impact.
Meiobenthic	Referring to small marine invertebrates that can pass through a 1 mm mesh but will be retained by a 45 µm mesh.
Mitigation Measure	Measure which would avoid, reduce, or remediate an impact.
Neolithic	Referring to the final division of the Stone Age.
Palaeolithic	Referring to a period in human prehistory distinguished by the original development of stone tools.

Term	Meaning
Phylum	A principle taxonomic category that ranks above class and below kingdom.
Polychaete	A class of segmented worms often known as bristle worms.
Project	The Firefly floating offshore wind project is situated approximately 60 km to the east of Ulsan, South Korea in the East Sea.
Project Design Envelope (PDE)	Also known as the Rochdale Envelope, the PDE concept is routinely utilised in both onshore and offshore planning applications to allow for some flexibility in design options, particularly offshore, and more particularly for foundations and turbine type, where the full details of the project are not known at application submission but where sufficient detail is available to enable all environmental impacts to be appropriately considered during the EIA.
Scour Protection	Involves the removal of sediment such as sand and dirt from structures that frequently come into contact with water.
Sedimentology	The scientific discipline concerned with the physical and chemical properties of sedimentary rocks and the processes involved in their formation.
Sensitive Receptor	Physical or natural resource, special interest or viewer group that may experience an impact.
Sensitivity	Vulnerability of a sensitive receptor to change.
Subtidal	Area extending from below low tide to the edge of the continental shelf.
Transboundary	Crossing the border between two or more countries or areas, affecting both or all areas.
Turbidity	A key test of water quality referring to the cloudiness or haziness caused by particles suspended in liquid.

ACRONYMS

3D	3-Dimensional
ADCP	Acoustic Doppler Current Profile
ADIZ	Air Defence Identification Zone
AIS	Automated Identification System
AMSL	Above Mean Sea Level
AoI	Area of Influence
ATC	Air Traffic Control
AWC	Asian Waterbird Census
BP	Before Present
CCR	Climate Change Resilience
CD	Chart Datum
CHA	Cultural Heritage Assessment
CHP	Cultural Heritage Protection
CIA	Cumulative Impact Assessment
CITES	The Convention on International Trade in Endangered Species
CNS	Carbon Neutral Strategy
COWRIE	Collaborative Offshore Wind Research into the Environment
CPFDM	Comprehensive Plan for Fine Dust Management
CRM	Collision Risk Modelling
CTD	Current Temperature Depth
CTV	Crew Transfer Vessel
DP	Dynamic Positioning
E&S	Environmental and Social
EAAF	East Asian- Australasian Flyway
EAAFP	East Asian-Australasian Flyway Partnership
EBL	Electrical Business License
EBS	Environmental Baseline Studies
EcIA	Ecological Impact Assessment
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Electro Magnetic Field
EN	Endangered
ERC	Electricity Regulatory Commission
ESIA	Environmental and Social Impact Assessment
FAA	Federal Aviation Administration
FOWF	Floating Offshore Wind Farm
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GIS	Geographical Information Systems
GND	Green New Deal
GVA	Gross Value Added
HLV	Heavy Lift Vessels
HSSE MS	Health, Safety, Security and Environmental Management System
HVAC	High Voltage Alternating Current

IBA	Important Bird Areas
ICAO	International Civil Aviation Organisation
ICH	Intangible Cultural Heritage
ICOMOS	International Council of Monuments and Sites
ICPC	International Cable Protection Committee
IFC	International Finance Corporation
IFR	Instrument Flight Rules
IMO	International Maritime Organisation
INDC	Intended Nationally Determined Contribution
INNS	Invasive Non-Native Species
IUCN	International Union for the Conservation of Nature
IWC	International Waterbird Census
JNAPC	Joint Nautical Archaeology Policy Committee
KEI	Korea Environment Institute
KEPCO	Korea Electrical Power Corporation
KNOC	Korea National Oil Cooperation
KOSTAT	Korea's Statistical Organisation
LAT	Lowest Astronomical Tide
LC	Least Concern
MHWS	Mean High Water Springs
MOA	Military Operations Area
MOE	Ministry of Environment
MOF	Ministry of Oceans and Fisheries
MOLIT	Ministry of Land, Infrastructure and Trade
MOTIE	Ministry of Trade, Industry and Energy
MRCC	Maritime Rescue Coordination Centre
MSA	Minimum Safe Altitude
MSRC	Marine Search and Rescue Centres
MTA	Military Training Area
MVBS	Mean Volume Backscattering Strength
NGOs	Non-Governmental organisations
NIMA	National Imagery and Mapping Agency
NT	Near Threatened
NTM	Notice to Mariners
NTS	Non-Technical Summary
OECD	Organisation for Economic Cooperation and Development
OSP	Offshore Substation Platform
PDE	Project Design Envelope
PM	Particulate Matter
PS	Performance Standard
PSR	Primary Surveillance Radar
PVA	Population Viability Analysis
RFMOs	Regional Fisheries Management Organisation
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
ROV	Remote Operated Vehicle

SAR	Search and Rescue
SEP	Stakeholder Engagement Plan
SOV	Service Operations Vessel
SSC	Suspended Sediment Concentrations
TEL	Threshold Effect Levels
THAAD	Terminal High Altitude Area Defence
ToR	Terms of Reference
UHF	Ultra-High Frequency
UMCG	Ulsan Metropolitan City Government
UNCLOS	United Nations Convention on the Law of the Sea
UXO	Unexploded Ordnance
VEC	Valued Environmental and Social Components
VHF	Very High Frequency
VMS	Vessel Monitoring System
VRP	Visual Reference Point
VU	Vulnerable
WHO	World Health Organisation
WTG	Wind Turbine Generator
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

UNITS

Unit	Description
dB	Decibel (unit used to measure the intensity of sound)
d	Depth
ft	Feet
GW	Gigawatt (power equal to one billion (10^9) watts)
km	Kilometres
kV	Kilovolt (electrical potential)
<	Less than
m	Metre
m/s	Metres per second (wind speed)
mt	Million tonnes
mg/l	Milligrams per litre
MW	Megawatt (power; equal to one million watts)
>	More than
nm	Nautical Mile (distance; equal to 1.852 km)
%	Percentage
nm	Nautical Mile
gt	Gross Tonnes
kwh	Kilo watt hours
cm/s	Centimetres per second
µm	Micro metre
USD	United States Dollar (currency)
nt	Nanotesla (unit used to measure the strength of a magnetic field)
Won	South Korean Currency

1 INTRODUCTION

1.1 Background

In July 2020, the South Korean government announced its 'Green New Deal' (GND). The GND plans to invest in more renewable energy projects to reduce the country's reliance on fossil fuels. The government also announced the Offshore Wind Collaboration Plan in the same month , which included ambitions to expand offshore wind capacity to 12 gigawatts (GW) by 2030, and set out the country's 2050 carbon neutrality goal in November 2020.

Firefly (hereafter referred to as 'the Project') is a proposed floating offshore wind farm being developed by Equinor approximately 60 km off the coast of the city of Ulsan in South Korea, with a landfall point located adjacent to the Ubong Village located south of Onsan National Industrial Complex The Project has the potential to contribute 810 megawatts (MW) to South Korea's renewable production capacity by 2030.

The Project would comprise an array of up to 15MW X 54 turbines on semi-submersible floating platforms, associated moorings and the onshore and offshore components of a transmission system. The onshore aspects of the Project (those landward of Mean High Water Springs (MHWS) are hereafter referred to as 'the Onshore Project.' The offshore aspects of the Project (those seaward of Mean High Water Springs (MHWS) are hereafter referred to as 'the Offshore Project.' Where there is overlap in the assessment of activities within the intertidal area (between MHWS and Mean Low Water Springs (MLWS)) the relevant technical assessments will refer to the relevant offshore and onshore infrastructure components and consenting/ regulatory regimes.

1.2 Purpose of Scoping Report

Equinor will secure the necessary consents and project-level assessments required under local regulations, for example, via the local Korean Environment Impact Assessment (EIA). The core legislative framework for the Project is set out in Section 2.1.4. Through its contracted consultant, RPS, Equinor will conduct an Environmental and Social Impact Assessment (ESIA) of the Project to assess potential adverse social and environmental impacts in detail. The development process also takes other international guidelines into consideration.

This Scoping Report has been prepared to support the Environmental and Social Impact Assessment (ESIA) process. The purpose of this EIA Scoping Report is to provide stakeholders with information on the Project and allow for engagement with stakeholders on the key topics to be addressed in the ESIA Report, as well as the baseline surveys and data sources and assessment methodologies to be used to inform the ESIA Report. This report will consider the available information on environmental and social aspects of the Project to ensure it is sufficient to meet international sustainability standards. Specifically, the International Finance Corporation's (IFC) Performance Standards (PS) in relation to social and environmental risks associated with new developments. Further information on the IFC PS is detailed in Section 2.1.3.

This Scoping Report will present a review of the latest Project information available in relation to the IFC PS and the extent to which the process and evidence standards have been met, or otherwise the actions required to meet them. In accordance with Performance Standard 1 (PS1), this report addresses the scope of risks and impacts to be considered, the process to identify them and provisions for consultation with stakeholders.

A series of impact identification matrices consolidate this review and provide a systematic check of all the potential Project-environment (natural and socio-economic) interactions and any further investigations and supplementary information that might be necessary to comply with IFC standards.

The overarching objective of this Scoping Report is to demonstrate that the approach to the assessment of potential cultural, social and environmental impacts (as set out within this report) aligns with good international industry practice (GIIP). To that end, the following specific objectives have been defined for this report:

- To provide a high-level description of the legislative background and the Project (Sections 2 and 3);
- To identify the Project's Area of Influence (AoI) and appropriate Study Areas for the environmental and social baseline surveys to national legislative requirements and IFC PS (Section 6);
- To provide an overview of existing information on environmental and social resources and receptors;
- To identify potential interactions between the Project and the receiving environment that may result in effects to environmental and social resources and receptors;

- To propose an approach to data gathering, analysis, and methodology to be used to assess impacts;
- To identify potential environmental, social and labour impacts associated with the Project. Describe the potential nature and source of the potential impacts;
- To develop a Terms of Reference (ToR) for the baseline surveys and plan for a detailed assessment of impacts; and
- To prepare of an outline Environmental and Social Management Plan.

1.3 Document Structure

The structure of this Scoping Report is set out in Table 1-1 below.

Table 1-1: Structure of this scoping report

Section	Section Header	Summary Content
Introductory Section		
Section 1	Introduction	Background to the Project and outlines the purpose and approach of the Scoping Report.
Section 2	Institutional, Legislative and Regulatory Context	Overview of internal obligations, Korean legislation and policy and international agreements applicable to the Project.
Section 3	The Project	Description of the proposed design for the Project, based on preliminary conceptual design information and current understanding of the environment from initial site investigation studies. Description of the construction, operation and maintenance and decommissioning phases of the Project.
Section 4	Stakeholder Engagement	Description of the proposed stakeholder consultation process and its objectives for the Project.
Section 5	Environmental and Social Impact Assessment Methodology	Description of the proposed principles of the ESIA process and the approach that will be applied in the ESIA. Description of the methodology to be used to identify and evaluate the likely impacts and, subsequently, evaluate the significance of effects, associated with the Project.
Section 6.1	Project Area of Influence	Description of the proposed Area of Influence of the Project and description for provision of a study area for each environmental and social topic
Section 6.2.1	Topics to be Scoped Out of the ESIA	Description and justification of the ESIA topics to be scoped out from further assessment.
Offshore Physical Environment		
Section 6.3	Marine Processes	Overview of the offshore physical environment (tidal elevations, current, waves, bathymetry, geology and seabed sediments, suspended sediments and sediment transport) within the Project. Required for understanding of potential impacts to the offshore physical environment from construction, operation and maintenance and decommissioning.
Offshore Biological Environment		
Section 6.4	Benthic Subtidal and Intertidal Ecology	Overview of the ecology of the seabed within the Project. Required for understanding of potential impacts to seabed ecology from construction, operation and maintenance and decommissioning.
Section 6.5	Fish and Shellfish and mMarine Reptile Ecology	Overview of the fish and shellfish and marine reptile ecology of the seabed within the Project. Required for understanding of potential impact to fish, shellfish and sea turtle ecology from construction, operation and maintenance and decommissioning.
Section 6.6	Marine Mammals	Overview of the marine mammals within the vicinity of the Project. Required for understanding of potential impacts to marine mammals from construction, operation and maintenance and decommissioning.
Section 6.7	Seabirds and Migratory Birds	Overview of the ornithology features within the vicinity of the Project. Required for understanding of potential impacts to ornithology from construction, operation and maintenance and decommissioning.
Offshore Human and Socio-economic Environment		
Section 6.8	Commercial Fisheries and Aquaculture	Overview of commercial fisheries within the Project's Area of Influence (AoI). Required for understanding of potential impacts to commercial and artisanal fisheries from construction, operation and maintenance and decommissioning.
Section 6.9	Shipping and Navigation	Overview of the baseline shipping and navigation within the vicinity of the Project. Required for understanding of potential impacts to shipping and

		navigation from construction, operation and maintenance and decommissioning.
Section 6.10	Military and Civil Aviation	Overview of civil and military aviation communications within the vicinity of the Project. Required for understanding of potential impacts to civil and military aviation and communications from construction, operation and maintenance and decommissioning.
Section 6.11	Seascape and Visual Amenity	Overview of the seascape, landscape, and visual resources within the vicinity of the Project. Required for understanding of potential impacts to seascape, landscape, and visual resources from construction, operation and maintenance and decommissioning.
Section 6.12	Marine Archaeology	Overview of marine archaeology within the vicinity of the Project. Required for understanding of potential impacts to marine archaeology from construction, operation and maintenance and decommissioning.
Section 6.13	Marine Infrastructure and Other Users	Overview of infrastructure and pre-planned activity within the vicinity of the Project. Required for understanding of potential impacts to airborne noise, aggregate resource availability and additional renewable energy projects from construction, operation and maintenance and decommissioning.
Section 6.14	Marine Tourism and Recreation	Overview of the baseline offshore socio-economics, tourism and recreation within the vicinity of the Project. Required for understanding of potential impacts to baseline offshore socio-economics, tourism and recreation from construction, operation and maintenance and decommissioning.
Onshore Physical Environment		
Section 6.15	Geology, Hydrogeology and Ground Conditions	Overview of the geology, hydrogeology and ground condition features within the vicinity of onshore Project components. Required for understanding potential impacts to geology, hydrogeology and ground conditions from construction, operation and maintenance and decommissioning.
Section 6.16	Cultural Heritage	Overview of cultural heritage within the vicinity of the onshore Project components. Required for understanding of potential impacts to onshore cultural heritage from construction, operation and maintenance and decommissioning.
Section 6.17	Hydrology and Flood Risk	Overview of the hydrology and flood risk features within the vicinity of onshore Project components. Required for understanding potential impacts to local hydrology and flood risk from construction, operation and maintenance and decommissioning.
Section 6.18	Airborne Noise and Vibration	Overview of the airborne noise and vibration features within the vicinity of onshore Project components. Required for understanding potential impacts to airborne noise and vibration from construction, operation and maintenance and decommissioning.
Section 6.19	Air Quality	Overview of the baseline air quality parameters within the vicinity of the onshore Project components. Required for understanding of potential impacts to regional air quality from onshore construction, operation and maintenance and decommissioning.
Onshore Biological Environment		
Section 6.20	Terrestrial Ecology	Overview of the baseline terrestrial ecology within the vicinity of the onshore Project components. Required for understanding of potential impacts to regional terrestrial ecology from onshore construction, operation and maintenance and decommissioning.
Onshore Human and Socio-Economic Environment		
Section 6.21	Population, Human Rights and Human Health	Overview of the baseline population and human health demographics within the vicinity of the onshore Project components. Required for understanding of potential impacts to local population and human health from onshore construction, operation and maintenance and decommissioning.
Section 6.22	Landscape and Visual Amenity	Overview of the landscape and visual resources within the vicinity of the onshore Project components. Required for understanding of potential impacts to landscape, and visual resources from onshore construction, operation and maintenance and decommissioning.
Section 6.23	Land Use, Infrastructure and Material Assets	Overview of land use, infrastructure, and pre-planned activity within the vicinity of the onshore Project components. Required for understanding of potential impacts to land use, aggregate resource availability, and additional industrial projects from construction, operation and maintenance and decommissioning.

Section 6.24	Traffic and Transport	Overview of the baseline traffic and transport features within the vicinity of the onshore Project components. Required for understanding of potential impacts to local traffic and transport from onshore construction, operation and maintenance and decommissioning.
Section 6.25	Major Accidents and Natural Disasters	Overview of the potential impacts of major accidents and natural disasters on the onshore Project components during construction, operation and maintenance and decommissioning.
Section 6.26	Waste	Overview of potential impacts resulting from waste generated by onshore Project components during construction, operation and maintenance and decommissioning.
Section 6.27	Climate Change	Consideration of predicted changes in baseline environmental conditions, including changes resulting from climate change will be addressed.
Concluding Chapters and Annexes		
Section 7	References	Includes a list of all references included in the Scoping Report.
Appendix A-1	Transboundary Impacts Screening Assessment	Includes a screening assessment of potential transboundary impacts arising from the Project.
Appendix A-2	Wave Height and Directions Data	Includes wave height and direction for each month of 2020 from metocean buoys located near to the Project
Appendix A-3	Baseline Survey Coordinates	Coordinates of historical survey coordinates and proposed baseline surveys within the Area of Influence
Appendix A-4	Biodiversity Risk Assessment	Description of the critical habitat assessment that will be undertaken in accordance with PS6
Appendix A-5	List of onshore and offshore Bird Species in Korea	List of onshore and offshore bird species identified within Korea

2 INSTITUTIONAL, LEGISLATIVE AND REGULATORY CONTEXT

2.1 Institutional

2.1.1 Equinor Management System

Equinor's Management System is structured on three levels: (1) fundamentals, (2) requirements, and (3) recommendations (Figure 2-1). Fundamentals are applicable to all positions and divisions within Equinor. Requirements apply to specific areas of Equinor and are personalised to pertinent business needs. Each of these specific divisions of Equinor is responsible for establishing and implementing appropriate governing documentation, designed to fit business and operational contexts. Lastly, recommendations are the supporting documents which help to provide additional information to fully understand how to meet diverse requirements in the most efficient and effective way possible.

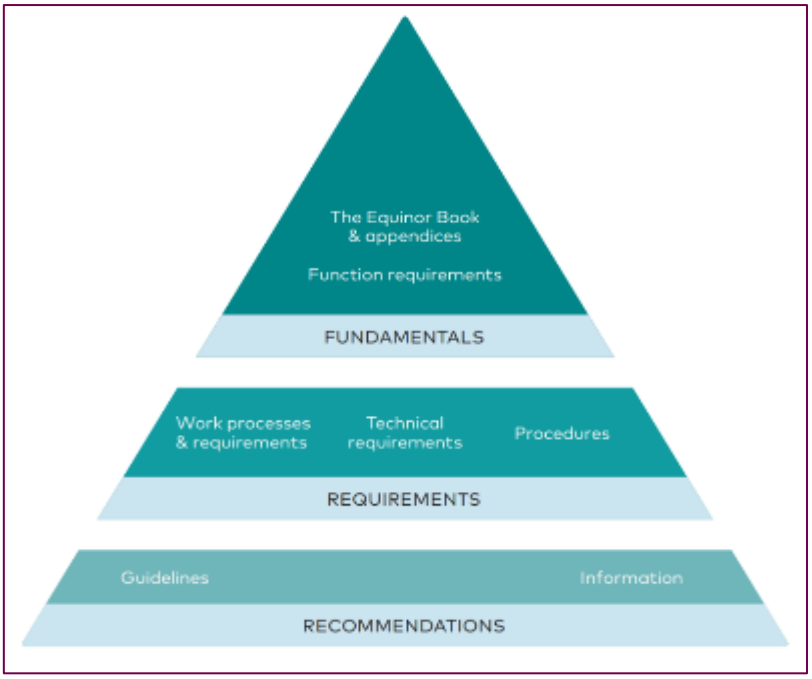


Figure 2-1: Equinor's Management System Hierarchy including fundamentals, requirements, and recommendations. (equinor-book.pdf)

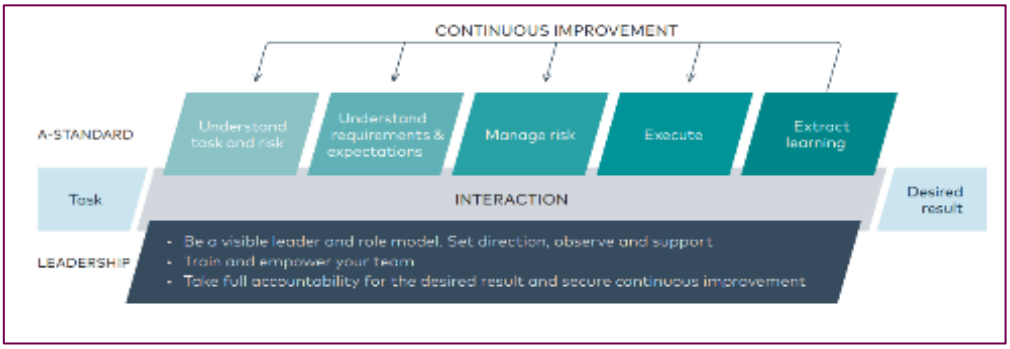


Figure 2-2: Equinor's compliance and leadership process to manage project risks. (equinor-book.pdf)

Equinor uses compliance and leadership to successfully manage risks effectively and ensure safe and efficient operations through precision, quality, and execution of tasks. Equinor's compliance and leadership approach involves a five-step method to reach results (Figure 2-2). Once the result is achieved, the method then evaluates that result and the lessons learnt, promoting a culture and feedback loop of continuous improvement.

2.1.2 Sustainability in Equinor

Equinor is transitioning into a broad energy company by leveraging the strong synergies between oil, gas, renewables, carbon capture and storage, and hydrogen. We provide reliable energy for societies worldwide and aim to be a leading company in the energy transition.

We recognise that our activities may have substantial impacts on society and the environment. Our operations may impact biodiversity and ecosystems through emissions, disturbances, spills, waste, discharges and effluents to water, soil and air. Health, safety, human rights, integrity and security risks are inherent in the activities we and our suppliers perform in the regions where we operate.

'How' we deliver is as important as 'what' we deliver. Our approach to sustainability is embedded in the way we work. This includes our corporate governance principles, performance and reward framework, risk and impact management and how we work with suppliers and partners. Our approach to sustainability is integrated in our management system and reflected in our policies, positions and codes. It is also summarised in the publicly available Equinor book.

2.1.3 IFC Performance Standards

The International Finance Corporation (IFC) is an international financial institution that offers investment, advisory, and asset management services to encourage private sector developments. To support its clients in the management of performance risk, the IFC has developed a set of eight Performance Standards (PS) to manage social and environmental risks (termed 'E&S' risks) associated with new developments. The IFC Environmental and Social Performance Standards (last amended in 2012), associated Guidance Notes[1] and implementation resources[2] are hereafter, referred to as the 'IFC guidance.'

The ESIA Report will be prepared in accordance with the IFC guidance and the Equator Principles. Therefore, this Scoping Report is based on the relevant IFC guidance and the Equator Principles. The application of these standards demonstrates that the approach to the assessment of potential environmental and social impacts (as set out within this report) accord with an international baseline standard. This approach facilitates the early identification and potential avoidance of risks and potential impacts as well as the opportunity to develop mitigation where necessary.

The relevant aspects of the IFC Performance Standards (PS) are in Table 2-1 and drawn out in Section 6 on topic specific basis. The following IFC PS (1-8) have been referenced as required in the development of the Scoping Report:

- PS1: Assessment and Management of Environmental and Social Risks and Impacts.
- PS2: Labour and Working Conditions.
- PS3: Resource Efficiency and Pollution Prevention.
- PS4: Community Health, Safety, and Security.
- PS5: Land Acquisition and Involuntary Resettlement.
- PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- PS7: Indigenous peoples.
- PS8: Cultural heritage.

[1] A Guidance Note is provided for each Performance Standard. Available on the IFC website (ifc.org)

[2] A range of implementation resources are provided for each Performance Standard. Available on the IFC website (ifc.org)

Table 2-1: IFC requirements of relevance for Project Scoping for each PS.

PS	Title	Responsibility	Objectives
1	Assessment and Management of Environmental and Social Risks and Impacts	Underscores the importance of managing environmental and social performance throughout the life of a project	• Identify and evaluate the environmental and social risks and impacts of a project • Adopt a mitigation hierarchy to anticipate, avoid and/or minimize risks to workers, community, and environment • Promote improved environmental and social performance • Ensure grievances are responded to and handled appropriately • Promote and provide means for engagement with affected communities
2	Labor and Working Conditions	Recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by the protection of fundamental rights of workers	• Promote fair treatment, non-discrimination, equal opportunities to workers • Establish, maintain, and improve worker-management relationships • Promote compliance with national employment and labor laws • Protect workers, including vulnerable workers • Promote safe and healthy working conditions • Avoid the use of forced labor
3	Resource Efficiency and Pollution Prevention	Understands that increased economic activity has the potential to increase pollution levels to air, water and land, consuming finite resources and threaten local, regional, and global environments	• Avoid and minimise adverse impacts on human health and the environment • Promote more sustainable usage of resources, including energy and water • Reduce project related GHG emissions
4	Community Health, Safety, and Security	Appreciates that Project activities, equipment and infrastructure could potentially increase the community's exposure to risks and impacts	• Anticipate and avoid adverse impacts on the health and safety of the Affected Community • Ensure that the safeguarding of personnel is imperative
5	Land Acquisition and Involuntary Resettlement	Recognises project-related land acquisition and restrictions on land use can potentially have adverse impacts on communities and persons that use the land	• Avoid and/or minimise displacement by exploring alternative project designs • Avoid forced eviction • Anticipate and avoid adverse social and economic impacts from land acquisition or restrictions on land use • Improve, or restore, the livelihoods of displaced persons • Improve living conditions among physically displaced persons
6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Recognises that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are imperative to sustainable development	• Protect and conserve biodiversity • Maintain the benefits resulting from ecosystem services • Promote sustainable management of living natural resources
7	Indigenous Peoples	Understands that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups and national societies, are often among the most marginalized and vulnerable segments of the population	• Ensure that the development process fosters full respect of Indigenous Peoples • Anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples • Promote sustainable development benefits and opportunities for Indigenous Peoples • Establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) • Ensure Free, Prior and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples • Respect and Preserve culture, knowledge, and practices of Indigenous Peoples

PS	Title	Responsibility	Objectives
8	Cultural Heritage	Recognises the importance of cultural heritage for current and future generations	• Protect cultural heritage from adverse impacts of project activities and support its preservation • Promote equitable sharing of benefits from the use of cultural knowledge

2.1.4 Equator Principles

The Equator Principles (EP) correlate with the IFC standards and are intended to serve as a common baseline and risk management framework for financial institutions to identify, assess and manage environmental and social risks when financing Projects. They have been adopted by some of the world's largest financial institutions (the Equator Principles Financial Institutions or "EPFIs") including many of the major banks in Korea to provide a minimum standard for due diligence to support responsible decision making. The most recent version (July 2020), EP4 covers the following areas:

- Principle 1: Review and Categorization
- Principle 2: Environmental and Social Assessment
- Principle 3: Applicable Environmental and Social Standards
- Principle 4: Environmental and Social Management System and Equator Princples Action Plan
- Principle 5: Stakeholder Engagement
- Principle 6: Grievance Mechanism
- Principle 7: Independent Review
- Principle 8: Covenants
- Principle 9: Independent Monitoring and Reporting
- Principle 10: Reporting and Transparency

The Equator Principles (EP) make a distinction between Designated and Non-Designated Countries in the application of the EP. Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment. The Republic of Korea is a designated country and under previous iterations of the EP, compliance with domestic jurisdiction laws in Designated Countries was considered sufficient to be aligned with the Equator Principles. Under EP4, compliance with domestic laws is still required for projects in Designated Countries. However, EP4 will now make projects in Designated Countries equally subject to evaluation against IFC Performance Standards, where the specific risks associated with the project warrant it. This means that, under EP4, compliance with local laws and regulatory processes may not be the only assessment required of a project in a Designated Country; as of October 1, 2020, the project may now also require evaluation against relevant IFC Performance Standards.

Principle 1 (Review and Categorization) is the responsibility of EPFIs to categorize the project[3] based on the magnitude of potential environmental and social risks and impacts. Such categorization is based on the IFC's environmental and social categorization process.

Principle 2 (Environmental and Social Assessment) is the responsibility of the client (developer). EPFIs will require the client to conduct an appropriate assessment process to address the relevant environmental and social risks and scale of impacts of the proposed project. The assessment documentation should propose measures to minimize, mitigate and where residual impacts remain, to compensate/offset/remedy for environmental and social risks and impacts.

Principle 3 (Applicable Environmental and Social Standard) shall be taken into account during the assessment process. The assessment shall address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. The EPFIs will evaluate the specific risks of the project to

[3] Category A – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;
Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and
Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

determine whether one or more of the IFC PS could be used as guidance to address those risks, in addition to host country laws.

For Category A and B projects, Principle 4 (ESMS and EP Action Plan) requires clients to develop and maintain an Environmental and Social Management System (ESMS). As part of the ESMS, an Environmental and Social Management Plan (ESMP) needs to be prepared by the client to address issues raised in the assessment process and incorporate actions required to comply with the applicable standards.

For all Category A and Category B projects, Principle 5 (Stakeholder Engagement) requires the client to demonstrate effective Stakeholder Engagement, as an ongoing process in a structured and culturally appropriate manner, with affected communities, workers and, where relevant, other stakeholders. To facilitate Stakeholder Engagement, the client shall make the appropriate assessment documentation readily available to the affected communities which commensurate with the project's risks and impacts. The Client shall take account of, and document, the results of the stakeholder engagement process, including any actions agreed resulting from such process. Disclosure of environmental and social risks and adverse impacts should occur early in the assessment process, in any event before the project construction starts, and on an ongoing basis.

Principle 6 (Grievance Mechanism) requires the client to establish effective grievance mechanisms for category A and B projects as part of the ESMS. The mechanisms shall be designed for use by affected communities and workers to receive and facilitate resolution of concerns and grievances about the project's environmental and social performance. The client shall inform affected communities and workers about the grievance mechanism in the course of the stakeholder engagement process.

According to the Principle 7, Independent Review is required for all category A and as appropriate, category B projects. An independent environmental and social consultant will carry out a thorough review of the assessment process including ESMPs, the ESMS and the stakeholder engagement process documentation in order to assist the EPFI's due diligence and determination of EP compliance.

According to the Principle 8 (Covenants), for all projects, the EPFIs will work with the client on remedial actions to being the project back into compliance where a client is not in compliance with its environmental and social covenants.

Principle 9 (Independent Monitoring and Reporting) requires independent monitoring and reporting of the project over the life of the loan to assess project compliance with the EP after financial close for category A and B projects. Monitoring and reporting should be provided by an independent consultant; alternatively; the EPFI may require that the client retain qualified and experienced external experts to verify its monitoring information, which will be shared with the EPFI in accordance with the frequency required in the Principle 8.

Principle 10 applies to category A and B projects. This principle requires clients to disclose the following information.

- Ensure that, at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of Human Rights and climate change risks and impacts when relevant.
- Report publicly, on an annual basis, GHG emission levels (combined Scope 1 and Scope 2 Emissions, and, if appropriate, the GHG efficiency ratio) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.
- The EPFI will encourage the client to share commercially non-sensitive Project-specific biodiversity data with the Global Biodiversity Information Facility (GBIF) and relevant national and global data repositories, using formats and conditions to enable such data to be accessed and re-used in future decisions and research applications.

2.2 Legislative

The following sections provide a summary of the key Korean legislation relevant to the ESIA scoping document as it is a requirement of the IFC PS that Korean legislation is considered.

2.2.1 Law of Electricity Business

The Law of Electricity Business requires a developer who seeks to obtain exclusivity to construct, own and operate an offshore wind project in Korea, to obtain an electrical business licence (EBL). An EBL is obtained from Korea's Ministry of Trade, Industry and Energy (MOTIE) once the application is received it is then

comprehensively reviewed by the Electricity Regulatory Commission (ERC) which will confirm if the MOTIE can grant the EBL. They must specify the amount of generation capacity licensed to be developed, the location for the project and a "preparation period" during which the proposed project must come into operation. The preparation period with respect to wind power projects is four years from the issuance of the EBL, i.e., Equinor is required to complete construction within four years of the date of the EBL. Although this period may be extended at the discretion of the MOTIE. As of August 2018, an EBL for an OWF will only be issued after collection of at least a year's meteorological data for a specific site. RPS was engaged by Equinor to deploy floating Lidar buoys with a full dataset collected by December 2021An EBL has been issued for the project in November 2021.

2.2.2 Public Waters and Management Reclamation Act

The Public Waters Management and Reclamation Act (and its Enforcement Decree) requires developers to obtain a permit for occupancy or use from the agency in charge of public waters (For this project, Ulsan Regional office of ocean and fisheries, Ulju county and Dong-gu county) when intending to perform newly build, reconstruct, extend, alter, or remove renewable energy facilities. Once obtained, the permit bestows the developer an exclusive right to occupy and use the public waters for 30 years.

Documents to be attached in the application for the permit include the following items:

- Detailed project engineering design including direct and indirect area;
- Consent from persons of rights on occupation and use of the public waters; and
- EIA consultation results

Developers are required to obtain consent from stakeholders and interested parties for the use of public waters. These stakeholders and interested parties refer to the people/ organisations who hold the rights which are expected to be infringed on by a relevant public waters occupancy permit, including persons with fishing rights to such public waters.

A developer is liable to compensate the fishermen stipulated by the Fisheries Act Article 31 for losses, e.g., reduction in the revenues of fishing business, arising out of the use of public waters. OWFs are generally further from the shoreline, therefore it may be more difficult to identify the stakeholders and interested parties and determine the appropriate scope of loss or compensation.

Stakeholder mapping for the ESIA will inform the process for gaining stakeholder acceptance.

2.2.3 The Environmental Impact Assessment Act and EIA Manual

Under the Environmental Impact Assessment Act (EIA Act), offshore wind projects with generation capacity exceeding 100 MW are required to complete an EIA to assess any impact the project may have on the environment and to implement any required mitigation measures. Offshore wind projects with a generation capacity under 100 MW are required to complete other assessment process such as Sea Area Utilization Consultation or Sea Area Utilization Impact Assessment, depending on the generation capacity. Preliminary advice from the Ministry of Environment (MOE) has confirmed the Project is to be assessed via formal EIA process.

For electrical business subject to EIA, developer must submit its EIA scoping report to the MOTIE outlining its proposed scope, methods, analysis, limitations, etc. to be included in the EIA. The EIA should cover, among other things, an assessment of the proposed site's natural and ecological environment, air, water, soil, living environment, social environment, and economic environment. The EIA process generally involves information session with the stakeholders and takes approximately one and a half year to complete.

MOE and the Korea Environment Institute (KEI) have released a manual for EIA including technical studies in July 2021. This new document outlines the regulators expectations as a series of recommendations to be considered by proponents in developing their EIA and environmental baseline studies (EBS). Two further documents were issued by MOE in 2022 to guide the development of the industry: '*Guidelines for consultation on environmental assessment of offshore wind power generation* (April 2022); and '*Guidebook for the composition of EIA report'* (March 2022). The EIA Manual (MOE 2021) and these more recent guidance have been considered in developing the scope for the ESIA.

2.2.4 Soil Environment Conservation Act

The purpose of this Act is to prevent potential hazard to public health and environment caused by soil contamination, to conserve the soil ecosystem by properly maintaining and preserving soil including rehabilitating contaminated soil and to enhance the value of the soil as a resource, and to enable all citizens of the nation to live in a healthy and comfortable environment.

The soil contamination monitoring surveys will assess the risk associated with onshore soil disturbance during cable laying and tunnelling as required.

2.2.5 Marine Environment Management Act

The purpose of this Act is to prescribe matters necessary for the prevention, improvement, response, and recovery with regard to marine pollution, by managing sources that generate pollutants, such as ships, marine facilities, and marine spaces, and regulate discharge of marine pollutants such as oil and noxious liquid substances, thereby contributing to the protection of the health and wealth of the people of the Republic of Korea.

This act will be considered in establishing management plans for vessel activities during construction and operations phases of the Project.

2.2.6 Act on the Conservation and Use of Biological Diversity

The Act on the Conservation and Use of Biological Diversity 2012 (ACUBD) Article 14 specifies the duty and right of the Minister of Environment, the heads of relevant central administrative ministries and agencies, and the heads of provincial-level governments (“the authorities”) to take necessary emergency measures to avoid or mitigate adverse effects on biodiversity when deemed to be under significant threat from development projects.

The assessment of potential biodiversity impacts under IFC PS6 is consistent with the intentions of this act.

2.2.7 Cultural Heritage Protection Act

The purpose of this Act is to promote the cultural edification of Korean nationals and to contribute to the development of human culture by inheriting national culture and enabling it to be utilized through the preservation of cultural heritage.

Under the local Environmental Impact Assessment (EIA), a development project should consider protected zones pursuant to Article 27 of this Act. EIA should also cover status survey, impact assessment, and mitigation measures for fauna and flora including natural monuments defined by Article 2 and designated according to Article 25 of this Act.

2.2.8 Other Legislation

- Maritime Safety Act: designates Specific Sea Areas for Traffic Safety
- Framework Act on Environmental Policy: defines and designates special measures area for environmental preservation
- Act on Marine Spatial Planning and Management: defines and stipulates military action zones

2.3 Korean Regulations and Policies

2.3.1 Improvement Plan of Renewable Energy Policy (2022)

The government of the Republic of Korea has laid out ambitious policies to foster renewable energy since 2017, with the implementation of the Renewable Energy 3020 (or “RE 3020”). RE 3020 includes a target to produce 20% of the entire electricity generation in the country in 2030 through renewable energy sources (Implementation Plans for RE 3020, 2017). It has been the cornerstone of renewable energy policies in the former Moon Administration, along with the government’s another pledge to implement a Green New Deal, which was proposed as a means of catalysing the creation of jobs to help the economy recover from COVID19-

related economic downturn and revitalizing Korea's industrial base and export industries while simultaneously achieving carbon neutrality and improving Korea's energy security (Kim & Chang, 2020).

Even with the Yoon administration which came into office in May 2022, government support for the development of offshore wind power in the Republic of Korea continues to be at a steady high. Improvement Plan of Renewable Energy Policy (2022), laid out by MOTIE in November 2022, plans to drastically enhance the proportion of from wind electricity generation compared to that of solar – from 13 to 87 in 2021 to 40 to 60 in 2030. It also maintains the country's 2030 renewable energy target to 21.6%.

Other relevant elements of the plan includes:

- Encouraging local stakeholder acceptance and local participation to renewable energy projects through establishment of stakeholder acceptance guidelines and extended profit-sharing for local stakeholders in renewable energy projects coupled with government-backed financing, etc.
- Providing government assistance in locating, planning and expediting renewable energy projects in energy clusters to be promoted by local governments.

These elements maintain or strengthen similar measures planned out under the Green New Deal, which has been considered in developing the Stakeholder Engagement Plan (SEP) to IFC PS and is consistent with those requirements stipulated in IFC PS1 and PS4.

2.3.2 Offshore Wind Collaboration Plan (2020)

In July 2020, several ministries of the Korean Government have jointly issued the "Plan for Offshore Wind Power Generation in Collaboration with Local Residents and the Fishing Industry" or the Offshore Wind Collaboration Plan. It sets out specific measures to encourage the rapid development of large-scale offshore wind farms and trickle-down benefits to local stakeholders. The collaboration Plan is in essence, an implementation plan for Korea's Green New Deal (Kim & Chang, 2020). The relevant policy objectives laid out in this plan and described below is being maintained in the current Yoon Administration.

The objectives of the Collaboration Plan are:

- Install 12GW of offshore wind power, creating 87,000 new jobs annually, by 2030 to become one of the world's five largest offshore wind power generating countries; and
- Share the economic benefits of offshore wind development with local residents and the fishing industry.

Initiatives of the collaboration plan of relevance to the project include:

- Local governments will lead the development of large-scale offshore wind farms in energy clusters, such as the one proposed off Ulsan;
- The government will seek to expedite the construction of and prioritise grid connection for large-scale offshore wind farms;
- The MOTIE will seek to enhance industrial competitiveness in the offshore wind sector; and
- The MOTIE will increase offshore wind economic feasibility.

This initiative is consistent with IFC PS relating to sustainable and equitable development.

2.4 International Agreements and Conventions

The following international agreements were considered as relevant when designing baseline survey scopes and in ESIA planning in relation to biodiversity and heritage conservation. Conservation status listings will be considered in assigning consequence levels for ESIA risk assessments. These agreements will be key considerations in the ESIA for assessing cumulative and transboundary impacts of the project, noting that no wetland sites of international importance under the Ramsar Convention or UNESCO World Heritage sites are likely to be affected by the Firefly Project.

2.4.1 ROKAMBA

The Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA) is part of international efforts to conserve migratory birds. It came into force in 2007 and forms the basis for the joint conservation of 59 species of migratory birds listed in the agreement and the protection of their habitat. The agreement prohibits the taking of migratory birds and their eggs except for scientific purposes, for hunting during hunting season or for

protecting people and their property. Any sale, purchase or exchange of migratory birds or their eggs is also prohibited. The agreement encourages the exchange of data and publications regarding research on migratory birds and encourages the management and conservation of the habitat of migratory birds through seeking means to prevent damage to migratory birds and their environment.

2.4.2 IUCN

The International Union for the Conservation of Nature (IUCN) comprises government and civil society organisations and aims to conserve nature and accelerate the transition to sustainable development. The IUCN is often considered the global authority on the status of the natural world and the measures needed to safeguard it. The IUCN Red List is an indicator of the health of the world's biodiversity. It can be used to inform action for biodiversity conservation and policy change, critical to protecting the natural resources we need to survive. It provides information about range, population size, habitat and ecology, use and/or trade, threats, and conservation actions that will help inform necessary conservation decisions.

The IUCN classifications include Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct. A definition of the classifications are provided below:

- A taxon that is considered Data Deficient is one in which there is an inadequate amount of information to make a direct, or indirect assessment of its risk of extinction based on its distribution and population status.
- A taxon that is classified as Least Concern signifies that the species has been evaluated against the Red List criteria and that at this time, it does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened.
- A Near Threatened taxon is one that has been evaluated against the Red List criteria, but it does not qualify for Critically Endangered, Endangered or Vulnerable at the moment, however, it is close to qualifying for or likely to qualify for a threatened category in the future.
- Vulnerable species are denoted due to the fact that the best available evidence indicates that a specific taxon meets the criteria to be classified as vulnerable and is therefore facing a high risk of extinction in the wild.
- Endangered species refers to a taxon in which the best available evidence indicates that it is facing a very high risk of extinction in the wild.

2.4.3 Bonn Convention

The Convention on the Conservation of Migratory Species of Wild Animals (CMS; also known as the Bonn Convention) is an environmental treaty of the United Nations. The CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats, and brings together the States through which migratory animals pass (the Range States), and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range. As the only global convention specializing in the conservation of migratory species, their habitats and migration routes, the CMS complements and co-operates with a number of other international organizations, NGOs and partners in the media as well as in the corporate sector. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species. Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention. For this reason, the Convention encourages the Range States to conclude global or regional agreements. In this respect, CMS acts as a framework Convention.

2.4.4 RAMSAR

The Ramsar convention on wetlands designates wetland sites of international importance for containing representative rare or unique wetland types or for their importance in conserving biological diversity. It provides the only international mechanism for protecting sites of global importance and is thus of key conservation significance. It includes all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans.

Under the "three pillars" of the Convention, the members commit to:

- Work towards the wise use of all their wetlands;
- Designate suitable wetlands for the list of Wetlands of International Importance (the “Ramsar List”) and ensure their effective management; and
- Cooperate internationally on transboundary wetlands, shared wetland systems and shared species.

2.4.5 UNESCO World Heritage

The World Heritage Convention, adopted in 1972, is a legally binding instrument providing an intergovernmental framework for international cooperation for the identification and conservation of the world's most outstanding natural and cultural properties. The Convention sets out the duties of the members in identifying potential sites and their role in protecting and preserving them. The members are encouraged to invest in the protection of the cultural and natural heritage into regional planning programmes, set up staff and services at their sites, undertake scientific and technical conservation research to involve the heritage in the day-to-day life of the community. Members have to report regularly to the World Heritage committee on the state of conservation of their world heritage sites.

3 THE PROJECT

3.1 The Need for the Project

In December 2020, the Government of the Republic of Korea submitted its Intended Nationally Determined Contribution (INDC) to the United Nations (The Government of the Republic of Korea, 2020a), together with its 2050 Carbon Neutral Strategy (CNS) (The Government of the Republic of Korea, 2020b). In December 2021, the government submitted Enhanced Update of its First Nationally Determined Contribution to the United Nations with an enhanced 2030 climate target (The Government of the Republic of Korea, 2021). These submissions, supported by a revised roadmap (the 2030 Roadmap) for implementation (The Government of the Republic of Korea, 2016) set out the national climate policies to meet obligations under the Paris Agreement and a long-term strategy for carbon neutrality by 2050.

The GND (2020) is one pillar of a synergised strategy to address climate and ecological crises. The GND focuses on decarbonisation and low-carbon and decentralised energy provided through renewable energy and green infrastructure. To achieve carbon neutrality in the energy sector by 2050, CNS directs that clean and renewable energy, i.e., solar and wind, should become central power sources and a 3-fold increase in wind energy facilities is needed by 2025.

As a renewable energy infrastructure project, the Project enacts fundamental and urgent national objectives. Wind generation is an essential element of South Korea's plan for industrial decarbonisation and investment in low carbon electricity generation and transmission assets. The INDC is recognised as an ambitious target. The project can contribute to a security of energy supply during the large-scale phasing out of existing nuclear and coal-fired powered stations and help Korea meet its emission reduction and renewables targets.

3.2 The Proponent

Equinor is an international energy company committed to long-term value creation in a low-carbon future. Equinor's purpose is to turn natural resources into energy for people and progress for society.

Equinor is building material offshore wind clusters in the UK, the US North East and in the Baltic Sea. Offshore wind is an important enabler in the world's energy transition. Equinor's experience of operating in the demanding conditions in the North Sea provides valuable insight and knowledge that is transferable to offshore wind projects.

Equinor has an ambition of becoming a net-zero energy company by 2050. Headquartered in Stavanger (Norway), Equinor is present in around 30 countries worldwide.

3.3 Assessment of Alternatives

Alternatives can include variations in layout on the project site, alternative engineering processes and construction practices, the selection of different sites or routing of linear facilities, and screening of suppliers to select those with appropriate environmental and social risk management systems (A Guide to Biodiversity for the Private Sector, IFC).

Whilst the detail design of the Firefly Project has not yet been finalised, several alternatives that have been considered as part of the Korean EIA process are detailed within the sections below. The Project Design Envelope (PDE) approach (also known as the Rochdale Envelope approach) will be adopted for the IFC ESIA for the Project, in accordance with current best practice and the "Rochdale Envelope Principle". The PDE concept allows for some flexibility in project design options, particularly for foundations and wind turbine type, where the full details of a project are not known until the ESIA is undertaken. Further detail on the PDE approach is presented within Section 5.3 below. The outcome of the PDE including adopted mitigation is to be presented within the Social and Environmental Management Plan as appended to the ESIA Bridging document and will be consistent with the results of the Korean EIA process.

3.3.1 Array area design

- changes to avoid military operations area to the west
- creation of shipping lane through the centre of the Ulsan offshore wind area led to modification of turbine array area

3.3.2 Offshore substation

- consideration of floating vs fixed substation platform for feasibility and reducing underwater noise impacts

3.3.3 Turbine options including capacity and platform design

- consideration of different sized WTGs

3.3.4 Mooring design options

- Consideration of noise reduction vs stability in different bottom types, with preference for suction piles which generate lower noise impacts where practicable

3.3.5 Cable routing

- Consideration of different construction options trenching, drilling/tunnelling/overhead lines
- Overhead lines would be cheaper but were excluded due to the higher expected regulatory approvals burden higher stakeholder opposition based on other projects in the regions,
- Tunnelling preferred method due to lower impact on receptors including birds (avoiding risk of collision with wires) and stakeholders which would be affected by overhead or trenched options
- Select cable route that only runs through industrial land to reduce stakeholder impacts

3.4 Location of the Project

The Project area, defined as the boundary limit to all infrastructure development covers 282.43 km^2 (comprising the combined footprint areas of the Onshore and Offshore Project Areas. The Offshore Project Area covers 276.56 km^2 (the Offshore Array Area and Project offshore export cable corridor) and is where the offshore infrastructure such as wind turbines, offshore substation, array cables and the start of the export cable corridor will be located (Figure 3-1). The array area is approximately 20.04 km long and 9.21 km wide, covers an area of 152.3 km^2 and is located, at its closest point, approximately 60 km off the coast of the city of Ulsan in South Korea, in the East Sea. The Project offshore export cable corridor has a single corridor option 73.77 km long and includes a 1 km buffer across the cable, (Figure 3-1).

The Onshore Project Area will cover 5.87 km^2 (comprising the Project onshore substation and Project onshore cable corridor). The Project onshore cable corridor will be approximately 5.3 km long and include a 500 m buffer either side of the cable (Figure 3-2).

The key components of the Project would be located at the following coordinates:

- The array area (centre point) 130° 5' 10.034" E, 35° 31' 37.998" N.
- The Onshore Project (centre point) 129° 20' 9.118" E, 35° 24' 55.336" N.
- Landfall 129° 21' 15.436" E, 35° 23' 53.981" N.

Note that as the project design evolves and following ongoing consultation with the Ministry of Defence (MoD) and other stakeholders, the Project location may have to be further modified accordingly.

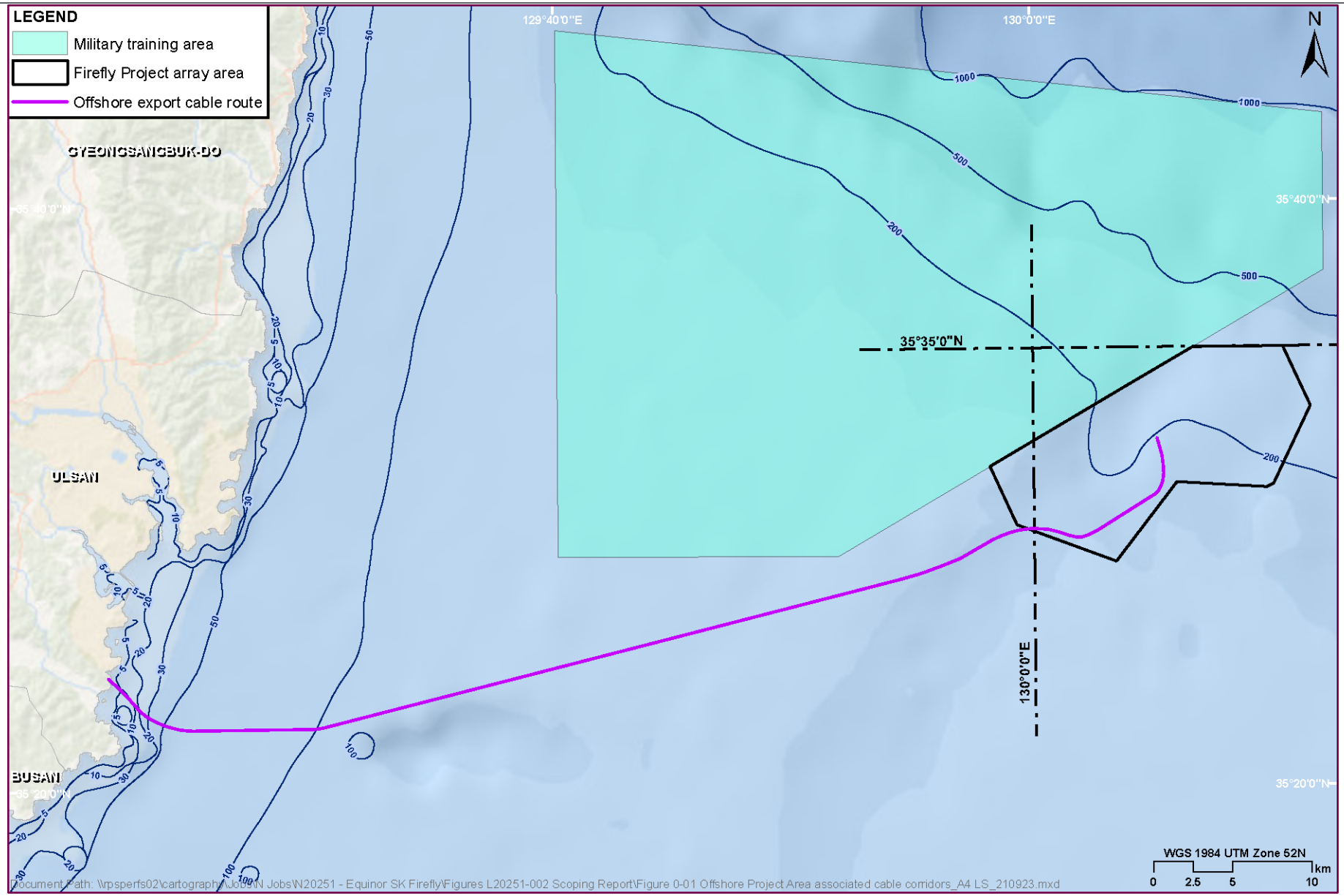


Figure 3-1: The offshore Project Area and associated offshore export cable route.

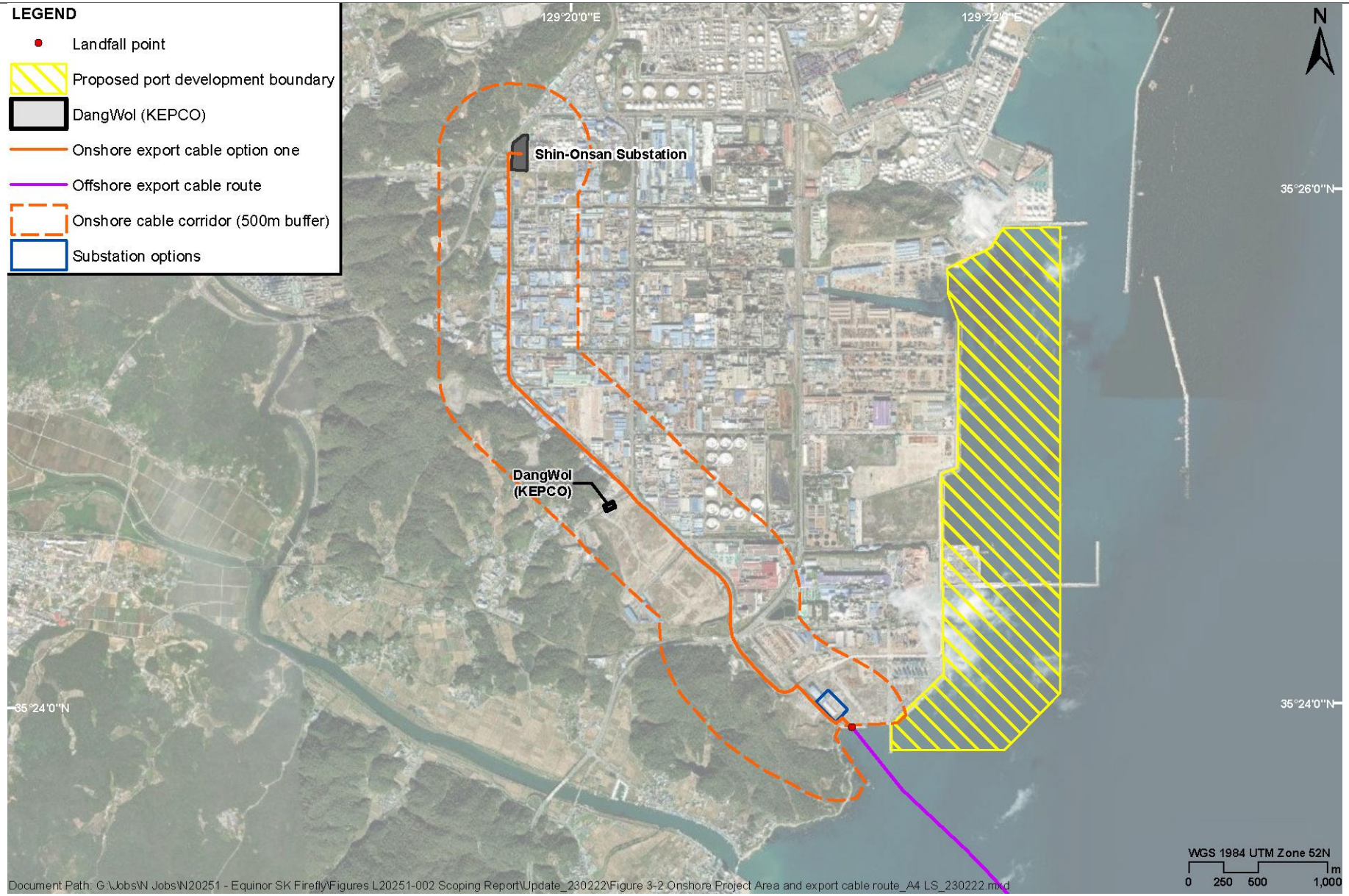


Figure 3-2: The onshore Project Area and export cable route.

3.5 Offshore Infrastructure

The key components of the Offshore project are likely to include:

- 54 wind turbines (54 WTG x 15 MW) with up to four mooring points per turbine, using either suction anchors, piled anchors or drag anchors;
- One Offshore Substation Platform (OSP) and associated support structures and foundations;
- A network of inter-array cabling linking the individual wind turbines to the OSP; and
- Up to two offshore export cables connecting the offshore substation to the onshore substation.

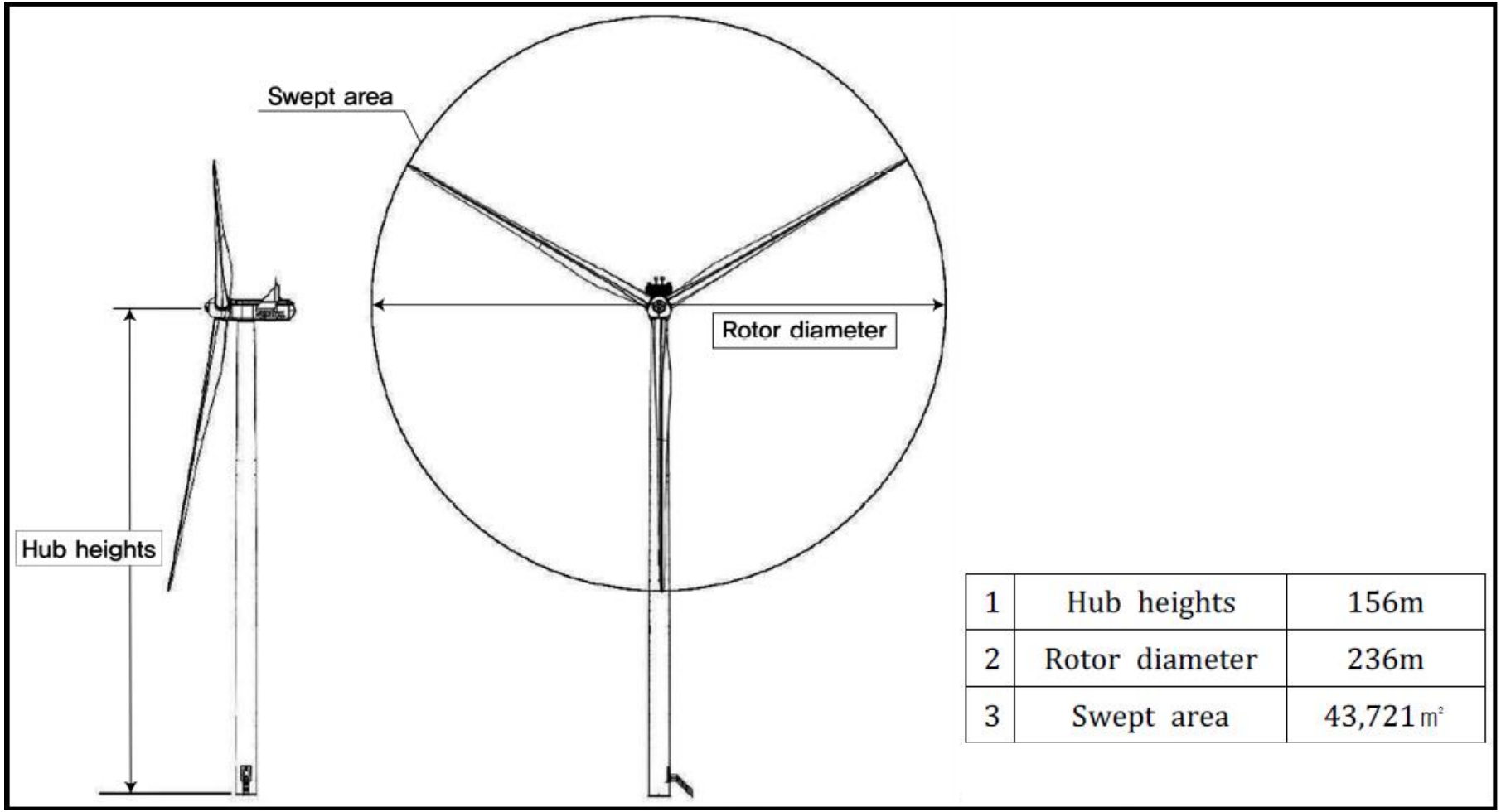
The following sections (sections 3.5.1-3.5.5) provide a description of each component of the Offshore Project.

3.5.1 Wind Turbines

The Project will comprise up to 54 wind turbines, the final number of wind turbines will be dependent on the capacity of individual wind turbines used and environmental and engineering survey results. There is the potential for a reduced number of wind turbines to be used if an increased rated output of wind turbine model is chosen when the final project design is developed.

Each turbine would comprise a tower section, nacelle and three rotor blades on a three pillared semi-submersible floating platform, of which the design is shown in Figure 3-3 and Figure 3-4. The maximum rotor blade diameter is expected to be 236 m, with a maximum blade tip height of 261 m above LAT and a minimum blade tip height of 22 m above LAT. The top of the wind turbine (the nacelle) will be approximately 160 m above LAT. A scheme for wind turbine lighting and navigation marking will be agreed with consultees post-approval.

The layout of the wind turbines will be developed to best utilise both the available wind resource, while ensuring environmental effects and impacts on other marine users (such as fisheries and shipping routes) are minimised. As mentioned above there are currently three turbine design options planned. The final layout of the wind turbines will be confirmed at the during development of the ESIA. Indicative turbine layout is presented in Figure 3-5. The array configuration is being agreed with the Ministry for Defence to minimise impacts on the adjacent military training area, and is likely to avoid overlap with the military zone.



1	Hub heights	156m
2	Rotor diameter	236m
3	Swept area	43,721 m²

Figure 3-3: Wind turbine design. (Firefly draft EIA, 2022)

Due to the water depths within the Offshore Project area, floating foundation turbines are being proposed. Each turbine would require up to four mooring points (three to four anchors per turbine). To allow for flexibility in final design, two types of anchor are under consideration: suction anchors are the preferred option, with driven piles as an alternative. The anchors would be 5-16 m high with a weight up to 110 tonnes.

The design envelope of wind turbines is presented in Table 3-1.

Table 3-1: Design Envelope: Wind turbines.

Parameter	Maximum Design Envelope
Maximum number of wind turbines	54
Range of wind turbine capacity (MW)	15
Maximum rotor blade diameter (m)	236
Maximum hub height above LAT (m)	156
Maximum blade tip height above LAT (m)	257
Minimum blade tip height above LAT (m)	22-25
Length of mooring lines (water column) (m)	1,000
Length of mooring lines (seabed) (m)	50
Mooring line diameter (mm)	263 / 200
Number of Suction Anchor / Driven Pile	189 / 27
Number of anchors per mooring point	1
Number of anchors per WTG	4
Number of mooring points per anchor	3

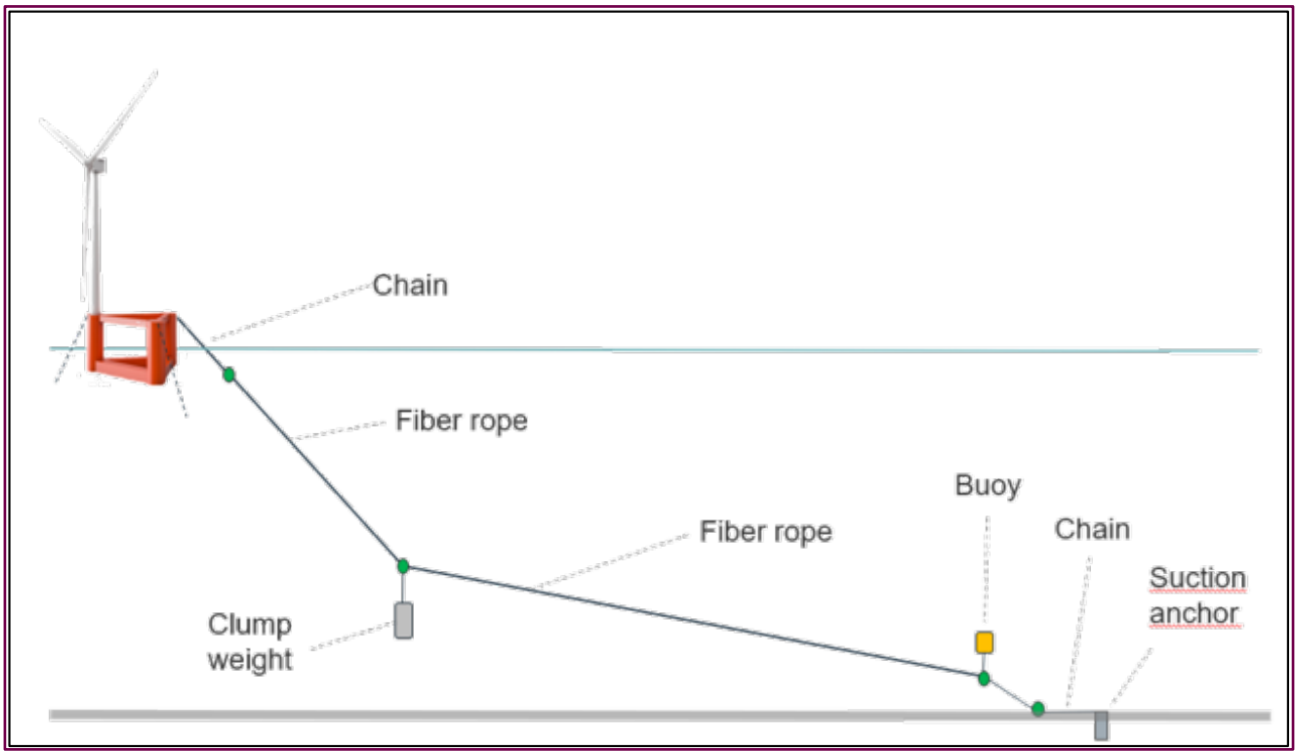


Figure 3-4: One of the options for mooring arrangement of floating WTG.

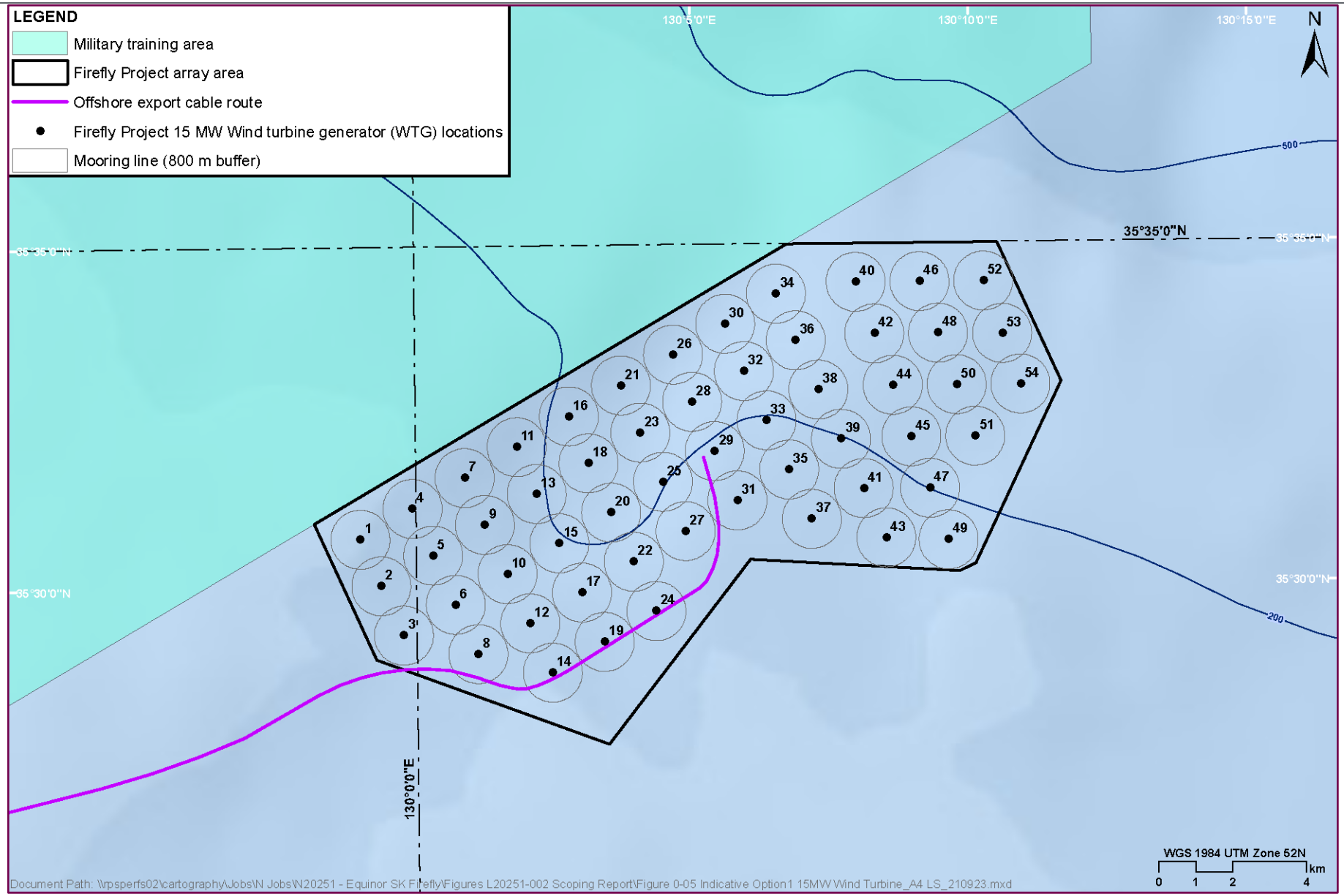


Figure 3-5: Indicative 15 MW Wind Turbine Generator locations.

3.5.2 Offshore Substation Platform (OSP)

One offshore substation (OSP) is proposed to collect and export (through the offshore export cable) the power generated by the turbines to the onshore substation. The purpose of the OSP is to transform the electricity generated by the wind turbines (at 66 kV) to a higher voltage (220 kV), allowing the power to be efficiently transmitted to shore.

3.5.3 Inter-array Cables

Inter-array cables carry the electrical current produced by the wind turbines to an offshore substation. A small number of wind turbines will typically be grouped together on the same cable 'string' connecting those wind turbines to the substation, and multiple cable 'strings' will connect back to each offshore substation.

The inter-array cables will be buried where possible and protected with a hard-protective layer (such as rock or concrete mattresses) where burial is not achievable, for example where crossing pre-existing cables, pipelines or exposed bedrock. If cable protection is required, the protection measure will be dependent on several factors such as seabed conditions, seabed sedimentology and the physical processes. The Project Description in the ESIA will provide further detail on the proposed cable installation methodology and potential cable protection measures..

3.5.4 Offshore Transmission Infrastructure

The offshore transmission system would comprise subsea export cables to transfer power to shore. The offshore export cables will have a maximum total length of 140 km, comprising up to two cables up to 70 km long. It is expected that a 230 kV High Voltage Alternating Current (HVAC) cable will be used for the offshore export cables. Each of these export cables will be buried to a depth of between 0.5 m and 1.5 m per cable within a cable corridor of a 1 km buffer around the route centreline. There is the potential for seabed preparation to be required prior to cable installation, with methods such as jet trencher, mechanic trencher or grapnel currently being considered. The scoping for the baseline studies and modelling assumes no drilling or blasting is required to install cables offshore.

The offshore export cable route is presented in Figure 3-1. the exact locations of the offshore export cables are yet to be determined and will be based upon geophysical and geotechnical survey information and the location of the OSP. This information will also support the decision on requirements for any additional cable protection. Flexibility is required in the location, depth of burial and protection measures for the export cables to ensure physical and technical constraints, changes in available technology and project economics can be accommodated within the final design.

It may be necessary to install cable protection to prevent cable exposure and minimise the risk of damage to the offshore export cables. The requirements for any cable protection (for example concrete mattresses, rock or artificial fronds) will be defined during detailed design and assessed within the ESIA.

3.5.5 Landfall

Equinor is currently considering the feasibility of construction at the preferred landfall location:

- Landfall 129° 21' 19.44" E, 35° 23' 54.75" N.

Equinor has refined the design to one landfall option for construction, to reduce impacts on adjacent landholders and other stakeholders and for better constructability. This lies on the northern side of the small coastal harbour. It is planned that Equinor and other developers will install eight pipes within the harbour and that each can carry transmission cables from offshore facilities. Two of the pipes will be used by Equinor Firefly Project and the remaining six by other developers. This is a requirement of KEPCO and is intended to minimise cumulative disturbance impacts through multiple shore-crossing constructions. Power export cables will be pulled through the pipes from an onshore construction area to the north of the harbour.

The selected installation method for the buried pipes will depend on pre-construction confirmation of ground conditions but would likely involve open-cut trenching or tunelling. The width of the open cut trench would depend on the cable requirements. Another method under consideration is installation of a sheet-piled bund, dewatering of the harbour and dry excavation and laying of the pipe in trenches.

A floating installation vessel using dynamic positioning (DP) is likely to pull the cable in to shore from the offshore array area. The offshore cables would then be jointed to the onshore cables at junction boxes on the landward side of the landfall site.

3.6 Onshore Infrastructure

The onshore transmission system would comprise export cables to transfer power from the landfall junction boxes to the onshore substation. The export cable is proposed to run underground from the coastal substation to the Sinosan Substation approximately 5 km to the north west. The earth excavated during installation will be stock-piled in open industrial land near the coast and disposed of wither as fill in the planned port expansion project, or to landfill according to Korean regulations and permits at the time. These permits are not part of the ESIA process.

The onshore export cables will have a maximum total length of 5.2 km and will be buried within a cable corridor. For installation of the onshore cable, open cut and tunnelling will be used one after another along the cable route as shown in Figure 3-2.

3.7 Construction

The Project is likely to be constructed over a period of 22 months (2024 Jan – 2025 Oct) with the general construction series outlined below:

- Foundation installation;
- OSP installation/commissioning;
- Inter-array cable installation;
- Offshore and onshore export cable; and
- Wind turbine installation/commissioning.

The offshore construction phase will be supported by various vessels including jack-up or floating Heavy Lift vessels (HLV), survey vessels, cable lay vessels, pre-lay survey vessels, crew transfer vessels, scour/cable protection installation vessel, tug/anchor handlers, service and commissioning support vessels, and guard vessels.

Wind turbines, floating turbine platforms and the mooring system for each turbine (ropes, chains, buoys, anchors) will be transported from the pre-assembly harbour where sub-assemblies (nacelle, rotor blades and towers) will be loaded onto an installation vessel or support vessel. At the installation location, the wind turbine tower will be erected first, followed by the nacelle and blades. The blades may be installed one at a time or may be pre-assembled. Following installation of the wind turbine and connection to the necessary cabling, a process of testing and commissioning will be undertaken.

3.8 Operation and Maintenance

The Project is designed to operate with minimal daily intervention over its lifetime of 25 years from October 2025 to October 2050. Once commissioned, the Project will operate automatically, with each individual WTG operating independently. Operations and maintenance works will be conducted from either a Crew Transfer Vessel (CTV) or Service Operations Vessel (SOV). An Operations and Maintenance (O&M) is planned to be constructed near the onshore substation area for effective implementation of O&M. The detailed description and its potential impacts will be described in the ESIA report.

Typical operation and maintenance activities include:

- Inspection and maintenance of foundations and ancillary equipment;
- Inspection and maintenance of wind turbines and OSPs, including:
    - Local resets;
    - Scheduled maintenance;
    - Unscheduled maintenance; and

- Inspection and maintenance of inter-array cables and offshore export cables.

The details of estimated annual and total operations and maintenance activities will be detailed within the project description of the ESIA.

3.9 Decommissioning

Decommissioning will likely consist of the reversal of the installation process and impacts from decommissioning will be considered similar to those during construction. Platforms, mooring lines and WTGs will be returned to local ports for disassembly, recycling and disposal. A decommissioning plan will be submitted to the appropriate regulator for their approval prior to the decommissioning of the Project. This process will take into consideration the best industry practice at the time. It is expected that the decommissioning process of the offshore wind array will utilise similar vessels to the installation and will require a similar time frame.

4 STAKEHOLDER ENGAGEMENT

4.1 Context

The public participation process is one of the vital stages of an ESIA. IFC Performance Standards require that an ESIA is carried out with the participation of the concerned population through public consultations and public audiences, in order to gather the viewpoints of the population regarding the project. During the conduct of an ESIA, the public should be consulted within the project areas of influence. National law also requires community consultation as part of the prescribed EIA process.

4.2 Objectives

Stakeholder engagement objectives include:

- Bring the affected and interested stakeholders and representatives of the local population into the decision-making process to foster justice, equity and potential collaboration;
- Inform and educate the stakeholders on the proposed project and its consequences;
- Gather data and information from the public about their human (including cultural, social, economic and political dimensions) and biophysical environment and other relations;
- Provide opportunities for stakeholders to discuss their opinions and concerns;
- Manage expectations and misconceptions regarding the project; and
- Obtain information to fine-tune the development of appropriate mitigation and management measures, as well as to identify the institutional arrangements for effective implementation and monitoring of the elaborated environmental management measures.

4.3 Stakeholder Consultation Process

The stakeholder engagement process is described separately in Equinor's Stakeholder Engagement Plan (SEP). The SEP is a public document that describes Equinor's approach to stakeholder engagement. The SEP will be published for public comment at the same time as this Scoping Report goes through public review, so stakeholders will have an opportunity to contribute to the consultation approach early in the project planning phase. The SEP and the Scoping Report will be published on the website for Equinor's Firefly Project (Equinor Firefly Floating Offshore Wind-To Get There,Together (fireflywind.com)).

The SEP describes Equinor's transparent approach to sharing project information, and how stakeholders can have meaningful engagement with Equinor. The plan also describes how Equinor will report back to the community on how their input was considered.

A grievance mechanism is also included in the SEP which provides an avenue for stakeholders to escalate issues should they feel they have been unfairly treated, or their issues have not been reasonably considered.

4.3.1 Regulator Engagement

As part of the Korean EIA process, engagement has been undertaken and considered while developing the scope of the ESIA. The preliminary EIA application (Scoping Report) has been evaluated by MOTIE on 8 June 2022 and comments provided on the scope of the assessment. The draft EIA application has been evaluated by MOTIE and public consultation agencies per local legislation on 8 December 2022, with comments provided on the draft EIA. These comments have been incorporated into the ESIA assessment methodology where relevant. The EIA process will further have MOTIE and relevant regulators and public consultation agencies engaged in the stakeholder consultation process.

For other related local regulatory process, engagement has been and will further be undertaken with relevant public authorities for the following consents and consultations:

- Military Operations Review (Radar Impact Assessment; RIA)
- Maritime Traffic Safety Assessment (MTSA)
- Underwater Cultural Heritage Investigation (underwater CHI)

- Disaster Impact Assessment (DIA)
- Fishery Loss Impact Study and Fisheries Loss and Damages Study

Information about the progress of these consents can be found on Firefly project website (Equinor Firefly Floating Offshore Wind-To Get There,Together (fireflywind.com)), and the progress of the EIA has been and will further be publicly registered in the EIA Support System (EIASS) according to the local regulation, a web-based EIA information system managed by the Ministry of Environment (MOE).

4.3.2 Engagement with other Stakeholders

As another part of the Korean EIA process, engagement with local non-public stakeholders has been undertaken and reflected in the development of the scope of the ESIA. Information Session for local residents on the draft EIA application took place according to the local legislation on 23 November 2022, taking opinions of the residents to reflect on the further project development. As due amount of request for Public Hearing has been made as following the Information Session, a Public Hearing session will be prepared to further ensure engagement of local stakeholders. Beyond the legally required process, a stakeholder engagement log for the project has been recorded and kept by Equinor. The contents of such local engagement will also be incorporated into the ESIA assessment methodology where relevant.

Below is a brief summary of the type of stakeholders of this project that Equinor recognizes:

- Governent stakeholders: this includes national government departments and agencies, and local City and County officials.
- Offshore zone stakeholders: all stakeholders that may be directly impacted by the construction and/or operation of the Project's offshore zone (array area, offshore cable corridor, and adjacent areas) and its related works.
- Onshore zone stakeholders: all stakeholders that may be directly impacted by the construction and/or operation of the Project's onshore zone (onshore substation, onshore cable corridor, and adjacent areas) and its related works.
- Stakeholders for wider consultation: interested individuals or parties who are not within the core consultation zone. Per the SEP, Equinor is committed to ensuring that these interested parties still have an opportunity to view Equinor's proposal and have their say.
- Hard-to-reach groups: individuals or groups that may have difficulties taking part in the consultation process for a range of reasons (e.g. COVID-19 pandemic or the instance of any future recurring or regional lockdown measures).

The overview of the stakeholder engagement timeline for the project is shown in

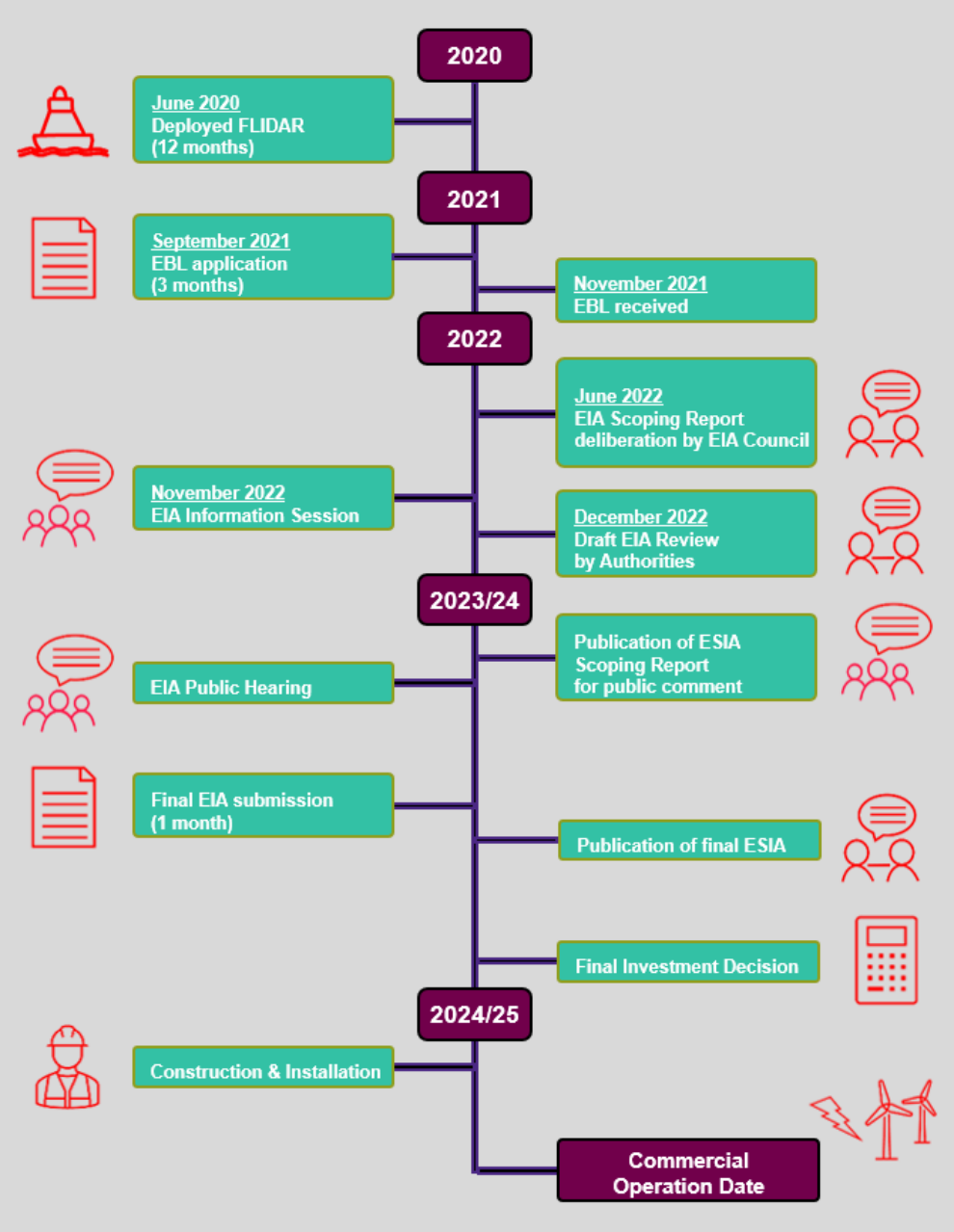


Figure 4-1.

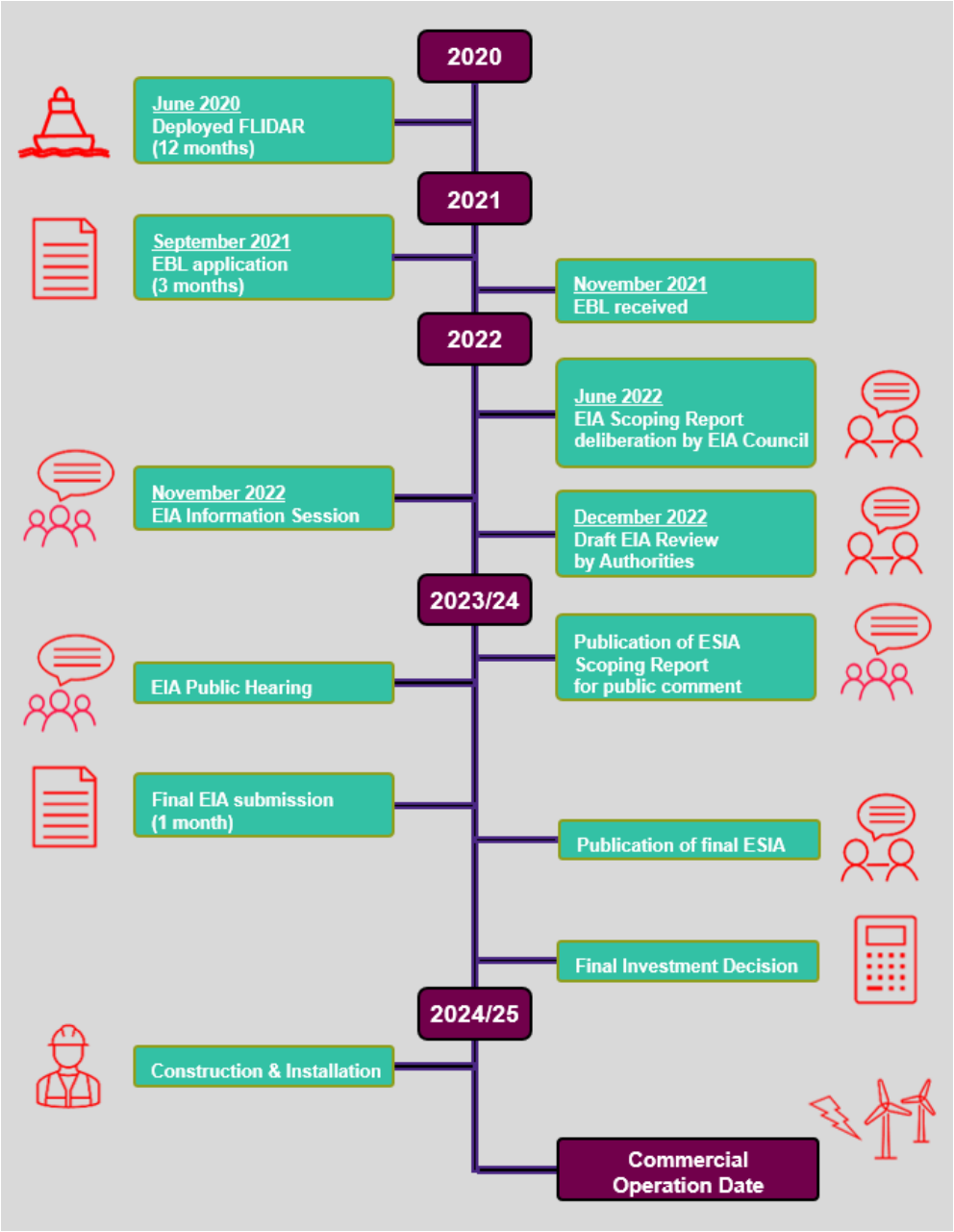


Figure 4-1: Stakeholder engagement timeline.

5 ESIA METHODOLOGY

5.1 Introduction

This section presents an outline of the ESIA methodology to be employed for the Project. It outlines the methods for the identification and evaluation of potential likely significant environmental effects and also presents the methods for the identification and evaluation of potential cumulative and interactive impacts and potential transboundary effects.

A systematic and auditable evidence-based approach is proposed to evaluate and interpret potential effects on physical, biological and human environment receptors.

5.2 Approach to the Scoping and ESIA

The ESIA is an interactive process relying on the professional interpretation of environmental, technical and regulatory information. The ESIA will include a description of stakeholder engagement activities and outcomes from those engagements undertaken at various stages throughout the process.. The ESIA process is outlined in Figure 5-1.

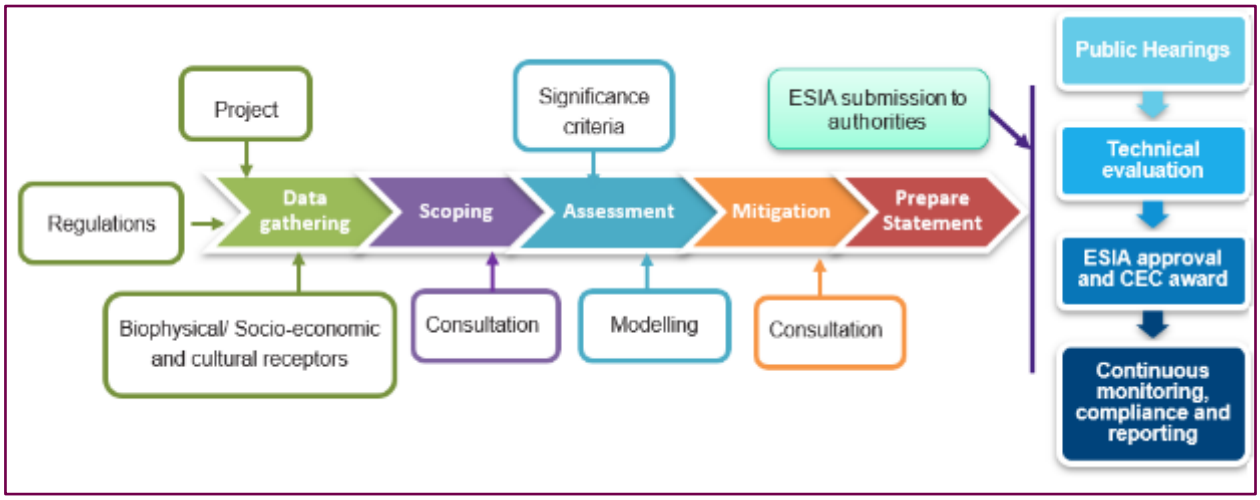


Figure 5-1: ESIA Process.

5.3 Project Design Envelope Approach

The Project Design Envelope (PDE) approach (also known as the Rochdale Envelope Approach[4]) will be adopted for the assessment of the Project. The PDE concept allows for some flexibility in project design options, particularly for foundations and wind turbine type, where the full details of a project are not known at the time of writing the ESIA.

Whilst a range of options may be included in the PDE, sufficient detail is available to enable all environmental impacts to be appropriately considered, within a maximum design scenario, as part of the ESIA. For each impact assessment the maximum design scenario from within the range of potential options for each development parameter will be identified, and the assessment will be undertaken on this basis.

For example, if several turbine types are possible, then the assessment of the Project will be based on the turbine type known to have the greatest impact. This may be the turbine type with the largest footprint, the greatest tip height or the largest area of seabed required during construction, depending upon the topic under

[4] The 'Rochdale Envelope' arises from two cases: R. v Rochdale MBC ex parte Milne (No. 1) and R. v Rochdale MBC ex parte Tew [1999] and R. v Rochdale MBC ex parte Milne (No. 2) [2000]. This approach requires consideration of the likely worst case in terms of variations within a project, but the detailed design of the Project and the variations should not vary beyond these limits.

consideration. If, after undertaking the impact assessment it is shown that no significant effect is anticipated, it can be assumed that any project parameters equal to or less than those assessed in the PDE will have environmental effects of the same level or less and will therefore also have no significant effect upon the receptors for the topic under consideration.

The PDE will also include a number of 'embedded' measures which will form part of the design of the Project. These standard measures applied to offshore wind development include lighting and marking of the wind farm, and as such, the determination of significance will consider implementation of these measures.

By employing the PDE approach the developer retains flexibility in design of the offshore wind farm and associated offshore infrastructure within certain maximum extents and ranges, all of which are fully assessed in the ESIA.

5.4 Iterative Approach

The approach to assessment will utilise an iterative approach, where impacts that are initially assessed as significant will be discussed with the Developer in order that changes to the design to reduce or offset the impact can be incorporated. The development of mitigation measures will also be considered as part of this iterative approach.

5.5 Identification of Impacts and Assessment of Significant Effects

5.5.1 Impacts and Effects

The Firefly Project has the potential to cause a range of impacts and effects with regard to the physical, biological and human environment. For the purposes of the ESIA, 'impact' will be used to define a change that is caused by an action. For example, burial of the offshore export cable will result in increased levels of suspended sediments (impact on water quality). Impacts can be defined as direct, indirect, secondary, cumulative and interactive. They can also be positive, neutral or negative, although the relationship between them is not always straightforward. In addition, for certain impacts, the reversibility of an impact is relevant to its overall effect. An irreversible (permanent) impact may occur when recovery, or restitution, is not possible, or not possible within a reasonable timescale. In contrast, a reversible (temporary) impact is one where natural recovery is possible over a short time period, or where mitigation measures can be effective in reversing the impact.

The term 'effect' will be used in the ESIA to express the consequence of an impact. Using the cable burial example again, the burial of the offshore export cable (action) results in increased levels of suspended sediments (impact), with the potential to disturb benthic habitats (effect).

In general, the ESIA will determine the magnitude of the impact, the sensitivity of the receptor, and the significance of the effect, following the methodology outlined below. There may be some variations to the general ESIA methodology where required by specific topic guidance, and where this is the case, this will be explained within each relevant topic chapter.

5.5.2 Defining Magnitude of Impact

The magnitude of an impact is the combination of extent, duration, frequency and reversibility of an impact. For each impact assessed within the ESIA, a magnitude will be assigned. For each topic, the magnitude of impact will be categorised into the below scale:

- Negligible;
- Low;
- Medium; or
- High.

Scales of magnitude will be defined for each subject area within the ESIA that is relevant to the particular receptor being assessed. Design of such topic-specific scales will draw upon relevant external guidance and specialist knowledge relevant to each topic.

5.5.3 Defining Sensitivity of Receptor

Receptors will be defined as the physical or biological resource or user group that would be affected by the potential impacts. Potential receptors will be informed by desktop and baseline studies.

In defining the sensitivity for each receptor, the vulnerability, recoverability and value/importance of that receptor will be taken into account.

The sensitivity of each receptor will then be defined for each topic according to the below scale:

- Negligible;
- Low;
- Medium; or
- High.

5.5.4 Evaluation of Significance of Effect

Effect is the term used to express the consequence of an impact (expressed as the 'significance of effect'). The significance of an effect will be determined by the consideration of the magnitude of impact alongside the sensitivity of receptor. In order to ensure consistency, a risk matrix approach will be adopted for the ESIA as presented below in Table 5-1.

Table 5-1: Typical risk matrix used for the assessment of the significance of the effect.

		Magnitude of Impact			
		Negligible	**Low**	**Medium**	**High**
Sensitivity of Receptor	**Negligible**	*Negligible*	*Negligible*	*Negligible*	*Minor*
	Low	*Negligible*	*Minor*	*Minor*	*Moderate*
	Medium	*Minor*	*Minor*	*Moderate*	*Major*
	High	*Minor*	*Moderate*	*Major*	*Major*

The significance of effect levels are defined as follows:

- **Major**: Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and/or breaches of legislation.
- **Moderate**: Intermediate change in receptor condition, which are likely to be important considerations at a local level.
- **Minor**: Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
- **Negligible**: No discernible change in receptor condition.

For the purposes of the ESIA, any effects with a significance level of 'Negligible' or 'Minor' will not be considered as significant. Effects with a significance level of 'Moderate' will be considered as potentially significant, and those with a significance level of 'Major' will be considered as significant.

5.6 Cumulative Impact Assessment

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to in this document as “developments”) when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognised as important on the basis of scientific concerns and/or concerns of affected communities.

The Cumulative Impact Assessment (CIA) will consider the likely cumulative impacts arising from the Project alongside the likely impacts of other development activities in the vicinity of the Project, based on publicly available information.

The following guidelines will be considered in undertaking the CIA:

- Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. Good Practice Handbook (IFC 2013).
- Canadian Environmental Assessment Agency’s Cumulative Effects Assessment Practitioners’ Guide (Hegmann *et al.* 1999).

A fundamental requirement of undertaking CIA is to identify those projects, plans or activities with which the Project may interact to produce a cumulative impact. This process is referred to as ‘screening’. A specialised process has been developed in order to methodically and transparently screen the large number of projects, plans and activities that may be considered cumulatively alongside the Project. This three-staged approach is used to gather information on other projects, plans and activities within the defined cumulative Zone of Influence (ZoI) for each topic considered in the ESIA. The initial long list of projects outlined in Stage 1 is reduced in Stage 2 on an assessment of criteria/assumptions used to determine whether to include or exclude other existing/approved developments. Information is then gathered on the projects, which is used to inform the topic-specific screening carried out by each topic specialist at Stage 3.

The CIA will be undertaken through review of existing Korean EIAs; ESIAs, strategic, regional, and/or resource planning documents; and reports from non-governmental organisations (NGOs), the scientific community, and other parties in South Korea. The status of each project will be identified (i.e. application, consented, under construction, operational) and approximate distances to the Project provided. In order to provide an initial screening of these projects, it is proposed that the following assumption will apply:

- Temporal Overlap: A construction commencement date of January 2024 has been assumed for the Project with one year construction period. Any licence/lease/consent which expires before end of 2024 will be excluded on the basis of no temporal overlap with the Project;

The list of other projects and plans will be tailored to the cumulative study area (or ZoI) identified for each of the key specialist disciplines. Based on our current understanding of the Project and the key sensitive receptors, it is expected that the largest ZoI will span the East Sea and Korea Strait to consider mobile species with large foraging distances associated with some seabird and marine mammal species. These projects and plans will then be screened in accordance with a set of defined criteria to identify projects for assessment in each chapter. The maximum design scenario for each relevant cumulative impact will be identified and assessed, and the CIA will be undertaken on the basis of information presented in the ESIA for the other projects, plans and activities. According to IFC PS 1, cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

The CIA will consider the following:

- Other project/plans currently under construction;
- Other projects/plans with consent;
- Other projects/plans in the consenting process; and
- Other projects/plans currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact.

5.7 Transboundary assessment

IFC PS1 requires Transboundary impacts to be considered. PS1 aims to prevent, mitigate and monitor environmental damage by ensuring that explicit consideration is given to transboundary environmental factors before a final decision is made as to whether to approve a project. Transboundary impacts will be determined as part of the ESIA.

A screening exercise has been undertaken to identify potential significant transboundary effects on another state arising from the Project (see Appendix A-1).

5.8 ESIA Structure and Content

According to the EP4, The EPFI will require the client to conduct an appropriate Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and scale of impacts of the proposed Project. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A and, as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA).

Under the Environmental Impact Assessment Act (EIA Act) of Republic of Korea, offshore wind projects with generation capacity exceeding 100 MW are required to complete an EIA to assess any impact the project may have on the environment and to implement any required mitigation measures. Following its act, an EIA report will be produced and relevant consultations will be held in line with the Korean legislation.

Alongside the Korean EIA, the ESIA will be developed as an ESIA bridging document, which will signpost to the Korean EIA as required, with additional sections developed to bridge the gap identified between the Korean EIA and an IFC compliant document. The ESIA will identify the environmental and social baseline surveys, information and data required to inform a financially acceptable ESIA using an approach to bridging the ESIA process to the EIA scoping and EIA process.

The impact assessment of ESIA will be undertaken in line with guidance by:

- Korean EIA Guidance Manual (2021);
- IFC (2019) International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. January 1, 2012 (updated June 27, 2019);
- Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019);
- A Review of Assessment Methodologies for Offshore Wind Farms (Collaborative Offshore Wind Research into The Environment (COWRIE) METH-08-08) (Maclean et al., 2009);
- Environmental impact assessment for offshore renewable energy projects (British Standards Institute (BSI), 2015); and
- IEMA Environmental Impact Assessment Guide to Shaping Quality Development (IEMA, 2015).

An indicative structure of the ESIA for the Project is set out in Table 5-2.

Table 5-2: Indicative structure of the Project offshore infrastructure ESIA.

Chapter	Chapter/Report
Chapter 1	Non-Technical Summary (NTS)
Chapter 2 - Project Overview	Introduction
	Description of Development
	Consideration of Alternatives
Chapter 3 – Administrative Framework	Korean Legislation and EIA Process
	International Agreements
	Equator Principals and IFC Performance Standards and Guidelines
	Equinor Policies and Management System
	ESIA Methodology

Chapter	Chapter/Report
Chapter 4 – Environmental Assessments (signposted to Korean EIA where possible)	Marine Processes
	Noise and Vibration
	Air Quality
	Hydrology and Hydrogeology
	Terrestrial Biodiversity
	Benthic Subtidal and Intertidal Ecology
	Fish, Shellfish and Sea Turtle Ecology
	Marine Mammals
	Ornithology - Onshore
	Ornithology - Offshore
Chapter 5 – Socio-Economic Assessments (signposted to Korean EIA where possible)	Commercial Fisheries and Aquaculture
	Shipping and Navigation
	Civil and Military Aviation
	Seascape, Landscape and Visual Amenity
	Marine Archaeology
	Infrastructure and Other Users
	Tourism and Recreation
	Cultural Heritage
	Traffic and Transport
	Waste
	Population and Human Health
	Major Accidents and Natural Disasters
Chapter 6 – Technical Appendices	Korean EIA
	Consultation Report
	Subsea Noise Technical Report
	Marine Mammals Noise Impact Assessment
	Collision Risk Modelling (CRM) - sea birds
	Civil Aviation Impact Assessment
	GHG Emissions Study
	Social impact Assessment
	Biodiversity Risk Assessment
	Rapid Cumulative Impact Assessment (CIA)
	Transboundary Impact Assessment
	Summary of Mitigation, Monitoring and Residual Effects
	Environmental and Social Management Plan

6 SCOPING OF ESIA

6.1 Area of Influence

The Area of Influence provides the physical and/or social extent over which the assessment will be performed. PS1 states that potential impacts should be identified with reference to a project's Area of Influence (AoI) (IFC, 2012a). PS1 defines the AoI as the area likely to be affected by:

1. A project, its activities (e.g. transport corridors) and directly owned facilities;
2. Developments that might predictably result from a project, such as housing (these may result later);
3. Impacts on biodiversity or ecosystem services upon which receptors are dependent;
4. Associated facilities (e.g., roads and utilities), which would not exist but for the project and are needed to make it viable; and
5. Cumulative impacts from the incremental impacts of a project together with existing, planned or reasonably defined developments.

The AoI (and associated Study Areas for which information is collated) will vary depending upon receptor and takes into consideration, receptor-specific sensitivities and factors. For example, a species and behaviour (mobility) and its potential to be spatially connected to the project's area of influence.

For the purposes of this scoping report, the AoI has been identified considering the maximum extent in which environmental and social receptors could be impacted by the project and its activities. The AoI for the offshore and onshore Project area defined for this document is presented below in Figure 6-1. Based on the understanding of the potential impacts from the offshore Project area the AoI extends 50 km from the proposed project area boundary shown in Figure 6-1 based on the potential extent of a fuel spill during project activities. For the purposes of onshore Project area the AoI extends 1km from the onshore project area boundary to account for onshore impacts during project activities (Figure 6-1).

For the purposes of each topic section a topic study area has been described. The study area for each topic and AoI will be further defined as the design envelope becomes further refined and site-specific data/ information becomes available. The outputs from modelling of underwater noised and fuel spills may also affect the final extent of the AoI.

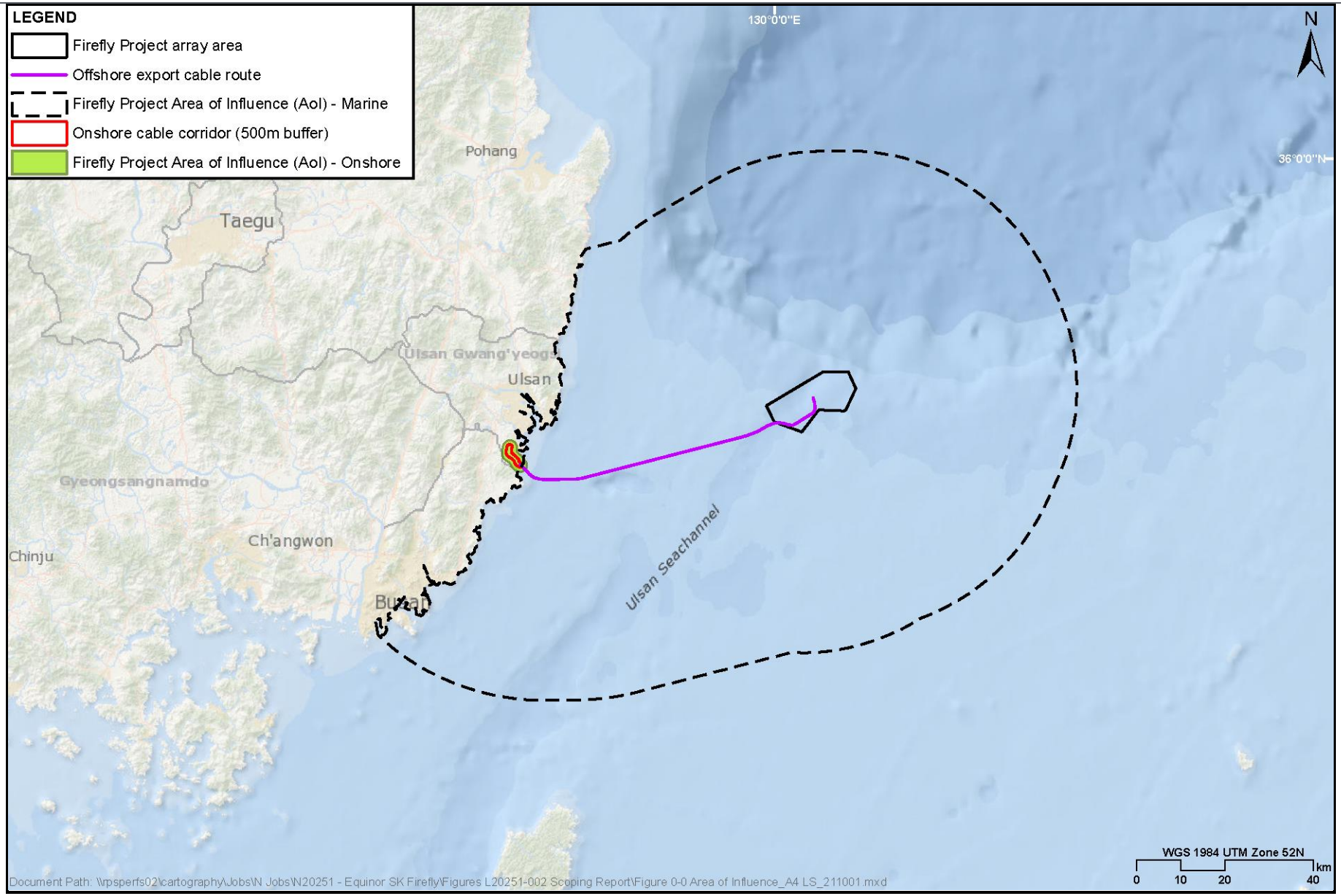


Figure 6-1: The Project Area of Influence (AoI), which extends 50 km from the centre of the array for the offshore project area and 1 km for onshore Project area.

6.2 Screening

The ESIA is responsible for assessing the potential impacts that the Project could have on the surrounding environment through development, operation and maintenance and decommissioning. The Project has the potential to cause a range of impacts on the physical, biological and human environment. The scoping process helps to identify significant impacts that could occur and then outline specific mitigation methods which will be used to reduce or remove these impacts. Impacts can be defined as direct, indirect, secondary, cumulative and interactive. Impacts can be both positive and negative given specific circumstances.

Continuing through the development phase until construction of the Project is complete, the ESIA process is systematic and involves a detailed understanding of both the project and the surrounding environment. This process helps to illustrate the effects on certain receptors within an AoI from the development.

A high-level appraisal of potential impacts is presented herein, drawing on best judgement of the available data and relevant professional expertise. The following steps will be undertaken in refining the assessment as the project develops:

- Comprehensive review of the available existing information;
- Review the potential impacts that could be expected to arise from Project;
- Impacts which have been fully considered, but are found to be insignificant will be scoped out of the planned ESIA;
- If impacts are considered to need assessment at the ESIA phase, a determination on whether the available data is satisfactory to conduct full ESIA assessments with assurance will need to be undertaken;
- Identification of additional data surveys and modelling will be required to carry out an effective ESIA because available data is insufficient.

A list of environmental topics to be further examined within the ESIA regarding the Project based on the current Project design and likely effects is provided in Table 6-1.

Table 6-1: Identified interactions from the effects of the Projects activities on identified environmental and social topics.

Environmental Topics	Noise & vibration	Light	Accidental Discharges	Presence of substation and onshore export cable	Presence of FOWF and export cable	Vessel Operations	Introduced Marine Species	Seabed Disturbance
Marine processes					x			x
Benthic Ecology	x		x		x		x	x
Fish, shellfish, and sea turtle ecology	x		x		x	x	x	x
Marine Mammals	x	x	x		x	x		
Offshore Ornithology	x	x	x		x	x		
Commercial Fisheries and Aquaculture	x	x	x		x	x		x
Shipping and Navigation		x			x	x		
Civil and Military Aviation		x			x			
Seascape, landscape, and visual amenity		x			x			
Marine Archaeology					x			x
Infrastructure and Other Users						x		
Air Quality and Climate				X		x		
Population, Human Rights and Human Health	x		x					
Tourism and Recreation	x	x	x	X	x			
Terrestrial Biodiversity	x	x	x	X				
Land and Agriculture				X				
Soil Geology and Hydrogeology				X				
Cultural Heritage				X				
Traffic and Transport				X				
Waste			x	X		x		

Environmental Topics	Noise & vibration	Light	Accidental Discharges	Presence of substation and onshore export cable	Presence of FOWF and export cable	Vessel Operations	Introduced Marine Species	Seabed Disturbance
Major Accidents and Disasters			x			x		

6.2.1 Topics and receptors to be scoped out

Given the very low level of existing baseline information available at the time of this initial screening and the potential for project design changes, no offshore aspects or receptors can be screened out at this stage. It is expected that some aspects and receptors will be identified that will not need to be addressed in this ESIA because they are not relevant in assessing the impacts and risks associated with the project. The list is expected to develop as the studies progress and more data become available, for example through consultation and undertaking surveys.

Taking into account the findings of the studies detailed below, together with knowledge of the Project and surrounding area, it is proposed that the following topics are not included in the scope of the ESIA:

- Daylight, sunlight and microclimate. Due to the location of the Project and the nature of the surrounding land use it is not considered likely that the proposed development will have significant effects in relation to daylight and sunlight. In addition, the nature of the Project is not likely to result in microclimate changes and therefore this topic is also scoped out of the assessment.
- Radiation and heat. Given the nature of the Project, no significant radiation or heat effects are anticipated, and these effects have been scoped out of the assessment.

6.3 Marine Processes

This ESIA chapter will consider the potential impacts the Project could have on marine processes during the construction, operational and maintenance and decommissioning phases of the Project. The baseline has been established through the use of data on bathymetry, tidal regime, meteorological information, wave climate and seabed sediments. To provide a wider context, the desktop review has considered the marine processes within the broader offshore area in proximity to the Project. Key data sources are listed in Table 6-2, noting that this list is not exhaustive.

Table 6-2: Key sources of information for the marine processes baseline.

Data	Description	Source
Jinha Observation Buoy measurements	Current data from February, May, August, and October 2020 was collected from the Jinha Ocean Observation Buoy, located adjacent to the project offshore cable landfall.	Korea Meteorological Association, 2020
Ulsan Ocean Buoy measurements	Monthly wave data including significant wave height, period and wave direction were recorded at the Ulsan Ocean Wave buoy over a 12-month timeframe.	Korea Meteorological Association, 2020
Current observation in the Korea/Tsushima Strait	Current measurements were collected from, the Korea/Tsushima Strait from 1999-2000 to successfully investigate variations.	Teague *et al*., 2002.
Variation of Korea Strait Bottom Cold Water and bottom current	Assessing seasonal variations in the Korea Strait Bottom Coldwater (KSBCW) and bottom currents.	Kim *et al*., 2006
Surface currents in the Tsushima Strait	Seasonal variations of surface currents in the Tsushima Strait, South Korea measured by HF radar technology.	Yoshikawa, 2010
Core sediments from the East Sea	Stratigraphical and sedimentological core samples from Ulleung Basin, East Sea were analysed to investigate substrate composition.	Park *et al*., 2002
Sediment resuspension case study of Ulsan, Korea	Analysing the dynamics of sediment resuspension in the inner Harbour under various forcing conditions: Case study of Ulsan, Korea.	Ha *et al*., 2020
Sediment transport systems in the East Coast of Korea	Analysis and observation on the sediment transport system in the East Coast of Korea.	Shim *et al*., 2020

6.3.1 Baseline Environment

6.3.1.1 Bathymetry

The array area and offshore export cable corridor are located in water depths ranging from 0m LAT to 434 m (offshore). Within the array area water depths range from -143 m to -325 m approximately (Figure 6-2).

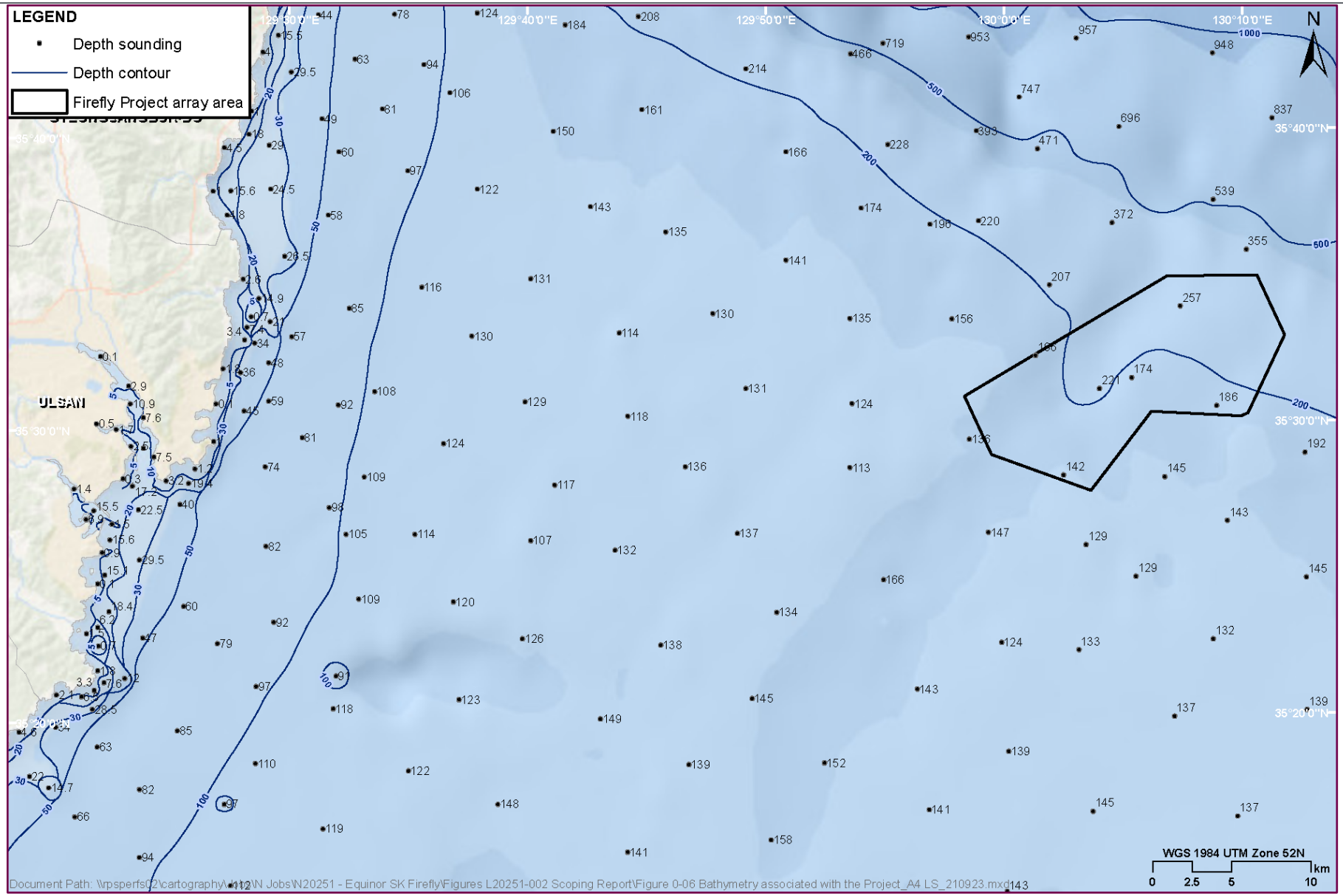


Figure 6-2: Bathymetry associated with the Project.

6.3.1.2 Currents

Current data was extracted for February, May, August, and October of 2020 from the Jinha Ocean Observation Buoy located adjacent to the project offshore cable landfall approximately 45 km from the centre of the array area Figure 6-3.

Table 6-3 provides a summary of the data collected while Table 6-4 present the time series of current speed and direction observed. The residual current provided in Figure 6-4 represents the current speed and direction calculated from the average values of the eastern component (U) and northern component (V) of the observed data. Observed current data were divided into Flood currents and Ebb currents.

The main direction of the residual current was SSW, and speed was the largest at 8.8 cm/s in October and the smallest at 3.6 cm/s in August. In the flood current, the maximum current speed was 109.3 cm/s in October, 82.1 cm/s in August, 70.6 cm/s in February, and 61.8 cm/s in May. In Ebb current, the maximum current speed was 63.1 cm/s in October, 63.1 cm/s in August, 59.7 cm/s in May, and 46.6 cm/s in February (Table 6-4).

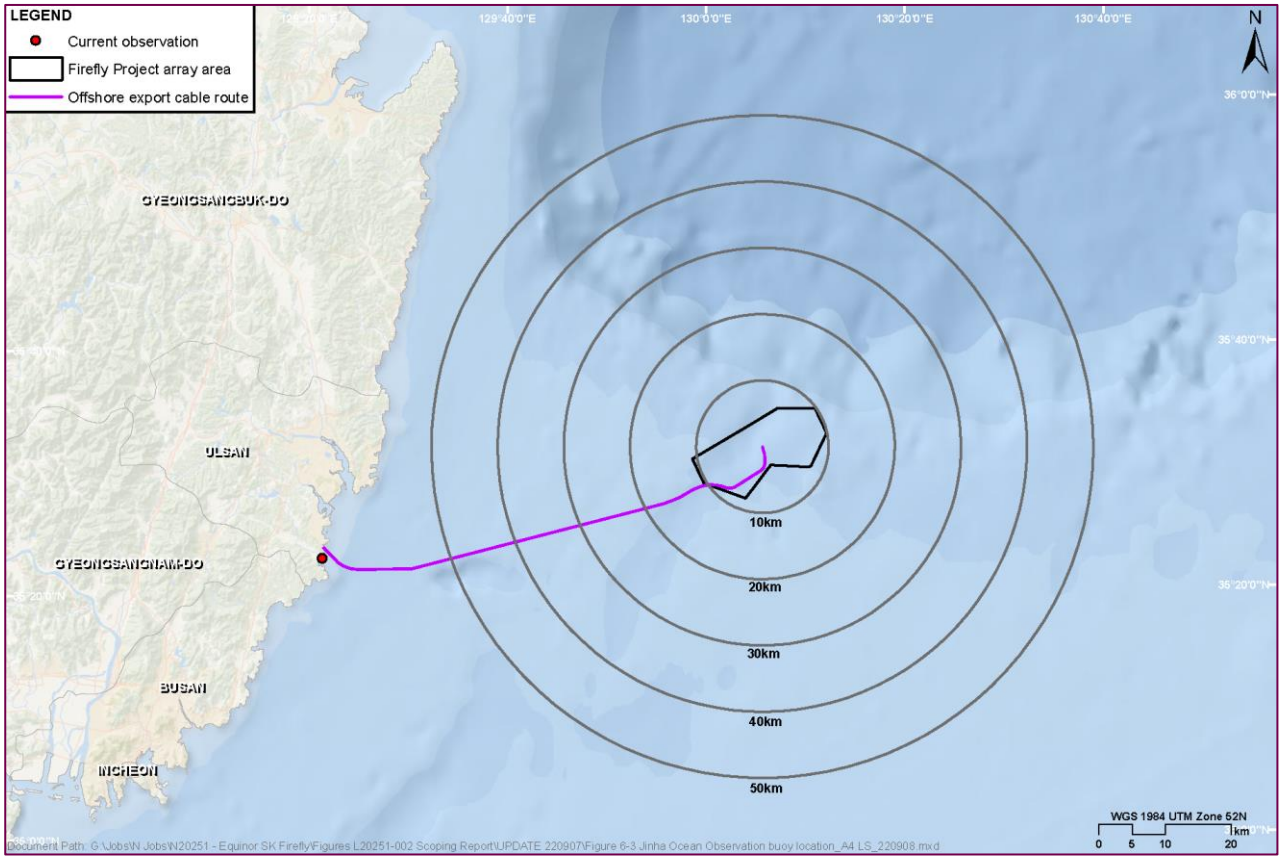


Figure 6-3: Jinha Ocean Observation buoy location.

Table 6-3: Summary of current speed and direction from the Jinha Buoy.

Month	Residual		Flood		Ebb	
	Speed (cm/s)	Direction (degrees)	Max. current speed (cm/s)	Dominant Current direction (degrees)	Max. current speed (cm/s)	Dominant Current direction (degrees)
Feb.	6.6	202	70.6	182	46.6	5
May	5.7	203	61.8	170	59.7	286
Aug.	3.6	193	82.1	284	63.1	10
Oct.	8.8	197	109.3	171	65.7	41

Scatter plots detailing and illustrating the current direction at the Jinha Ocean Observation Buoy during February, May, August, and October of 2020 are presented in Figure 6-4. The current direction, which was observed seasonally, showed an overall distribution in the north-south direction, and the flow velocity was larger in August and October than in February and May (Figure 6-4).

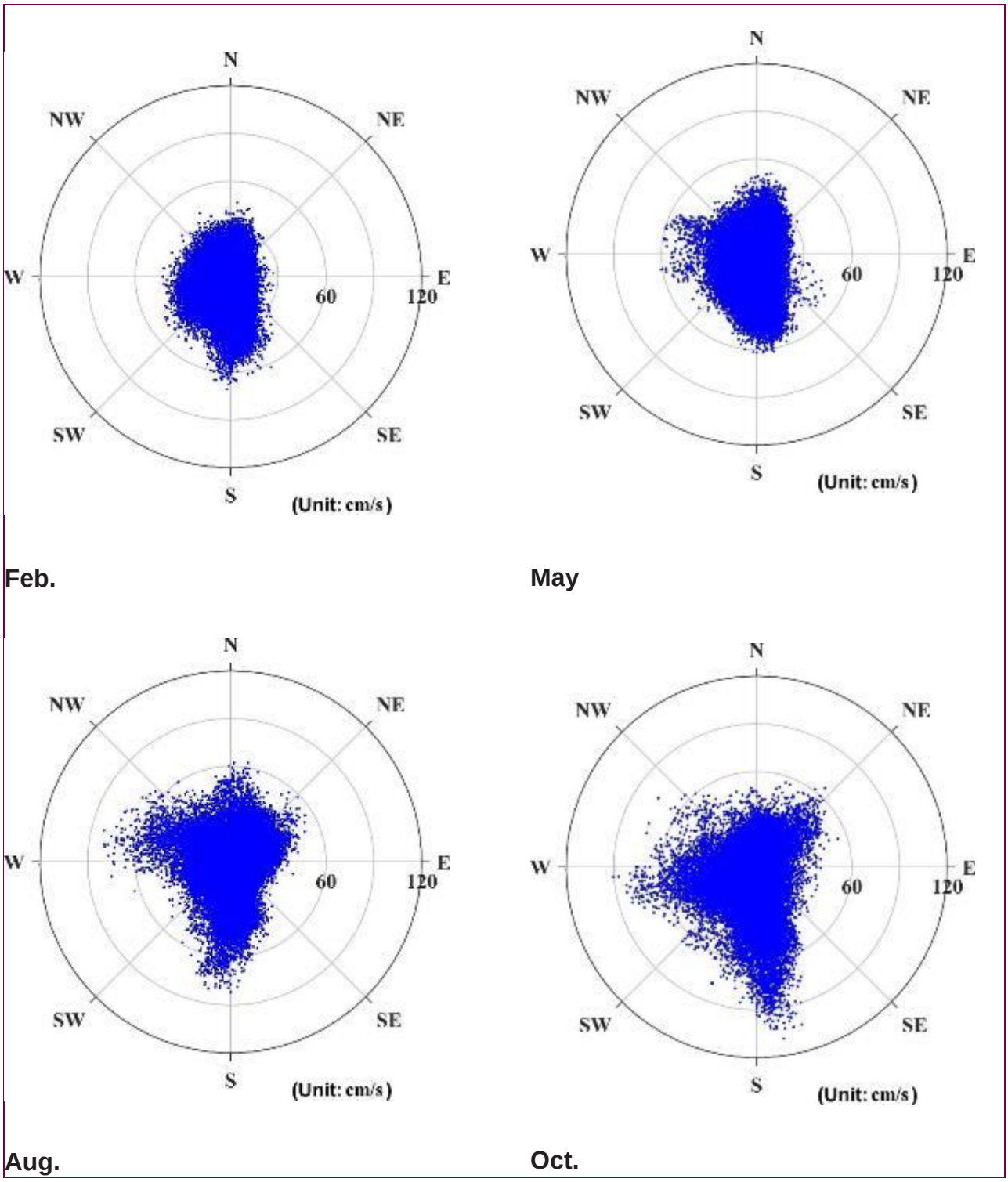


Figure 6-4: Scatter Plot of Jinha Ocean Observation Buoy illustrating current direction by season.

6.3.1.3 Waves

Wave data was extracted over a period of 12 months from 01 January 2020 to 31 December 2020 from the Ulsan Ocean Observation Buoy located approximately 30 km to the south/southwest of the central point of the array area (Figure 6-5).

The data were analysed using monthly statistics for significant wave height by wave direction and significant wave height by wave period. A summary of the data collected is shown in Table 6-4.

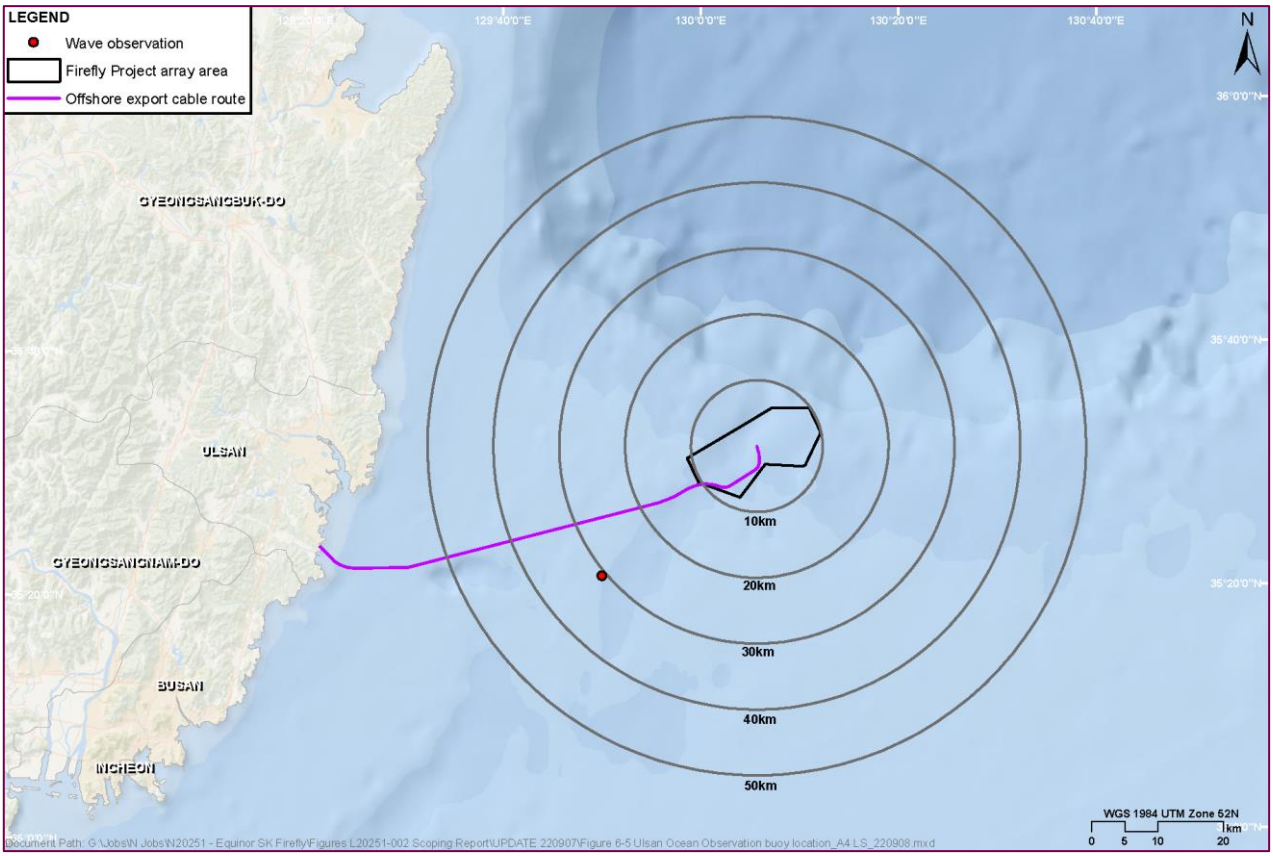


Figure 6-5: Ulsan Ocean Observation buoy location.

The maximum wave height was identified as 8.7 m in September, and the highest average wave height was 1.8 m in January and September with a standard deviation 1.3 m.

Significant wave height and wave direction presented monthly are provided in Appendix A-2. From January to March and September to December, waves from the northeast prevail. From April through to August waves from the southwest prevail, except for July where it was identified waves from north and south direction were dominant.

Wave heights of 1-2 m were identified in January through April, decreasing to less than 1 m between all months between May and December except for September. In September, wave heights of 2-4m were identified.

Wave period were generally ranged between 5 and 10 seconds.

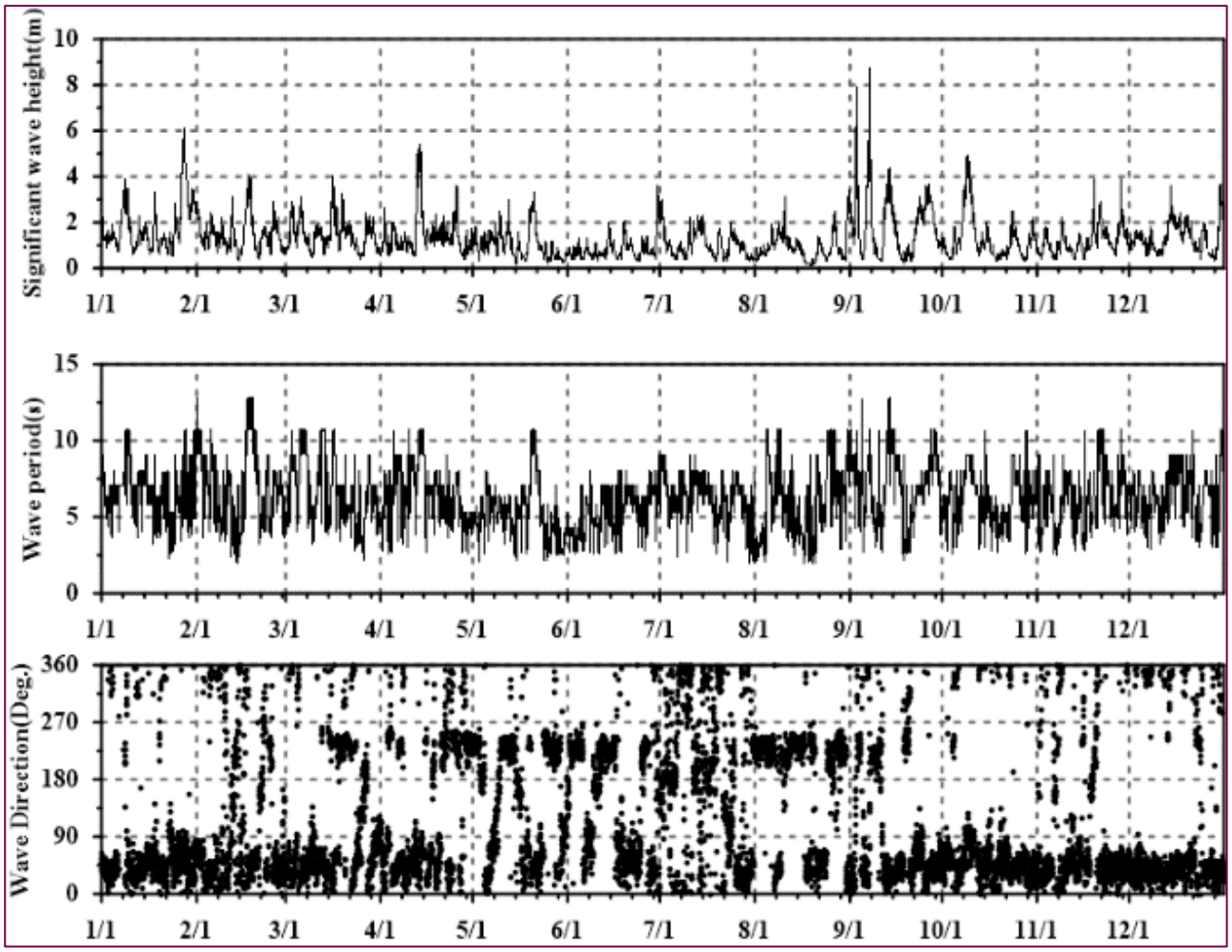


Figure 6-6: Significant wave height, wave period and wave direction time series (Ulsan Ocean Observation Buoy).

Table 6-4: Monthly statistical analysis of Significant Wave Height (m) (Ulsan Ocean Observation Buoy).

Month	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
Maximum	6.1	4.1	4.0	5.4	3.3	3.6	3.0	3.4	8.7	4.9	3.9	3.7
Minimum	0.5	0.3	0.4	0.4	0.2	0.3	0.3	0.1	0.2	0.3	0.4	0.3
Average	1.8	1.4	1.4	1.5	1.0	0.8	1.0	0.9	1.8	1.3	1.2	1.3
Standard deviation	1.0	0.7	0.6	0.9	0.6	0.5	0.6	0.6	1.3	0.9	0.6	0.7

Two Lidars were deployed Wind Power AS (Equinor) between June 2020 and December 2021 to collect real-time profiling and meteorological data at two points within the array.

A summary of the data is shown in Table 6-5 and Table 6-6 below.

Table 6-5: Summary Windspeed Lidar Data at 100m

Lidar reference	Mean Windspeed	Maximum Wind speed	Wind Direction (.15% Occurrence)	Mean Turbulence Intensity
Equinor #1	8.47 m/s	41.87 m/s	No dominant wind direction	0.12
Equinor #2	8.52 m/s	43.30 m/s	No dominant wind direction	0.12

Table 6-6: Summary Wave Data

Lidar reference	Mean Significant Wave Height	Maximum Wave Height	Wave Direction (.15% Occurrence)	Mean Wave Period (Tm)
Equinor #1	1.28 m	16.77 m	No dominant wave direction	5.11 s
Equinor #2	1.31 m	13.03 m	No dominant wave direction	5.15 s

6.3.1.4 Sedimentology

Core samples obtained from the southwestern margins of the East Sea were analysed and found to consist predominantly of muddy sediments and silty sands with overall grain size decreasing as the distance from the coastline increased (Park *et al*., 2002; Kim *et al.,* 2001). Surface sediment samples collected as part of identification of benthic fauna near to and within the Project area described in Section 6.4.1 was comparable to the studies referenced above with sediments generally comprising of high silt fractions and low fractions of sand. Sand fractions were found to decrease further with increasing distance offshore (Section 6.4.1).

6.3.1.5 Suspended Sediments

Energetic conditions around the Korean Peninsula begin late October each year with monsoonal winds that produce outpourings of cold air and initiate sediment resuspension and southern flowing currents (Wells, 1988). During the transition from summer to winter, suspended sediment concentrations vary greatly in surface and bottom waters, with the highest concentrations occurring off the southwestern point of the Korean Peninsula and the lowest occurring centrally within the Korean Strait (Wells, 1988).

Bottom mooring data were collected from the inner Onsan Harbour off the coast of Ulsan from July 5 2016 to August 5 2016 using 1200-Hz acoustic Doppler current profiler (ADCP) technology (Ha *et al*., 2018). Mean volume backscattering strength (MVBS), which can be used as a proxy for suspended sediment concentrations (SSC), continually exhibited signs of resuspension under various forcing conditions such as tides, precipitation, and wind (Ha *et al*., 2018).

6.3.1.6 Sediment Transport

Korea's slope along its east coast is relatively steep, resulting in waves propagating from the open ocean and having a direct effect on local sediment transport which alter the marine environment through erosion and accretion (Shim *et al*., 2020).

Sediment transport and seasonal destratification could potentially depend on intensity and timings of local monsoonal surges (Wells, 1988). Monsoonal winds that arrive late in the season effectively allow waters to persist in a moderately stratified summer condition, while early winds tend to mix the water column which results in increased concentrations of suspended sediments from surface to bottom waters (Wells, 1988). It was found that these bands of turbid coastal waters end 25-50 km offshore and wind-driven water flows to the south, transporting significant volumes of water into the Korea Strait (Wells, 1988).

Recent findings show that the east coast of Korea, an area comprising monotonous lengths of coastline, can observe accretion and erosion at a repeated rate due to seasonal influences (Shim et al., 2020). Due to sea level rise and irregular climates resulting from the ramifications of climate change, the frequency and period of high wave groups has increased, causing large-scale morphological change accelerating beach erosion along the east coast of Korea (Shim et al., 2020). This was most recently observed during field operations, where wave heights over 3 m were increasingly observed along the east coast of Korea (Kim and Shim, 2014; Kim *et al*., 2019).

6.3.1.7 Sediment Contamination

The sediments associated with area are predominantly located in a locality likely to present contaminant concentrations at background levels due to low levels of anthropogenic activities in the array area. However,

there is the potential for contamination within the south-west section of the array area that overlaps within an existing waste disposal ground know as East-J (Figure 6-7). East-J extends over an area 1,064 km^2 with an average depth of 150 m. Historical waste disposal within the array area has predominantly been from the disposal of livestock excreta (closed since 2012), manure (closed since 2013) and wastewater (closed since 2016). Currently fishery processing remnants and dredge material are disposed here. Since 2012 there has been no disposal of non-dredge material within the disposal ground except for 2019 when 27,000 m^3 of material was disposed. Dredge material has been disposed within the disposal ground each year since 2004 ranging between 84,000 m^3 and 2,328,000 m^3 of material per year up to 2020.

Responsibility zones illustrated in Figure 6-8 were introduced in 2007 to ensure that dumping points closest to land were not becoming overly accumulated and therefore, vessels were required to dispose of waste materials on designated areas within the G-1 and G-2 zones (Song et al., 2015).

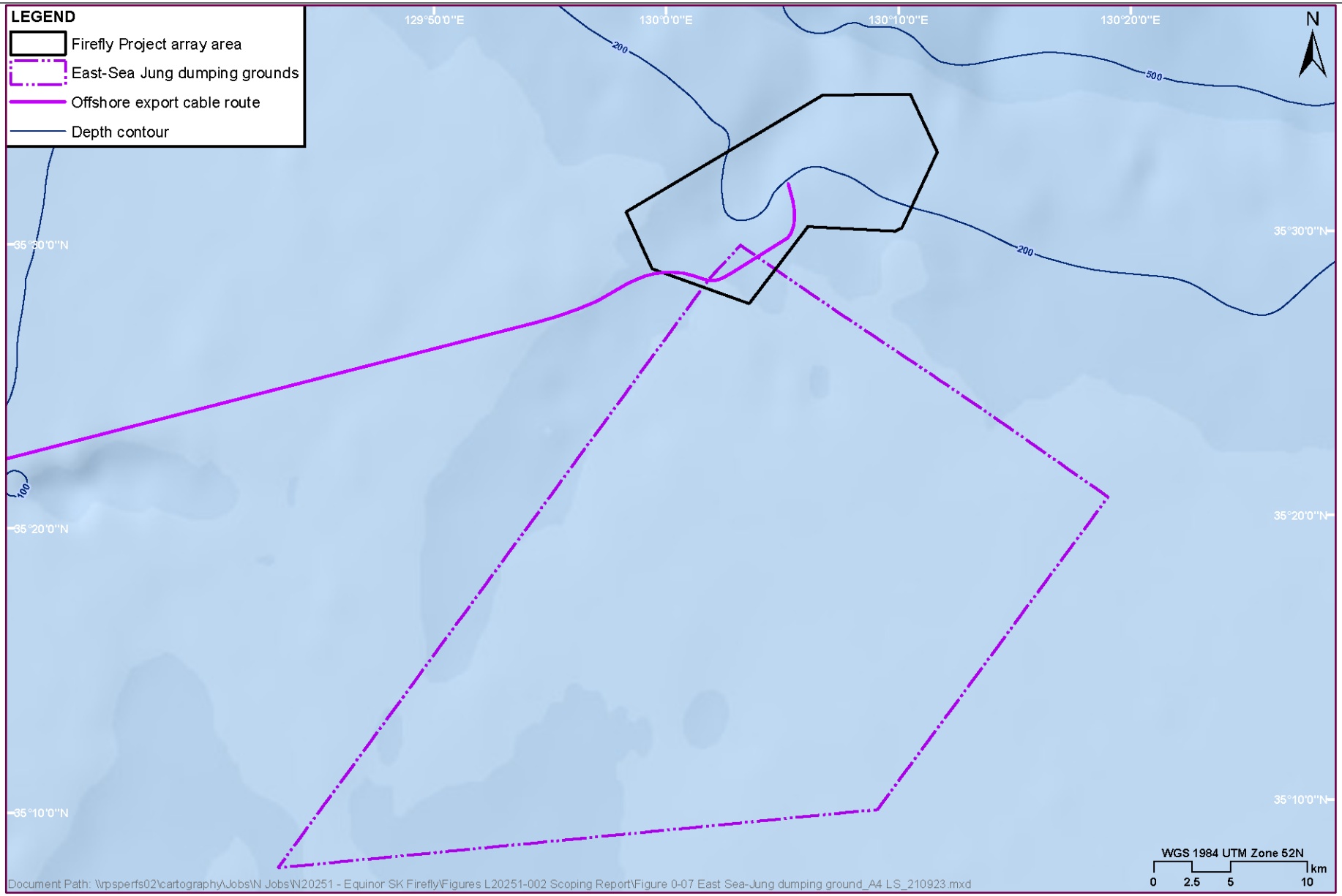


Figure 6-7: East Sea-Jung dumping grounds depicted in proximity to the array area.

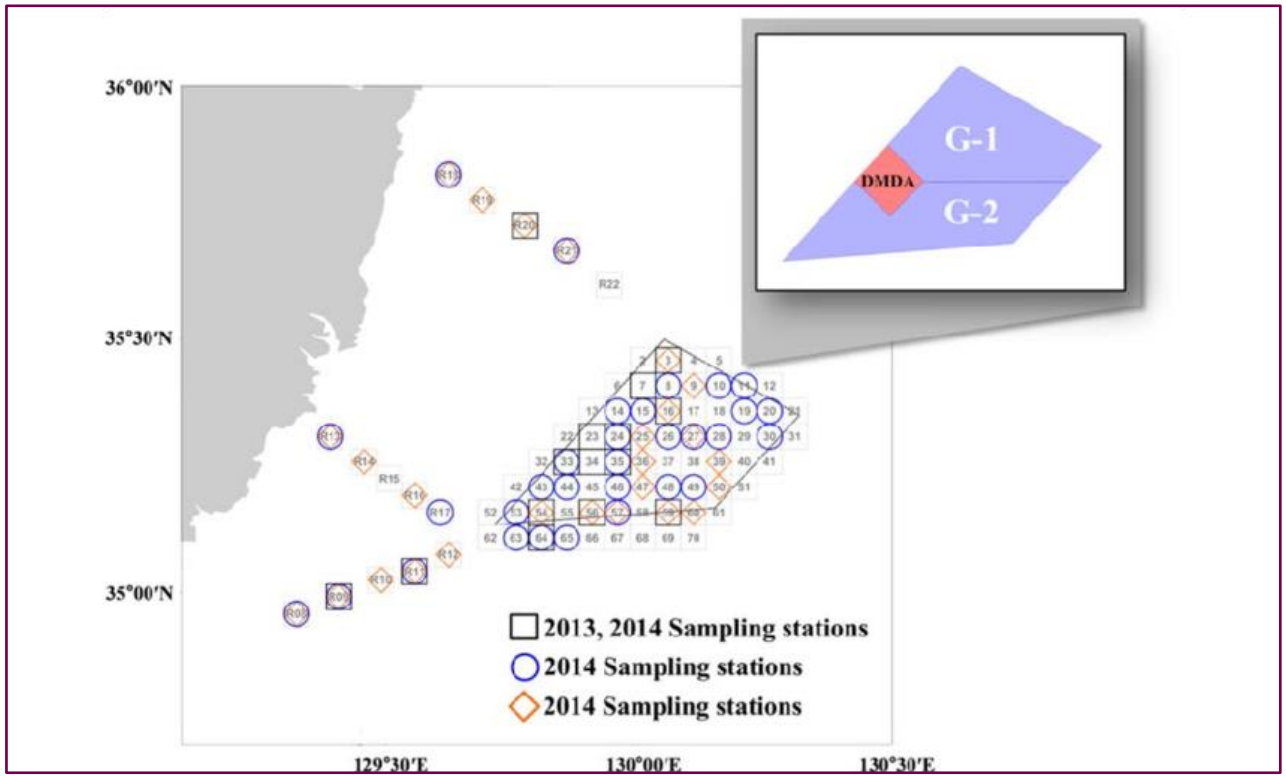


Figure 6-8: East Sea-Jung dumping grounds and sampling stations from 2007-2014 (Song et al., 2015).

Assessment of the East Sea-Jung dumping grounds have found the area to be relatively uncontaminated by heavy metals, with locations to the north exhibiting higher heavy metal concentrations, potentially influenced by nearby cities (Song *et al*., 2015). Sediment data from four sampling locations adjacent to the array area within East-J disposal ground identified concentrations of organic carbon and heavy metals higher than that of the control site that was also sampled (located to the south-west outside the disposal ground) although all metal concentrations were below adopted guideline compliance levels (Canadian Threshold Effects Level). Sediments were classified as silt (average phi 2.38 – 3.49). As a result, the East-Sea-Jung dumping grounds are considered uncontaminated and/or slightly contaminated, which suggest that the Korean government has effectively managed the dumping site through critical policies and responsibility zones (Song *et al*., 2015).

The contaminant status of sediments located adjacent to the nearshore export cable route have regularly been assessed to assist with determining levels of contamination from Port of Ulsan activities. A recent study that analysed for persistent toxic substances in sediments calculated concentrations for traditional PAHs, styrene oligomers, alkylphenols and emerging PAH concentrations. Concentrations for traditional PAHs, SOs, and APs ranged from 35 to 1300 µg/kg, 30 to 3800 µg/kg and 30 to 430 µg/kg, respectively (An Y *et. al* 2020,) 12 E-PAHs were also detected, with a maximum of concentration of 240 µg/kg (for benzo[e]pyrene) although it was stated that in the last 20 years, PTSs contamination in the bay area has improved. Identified E-PAHs appeared to originate from surrounding port activities, such as biomass combustion, mobile sources, and diesel combustion.

Another study by Ra *et al.* (2014) investigated metal concentrations in sediments in Ulsan Bay. The order of mean concentration (mg/kg) of metal species analysed was Zn (361.9) > Cu (95.6) > Pb (90.7) > Cr (64.7) > Ni (32.2) > Co (16.6) > As (15.8) > Cd (0.40) > Hg (0.16). Metal concentrations in sediments were found to be elevated when compared with adopted guideline criteria (TEL levels). Metal concentrations in sediments were 80% for Cu, 96.7% for Zn, 50% for As, 70% for Pb and 50% for Hg above the threshold effects level (TEL), respectively. Spatial distribution of metals in sediments showed a significantly higher concentration near industrial complexes, indicating that metal pollution is caused by anthropogenic sources. Based on the concentrations identified Hg and Cd were found to pose a very high potential ecological risk. Cu and As posed a moderate potential ecological risk, while, other metals (Cr, Co, Ni, Zn and Pb) rarely posed any potential ecological risk to the study area.

6.3.2 Proposed Additional Data Collection

Existing data from the 12-month lidar buoy deployment will be used to characterise the oceanographic conditions over a full year. Further data will be collected for the local-EIA process and will be used to augment the dataset. The full dataset will enable a detailed description of the oceanographic conditions in all development areas and will support development of hydrodynamic modelling that may be required as part of the ESIA, depending on final construction methods.

Table 6-7 provides a summary of the data that will be collected including survey design, parameters and frequency of data collection for subtidal and intertidal ecology. Figure 6-9 shows the indicative sampling locations, which will be subject to review as part of the local EIA application and scoping process.

Table 6-7: Proposed data collection for marine processes.

Data Parameters	Number of Sampling locations / Length of transects	Survey Frequency/ Duration	Sampling Equipment
Current speed and direction (m/s)	Current: 3 locations – 1 x nearshore, 1 x mid shore along export cable route, 1 x offshore within the array)	Current (1 month of continuous data per seasons (4 months of data)	ADCP 250/300 kHz
Turbidity (NTU)	Turbidity: 3 locations – 1 x nearshore, 1 x mid shore along export cable route, 1 x offshore within the array	Turbidity (1 month of continuous data per seasons (4 months of data)	Nephelometer
Tidal difference (m)	Tidal difference: 1 location - (1 x nearshore)	Tidal difference (1 month of continuous data per seasons (4 months of data	ADCP 250/300 kHz
Wave height (m)	Waves: (2 locations 1 x nearshore, 1 x offshore within the array)	Waves – 1 month of continuous data per seasons (4 months of data	Wave Height meter ADCP 250/300 kHz
Total suspended sediments (mg/L)	Spatial distribution of CTD and suspended sediment (30 locations)	Spatial distribution of suspended sediment and Temp, Salinity – 1 survey event per season (4 seasons)	Water Sampler Bottle (Niskin)
Sediment Particle Size (µm)	Seabed sediment (30 locations within array area and offshore export cable)	Seabed sediment – 1 survey	Grab /corer
Sediment contaminants (mg/kg) (As, Cd, Cr, Cu, Fe, Hg, Ni, Pb, Zn, Li, Al) (TPH and PAHs)	Seabed sediment (30 locations within array area and offshore export cable)	1 survey event per season (4 seasons)	Grab /corer

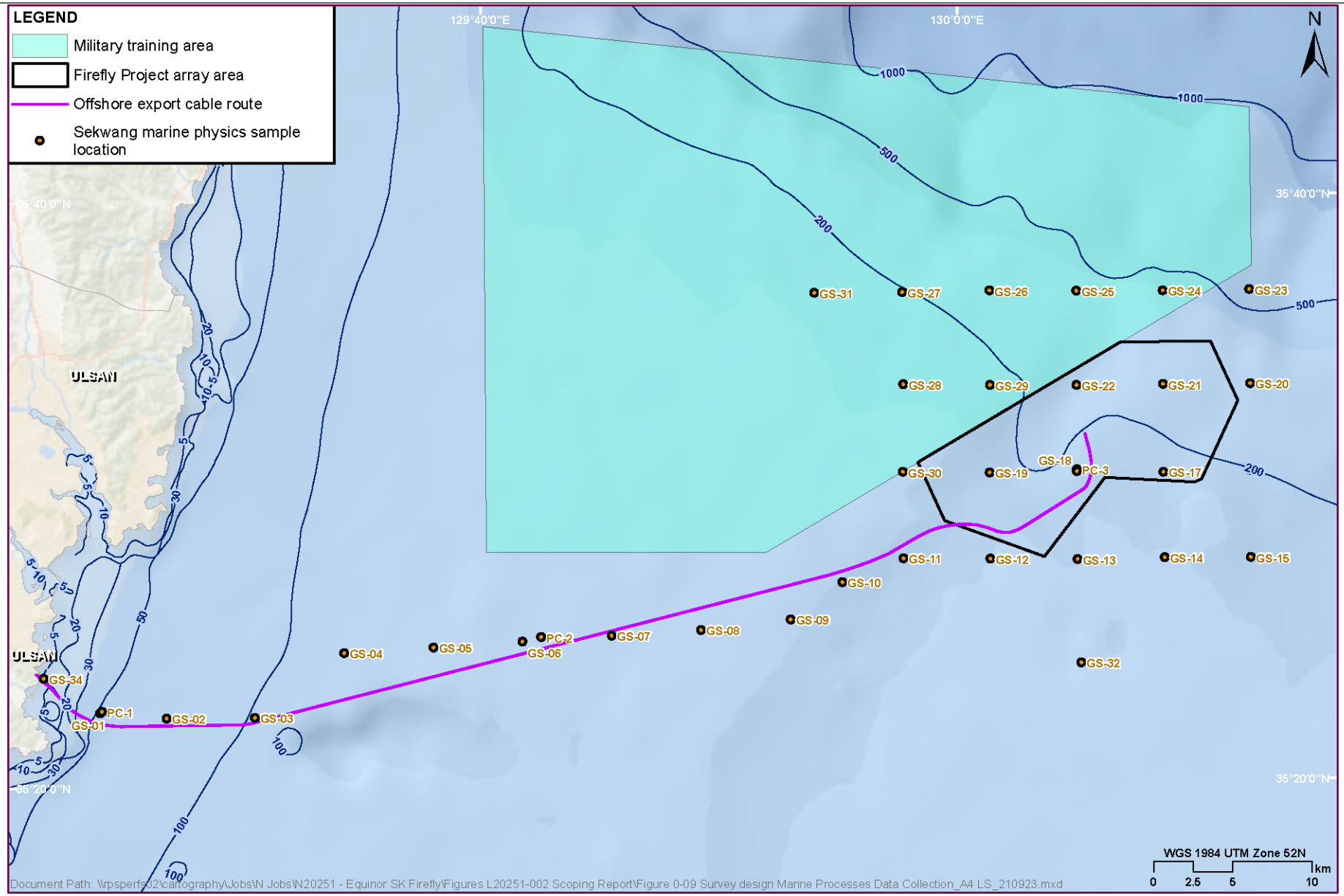


Figure 6-9: Survey design for Marine Processes Data Collection.

6.3.3 Potential Project Impacts

A range of potential impacts on marine processes have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-8.

Table 6-8: Impacts Proposed to be Scoped Into the Project Assessment for Marine Processes.

Potential impact	Phase			Justification
	C	O	D	
Increased suspended sediment concentrations and sediment deposition	✓	✓	✓	**Construction and decommissioning phase** • Inter-array and offshore export cables are likely to be installed in trenches by jetting or ploughing within the sand/gravel layer of the seabed. Therefore, smaller particles located within the sediment could potentially be raised into suspension during the constructional phase of the Project. •
Presence of infrastructure may lead to changes in the local tidal regime, wave climate and sediment transport	✗	✓	✗	**Operational and maintenance phase** • The presence of infrastructure (mooring system of WTGs and OSPs) may lead to changes in the local hydrodynamic conditions. The resulting magnitude of these changes will be quantified in terms of influence of individual structures and their potential for interaction effects collectively. • The impact of the Project area on local hydrodynamic conditions would be analysed and assessed by comparing wave climate and tidal currents within the Project area and surrounding vicinity with and without the presence of the Project area. • Resulting changes in local hydrodynamic conditions from Project could potentially alter surrounding sediment transport. This will be particularly important when assessing the need for scour protection and choosing mooring systems. • It is not expected that there would be a significant change from the baseline hydrodynamic conditions from the FOW array and therefore will have little effect on baseline sediment transport. • Localised seabed morphology could be modified because of substation foundations and anchoring structures at the Project site.
				•
Increased intensity of coastal erosion	✓	✓	✗	**Construction phase** • Sediment transportation modifications from infrastructure installation at the Project site could cause changes along the coast. **Operational and maintenance phase** • Alterations in the local hydrodynamic regime (tidal energy and wave direction) could affect the coastal erosive regime over the lifetime of the Project. The impact on coastal erosion will be analysed and assessed by comparing sediment transport rates with and without the presence of the Project area. Due to water depths withing the Project site (~200 m) and distance to shore (45.57 km) this is unlikely to have significant impacts on the local coastal areas.
Activities affecting water quality	✓	✗	✓	**Construction and decommissioning phase** • Construction activities conducted near the shoreline (e.g., trenching for the cable route) could impact marine and terrestrial ecology in proximity to the coastline. Increased suspended sediment from construction works could potentially lead to the surrounding habitats being smothered. • Construction activities could cause toxicity affects through mobilisation of contaminated sediments through sediment disturbance during cable installation • Construction vehicles and vessels have the potential to cause accidental spills and pollution within the area of development and the surrounding project footprint. **Operational and maintenance phase** • Construction activities could cause toxicity affects through mobilisation of contaminated sediments through sediment disturbance during cable repair activities and movement of mooring cables during operation.

Potential impact	Phase			Justification
	C	O	D	

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.3.4 Proposed Assessment Methodology

Based on the scope of works being completed for the Korean EIA, it is anticipated no further modelling for coastal processes is required for the purposes of informing the ESIA. A review of the findings and process of data validation will be undertaken as part of the ESIA.

The requirements around modelling of sediment plumes as a result of nearshore construction will be informed through the design process. Work done as part of the Korean EIA will be reviewed and some additional modelling assessments may be required to inform the ESIA. The scope of this has yet to be confirmed but it would be expected that the sediment plume modelling would consider the impact of sediment released into the water column to replicate the construction phase works during the installation of inter-array and offshore export cabling, to gauge sediment dispersion and fate. The impact of the cable laying on the level of suspended sediments would be modelled by releasing the appropriate amount of sand particles into the water column at 1 m to 2 m above the seabed and evaluated in the context of existing background levels. This information will be used to inform the assessments of the biological environment topics.

6.4 Benthic Ecology

This section considers the potential impacts of the Project on benthic ecology during the construction, operation and maintenance and decommissioning phases.

6.4.1 Baseline Environment

Information regarding the benthic subtidal and intertidal ecology near Ulsan, Korea has been collated through a detailed and comprehensive review of currently accessible studies and datasets. To provide a wider context, the desktop review has considered benthic subtidal and intertidal habitats, communities and species present within the broader offshore area in proximity to the Project. Key data sources are listed in Table 6-9, noting that this list is not exhaustive.

A description of the bathymetry is provided in Section 6.3.1 which shows the array area and offshore export cable corridor are located in water depths ranging from -0m CD to -434 m (offshore) CD. Within the array area, water depths range approximately from -143 m to -325 m. Soft sediments are generally thought to dominate the substrate within the Project area with sediments increasing in fineness from sandy mud nearshore to fine silt offshore.

Table 6-9: Key sources of information for the benthic subtidal and intertidal ecology baseline.

Data	Description	Source
ecosystem surveys	The habitat density and biomass of macrozoobenthic and meiobenthic communities were collected at locations 2 km from the Project's shore crossing and 6 km from the offshore export cable corridor respectively.	MEIP, 2021
Bivalve molluscs in Ulsan Bay	Mollusc presence in Ulsan Bay.	Lutaenko, 2014
Macrobenthic community structure	Assessing the macrobenthic community structure along specific environmental gradients of Ulsan Bay.	Yoon et al., 2009
Macrofaunal communities in Ulsan Bay	Spatial distribution of benthic macrofaunal communities in Ulsan Bay.	Shin et al., 2001
Crab species in Korean coastal waters	Ecological checklist of crabs inhabiting Korean coastal waters.	Lee et al., 2021
Rocky reef and benthic habitat in the East Sea	Analysing the correlation between rocky reefs and the surrounding benthic habitats in the East Sea of South Korea.	Kim et al., 2021
Benthic polychaete community of Ulsan	Spatio-temporal variation and evaluation of benthic healthiness of polychaete community on the Ulsan coast.	Jeong and Shin, 2018
Macrozoobenthic communities in the East Sea, Korea	Environmentally associated spatial distribution of a macrozoobenthic community in the continental shelf off the southern area of the East Sea, Korea.	Lee et al., 2014

A number of benthic studies have been undertaken in the study area since 1982. A study by Lee *et al*. undertaken in 2012 at 16 sites located in water depths from 100-500 m within and adjacent to the array area and eastern sections of the offshore export cable route (Figure 6-10) identified a total of 158 benthic species. The dominant species group was found to be polychaetes comprising 76 species (46% of all species) followed by 43 arthropod species (27%), 24 mollusc species (15%) and 8 echinoderms species (5%). It was found that generally samples with higher sand content showed an increase in number of species and decrease in biomass (Lee *et al*., 2014).

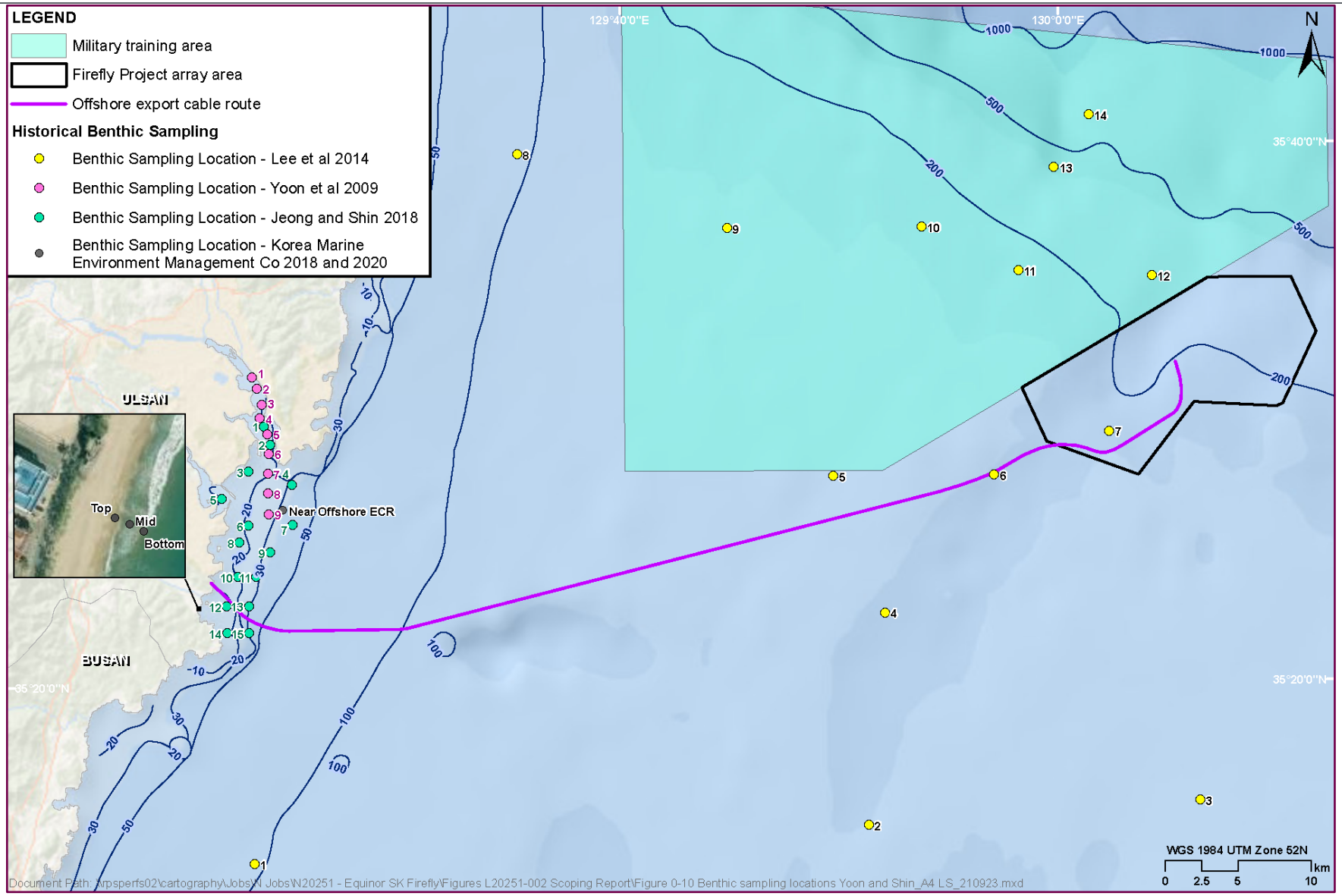


Figure 6-10: Historical Benthic sampling locations in proximity to the onshore and offshore Project infrastructure (Lee *et al*., 2014; Yoon *et al*., 2009; Jeong and Shin, 2018; KMEMC, 2020).

In nearshore areas adjacent to the cable route, two studies have been undertaken. A study by Yoon *et al.* (2009) undertaken between February to November 2006, collected benthic samples at nine sampling locations in water depths ranging from 3 m to 25 m in an area approximately 4 -10 km north of the offshore export cable route landfall location at the entrance to Taehwa River and within Ulsan Bay (Figure 6-10). Sediments across all sampling locations were classified as silt. A total of 118 species were identified dominated by 99 polychaete species including *Aphelochaeta monilaris, Ruditapes philippinarum, Magelona japonica, and Lumbrineris longifolia* followed by crustaceans (48 species) and mollusc species (22 species). Species presence and distribution was found to vary due to differences in benthic environmental conditions such as depth, temperature and salinity (Yoon *et al.*, 2009).

A second study undertaken by Jeong and Shin (2018), collected benthic samples from 14 sampling locations also within Ulsan Bay area, to the north and the south and within nearshore sections of the offshore export cable corridor (Figure 6-10). Samples were collected on a seasonal basis in January, April, July and October 2016. Sediments across all sampling locations were dominated by silt fractions (79%) with remaining fractions being sand and gravel. There was a general trend, however, of an increase in silt and organic content with increasing distance offshore. The study identified 84 species of polychaete (other species groups were not identified as part of the study) with dominant species being *Magelona japonica, Lumbrineris longifolia* and *Heteromastus filiformis,* similar *to* Yoon *et al.* (2009). *Magelona japonica and Heteromastus filiformis were* mainly restricted to shallow coastal areas in water depths <30m while *Lumbrineris longifolia* was observed in higher densities in water depths >30 m, (Jeong and Shin, 2018).

A third study by the Korea Marine Environment Management Corporation, (2018 and 2020), collected benthic samples within the intertidal area 2 km south and subtidal area 6 km north of the offshore export cable corridor on 4 occasions seasonally in 2018 and 2020 (Figure 6-10). For this study both meiofauna and macrofauna species were identified. Findings from the survey illustrated that the nematode species were the most dominant of all species identified while macrofauna species were dominated by polychaete species as per the other coastal studies identified above during the summer of 2018. Contrastingly, during spring and summer of 2020, copepods were the most dominant macrofauna species compared with an absence of polychaete species which suggest there may some variability in benthic community composition between 2018 and 2020 surveys. Nematode species comprised 97.7% of overall density and 62.4% of overall biomass.

The biodiversity index calculated for the study was highest during 2018 (H'=2.03), spring 2020 (H'=1.70), and summer 2020 (H'=1.55). The biodiversity index was calculated to be the lowest during spring 2018 (H'=0.67) which highlights the low densities and biomass values observed during this period.

Of the mollusc species found within Ulsan bay, within the nearshore sections of the offshore export cable route, a 2014 study by Lutaenko identified 61 species of bivalve that are considered to be mainly subtropical and tropical species. However, it was found that boreal-arctic species of bivalve molluscs are also capable of inhabiting the study area due to cold water masses that appear off the southeast coast during summer months (Lutaenko, 2014). The landfall location identified for the cable route shows a cobbled beach with some rock outcrops. No further data is available to determine the benthic habitats associated with each landfall location.

Figure 6-11: Proposed landfall location.

6.4.1.1 Protected Species

34 marine invertebrate species are protected within Korea under the Conservation and Management of Marine Ecosystems Act, which includes the species from IUCN and CITES II, and the Korean Cultural Heritage Act (Park, 2019); 36 species as of February 2023. Based on the distribution and sightings data compiled by the MOE and MOF on endangered marine life, 11 marine invertebrate species have the potential to be found within the Project area (Table 6-10). Two of the cnidarian species, the black corals *Myriopathes lata* and *Myriopathes japonica,* are also designated Natural Monuments in Korea.

Seven species of seagrass are protected in Korean waters under both IUCN classification system and CITES II legislation, six of which could potentially occur with the study area (Table 6-11).Table 6-11: Protected seagrass species which may occur in the Project area.

None of the listed protected species below were identified as part of the studies described above.

Table 6-10: Protected marine invertebrate species which may occur in the Project area.

Phylum	Taxonomic Name	IUCN Conservation Status	Conservation Status in Korea	Other
Cnidaria	*Cirrhipathes anguina*	N/A	Marine protected species (MOF)	CITES II
Cnidaria	*Myriopathes lata*	N/A	Marine protected species (MOF) & Designated Natural Monument No. 457 (CHA)	CITES II
Cnidaria	*Dichopsammia granulosa*	N/A	Marine protected species (MOF)	CITES II
Cnidaria	*Myriopathes japonica*	N/A	Endangered Wildlife II (MOE) & Marine protected species (MOF) & Designated Natural Monument No. 456 (CHA)	CITES II
Cnidaria	*Dendrophyllia cribrosa*	N/A	Marine protected species (MOF) & Endangered Wildlife II (MOE)	CITES II
Cnidaria	*Euplexaura crassa*	N/A	Endangered Wildlife II (MOE) & Marine protected species (MOF)	-
Cnidaria	*Dendronephthya suensoni*	N/A	Endangered Wildlife II (MOE) & Marine protected species (MOF)	-
Arthropoda	*Pseudohelice subquadrata*	N/A	Endangered Wildlife I (MOE) & Marine protected species (MOF)	-
Arthropoda	*Chasmagnathus convexus*	N/A	Endangered Wildlife II (MOE) & Marine protected species (MOF)	-
Arthropoda	*Sesarmops intermedius*	N/A	Endangered Wildlife II (MOE) & Marine protected species (MOF)	-
Mollusca	*Charonia lampas*	N/A	Endangered Wildlife I (MOE) & Marine protected species (MOF)	-

Table 6-11: Protected seagrass species which may occur in the Project area.

Phylum	Taxonomic Name	IUCN Conservation Status	Conservation Status in Korea
Tracheophyta	*Phyllospadix japonicus*	Endangered	Marine protected species (MOF)
Tracheophyta	*Phyllospadix iwatensis*	Vulnerable	Marine protected species (MOF)
Tracheophyta	*Zostera asiatica*	Near Threatened	Marine protected species (MOF)
Tracheophyta	*Zostera caulescens*	Near Threatened	Marine protected species (MOF)
Tracheophyta	*Zostera caespitosa*	Vulnerable	Marine protected species (MOF)
Tracheophyta	*Zostera marina*	Least Concern	Marine protected species (MOF)

6.4.2 Proposed Additional Data Collection

While the studies identified above have undertaken characterisation of the benthic species within the vicinity of the array area and export cable corridor, these studies alone are considered not sufficient in order to obtain a complete dataset of the benthic habitats and communities associated with the array area and export cable corridor. In addition, some of the surveys have been undertaken over 5 years ago which may mean that the communities have potentially changed since these studies were undertaken.

Therefore, the following survey is proposed to be undertaken to collect additional up to date data on habitats and communities in the benthic subtidal and intertidal ecology study area. The proposed approach is to characterise the subtidal and intertidal marine ecology receptors that could be impacted by the project by determining the abundance and distribution of key marine ecological habitats, communities and species within the study area.

Table 6-12 provides a summary of the data that will be collected including survey design, parameters and frequency of data collection for subtidal and intertidal ecology. Figure 6-12 provides a map showing the location of sampling locations.

Table 6-12: Proposed data collection for subtidal and intertidal ecology.

Data Parameters	Number of Sampling locations / Length of transects	Survey Frequency/ Duration	Sampling Equipment
Abundance ***Species identification*** ***Species Diversity*** ***Sediment Type (Particle Size Distribution)***	Subtidal sampling locations- up to 33 locations Intertidal sampling locations- 4 locations x 2 transects at each location and one sampling point (#34) One additional location near the coast with 4 transects (three horizontal lines close to the coast and one line that goes out to the array area)	Seasonally (4 survey events)	Ecology (benthic grab) Intertidal benthic creatures incl. seagrass (visual transects) underwater Remotely Operated Vehicle (ROV) (as required)

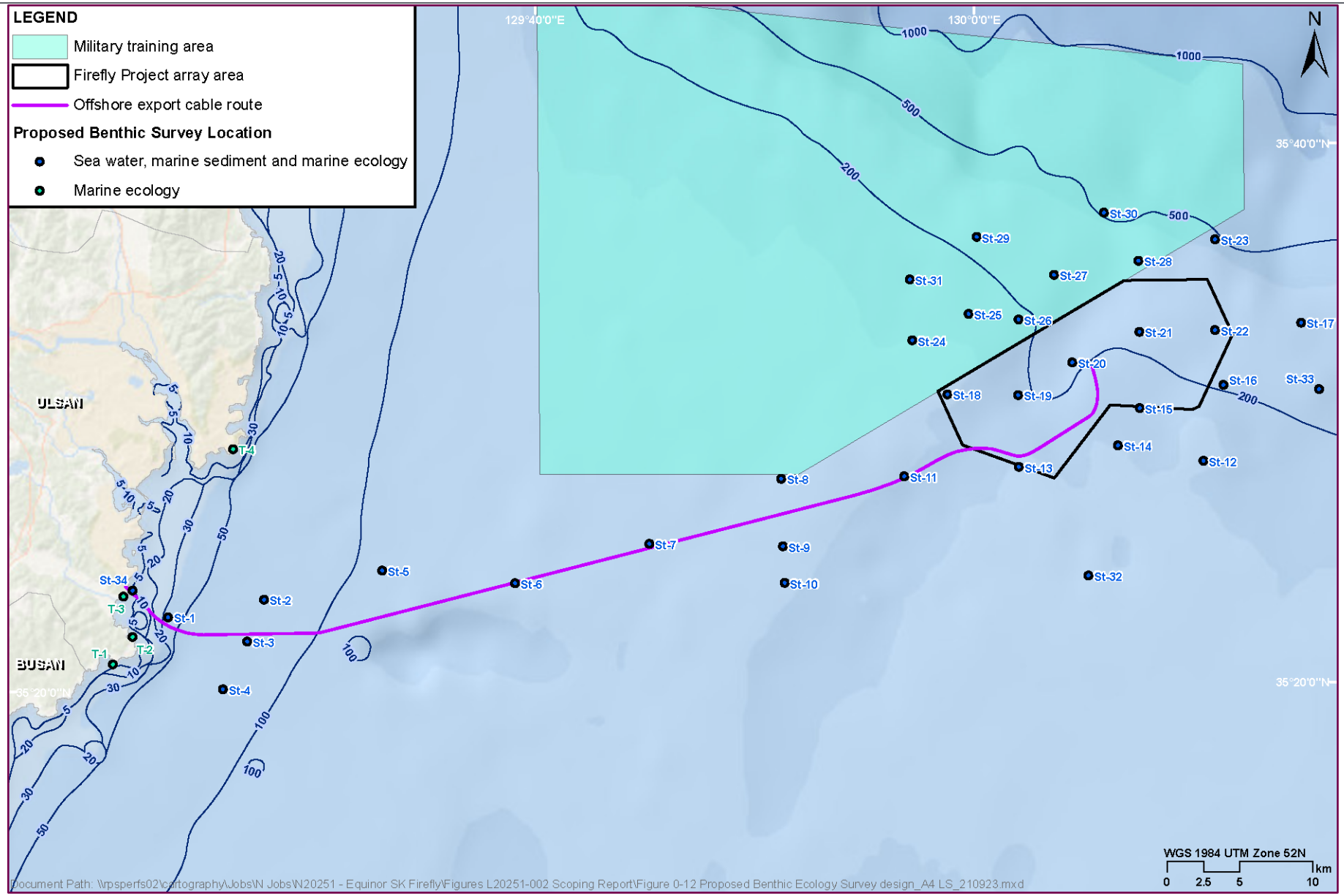


Figure 6-12: Proposed Benthic Ecology Survey design.

6.4.3 Potential Project Impacts

A range of potential impacts on benthic subtidal and intertidal ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-13.

Table 6-13: Impacts Proposed to be Scoped Into the Project Assessment for Benthic Subtidal and Intertidal Ecology.

Potential impact	Phase			Justification
	C	O	D	
Temporary subtidal habitat loss and/or disturbance	✓	✓	✓	**Construction and decommissioning phase** • There is potential for direct habitat and species loss in the subtidal proposed Project area due to site preparation activities and the installation, maintenance, and removal of development infrastructure (cables, OSP, WTGs). • Habitat sensitivities will depend on the individual species present in the Project area, determined during survey stages **Operational and maintenance phase** • Minor and temporary habitat and species loss during operation and maintenance (device repair). Minor and temporary habitat and species loss during operation and maintenance (e.g. device repair). These impacts will be similar, but of reduced magnitude compared to construction and decommissioning phases of the Project.
Increased suspended sediment concentrations and deposition	✓	✓	✓	**All phases** • Increased suspended sediment concentrations and sediment deposition from construction activities and cable installation/protection may potentially result in indirect impacts on the benthic habitats and communities. These indirect impacts include increased turbidity and smothering effects which could affect the water quality in the surrounding area.
Long-term subtidal habitat loss	✗	✓	✗	**Operational and maintenance phase** • Potentially, long-term habitat loss could occur directly under anchoring systems and foundation structures (OSP) as well as continuous movement of moorings and cables on the seabed due to currents and wave action, along with any cable protection that may be required for protection of inter-array and export cables.
Introduction of artificial habitat and colonisation of hard structures	✓	✗	✓	**Construction and decommissioning phase** • The introduction of new habitat, such as artificial structures used for mooring anchorage and/or scour and cable protection, in the offshore marine environment may potentially affect the established community environment by providing new habitat and ecosystem function. It is expected that the artificial structures will be colonised by a range of organisms which could lead to increases in biodiversity locally.
Accidental pollution in the surrounding area	✓	✓	✓	**All phases** • There is a risk of pollution to water and sediment through accidental release of chemicals and pollutants from vessels/vehicles and equipment/machinery during all stages of Project. This pollution could result in minor and temporary changes in benthic habitat species composition and ecosystem function.
Changes in hydrodynamic regime which could alter seabed habitats	✗	✓	✗	**Operational and maintenance phase** • Localised changes to the hydrodynamic regime have the potential to alter sediment transport pathways and therefore the surrounding benthic ecology. Some benthic species and their surrounding communities could be more vulnerable to changes in water flow (increases and/or decreases).
Removal of hard structures causing loss of colonising communities	✗	✗	✓	**Decommissioning phase** • During decommissioning, the removal of mooring anchorage, foundations and scour/cable protection could potentially lead to habitat and species loss of communities once colonising the Project structures.
Increased risk of introduction and spread	✓	✓	✓	**Construction phase** • INNS could potentially be introduced to the Project area through the transportation of organisms from different operational vessels during construction of the Project. **Operational and maintenance phase**

Potential impact	Phase C O D	Justification
of Invasive Non-native Species (INNS)		• Vessels utilised during all stages of the Project could inadvertently transport INNS resulting in significant impacts on the local fauna which have the potential to spread throughout the area and cause largescale disturbances and displacement. Long-term creation of hard structures could increase the potential risk of establishing INNS communities. **Decommissioning phase** • Similar to the construction phase of the Project, there is an increased risk of INNS species spreading during round trips of decommissioning vessels associated with Project activities.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.4.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project within the benthic subtidal and intertidal ecology study area.

For the purposes of undertaking the ESIA, marine habitats, communities and species identified as having the potential to occur in the study area will be grouped into broad habitat/community types. These broad habitat/community types will serve as the Valued Ecosystem Components (VECs) against which impacts associated with the construction, operational and maintenance and decommissioning phases of the Project will be assessed. Habitats with similar physical and biological characteristics (including species complement and richness/diversity) as well as conservation status/interest will be grouped together for the purposes of the ESIA. Consideration will also be given to the inherent sensitivities of different habitats in assigning the groupings, such that habitats and species with similar vulnerability and recoverability (e.g. due to similar broad sediment types and species complements) will be grouped together. Impacts on VECs s will be described in terms of the magnitude of that impact and correlated against the sensitivity of each VEC to that each impact, to produce a statement of significance.

A Biodiversity Risk Assessment will be undertaken in accordance with IFC PS 6 which will include determination of the presence of Critical Habitat that could be affected by the Project. Critical Habitat is habitat that is defined based on 5 criteria set out by IFC PS6 requirements and is considered to be of significant importance to certain species, threatened or unique ecosystems, or key evolutionary processes (further details are provided in Appendix A-4).

6.5 Fish, Shellfish and Marine Reptile Ecology

This section characterises the existing environment associated with Fish Shellfish and Marine Reptile Ecology Study Area and considers the potential impacts of the Project during the construction, operation and maintenance and decommissioning phases.

6.5.1 Baseline Environment

The Fish, Shellfish and Marine Reptile Ecology Study Area is defined as the area encompassing the Project Area, the offshore export cable routes and the surrounding area.

Information regarding the fish, shellfish and marine reptile ecology near Ulsan, Korea has been collated through a detailed and comprehensive review of currently accessible studies and datasets. To provide a wider context, the desktop review has also considered the fish, shellfish and marine reptile habitats, communities and species present within the wider area of the East Sea and the Korea Strait. The Korea Strait is located to the south of the Korean peninsula, and connects the East China Sea, the East Sea and the Yellow Sea. Key data sources are listed in Table 6-14, noting that this list is not exhaustive.

Table 6-14: Key sources of information for the benthic subtidal and intertidal ecology baseline.

Data	Description	Source
Seafood Market and Volume Report	Fish, shellfish, and crustacean species found and harvested in Korean waters.	South Korea Seafood Market Volume Report, 2021
Sea Turtles in Korean Waters	Presence and distribution of sea turtle species in Korean waters.	Korean Journal of Fisheries and Aquatic Sciences, 2009

Fisheries resources in Korea	Changes in fisheries resources in relation to variability of oceanic environments.	Kim, 2007
Fish assemblages present in Korean waters	Fish assemblages collected by bottom trammel gill net around Gampo in the East Sea of Korea.	Kang *et al*., 2015
Nekton per season in the East Sea	Number of species appearing, number of individuals, biomass, and biodiversity index of nekton per season in the East Sea area.	2020 Coastal ecosystem survey
Shark conservation and management in Korea	National plan of action for the conservation and management of sharks in the Republic of Korea.	Ministry for Food, Agriculture, Forestry and Fisheries, 2011
Brachyura presence in Korea	First comprehensive ecological checklist of Brachyura in Korea.	Sang-kyu *et al*., 2021

6.5.1.1 Fish

The Korea Strait which extends into to the East Sea and is located to the south of the Project is considered part of an important pelagic ecosystem between the East China Sea to the East Sea (Kim S, 2003). This area supports small pelagic species such as chub mackerel *Scomber japonicus*, horse mackerel *Trachurus japonicus,* sardine *Sardinops melanostictus,* pacific herring *Clupea pallasii* and anchovy *Engraulis japonica* as main commercial species (Kim S, 2007; Kim and Kang, 2000). The Korea Strait is also home to commercially important large pelagic species such as Spanish mackerel *Scomberomorus niphonius* and yellowtail *Seriola quinqueradiata*. In addition, hairtail *Trichiurus lepturus*, filefish *Thamnaconus modestus,* pacific cod *Gadus macrocephalus* and yellow croaker *Larimichthys polyactis* are major demersal fishes harvested in the Korean Strait (Chung et al. 2013; Jung et al. 2013c).

The East Sea is a semi-enclosed sea, and owing to the presence of a subpolar front, it is divided into cold and warm water masses in the surface layer of the ocean. This results in different spatial fish biomes (Kim & Zhang, 2016) including a cold water ecosystem in the north and warm water ecosystem in the south. Common species include common squid, Pacific saury *Colorabis saira*, chub mackerel, horse mackerel, yellowtail and sandfish. Most pelagic fishes in Korean waters spawn in the warmer southern coastal areas during the spring, before migrating north to feed during the summer, and then returning to the south for overwintering.

Several fish species found near the southern coast are resident although most species in this region are migratory (Jung S., 2013). It can therefore be assumed that fish species found in the south-west of the South Korea peninsula may be present in the Project area during summer feeding months. Studies conducted in the waters around Naro-do Island, approximately 280 km south-west of the array area found high abundance of seasonally variable species such as common toadfish *Tetractenos hamiltoni*, Tanaka's snailfish *Liparis tanakae* and spotted velvetfish *Erisphex pottii* in spring (all found in waters up to 120 m), and hairtail in summer and autumn (found in waters up to 350 m depth) (Kim J *et al.* 2003). In the coastal waters off Yeosu, approximately 240 km south-west of the array area, occurrence of the various stages of fishes indicated that chub mackerel, horse mackerel, anchovy, Pacific sand eel *Ammodytes personatus*, Japanese amberjack *Seriola quinqueradiata* and hairtail utilise the coastal zone as spawning and/or nursery grounds (Kim, Yeong Hye *et al.* 2003). Both studies showed that there is a seasonal variation in the fish assemblage attributed to the abundance of seasonally variable species due to seasonal variation of environmental factors and ecological pattern of fish species.

Studies conducted between 2010 and 2011 in coastal waters off Gadeok-do, approximate 130 km to the south-west of the array area, recorded 65 species of fish, of which Pacific herring, Kammal thryssa *Thryssa kammalensis (*anchovy*)*, anchovy *E. japonicus*, Valenciennes' dragonet Callionymus valenciennei, Japanese whiting *Sillago japonica*, horse mackerel, silver croaker *Pennahia argentata*, ocellate spot skate *Okamejei kenojei*, red tongue sole *Cynoglossus joyneri*, marbled flounder *Pseudopleuronectes yokohamae* and eelpout *Zoarces gillii* were the most dominant *(Jeong et al.* 2013*).* For comparison, results of a study conducted between 2005 and 2006 around Gampo, approximately 50 km north-west of the array area reported collecting 32 species, of which the fat greenling *Hexagrammos otakii*, Korean rockfish *Sebastes schlegelii*, threadsail filefish *Stephanolepis cirrhifer, Sebastes taczanowskii* and *Parajulis poecilepterus* were the dominant species identified (Kang, 2015).

A survey undertaken in the Project offshore export cable corridor in 2020 identified six species of fish during surveys undertaken in spring and four species of fish during sampling in the summer season, using the gill nets and fish traps. The number of species identified was substantially lower than the species numbers identified above (Table 6-15). The low number of species identified however, may in part be a direct result of the survey methods adopted.

Table 6-15: Number of species appearing, number of individuals, biomass, and biodiversity index of nekton per season in the East Sea area by the 2020 coastal ecosystem survey (FIP, 2021).

Parameter	Peak	Gill Net				Fish Trap			
		Fishes	Crustacea	Cephalopod	Other	Fishes	Crustacea	Cephalopod	Other
No. of species appearing	Spring	6	2	-	-	6	3	-	-
	Summer	4	1	-	-	5	4	-	-
No. of individuals	Spring	7	3	-	-	17	55	-	-
	Summer	13	2	-	-	17	44	-	-
Biomass	Spring	1,987.1	11.3	-	-	1,786.3	1,380.3	-	-
	Summer	5,628.1	67.9	-	-	3,041.4	519.8	-	-
Biodiversity mass	Spring		2.03				1.10	-	-
	Summer			1.20			1.27	-	-

6.5.1.2 Shellfish

The East Sea is home to 77 crab species. Coastal areas to the south of the South Korea peninsula are characterised by the highest species abundance. The three most dominant species in the southeast (Project area) are Asian shore crab *Hemigrapsus sanguineus,* gazami crab *Portunus trituberculatus,* Asian paddle crab *Charybdis japonica, Gaetice depressus,* sand crab *Ovalipes punctatus, Pugietta quadridens,* striped shore crab *Pachygrapsus crassipes,* brush-clawed shore crab *Hemigrapsus takanoi and Macrophthalmus japonicus (*Sang-kyu *et al.* 2021). Other shellfish species that are considered commercially important in South Korea waters include common squid, red snow crab, snow crabs *Chionoecetes opilio*, purplish Washington clams Saxidomus purpuratus, pen shells *Atrina pectinate* and horned turban *Turbo cornutus (*South Korea Seafood, 2021).

Recent scientific research has suggested that fish populations of Korea Strait could potentially be changing in accordance with climate/oceanographic changes (Lee et al. 2021; Jung S et al. 2013; Kim and Kang, 2013; Kim & Zhang, 2016). However, because different fish species have different life cycles and habitat areas, one large-scale climate change event might not show the same common effects for all fish species. It is anticipated that the retreat of cold-water species and colonization of warm water species will be apparent in proximity to the Project area as seawater temperatures increase.

The list of protected shellfish species in proximity to the Project area and their IUCN Red List classification (IUCN, 2021) is presented in Table 6-16.

6.5.1.3 Sharks

Korea's EEZ is home to around 40 shark species in 8 orders, 16 of which are considered to inhabit the eastern waters. The Ministry for Food, Agriculture, Forestry and Fisheries (2011) reported that species present in this area include whale shark *Rhincodon typus,* banded houndshark *Triakis scyllium,* copper shark *Carcharhinus brachyurus,* blue shark *Prionace glauca*, scalloped hammerhead *Sphyrna lewini,* smooth hammerhead *Sphyrna zygaena,* pelagic thresher *Alopias pelagicus,* common thresher *Alopias vulpinus,* basking shark *Cetorhinus maximus*, great white shark *Carcharodon carcharias,* shortfinned mako shark *Isurus oxyrinchus,* salmon shark *Lamna ditropis*, spiny dogfish *Squalus acanthias,* shortnose spurdog *Squalus megalops*, Japanese angelshark *Squatina japonica* and Japanese sawshark *Pristiophorus japonicus*. The list of the sharks and their status on the IUCN (International Union for Conservation of Nature) Red List (IUCN, 2021) is presented in Table 6-16.

6.5.1.4 Sea Turtles

Four species of sea turtles (green sea turtle *Chelonia mydas,* loggerhead sea turtle *Caretta caretta,* leatherback sea turtle *Dermochelys coriacea,* and hawksbill sea turtle *Eretmochelys imbricata*) have been recorded in Korean waters. *C. mydas* and *C. caretta* are the most dominant species and are found mostly around Jeju Island, located approximately 405 km south-west of the array area, from June to November (Chung S *et al.* 2013). Further scientific research and local interviews indicated that green sea turtles are frequently observed around Jeju Island during all four seasons using the area as foraging grounds (Ara Jo & Douglad Hykle, 2012; Moon *et al.* 2009). Of the species that might occur within the Study Area, green turtle is listed as Endangered, loggerhead sea turtle is listed as Vulnerable on the IUCN (International Union for Conservation of Nature) Red List (IUCN, 2021) (see Table 6-16).

6.5.1.5 Sea Snakes

South Korea is located beyond the typical distribution range of sea snakes. Three Hydrophiinae species (yellow-bellied sea snake *Hydrophis platurus*, slender-necked sea snake *Hydrophis melanocephalus*, and annulated sea snake *Hydrophis cyanocinctus*), in addition to two Laticaudinae species (Chinese sea snake *Laticauda semifasciata* and blue banded sea krate *Laticauda laticaudata*) have recently been identified in Korean waters. All species have been identified from around Jeju Island, located 303 km southwest of the cable corridor and 353 km southwest of the array area. Jeju Island is not considered a coastal area of the Korean Peninsula and is located outside of the Project area. In addition, given these species are warm water species it is unlikely that they exist within the Study Area although as seawater temperatures rise as a result of climate change, there is potential for the distribution of these species to extend northwards towards the Project area (Park *et al.* 2017b).

6.5.1.6 Protected Species

Four fish and four marine reptile species are protected within Korean waters under the Conservation and Management of Marine Ecosystems Act, which includes the species from IUCN and CITES, and the Korean Cultural Heritage Act (Park, 2019). Based on the distribution and sightings data compiled by the MOE and MOF on endangered marine life, four shellfish, 16 fish and four marine reptile species have the potential to be found within the Project area and offshore export cable corridor (Table 6-16).

Table 6-16: Protected fish, shellfish, and marine reptile species potentially found in the Study Area and their conservation status.

Species (by Class)	Taxonomic Name	IUCN Conservation Status	Conservation status in Korea	Other
Actinopterygii				
Thorny seahorse	*Hippocampus histrix*	Vulnerable	Marine protected specie (MOF)	CITES II
Yellow seahorse	*Hippocampus kuda*	Vulnerable	Marine protected specie (MOF)	CITES II
Flat-faced seahorse	*Hippocampus trimaculatus*	Vulnerable	Marine protected specie (MOF)	CITES II
Chondrichthyes				
Whale shark	*Rhincodon typus*	Endangered	Marine protected specie (MOF)	CITES II
Scalloped hammerhead	*Sphyrna lewini*	Critically Endangered	Marine protected specie (MOF)	CITES II
Banded houndshark	*Triakis scyllium*	Endangered	-	-
Copper shark	*Carcharhinus brachyurus*	Vulnerable	-	-
Blue shark	*Prionace glauca*	Near Threatened	-	-
Smooth hammerhead	*Sphyrna zygaena*	Vulnerable	-	-
Pelagic thresher shark	*Alopias pelagicus*	Endangered	-	-
Common thresher shark	*Alopias vulpinus*	Vulnerable	-	-
Basking shark	*Cetorhinus maximus*	Endangered	-	-
Great white shark	*Carcharodon carcharias*	Vulnerable	-	-
Shortfinned mako shark	*Isurus oxyrinchus*	Endangered	-	-
Salmon shark	*Lamna ditropis*	Least Concern	-	-
Spiny dogfish	*Squalus acanthias*	Vulnerable	-	-
Shortnose spurdog	*Squalus megalops*	Least Concern	-	-
Japanese angelshark	*Squatina japonica*	Critically Endangered	-	-

Species (by Class)	Taxonomic Name	IUCN Conservation Status	Conservation status in Korea	Other
Japanese sawshark	*Pristiophorus japonicus*	Least Concern	-	-
Malacostraca				
Convexed crab	*Chasmagnathus convexus*	N/A	Endangered Wildlife Class II (MOE) & Marine protected specie (MOF)	-
Red-clawed de Haan's crab	*Sesarmops intermedius*	N/A	Endangered Wildlife Class II (MOE) & Marine protected specie (MOF)	-
Three-spined shore crab	*Pseudohelice subquadrata*	N/A	Endangered Wildlife Class I (MOE) & Marine protected specie (MOF)	-
Gastropoda				
Trumpet shell	*Charonia lampas*	N/A	Endangered Wildlife Class I (MOE) & Marine protected specie (MOF)	-
Reptilia				
Green sea turtle	*Chelonia mydas*	Endangered	Marine protected specie (MOF)	CITES I
Loggerhead sea turtle	*Caretta caretta*	Vulnerable	Marine protected specie (MOF)	CITES I
Leatherback sea turtle	*Dermochelys coriacea*	Vulnerable	Marine protected specie (MOF)	CITES I
Hawksbill sea turtle	*Eretmochelys imbricata*	Critically Endangered	Marine protected specie (MOF)	CITES I

6.5.2 Proposed Additional Data Collection

The studies summarised above provide a broad overview of the fish, shellfish and marine reptile species and communities likely to occur in the vicinity of the array area and offshore export cable corridor. However, while these provide useful data in characterising the fish, shellfish, and marine reptile resources of the development areas, further data collected to meet the requirements of the local EIA will augment the dataset but collecting data form the specific locations to be affected. This will support a more targeted assessment in the ESIA.

The following surveys are proposed to be undertaken to collect additional site-specific data. The proposed approach is to characterise the fish, shellfish, and marine reptile receptors that could be impacted by the project by determining their abundance and distribution within the Study Area.

Table 6-17 provides a summary of the data that will be collected including survey design, parameters and frequency of data collection for subtidal and intertidal ecology. Figure 6-13 provides a map showing the location of proposed sampling locations. These site-specific survey data will be supplemented with a desktop review of other available data/information on fish, shellfish and marine reptiles in the vicinity of the project. This may include, but would not be limited to scientific studies, information from grey literature, stakeholder consultation, and information collected as part of the commercial fisheries assessment.

Table 6-17: Proposed data collection for fish, shellfish and marine reptiles.

Data Parameters	Number of Sampling locations / Length of transects	Survey Frequency/ Duration	Sampling Equipment
Fish and Shellfish Species, Abundance	10 locations	4 surveys undertaken seasonally	*Gill net* *Sample Storage (frozen)* *Camera*
Marine Reptiles – Species, Abundance	Refer to marine mammal additional data collection Section 6.6	Refer to marine mammal additional data collection Section 6.6	Refer to marine mammal additional data collection Section 6.6

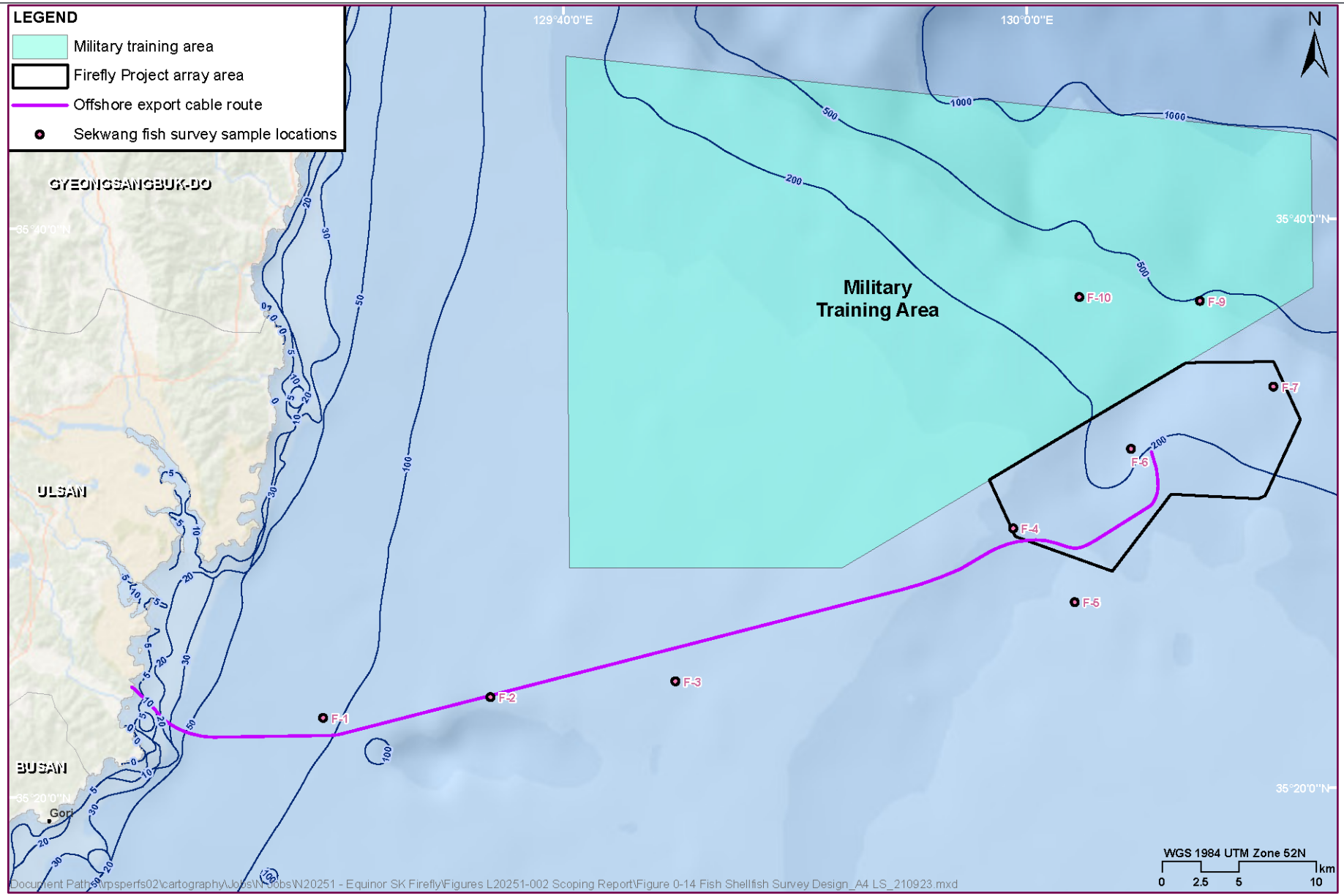


Figure 6-13: Proposed Fish and Shellfish Ecology Survey design.

6.5.3 Potential Project Impacts

A range of potential impacts on fish, shellfish and marine reptile ecology have been identified which may occur during the construction, operational and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-18.

Table 6-18: Impacts Proposed to be Scoped Into the Project Assessment for Fish, Shellfish and Marine Reptile Ecology.

Potential impact	Phase			Justification
	C	O	D	
Temporary habitat loss/ disturbance, including nursery and spawning habitats	✓	✓	✓	**Construction and decommissioning phase** • There is potential for temporary, direct disturbance and habitat loss to fish, shellfish and marine reptile communities resulting from site preparation, construction, operational and decommissioning activities. • Specific substrates and seabed types can be important to certain species of fish, such as some clupeids and sandeels which lay their eggs on distinctive seabed types. The significance of this impact will directly depend on installation methods, project design and location. **Operational and maintenance phase** • Maintenance operations (cable repair and burial) could potentially cause minor and temporary habitat loss via physical smothering of benthic habitats/communities from settlement of suspended solids. The impacts associated with these activities will be similar to those during construction, although of reduced magnitude. Sessile or low mobility species will be particularly vulnerable to Project operations.
Increased suspended sediment concentrations and deposition	✓	✓	✓	**Construction and decommissioning phase** • Construction and decommissioning activities (foundation and cable installation) within the Project area could increase sediment disturbance and therefore cause temporary increases in suspended sediment concentration (SSC) and sediment deposition leading to smothering effects on fish, shellfish and marine reptile communities. **Operational and maintenance phase** • Sediment disturbances from maintenance activities (cable repair and reburial) may have indirect impacts on fish, shellfish and marine reptile communities through temporary increases in SSC and deposition. These disturbances during operational and maintenance stages of the Project will be similar to those exhibited during construction and decommissioning, although of reduced magnitude.
Disturbances and injuries to sea turtle species from vessel activities	✓	✓	✓	**All phases** • Vessel traffic present due to all stage of development within the project could potentially increase the risk of collision for sea turtle species. The type, speed, size and ambient noise levels of vessels will directly influence the magnitude of this impact.
Disturbance and injury from underwater noise and vibration	✗	✓	✗	**Operational and maintenance phase** • Given the semi-submersible nature of the Project, noise and vibration generated by operational WTGs is not considered to have a significant impact on fish, shellfish and marine reptile species. • In addition, vessel noise during all phases has the potential to result in behavioural effects on fish, shellfish and marine reptile species.
Long-term subtidal habitat loss, including nursery and spawning habitats	✓	✗	✓	**Construction and decommissioning phase** • Long-term habitat loss could occur directly under anchoring systems and foundation structures (OSP) as well as continuous movement of moorings and cables on the seabed due to currents and wave action, along with any cable protection that may be required for protection of inter-array and export cables. • As outlined above for temporary habitat loss, this has the potential to affect sensitive fish, shellfish and marine reptile habitats (e.g. nursery and spawning habitats).
Changes in Electromagnetic Fields (EMF) from subsea cabling	✗	✓	✗	**Operational and maintenance phase** • Low-frequency EMFs are present along subsea cables used to transmit electricity from the array area to the appropriate substation and terminal locations. The sensory receptors of fish and shellfish could potentially be affected and lead to disruptions in orientation, effects on feeding, social interactions and avoidance behaviour.

Potential impact	Phase C	Phase O	Phase D	Justification
Sea turtle entanglement	✗	✓	✗	**Operational and maintenance phase** • Marine reptile species that inhabit the Study Area could become entangled in discarded fishing gear that has the potential to become tangled in the mooring system.
Marine fauna aggregations	✗	✓	✗	**Operational and maintenance phase** • Semi-submersible floating structures for WTGs, and mooring systems (lines/chains and buoys) provide hard substrate that will be colonised by fouling invertebrates and algae. These communities will attract fish, sea turtles and seabirds to the Offshore Project Area.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.5.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on fish, shellfish and marine reptile receptors.

For the purposes of undertaking the ESIA, all fish, shellfish and marine reptile species that have the potential to occur in the vicinity of the Project will be identified as VECs. Where it is appropriate to do so, and particularly where there are large numbers of species characterising a community, the VECs may be defined as a broad community ecotype with representative species highlighted. Each VECs will then be evaluated based on their legislative status together with the relative importance of the species/ecotypes present in the vicinity of the Project compared to the ecology of fish, shellfish and marine reptiles in the wider region. Consideration will also be given to commercial importance of the relevant VECs. Impacts on VECs will be described in terms of their magnitude and correlated against the sensitivity of each VECs to each impact to define the significance.

A Biodiversity Risk Assessment will be undertaken in accordance with IFC PS 6 which will include determination of the presence of Critical Habitat that could be affected by the Project. Critical Habitat is habitat that is defined based on 5 criteria set out by IFC PS6 requirements and is considered to be of significant importance to certain species, threatened or unique ecosystems, or key evolutionary processes (further details are provided in Appendix A-4).

6.6 Marine Mammals

This section considers the potential impacts of the Project on marine mammals during the construction, operation and maintenance and decommissioning phases.

6.6.1 Baseline Environment

Information regarding marine mammals within the East Sea, and more specifically off the coast of Ulsan in the Korea Strait, has been collated through a detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 6-19, noting that there were limited sources of information available on the distribution and occurrence of marine mammals within the East Sea.

Table 6-19: Key sources of information for the marine mammal baseline.

Data	Description	Source
Marine mammals of Korea	Detailed assessment of the conservation and management of marine mammals in South Korea, including distribution, habitat, feeding behaviour and migration.	Mammals of Korea Jo, 2015
Cetacean bycatch in proximity to the Project Area	Incidental takes of cetacean species as bycatch within the East Sea from 2011-2017.	National Institute of Fisheries Science, 2018,
Threatened marine mammal species	Korean Red List of Threatened Species. [online] (2nd). Available at: http://www.nationalredlist.org/files/2016/04/Korean-Red-List-of-Threatened-Species-English-compressed-2.pdf	National Institute of Biological Resources, 2014.

6.6.1.1 Cetaceans

Thirty-three species of cetaceans have been observed in Korean waters (Jo *et al*., 2018; Jo, 2015). Of these species, 18 are likely to occur within the Project area, based on their habitat and foraging preferences. The

high species richness of the area is attributed to the warm Tsushima currents which pass through the Korea Strait, supplying mild, high-salinity water resulting in an area of highly productive primary production and the availability of multiple prey species (Joo *et al*., 2016) Table 6-20 provides a summary of these species including their distribution and movement, depth range, and conservation status.

Marine mammals are protected under Korean legislation, through the Conservation and Management of Marine Ecosystems (CMME) Act as well as Cultural Heritage Protection (CHP) Act which protects animals, including their habitats, breeding grounds and migratory routes as they are observed to bring outstanding historic, artistic, academic, or scenic value to Korea and its people (Park, 2019). The conservation status of the species is identified in Table 6-20 under Korean legislation and international protection status. The species that are considered endangered or vulnerable in accordance with the IUCN red list include: the north pacific right whale (*Eubalaena japonica*), fin whale (*Balaenoptera physalus*) and narrow-ridged finless porpoise (*Neophocaena sunameri*). The remaining species are classified as near threatened (one species), of least concern (13 species) and data deficient (one species). The species with conservation status under the CMME Act as well as CITES and IWC include: North Pacific Right Whale (*Eubalaena japonica*), Fin Whale (*Balaenoptera physalus*), Humpback Whale (*Megaptera novaeangliae*), Gray Whale (*Eschrichtius robustus*), Killer Whale (*Orcinus orca*), False Killer Whale (*Pseudorca crassidens*), Bottlenose Dolphin (*Tursiops truncatus*) (Table 6-20).

Table 6-20: Key cetacean species likely to found within the Project area (Jo, 2015) and their conservation status.

Species	Taxonomic Name	Distribution	Diving Depth Range	Conservation Status in Korea	IUCN Conservation Status	Other
North Pacific Right Whale	*Eubalaena japonica*	Rarely found in Korean waters. Migratory species, infrequently occurring in waters around the East Sea between April and May.	Foraging typically occurs in water depths around 175m	Marine protected species (MOF)	Endangered	CITES I IWC
Common Minke Whale	*Balaenoptera acutorostrata*	Migratory species, occurring in Korean waters year-round, predominantly in the East and Yellow Seas. Species abundance peaks in spring. Rarely observed in coastal waters but are the second most observed cetacean in Korean waters.	Up to 200m	-	Least Concern	-
Fin Whale	*Balaenoptera physalus*	Occur in the Yellow and East Sea. Observed along the north-eastern coast of the East Sea in spring and autumn, the southern coast of the East Sea in August and November, and in waters of the Yellow Sea from October to May.	Up to 470m	Marine protected species (MOF)	Vulnerable	CITES I IWC
Humpback Whale	*Megaptera novaeangliae*	The first record for a humpback whale in Korean waters was off the coast of Ulsan. This species has been observed in waters southeast of Korea and seasonally migrates between cold and warm regions.	Up to 200m	Marine protected species	Least Concern	CITES I IWC
Gray Whale	*Eschrichtius robustus*	This species migrates along a Korean coastline of the East Sea approximately 20-30 km offshore towards wintering sites off the southern Korea coast. This species is known to pass Ulsan twice per year from late November to late January heading southbound and from mid-March to mid-May heading northbound.	Foraging typically occurs between 5-60m	Marine protected species (MOF)	Least Concern	CITES I IWC
Long-beaked Common Dolphin	*Delphinus capensis*	This species is the most common dolphin found in Korean waters and occurs predominantly along the eastern coast from spring to autumn in large social groups (100-500 individuals). It is rarely present during winter months.	Up to 280m	-	Least Concern	-
Risso's Dolphin	*Grampus griseus*	Occurs in waters around Korea, but predominantly in the East Sea. This species prefers deep water habitats.	400-1,000m	-	Least Concern	-
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	This species is generally found from early summer to late autumn in the central to northern East Sea of Korea.	Up to 1,000m	-	Least Concern	-

Species	Taxonomic Name	Distribution	Diving Depth Range	Conservation Status in Korea	IUCN Conservation Status	Other
Killer Whale	*Orcinus orca*	Killer whales have been encountered in the East Sea and waters around Jeju Island.	Foraging typically occurs between 50-150m	Marine protected species (MOF)	Data Deficient	CITES II IWC
False Killer Whale	*Pseudorca crassidens*	This species is observed in Korean waters from early summer to late autumn in the East Sea. Migratory routes for this species are not well known.	Prefer deep water habitats, > 1,000m	Marine protected species (MOF)	Near Threatened	CITES II IWC
Pantropical Spotted Dolphin	*Stenella attenuata*	This species is often observed in Korean waters. Although specific migratory patterns are unknown, they tend to move inshore during fall and winter and offshore in the spring.	Foraging typically occurs 2-50m	-	Least Concern	-
Bottlenose Dolphin	*Tursiops truncatus*	Encountered in waters around the Korean peninsula. A coastal species that prefers warm estuarine waters.	Up to 300m	Marine protected species (MOF)	Least Concern	CITES II IWC
Narrow-ridged Finless Porpoise	*Neophocaena sunameri* (Jo, 2015) **Neophocaena asiaeorientalis* (IUCN, 2023)	Observed in shallow coastal waters off Korea, peak occurrence is March to June. Seasonal movements occur between the southern Yellow Sea and the southern coast of Korea.	Foraging typically occurs between 2-40m	-	Endangered	-
Harbour Porpoise	*Phocoena phocoena*	Commonly found in bays, estuaries and harbours, this species prefers coastal areas and has been observed in cold waters of the East Sea.	Up to 200m	-	Least Concern	-
Dall's Porpoise	*Phocoenoides dalli*	This species occurs predominantly in the northern East Sea. During winter months, Dall's porpoises are found along Korea's east coast.	Prefers offshore waters > 180m	-	Least Concern	-
Dwarf Sperm Whale	*Kogia sima*	This species is expected to inhabit the East Sea of Korean waters. Some populations are known to migrate and spend the summer in Korean waters. There have been recorded stranding events 200 km from Busan.	Foraging typically occurs between 200-300m	-	Least Concern	-
Baird's Beaked Whale	*Berardius bairdii*	Observed in Korean waters, predominantly in the East Sea. Most sightings occur from March to October. This species migrates seasonally and locally due to surface water temperatures and prey availability.	Prefers deep oceanic waters > 1,000m	-	Least Concern	-
Blainville's Beaked Whale	*Mesoplodon densirostris*	Observed in the East Sea of Korean waters but considered quite rare. This species does not migrate.	Prefers deep waters 200-1,000m	-	Least Concern	-

Surveys conducted to identify cetacean species between 2000-2018 within the Study Area identified several species from the species listed above in Table 6-20 (National Institute of Fisheries Science, 2009; 2018; 2019; Korea Maritime Institute, 2020 and Lee *et al.,* 2019). Species typically encountered during the various surveys included common minke whale; Pacific white-sided dolphin; short-beaked common dolphin; finless porpoise; bottlenose dolphin; and Risso's dolphin.

According to the Cetacean Research Institute, between 2011 and 2017, nearly 4,000 individual cetaceans have been incidentally caught as bycatch in the East Sea (Table 6-21). Finless porpoise, short-beaked common dolphin, common minke whale, and pacific white-sided dolphin were the most common species that are caught as bycatch in the Study Area (National Institute of Fisheries Science,2018, Lee *et al*., 2018) Table 6-21 and Figure 6-14). This data confirms the results of the various surveys undertaken between 2000-2018 detailed above.

Table 6-21: Incidental cetacean bycatch species in the Study Area (West, South and East) between 2011 and 2017 (National Institute of Fisheries Science, 2018).

Species		Numbers of Individuals
Common Name	**Taxonomic Name**	
Finless porpoise	*Neophocaena sunameri*	119
Short-beaked common dolphin	*Delphinus delphis*	2,911
Common minke whale	*Balaenoptera acutorostrata*	381
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	377
Others	-	131
Total		**3,919**

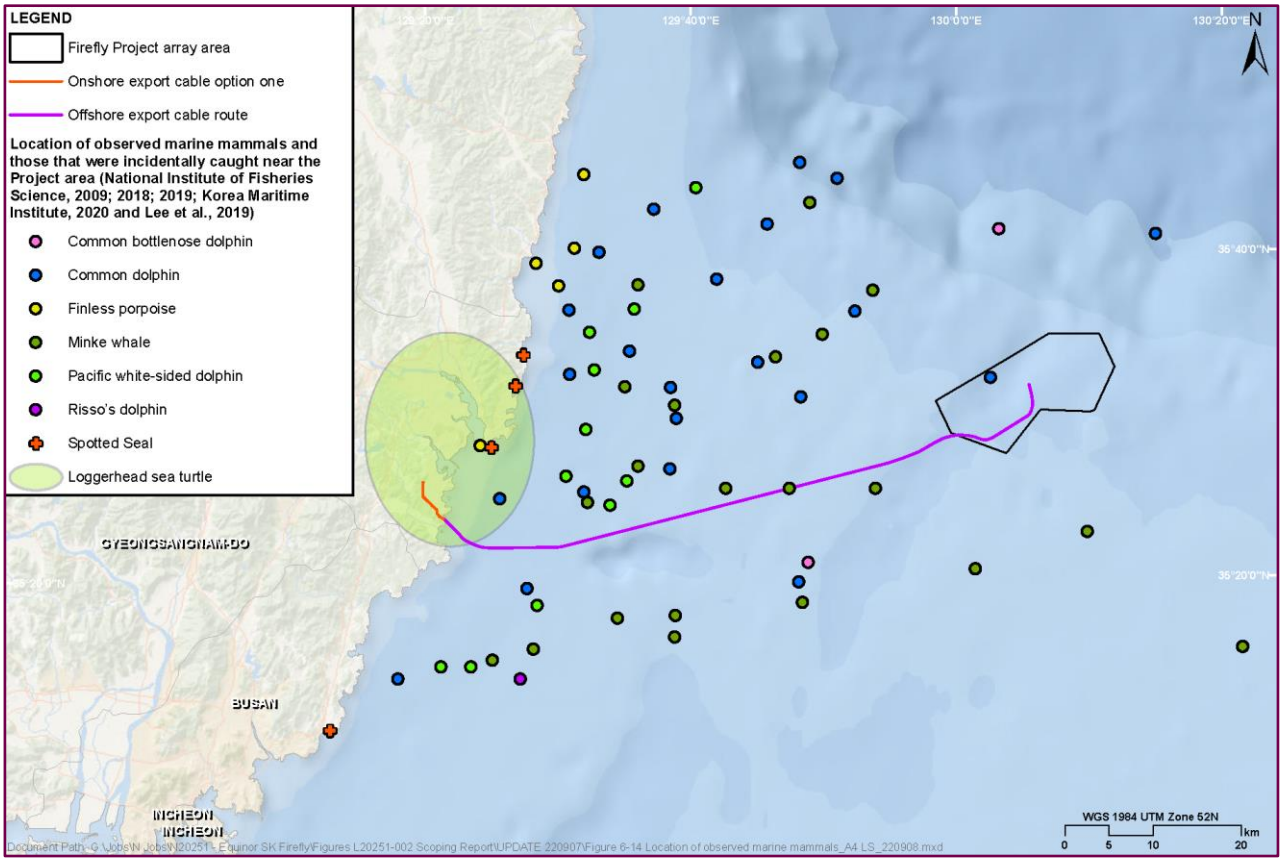


Figure 6-14: Location of observed marine mammals and those that were incidentally caught near the Project area (National Institute of Fisheries Science, 2009; 2018; 2019; Korea Maritime Institute, 2020 and Lee *et al.,* 2019).

6.6.1.2 Pinnipeds

Six species of pinniped have been observed in Korean waters (Jo, 2015; Jo *et al*., 2018 Kim *et al*., 2021). Of these, three species could be found within the Project area due to their likely population distribution: northern fur seal, stellar sea lion and spotted seal (Jo, 2015). Table 6-22 provides summary information of these species including their distribution and movement, depth range, and conservation status.

The most common pinniped species distributed along the Korean peninsula coast and within the East Sea is the spotted seal (*Phoca largha*). The population on the east coast of Korea consists of approximately 100,000 individuals (Park, 2020). There is little information available regarding the location of pupping and breeding sites along the east coast of Korea. However, the population is not known to have pupping and breeding sites within the Study Area (Jo, 2015; Park, 2020). The breeding season of the spotted seal occurs in spring while pups are born between February and May, dependent on location (Seal Conservation Society, 2011). This species will typically gather in late spring and summer to moult (Won and Yoo, 2004). Within the Study Area spotted seals are observed frequently utilising rocky outcrops and various haul out areas from mid-March to late December, which could suggest that they breed locally, however additional data would be needed to definitively make this conclusion (Jo, 2015). Spotted seals are pelagic foragers and are capable of diving up to 300 m to consume a variety of prey species (Jo, 2015).

The northern fur seal (*Callorhinus ursinus*) is found along rocky coasts of the Korean peninsula (National Institute of Biological Resources, 2014) while breeding rookeries are typically located in coastal areas where the continental shelf is found near to shore (Seal Conservation Society, 2011). This species exhibits strong fidelity to sites and females typically arrive mid-June to give birth (Seal Conservation Society, 2011). Feeding typically occurs in water depths ranging from 62-200 m and individuals spend 4-10 days at sea before returning to nurse during pupping seasons (Jo, 2015; Seal Conservation Society, 2011). The northern fur seal is considered threatened by predation from killer whale and white shark populations, incidental catches, and climate change (Jo, 2015).

The stellar sea lion (*Eumetopias jubatus*) is the largest pinniped found in Korean waters, occurring in winter and early spring along the east coast of Korea (Jo, 2015; Kim *et al*., 2021). Stellar sea lions do not migrate; however, they move seasonally to locate prey species and prefer remote rocky coastlines with ledges, boulders and gravel or sand beaches (Jo, 2015). This species prefers to utilise island sites as they offer increased protection from human interaction and close access to offshore prey (Gentry, 2009). Stellar sea lions are generalist feeders with some studies observing more than 63 prey species in their diet over their range, predominantly feeding in deep waters beyond the continental shelf (Gentry, 2009). Prey consumption patterns indicate that the species targets densely schooled, spawning, and migratory aggregations of fish along the continental shelf (Sinclair and Zeppelin, 2002). Breeding and pupping occur in locations where both sexes return to natal rookeries with pupping occurring from late May to early July (Wiles, 2015). Parental care typically lasts more than one year and as a result, many females do not breed annually which causes this species to exhibit lower productivity that other pinnipeds (Pitcher et al., 1998).

Pinniped species are protected under Korean legislation such as Conservation and Management of Marine Ecosystems (CMME) Act, Wildlife Protection and Management Act, and the Cultural Heritage Protection Act which protects animals, including their habitats, breeding grounds and migratory routes (Park, 2019). The conservation status of the species identified under the Cultural Heritage Protection Act of Korea and the IUCN red list of threat status is provided in Table 6-22. The IUCN considers the northern fur seal vulnerable, the stellar sea lion near threatened and the spotted seal as a species of least concern. However, all three species are listed as protected marine species under the Conservation and Management of Marine Ecosystems Act, and stellar sea lion is considered to be endangered under Wildlife Protection and Management Act.

In Korea, the spotted seal is designated as a Natural Monument by the Cultural Heritage Administration and was listed as an endangered species by the MOE in 1997 due to habitat destruction and human harassment within the region and as a protected marine species in 2007 (Jo, 2015; Won and Yoo, 2004). The South Korean government designated the northern fur seal and the stellar sea lion as endangered species in 1997, however, there has not been any practical conservation actions undertaken for these species in the region (Jo, 2015).

Table 6-22: Pinniped species likely to occur within the Project area based on known distribution of pinnipeds in South Korea (Jo, 2015).

Species	Taxonomic Name	Distribution and Movement	Diving Depth Range	Korean Conservation Status	IUCN Conservation Status
Northern Fur Seal	*Callorhinus ursinus*	Predominantly found along the northern eastern coast and occasionally the southern coast of the Korean peninsula. Most populations migrate South during winter (non-breeding) season.	Feeding typically occurs between 62-200 m	Endangered Wildlife II (MOE) & Marine protected species (MOF)	Vulnerable
Stellar Sea Lion	*Eumetopias jubatus*	Occurs in winter and early spring along Korea's east coast. Prefers the coastal shelf region but can be found 45-100 km from shore. This species does not migrate but travels seasonally to new feeding and resting grounds.	Foraging typically occurs between 20-400 m	Endangered Wildlife II (MOE) & Marine protected species (MOF)	Near Threatened
Spotted Seal	*Phoca largha*	The species has a large distribution that spans from the Yellow Sea in China to the Chukchi Sea in Russia Spotted seals are pelagic foragers and are found in the western East Sea. They are the most common phocid along the Korean peninsula coast. Spotted seals are known to arrive on Korean coasts in mid-March and leave in late December to breed.	Up to 300 m	Endangered Wildlife II (MOE) & Designated Natural Monument No. 331 (CHA) & Marine protected species (MOF)	Least Concern

6.6.2 Proposed Additional Data Collection

To ensure a complete baseline dataset is collected additional surveys will be undertaken in accordance with the South Korean Environmental Legislation, the EIA Manual and IFC Performance Standards.

Marine mammal surveys are proposed to identify the presence, seasonal patterns, migratory periods, densities, and abundance of key species within Project area. To achieve this the surveys proposed will include a combination of vessel-based visual surveys and acoustic monitoring conducted on a monthly basis within the proposed array area and export cable route. Survey programs may be extended to supplement the initial 12-month survey where data gaps have been identified and additional data may be required to address scientific uncertainty.

Table 6-23 and Figure 6-15 provide a summary of the survey methods that will be undertaken including survey design, parameters and frequency of data collection for marine mammals. Coordinates for acoustic logger positioning and survey transects can be found in Appendix A-3. Noting these may change following consultation with the Korean Navy and other stakeholders.

Table 6-23: Proposed data collection for marine mammals.

Data Parameters	Number of Sampling locations / Length of transects	Survey Frequency/ Duration	Sampling Equipment
Visual Observation Survey	Linear transects of 30 km in distance, spaced 2 km apart in a NEE to SWW direction across the array area. Single transect along the cable route. Linear transects of 2.5-3 km in distance, spaced about 2 km apart in a perpendicular to the shoreline across the nearshore area of the export cable route	Monthly surveys conducted for a minimum period of 12 months	Binoculars (6-10x magnification), camera for filming (200 to 800mm telescopic lens), unmanned drone (specifics TBD by permission from Navy)
Acoustic Monitoring ("Underwater Noise Monitoring")	3 locations	once for a period of 6 months and a follow up 6 months as needed	Underwater hydrophone (SoundTrap ST600-HF, UTS-9500, R 500, R 2K and IF-7500)

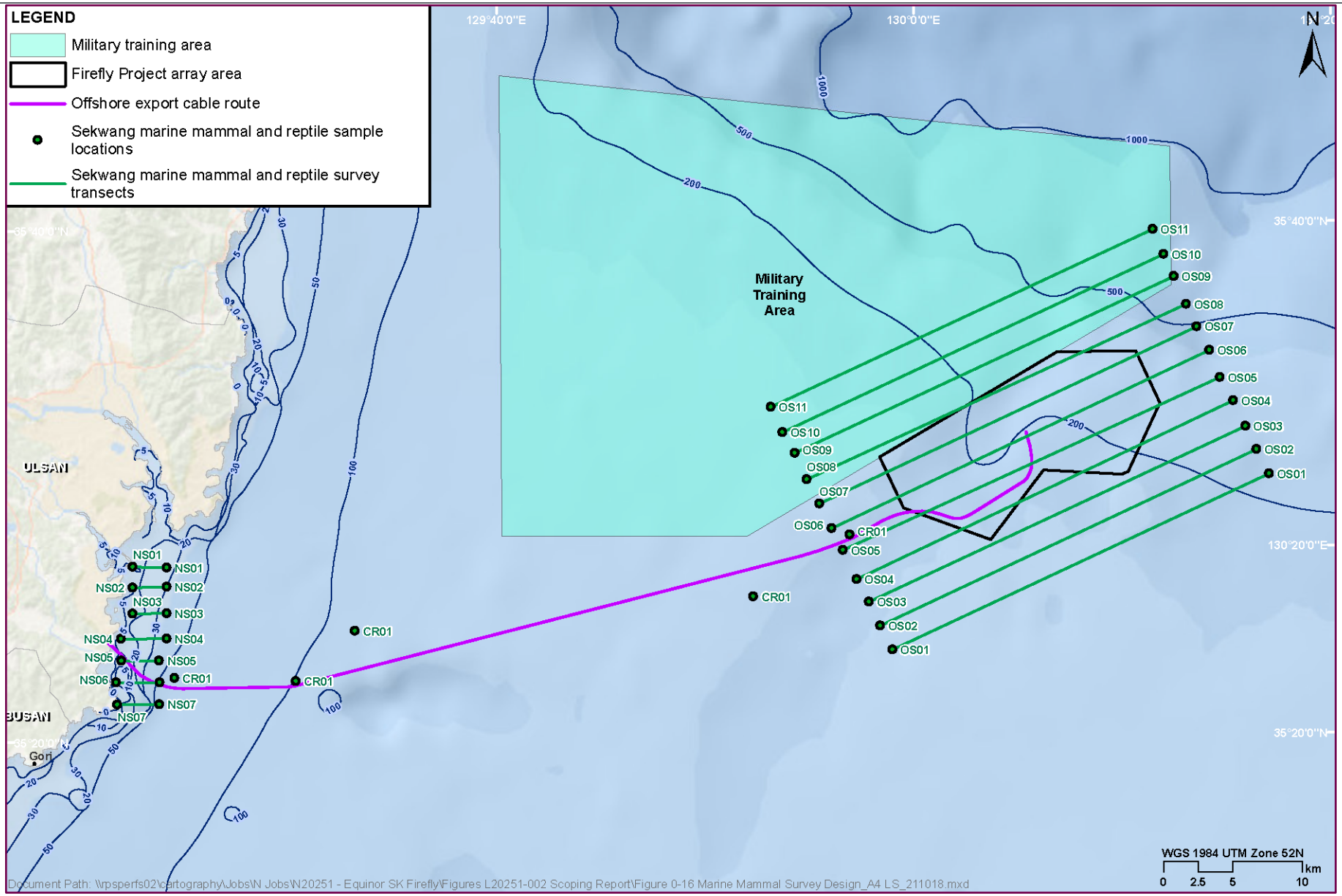


Figure 6-15: Marine mammal survey design plan for the Project.

6.6.3 Potential Project Impacts

A range of potential impacts on marine mammals have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-24.

Table 6-24: Impacts Proposed to be Scoped Into the Project Assessment for Marine Mammals.

Potential impact	Phase			Justification
	C	O	D	
Disturbances and/or injuries from underwater noise resulting from vessel movements and Project installations	✓	✓	✗	**Construction and Operation phase** • Marine mammals are extremely sensitive to underwater noise; using sound for foraging, orientation, prey detection and predator avoidance, communication and navigation. Underwater noise can lead to physical and auditory injury as well as behavioural changes. Site-specific noise modelling will be used to assess the potential ranges and areas of ensonification within which injury and/or disturbances could occur in each of the key species groups as a result of subsea noise associated with construction and operational activities. The offshore substation will require piling and the noise associated with this activity should be modelled to determine propagation ranges. The requirement for sheet piling of the shore crossing trenches will also create potential for an increase in underwater noise levels. Elevated noise associated with the operations of vessels, and trenching and cable protection activities, is possible and therefore is scoped into the impact assessment.
Disturbances and/or injuries from collisions and vessel presence	✓	✓	✓	**All phases** • Increased vessel traffic within the array area resulting from Project could potentially affect marine mammals through the increased risks in collision and increased subsea noise associated with vessels during all phases of the Project. The magnitude of this impact is directly related to vessel type, size, speed and ambient noise level.
Changes in prey resources (fish and shellfish community)	✓	✓	✓	**All phases** • Potential changes in resource availability of the prey species community could have an indirect effect on marine mammals in the Study Area. Changes in the distribution and abundance of certain prey species could directly lead to changes in the distribution of marine mammals resulting from potential decreases in foraging success. The assessment will be informed by the fish and shellfish assessment (Section 6.5).
Accidental pollution within the surrounding area.	✓	✓	✓	**All phases** • There is a risk of the accidental and unplanned release of chemicals and pollutants originating from vessels/vehicles and equipment/machinery utilised during all Project stages in the surrounding environment.
Changes in Electromagnetic Fields (EMF) from subsea cabling.	✗	✓	✗	**Operational and maintenance phase** • Low-frequency EMFs are present along subsea cables used to transmit electricity from the array area to the appropriate substation and terminal locations. Marine mammals are classified as magneto-sensitive species and the EMFs could potentially lead to disruptions in orientation, effects on feeding and social interactions and avoidance behaviour.
Injury from clearance of UXOs in the development area.	✓	✗	✗	**Constructional phase** • If required based on Project location and further UXO studies, controlled UXO detonation may be needed. This process can cause both lethal and sub-lethal injuries to marine mammals.
Increased suspended sediment concentrations and deposition	✓	✓	✓	**Construction and decommissioning phase** • Marine mammal vision can be imperative to navigation, prey detection and obstacle avoidance. This vision is adapted to facilitate lower levels of light within the marine environment. There is the potential for increased levels of suspended sediment concentrations to decrease light availability in the water column, increasing turbidity and decreasing vision. The assessment of effect of sediment deposition will be informed by a physical processes modelling study to determine the levels of increase in sedimentation and associated sediment deposition (see Section 6.3). **Operational and maintenance phase** • During Project operation and maintenance, isolated events (cable repair and reburial) could increase SSC and deposition, although of reduced magnitude comparatively. As

Potential impact	Phase C	Phase O	Phase D	Justification
				above, the impacts on marine mammals will be informed by the physical processes modelling study (see Section 6.3).
Remobilisation of contaminated sediments.	✓·	✓·	✓·	**All phases** • Disturbances to the seabed that are associated with all stages of project construction could potentially lead to remobilising contaminants found in the sediment, resulting in harmful effects on surrounding marine mammals. This will consider both the effects on marine mammals and their food sources (benthic fish and shellfish communities) through sediment contaminant data as per Section 6.3.1.7.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.6.4 Proposed Assessment Methodology

Ambient noise recordings from the additional data collection described above will inform a subsea noise assessment involving project-specific noise modelling to determine elevations in subsea noise as a result of the Project versus the existing baseline noise levels in the Study Area. Results of the subsea noise assessment will be used to support the assessment of effects on marine mammal species.

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project on marine mammal receptors. The proposed approach will follow best practice guidelines (South Korean and international) for undertaking ecological impact assessment such as:

- Korean EIA Guidance Manual (2021);
- IFC (2015) International Finance Corporation's Environmental, Health, and Safety Guidelines for Wind Energy. August 7, 2015;
- IFC (2019) International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. January 1, 2012 (updated June 27, 2019);
- A Review of Assessment Methodologies for Offshore Wind Farms (Collaborative Offshore Wind Research into The Environment (COWRIE) METH-08-08) (Maclean et al., 2009);
- Environmental impact assessment for offshore renewable energy projects (British Standards Institute (BSI), 2015); and
- IEMA Environmental Impact Assessment Guide to Shaping Quality Development (IEMA, 2015).

For the purposes of undertaking the ESIA, all marine mammal species that have the potential to occur in the vicinity of the Project will be identified as Valued Ecosystem Components (VECs). Where it is appropriate to do so, and particularly where there are large numbers of species characterising a community, the VECs may be defined as a broad community ecotype with representative species highlighted. Each VECs will then be evaluated based on their legislative status together with the relative importance of the species/ecotypes present in the vicinity of the Project compared to the ecology of fish, shellfish and marine reptiles in the wider region. Consideration will also be given to commercial importance of the relevant VECs. Impacts on VECs will be described in terms of their magnitude and correlated against the sensitivity of each VECs to each impact to define the significance.

A Biodiversity Risk Assessment will be undertaken in accordance with IFC PS 6 which will include determination of the presence of Critical Habitat that could be affected by the Project. Critical Habitat is habitat that is defined based on 5 criteria set out by IFC PS6 requirements and is considered to be of significant importance to certain species, threatened or unique ecosystems, or key evolutionary processes (further details are provided in Appendix A-4).

For the purpose of ESIA, the impact of construction noise on marine mammals is to be predicted through underwater noise modelling using three datasets: 1. hardness of seabed from G&G Study (Equinor), 2. Materials used during the construction stage (Equinor), and 3. sound speed calculated from marine process survey (Sekwang).

6.7 Seabirds and Migratory Birds

This section considers the potential impacts of the Project on seabirds and migratory birds during the construction, operation and maintenance and decommissioning phases.

6.7.1 Baseline Environment

Information regarding offshore seabirds and migratory birds within the East Sea, and more specifically off the coast of Ulsan in the Korea Strait, has been collated through a detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 6-25, noting that this list is not exhaustive.

Table 6-25: Key sources of information for the offshore ornithology baseline.

Data	Description	Source
Waterbird Populations within the Study Area	The Asian Waterbird Census (AWC) is part of the global International Waterbird Census (IWC). This citizen-science programme supports the conservation and management of wetlands and waterbirds worldwide by conducting annual surveys of waterbird populations in January each year.	Asian Waterbird Census
Protected bird species within the Project area	Database of information about bird species around the globe, including taxonomic and IUCN Red List category information.	BirdLife International
Migratory shorebirds count data	Site-specific count data for migratory shorebirds of the EAAF that are listed under conservation agreements such as ROKAMBA, JAMBA and CAMBA	Bamford et al. 2008
Bird species	Extensive database information system about bird species world-wide.	AviBase
Bird species within the East Asian-Australasian Flyway	Information on key bird species that occur within the East Asian-Australasian Flyway.	EAAFP Key Species
Protected Bird species under Korean legislation	Formally listed/protected as Marine under Republic of Korea legislation.	Marine Environment Information Map of the Ministry of Oceans and Fisheries (https://www.meis.go.kr/map/oemsBaseMap.do), National survey of seabirds (2018-2019)
Important Bird and Biodiversity Areas (IBA) - Asia	Catalogue of Important Bird Areas (IBA) in Asia including summary of their primary interest features	BirdLife International

6.7.1.1 International Flyways

The routes that migratory waterbirds traverse on an annual basis are known as 'flyways' (Figure 6-16). There are nine major flyways around the world. South Korea is part of the East Asian-Australasian Flyway (EAAF), which stretches from the Russian Far East and Alaska, southwards through East Asia and South-east Asia, to Australia and New Zealand, and encompasses 22 countries. The EAAF is home to over 50 million migratory waterbirds from over 250 different populations, including 36 globally threatened species and 19 Near Threatened species. During migration, waterbirds rely on a system of highly productive wetlands to rest and feed, building up sufficient energy to fuel the next phase of their journey. International cooperation across their migratory range is therefore essential to conserve and protect migratory waterbirds and the habitats on which they depend (EAAFP, 2021). The Korean Peninsula is an essential link in the EAAF (see Figure 6-16), with the coastline and shallow sea between the peninsula and mainland China (the Huang Hei and Bohai Wan) being a key staging and over-wintering area (Bamford *et al.* 2008).

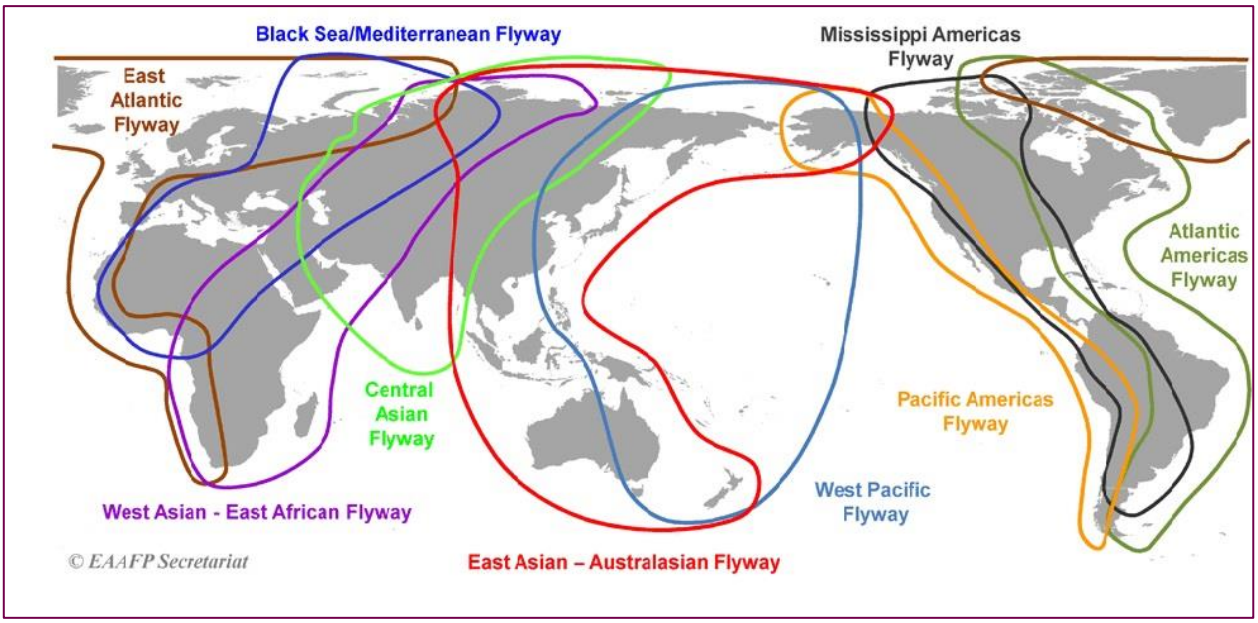


Figure 6-16: The major Flyways around the world. The East Asian-Australasian Flyway is noted on the map with the red line (EAAFP, 2021).

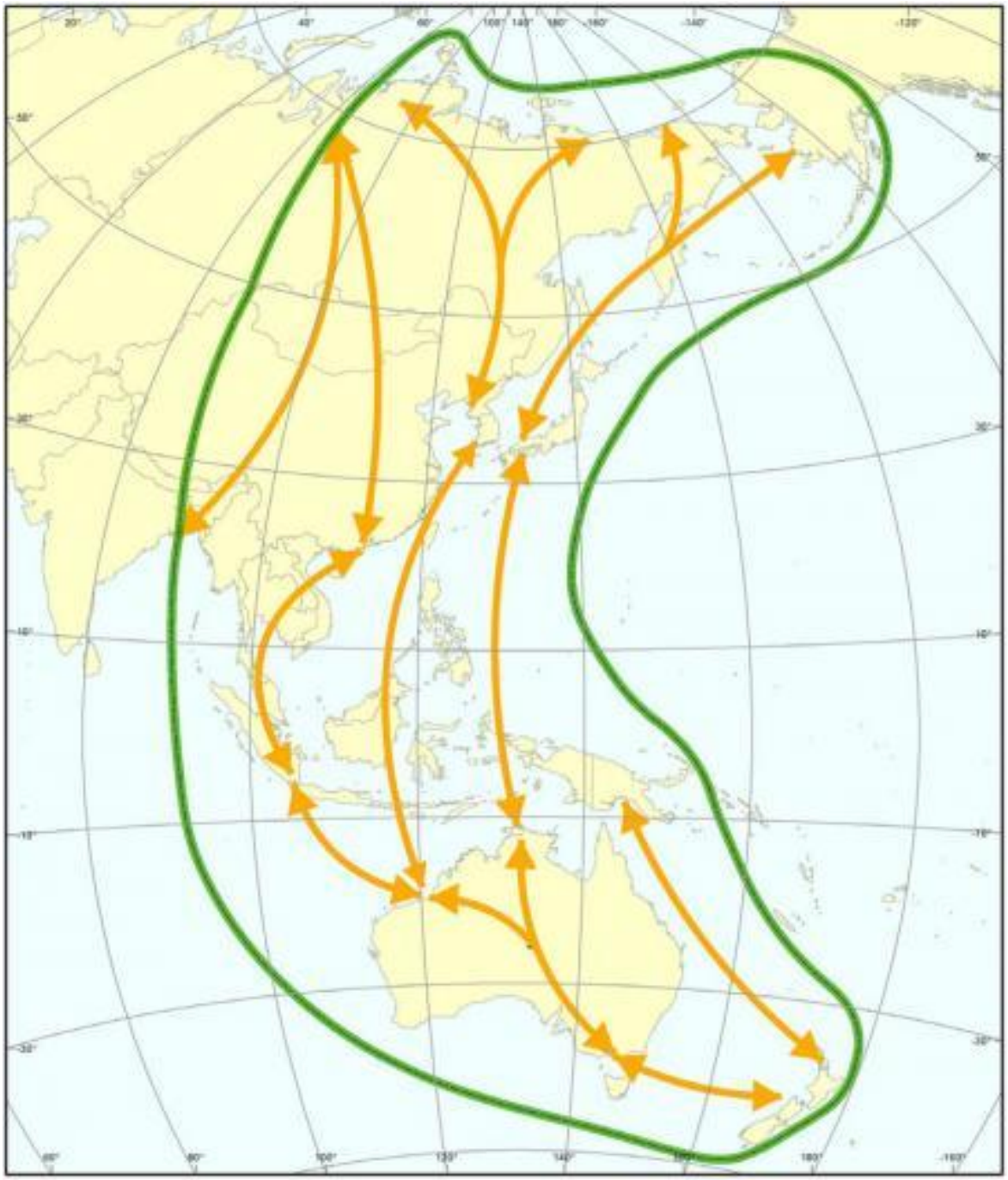


Figure 6-17: Migratory patterns in the East Asian-Australasian Flyway.

6.7.1.2 National

The desktop study identified 389 bird species regularly recorded in South Korea, including land birds and waterbirds. These species are listed in Appendix A-5.

Of these 389 bird species, six are listed as Critically Endangered by the IUCN, 11 species as Endangered, 26 species as Vulnerable, and 27 species as Near Threatened. A total of 314 species are considered Least Concern by the IUCN (and 4 species were unassigned). Migratory birds make up a large proportion of the South Korean bird assemblage, with 148 (38%) species listed as migratory under the Bonn Convention. Of these 148 migratory birds, 112 are waterbirds, with 31 of these migratory waterbirds also listed as threatened. In addition, there are four threatened birds of prey associated with wetlands and marine coasts.

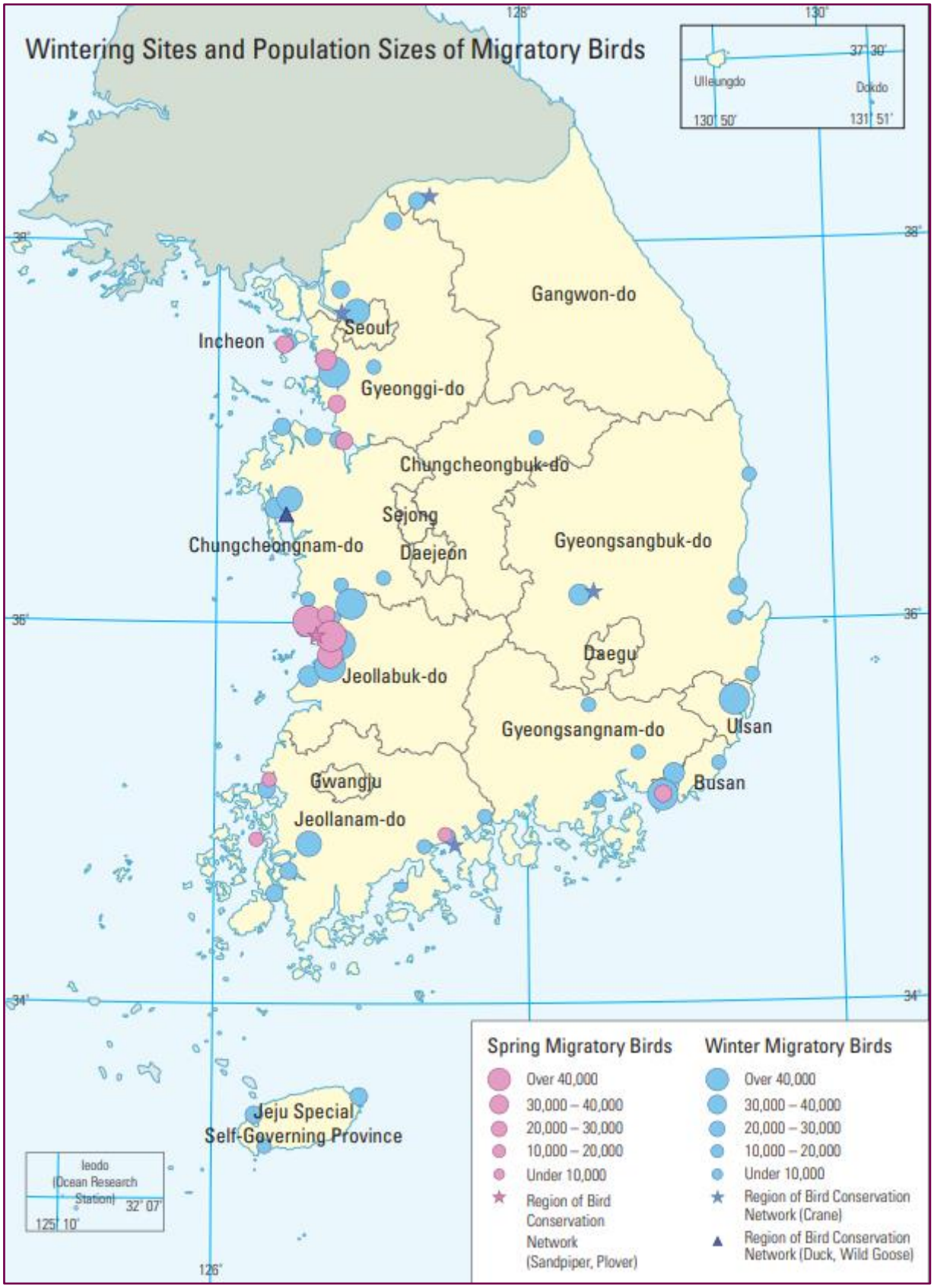


Figure 6-18: Important sites for migratory waterbirds in South Korea in the northern hemisphere spring (northward migration) and winter (non-breeding season). (source:- http://nationalatlas.ngii.go.kr/pages/page_709.php).

6.7.1.3 Regional

Ulsan is a small province on the south-east coast in a region that lacks extensive coastal or inland wetlands, but despite this the bird assemblage of 255 species includes a high proportion (108, 42%) of waterbirds (Appendix A-5). This is dominated by waterfowl (swans and ducks), with just 17 of the 48 shorebirds (plovers and sandpipers) recorded for South Korea.

The coastline is mostly developed and is a mixture of rocky and sandy shorelines, with a limited tidal zone and thus little habitat for shorebirds. Small rocky stacks are located just offshore at some locations. The nearest island, Tsushima (Japan) is about 150 km to the south-south-west.

There are several small reserves within and around Ulsan City, while the adjacent coastline and the Taehwa River, and one inland reservoir, were listed by the East Asian Australian Flyway Network (2021) as the Ulsan Taehwa River Flyway Network site in May 2021 (Figure 6-19).

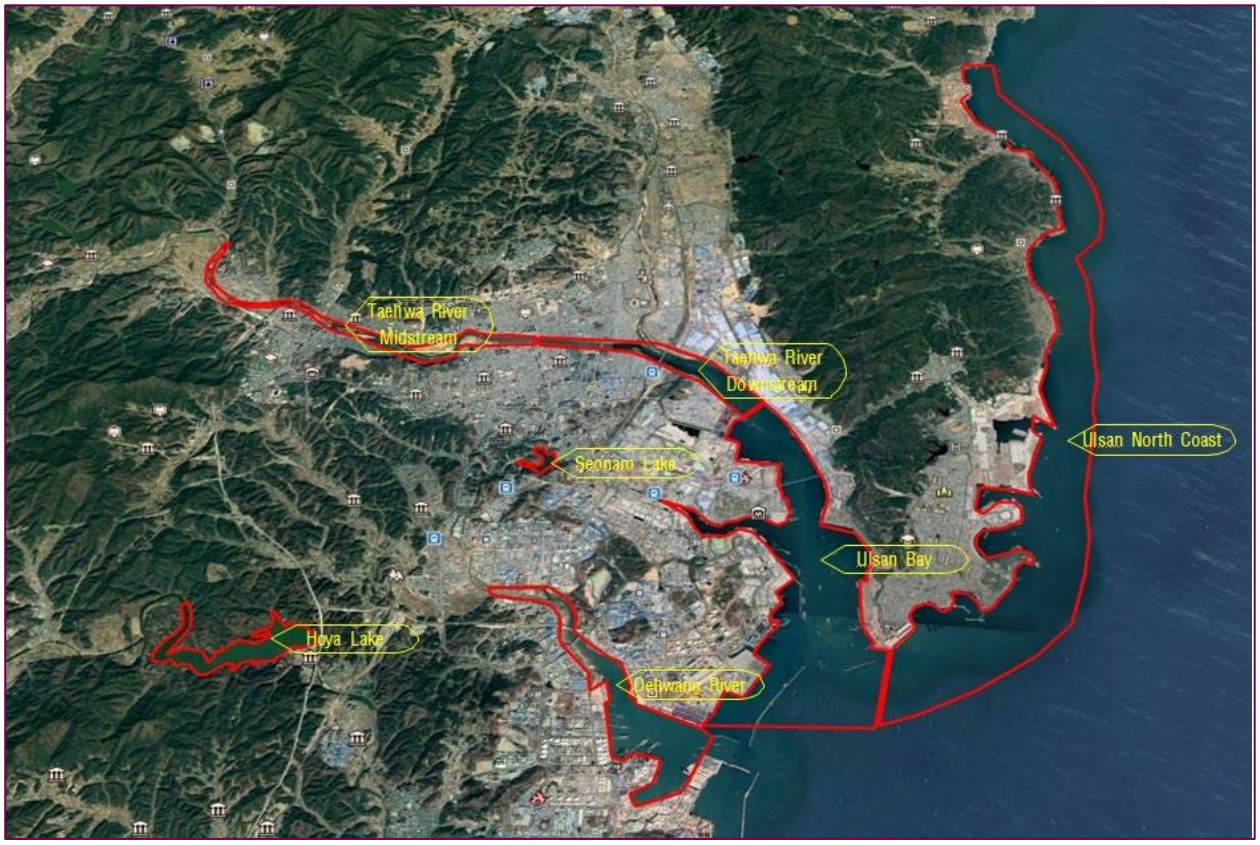


Figure 6-19: The Ulsan Taehwa River Flyway Network Area.

Waterbirds in the Ulsan area have been subject to surveys over the period 2014 to 2019 as part of an assessment of the Taehwa River and nearby coast for the listing as a Flyway Network site (EAAFP 2021;Figure 6-19). All waterbirds recorded from the Ulsan area (avibase) are listed in Appendix.A-5, with count data presented where available. Count data are available for 43 species, and the species actually counted, and the numbers present, give a good indication of the composition of the waterbird assemblage in the Ulsan area. The most abundant species was the Common Coot, with a maximum count of nearly 21,000 birds. The count associated with this one species therefore places the Taehwa River as a potentially important site under the Ramsar Convention. Other abundant species were: Mallard (3,825), Common Pochard (6,057), Greater Scaup (2,769), Eurasian Wigeon (3,891), Harlequin Duck (2,403) and Mew Gull (5,237). Abundant species are therefore mostly ducks, while shorebirds were recorded in very small numbers. This reflects the nature of the site, with sheltered open water of the estuary and coastal embayments, but little in the way of tidal mudflats. The high counts were noted as coming from the winter non-breeding period (roughly November to March), so these are migratory waterbirds that have moved south for the winter and will move north to breed. For seven species, the maximum counts represent >1% of their known population (see Appendix.A-5).

The absence of counts for some ducks, and notably for geese and swans, suggest that these species are not regular visitors to the Ulsan area. The lack of counts for marine species (murrrelets, guillemot, auklet, shearwaters, phalarope and some of the gulls and terns) may be due to a lack of offshore sampling. Under their listing as marine species, the Common Murre, Streaked Shearwater and Rhinoceros Auklet are noted as occurring in the East Sea, but this gives no indication of abundance. Shorebirds (plovers and sandpipers) are scarce or absent due to limited amount of intertidal habitat.

6.7.1.4 Project Specific

Nearshore and Onshore waterbird surveys located adjacent to the export cable route are listed in Table 6-26 and presented in Figure 6-20. The data collected during these surveys identified a total of 20 waterbird species (Table 6-27). The most common species counted was the Black-tailed Gull followed by Black-headed Gull and Vega Gull. All species observed were considered to be overwintering. One protected species, the Brant Goose was observed.

Table 6-26: Shorebirds survey references.

No.	Location	Category	References
1	Taehwa River (Myeongcheon-Samho Bridge)	Regional	(https://egis.me.go.kr) MEIP, 2021
2	Ulsan Bay	Regional	
3	Hoeya Lake	Regional	
4	Busan-Ulsan Coast	Export Cable Corridor landfall	
5	Jinha Beach	Export Cable Corridor landfall	Marine Environment Information Map of the Ministry of Oceans and Fisheries (https://www.meis.go.kr/map/oemsBaseMap.do), National survey of seabirds (2018-2019)

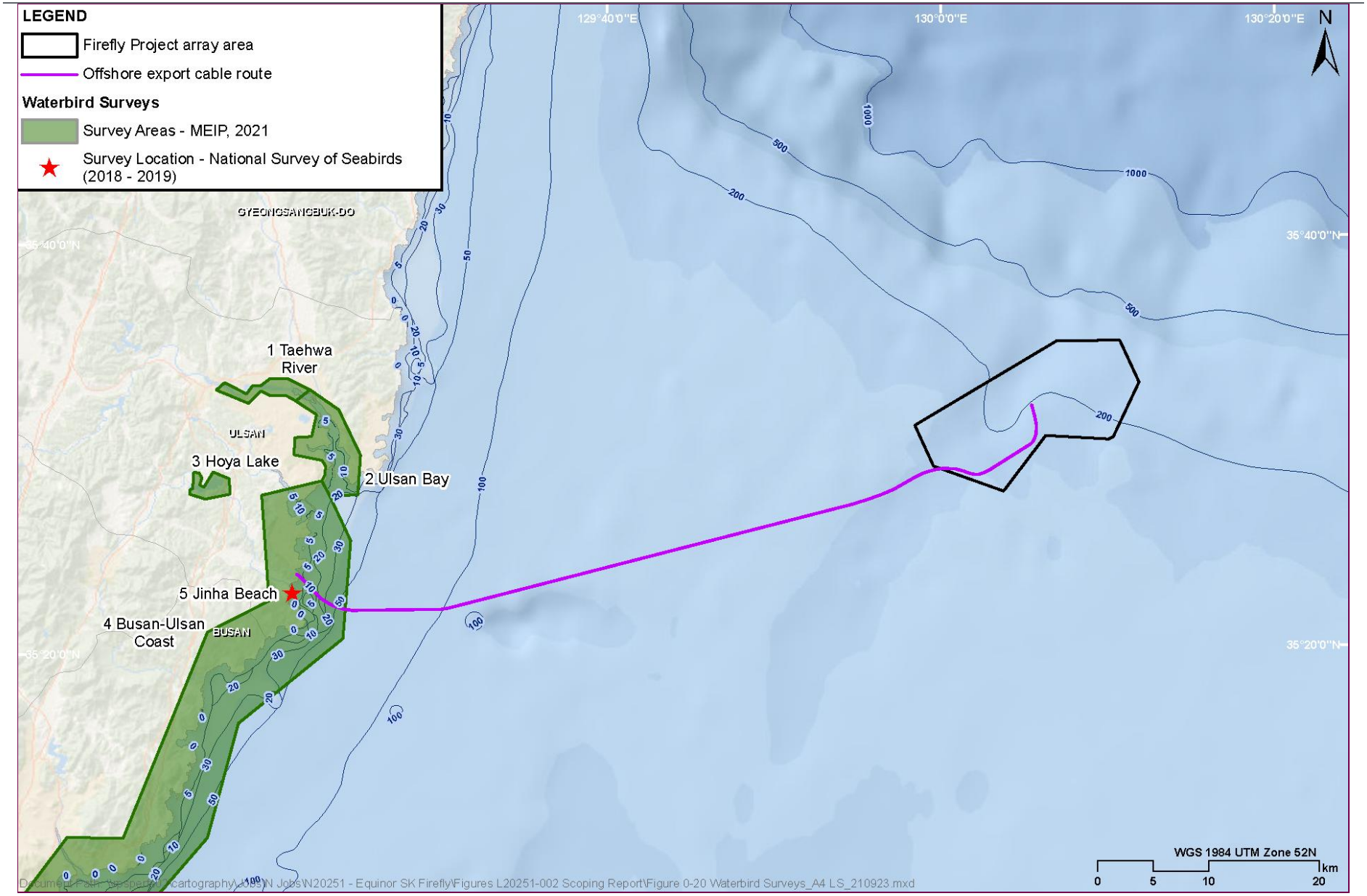


Figure 6-20: Location and range of waterbird surveys near the Project area

Table 6-27: Waterbird species identified in the intertidal and near shore between 2018 and 2019.

Species		Winter
Common name	**Scientific name**	
Black-tailed Gull	*Larus crassirostris*	*11,792*
Black-headed Gull	*Chroicocephalus ridibundus*	*6,477*
Vega Gull	*Larus vegae*	*1,345*
Eurasian Coot	*Fulica atra*	*645*
Slaty-backed Gull	*Larus schistisagus*	*574*
Great Cormorant	*Phalacrocorax carbo*	*514*
Great Crested Grebe	*Podiceps cristatus*	*293*
Mallard	*Anas platyrhynchos*	*270*
Eastern Spot-billed Duck	*Anas zonorhyncha*	*221*
Grey Heron	*Ardea cinerea*	*23*
Eurasian Wigeon	*Mareca penelope*	*17*
Gadwall	*Mareca strepera*	*12*
Common Pochard	*Aythya ferina*	*11*
Red-breasted Merganser	*Mergus serrator*	*3*
Little Egret	*Egretta garzetta*	*3*
Great Egret	*Ardea alba*	*3*
Brant Goose*	*Branta bernicla*	*1*
Black-necked Grebe	*Podiceps nigricollis*	*1*
Red-throated Loon	*Gavia stellata*	*1*
Common Shelduck	*Tadorna tadorna*	*1*

* Class II endangered wildlife

There is currently uncertainty regarding the numbers of birds moving through the array area. The types of species that are abundant around Ulsan, and the geography of the landscape, suggests that most movements will be along the coast or overland, but it is not known if birds move across towards Japan or are travelling over the East Sea from breeding grounds to the north. Several of the bird species recorded for Ulsan are oceanic, including the murrelets and allies, shearwaters, and some of the gulls and terns. Their abundance at the array area is however unknown. The distance from the coast and the absence of nearby islands may mean that bird densities are very low in the array area, but this is not certain as these oceanic birds disperse widely and may aggregate at food sources, making their distribution and abundance unpredictable. This may include foraging birds, travelling considerable distances from important seabird breeding colonies at Ulleung, Jukdo and Dokdo Islands or those in Japan, such as the Okinoshima and Koyajima Islands Important Bird Area (IBA).

6.7.2 Proposed Additional Data Collection

Based on the baseline data / information identified above survey programs may be extended to supplement the initial 12-month survey where data gaps have been identified and additional data may be required to address scientific uncertainty and support the development of seabird collision risk modelling (CRM) and cumulative impact assessment (CIA). Table 6-28 provides a summary of the data that will be collected including survey design, parameters and frequency of data collection for offshore ornithology. A map showing survey design is provided in Figure 6-21.

Table 6-28: Proposed offshore data collection for seabirds and migratory birds.

Data Parameters	Number of Sampling locations / Length of transects	Survey Frequency/ Duration	Sampling Equipment
Species ***Species Abundance*** ***Offshore***	Linear transects of 30 km in distance, spaced 2 km apart in a NEE to SWW direction across the array area. Single transect along the cable route	1 survey per month for a minimum of 12 months	*Binoculars (Zeiss 8×32, Nikon 10×42), Distance meter (Zeiss 30×60), DSLR (Canon EOS 50D, Nikon D500), Telescope lens (EF 100-400mm IS USM, AF-SNik, or 200-500mm f/5.6EED vr) and two x hand-held GPS.*
Species ***Species abundance*** ***Nearshore***	Linear transects of 2.5-3 km in distance, spaced about 2 km apart in a perpendicular to the	1 survey per month for a minimum of 12 months	*Binoculars (Zeiss 8×32, Nikon 10×42), DSLR (Canon EOS 50D, Nikon D500), Telescope lens (EF 100-*

Data Parameters	Number of Sampling locations / Length of transects	Survey Frequency/ Duration	Sampling Equipment
	shoreline across the nearshore area of the export cable route		*400mm IS USM, AF-SNik, or 200-500mm f/5.6EED vr).*

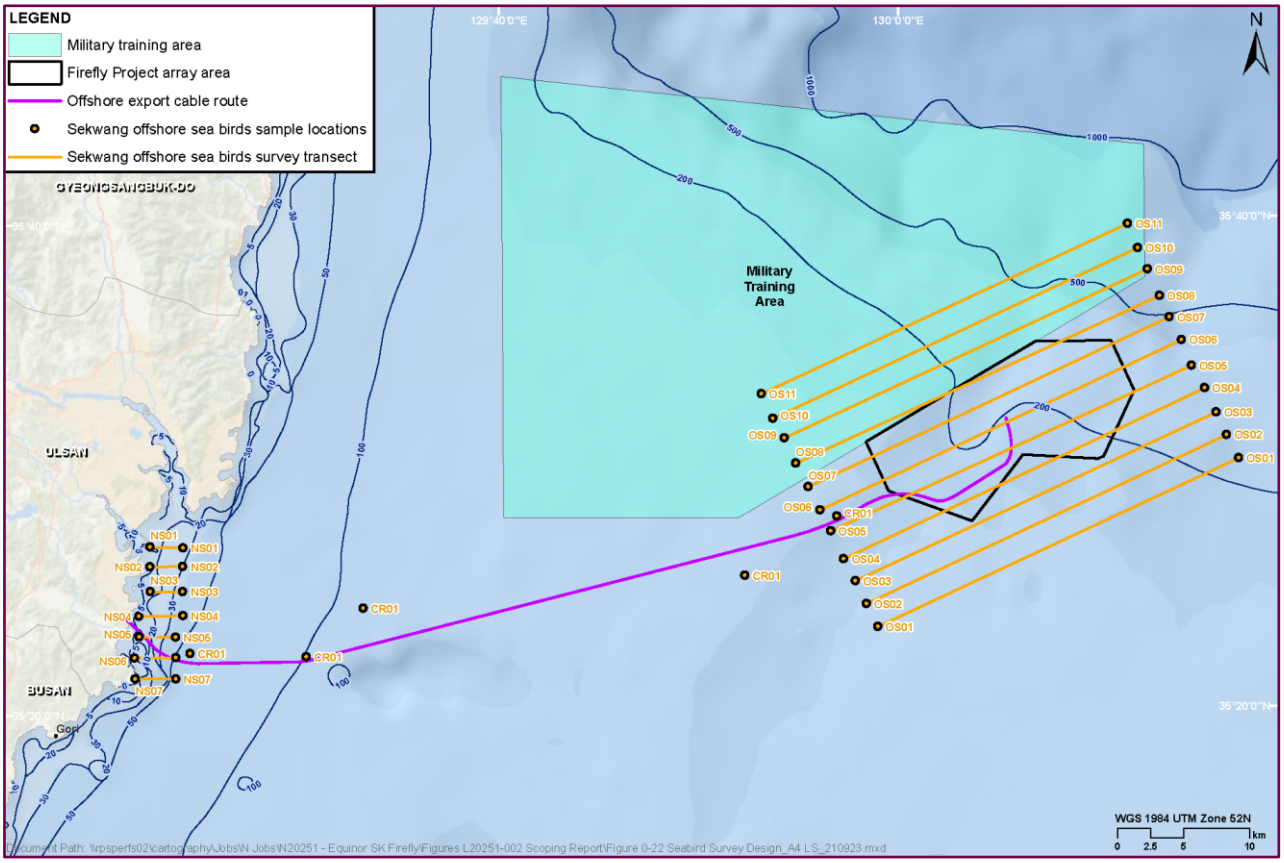


Figure 6-21: Proposed seabird survey design.

6.7.3 Potential Project Impacts

A range of potential impacts on seabirds and migratory birds have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-29.

Table 6-29: Impacts Proposed to be Scoped Into the Project Assessment for Offshore Ornithology.

Potential impact	Phase C	Phase O	Phase D	Justification
Disturbance and displacement of habitat	✓	✓	✓	**Construction and decommissioning phase** • The floating wind turbines have the potential to indirectly cause habitat loss, reducing the availability of areas used for feeding, moulting, and resting bird species. Visual and noise disturbances during construction and decommissioning activities within the Project area could potentially lead to displacement of bird populations. • The overall susceptibility of each species of bird present within the development site is dependent upon species characteristics, such as feeding strategies, migratory routes and breeding grounds. **Operational and maintenance phase** • The floating wind turbines have the potential to indirectly cause habitat loss, reducing the availability of areas used for feeding, moulting, and resting. • The lighting of the Project's wind turbines and their ancillary structures also have the potential to attract and or repel specific species of birds which could affect localised migratory routes.
Increased mortality due to collision risks with WTGs	✗	✓	✗	**Operational and maintenance phase** • There is the potential risk of birds colliding with WTGs as they fly through the array area during operation. Key sensitivities will include birds in transit between breeding sites and foraging areas, in addition to migrating birds. The species' individual susceptibilities depend on their physiological and behavioural characteristics, as well as project design specifications.

Potential impact	Phase C	O	D	Justification
Direct loss of seabed habitat due to project infrastructure for foraging seabirds	✓	✓	✓	**All phases** • The location of project infrastructure has the potential to lead to loss in benthic habitat. This is likely to be limited to areas of anchorage and the electrical infrastructure.
Increased mortality due to loss of prey availability d	✓	✓	✓	**All phases** • Activities during construction, operation and decommissioning has the potential to impact on prey items such as fish and shellfish which in turn may indirectly lead decrease in survivability or even to mortality of seabird species
Barrier effects on bird species to and from breeding sites, foraging grounds or on their migratory routes	✗	✓	✗	**Operational and maintenance phase** • During Project operation, the presence of WTGs and OSPs could potentially act as a barrier to natural movement and thus cause birds to change their flight paths in order to avoid the FOWF. This flight detour may increase the energy expended during foraging flights and migrations (DECC, 2009). Birds that regularly commute around the FOWF, those that are foraging, roosting or nesting could be considered most sensitive to changes in energy expenditures. The relatively small deviation required to fly around the FOWF on long migratory routes is unlikely to be significant.
Creation of roosting and nesting habitats among Project infrastructure	✗	✓	✗	**Operational and maintenance phase** • The introduction of semi-submersible floating platforms and associated infrastructure has the potential to create novel roosting and nesting habitat, which may attract some species of birds and offer new foraging opportunities or may expose them to increased risk of collision.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.7.4 Proposed Assessment Methodology

The following sections provide an overview of the assessment methodology.

6.7.4.1 Identification of Species and Sensitivity

The ESIA will consider the nature of the use of the site by birds, including seasonal differences and activities (i.e. foraging, overwintering, migrating or other) in order to determine the importance of the site relative to the wider area for migratory birds and seabirds.

Data analysis for the ESIA will consider seasonal differences in site usage by each key species as well as the importance of the site for the life stages of each species. Analysis will include abundance and density estimates (with associated confidence intervals and levels of precision).

Reference populations for each species and population sizes will be based on the best available information at the time of undertaking the assessment and will be consulted on and discussed with key stakeholders.

The sensitivity of each species will be determined based on the size of its population, its conservation status and its known sensitivity to offshore wind farms, using industry standard data sources and methods (e.g. Garthe and Hüppop, 2004; Furness and Wade, 2012; Adams et al., 2016). These sources for determining the sensitivity of species are from European and US waters; however, some of the same species may occur at the Project site and for others, it may be applicable to infer an appropriate sensitivity rating from closely-related species. Species identified as sensitive receptors will be subject to an assessment against the impacts listed above. Displacement and Barrier Effect

There are a number of different measures used to determine bird displacement from areas of sea in response to activities associated with an offshore wind farm. Furness and Wade (2012), for example, use disturbance ratings for particular species, alongside scores for habitat flexibility and conservation importance to define an

index value that highlights the sensitivity to disturbance and displacement. A similar approach is used by Ramiro and Cummins (2016) within an Irish context, as reported in Burke (2018).

A matrix approach (such as that promoted by the UK statutory Nature Conservation Bodies; SNCBs, 2017) will be used as a framework for calculating a range of predicted impact magnitudes. These relate varying levels of displacement to varying levels of additional consequent mortality, with consideration then given to the population-level impacts of the potential additional mortality. For species at risk of displacement during the non-breeding season, consideration will be given to a proposed approach for standardising assessments (i.e. to account for different numbers of non-breeding seasons between species for which data is available). Evidence presented in recent wind farm assessments in the UK will be used to help inform the species-specific rates of displacement and mortality used in the assessments for similar species associated with the Project (e.g. Vattenfall, 2019).

Barrier effects will be considered in a qualitative way with reference to published literature.

6.7.4.2 Collision Risk Modelling

Collision risk modelling (CRM) will be undertaken using industry-standard approaches that are routinely used for offshore wind farm assessments in the UK (e.g. Band, 2012; Wright et al., 2012; McGregor et al., 2018) to predict potential mortality levels from this impact and the consequences of this for relevant populations. The parameter values used, such as for avoidance rates, flight heights and speeds and nocturnal activity levels, will be based upon the best available evidence with clearly defined methods presented in the ESIA.

6.7.4.3 Population Models

Where appropriate, population models (e.g. Population Viability Analysis (PVA)) will be undertaken to provide guidance on the potential population consequences of estimated impacts. These models will be constructed in accordance with best practice for such methods (e.g. WWT, 2012) with an emphasis on the relative outcomes for impacted versus un-impacted population projections.

6.7.4.4 Biodiversity Risk Assessment

A Biodiversity Risk Assessment will be undertaken in accordance with IFC PS 6 which will include determination of the presence of Critical Habitat that could be affected by the Project. Critical Habitat is habitat that is defined based on 5 criteria set out by IFC PS6 requirements and is considered to be of significant importance to certain species, threatened or unique ecosystems, or key evolutionary processes (further details are provided in Appendix A-4).

6.8 Commercial Fisheries and Aquaculture

This section considers the potential impacts of the Project on commercial fisheries and aquaculture during the construction, operation and maintenance and decommissioning phases.

6.8.1 Baseline Environment

Information regarding commercial fisheries and aquaculture near Ulsan, Korea has been collated through a detailed and comprehensive review of currently accessible studies and datasets. To provide context, the desktop review will also consider commercial fishing activities and aquaculture within the wider area of the East Sea, specifically within the Korea Strait. Key data sources are listed in Table 6-30, noting that this list is not exhaustive.

Table 6-30: Key sources of information for the commercial fisheries and aquaculture baseline.

Data	Description	Source
Fisheries and Aquaculture in Korea	Organisation for Economic Cooperation and Development (OECD) Review of Fisheries presents and assesses the fisheries and aquaculture production in Korea.	Fisheries and Aquaculture in Korea, 2021
Korean Aquaculture	History and general overview of Korean aquaculture from 1975-2013.	Yun et al., 2015
Korea Marine Accident Report	September 2019 Marine Accident Report	Korea Maritime Safety Tribunal, 2020
Fisheries Statistics	Korean aquaculture and fisheries census report from Korea's Statistics Organisation (KOSTAT).	KOSTAT, 2014
Korea's Fisheries Sector Assessment	This report provides a comprehensive analysis on the fisheries, policy, trade, and seafood distribution within the Republic of Korea.	World Wildlife Foundation, 2016
Korea's Seafood Contribution	Korea's fisheries and aquaculture contribution to annual seafood production from 2005-2017.	FAO Dataset, 2021

In 2018, Korea was responsible for producing 3.6 million tonnes of fish, molluscs, and crustaceans, with a value surpassing $6.8 billion USD (Figure 6-22) (Fisheries and Aquaculture in Korea, 2021). Korean aquaculture production accounted for c.2.4m tonnes or 46% of this value, while commercial fisheries contributed c.1.2m tonnes or 54% of earnings (Fisheries and Aquaculture in Korea, 2021). The general trend shows increased aquaculture production while marine capture fisheries remain largely consistent from 2008 to 2018 and increased in value. Overall, between 2008 and 2018, the quantity of Korean seafood produced increased by 8% while its value simultaneously increased by 52% (Fisheries and Aquaculture in Korea, 2021).

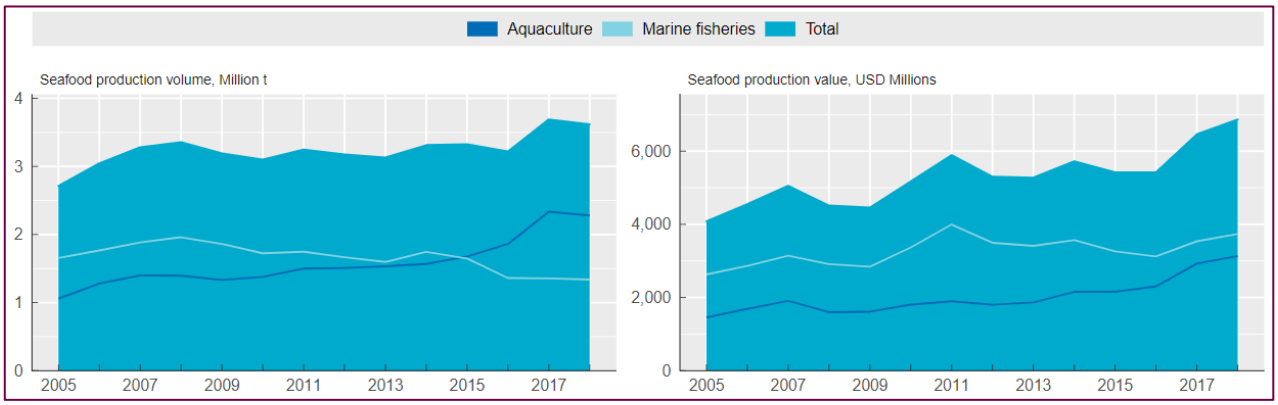


Figure 6-22: Korea's fisheries and aquaculture contribution to seafood production (Fisheries and Aquaculture in Korea, 2021).

Analysis of global production and trade, indicates that Korea is a net importer of fish and fish products, with exports increasing by 15% and imports increasing by 70% from 2008 to 2018 (Fisheries and Aquaculture in Korea, 2021).

Employment data from Korean commercial fisheries, aquaculture, and processing sectors in 2018 illustrated that more than 166,000 jobs were directly reliant on the seafood sector, a 12% (186,801) decline from 2008 findings (Fisheries and Aquaculture in Korea, 2021).

The remainder of this section focuses on relevant commercial fisheries that may be potentially affected by the Project. The role of Korean flagged distant water fleets (DWF) prosecuting fisheries in international waters under the auspices of RFMOs and 3rd country coastal state EEZs has been noted, and their respective contribution to Korean seafood production. However, it has been assumed that these fisheries will not be affected by the development. This assumption will be raised during the stakeholder engagement process to confirm this understanding.

6.8.1.1 National / Regional Commercial Fisheries

The United Nations Convention on the Law of the Sea (UNCLOS) came into force in 1994. This resulted in Korea and it's Japanese and Chinese neighbours establishing agreements which designated each nation's EEZ, and specifically, discrete and shared fishing boundaries and resources. The Korea-Japan Fisheries Agreement was enforced in 1999, and the Korea-China Fisheries Agreement, enforced in 2001.

Oceanographic conditions have created favourable fishing opportunities on both the west and east coasts of the Korean Peninsula within the East Sea, Korea Strait and Yellow Sea (Lery et al., 1999; World Wildlife

Foundation, 2016). Most fishing grounds overlap and support different fisheries by target species and fishing method (World Wildlife Foundation, 2016

In 2018 it was estimated that the Korean flagged commercial fishing fleet comprised c.66,000 powered vessels, a decrease of 18% (77,769) from 2008 (Fisheries and Aquaculture in Korea, 2021). In general, the majority, c.84% of vessels are considered small-scale, less than 12 metres in length. Major gear types deployed in Korean waters are trawl, gill net, purse seine, angling, stow net and trap and their respective catches are set out in (Figure 6-23).

The most significant catches per commercial species by weight in Korean EEZ waters were anchovies (*Engraulis japonicus*), common squid (*Todarodes pacificus*), chub mackerel (*Scomber japonicus*), largehead hairtail (*Trichiurus lepturus*) and Pacific herring (*Clupea pallasii*). The most important commercial species by economic value were common squid, anchovies, largehead hairtail, swimming crab (*Callinectes sapidus*) and yellow croaker (*Larimichthys polyactis*) (World Wildlife Foundation, 2016).

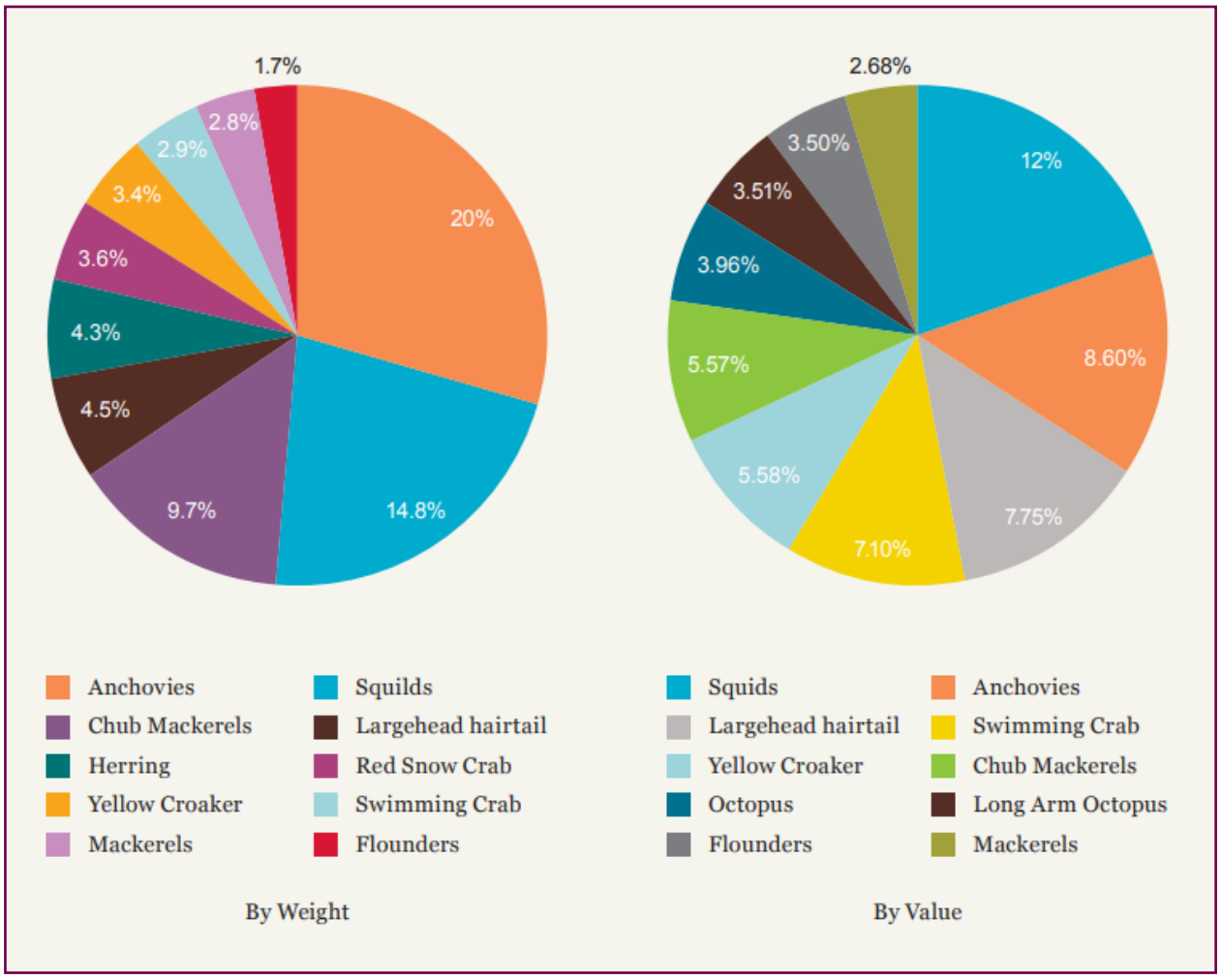


Figure 6-23: Top ten species caught by weight and value in Korea's 2013 coastal fishery (World Wildlife Foundation, 2016).

According to a more recent review of fisheries in 2020 by the Organisation for Economic Cooperation and Development (OECD), Korea has reported over 18 fish stocks that have a favourable biological status within their EEZ, allowing them to be further exploited in a sustainable manner. The review also identified that the most important economic species remain the same as those in 2013. Ranked in order these are: common squid, octopus, large head hairtail, anchovy and yellow croaker. Overall, catches of these species accounted for over 40% of Korea's most recent total economic value of landings (Fisheries and Aquaculture in Korea, 2021).

The majority of commercial fishing and aquaculture is conducted along the west coast of the Korean Peninsula (Figure 6-24). Key fisheries that potentially overlap with the array area, are jigging for squid, a seasonal fishery between June and December aligned with regional squid migrations (World Wildlife Foundation, 2016). Trawl fisheries for squid, flounder, sailfin sandfish and shrimp species also potentially overlap with the array area.

Other fisheries associated with the East Sea include a variety of active and passive gear types (purse seine, trawl, jigging, gill net, traps and longlining. Target species predominantly include but are not limited to; chub mackerel, spotted sardine (*Amblygaster sirm*), trevally (*Caranx* spp.), squid, flounder (*Paralichthyidae* spp.), sandfish, shrimp, croaker, anchovy, swimming crab (blue crab), puffers (*Takifugu* spp.), pomfret (*Pampus echinogaster*), Pacific herring, crabs, gastropods, Japanese eel (*Anguilla japonica*), and multiple rockfish species (*Sebastes spp*.) (Table 6-31) (World Wildlife Foundation, 2016). Table 6-31 provides further details of relevant fishing methods and target species within the East Sea and therefore within proximity to the array area.

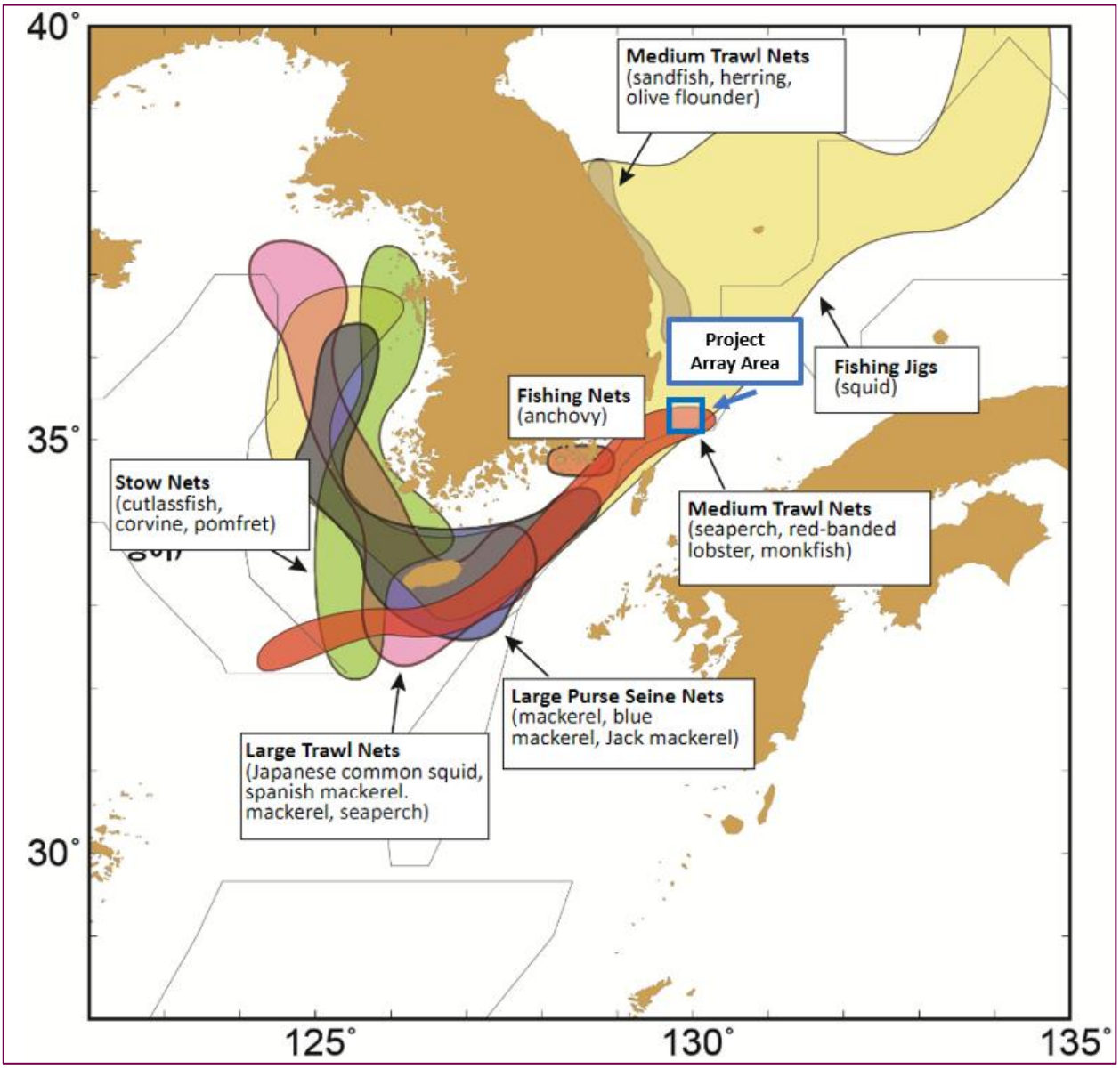


Figure 6-24: Commercial fishing methods along the Korean Peninsula.

Fisheries that span the Yellow Sea and East Seas (World Wildlife Foundation, 2016) will largely remain unaffected by the Project.

Table 6-31: Main coastal and offshore fisheries in Korea (adapted from World Wildlife Foundation, 2016).

Fishery		Vessel Tonnage (GT)	Target Species	Fishing Area
Purse Seine	Large Purse Seine	50-140	Chub mackerel, Spotted sardine, Trevally, Mackerel	Near Jeju Island and the southern area of the East Sea
	Small Purse Seine	<30		
Trawl	East Sea Danish Seine	20-60	Squid, Flounder, Sailfin sandfish, Shrimp	East Sea

Fishery		Vessel Tonnage (GT)	Target Species	Fishing Area
Jigging	-	10-90	Predominantly Squid Largehead hairtail, Puffer	Fishing grounds are variable due to squid migration and mainly occur June-December in the East Sea
Gill Net	Coastal Gill Net	>10	Croaker, Anchovy, Flounder, Swimming Crab	Entirety of the Korean Peninsula
	Offshore Gill Net	<10		
Trawl	East Sea Trawl	20-60	Shrimp, Flounder, Sailfin Sandfish, Pacific Herring, Squid	Offshore trawling typically occurs from the south to north in the East Sea
Trap	Coastal Trap	-	Fish, Crabs, Gastropods	East Sea
	Offshore Trap	-		East Sea
Longline	Various	-	Largehead hairtail, Horsehead, Black mouth goosefish, Puffer, Flounder, Eel, Rockfish	East Sea

6.8.1.2 Project Relevant Commercial Fisheries

Currently, Ulsan has approximately 810 registered fishing vessels (Table 6-32). The majority of these fishing vessels are between 1-2 tons (47.6%), 2-5 tons (20.6%) and <1 ton (14.3%). Ulsan district does not currently have any vessels registered that are larger than 100 tons.

The resolution of catch and effort data per registered vessel remains outstanding at this point. It is assumed that the catch is predominated by chub mackerel, anchovy, largehead hairtail, yellow croaker, flounder, squid, shrimp, and gastropod species (World Wildlife Foundation, 2016).

Table 6-32: Registered fishing vessels per ton in Ulsan, South Korea (FIP, 2021).

Weight	< 1 ton	1~2 ton	2~5 ton	5~10 ton	10~20 ton	20~30 ton	30~50 ton	50~100 ton	>100 ton	Total
Number	117	387	168	80	17	25	6	13	0	813

Data relating to commercial fisheries landings specific to the coast of Ulsan from the Ulsan Federation of Fisheries Cooperatives were provided from the Korea Environmental Management Corporation, 2020 (Table 6-33), illustrating the annual fishing trend. In order of ranking, fishing appears to be at its peak during the winter months (Dec, Jan, Feb (46.5%), followed by Spring (Mar, Apr, May) (19.5%), Autumn (Sep, Oct, Nov) (18.8%), and Summer (Jun, Jul, Aug) (15.2%). Finfish species accounted for the greatest proportion of sales during each month followed by molluscs, crustacea and shellfish with relatively similar sale volumes (Table 6-33).

As stipulated above fisheries that may be potentially affected by the array area include trawl nets for seaperch (*Sebastes* spp.), red-banded lobster (*Metanephrops thomsoni*) and monkfish (*Lophius* spp.), and utilising fishing jigs for squid. Trawl gear is also deployed to catch sandfish, herring and olive flounder north of the Project site.

Table 6-33: Sales by Ulsan Federation of Fisheries Cooperatives (FIP, 2021).

Species	Winter		Spring		Summer		Autumn		Total
	Amount (kg)	Ratio (%)	Amount (kg)	Ratio (%)	Amount (kg)	Ratio (%)	Amount (kg)	Ratio (%)	
Total	5,718,963	46.5	2,398,906	19.5	1,865,992	15.2	2,304,060	18.8	12,287,921
Fishes	5,424,055	44.1	2,028,931	16.5	1,553,503	12.6	1,843,357	15.0	10,849,846
Crustacea	57,023	0.5	24,627	0.2	12,702	0.1	111,121	0.9	205,473
Shellfish	58,839	0.5	99,536	0.8	138,974	1.1	94,079	0.8	391,428
Mollusca	179,046	1.5	245,812	2.0	160,813	1.3	255,503	2.1	841,174

6.8.1.3 National / Regional Aquaculture Activities

Korea is home to a 9,000 km coastline with an archipelago of >3,000 islands and abundant fishery resources (World Wildlife Foundation, 2016). Historically reliant on fishing, recent commercial landings data has pushed the country towards an increased focus on aquaculture practices and sustainable fisheries management (Yun *et al.,* 2015). Aquaculture in the region focused on shellfish pen and cage practices in the 1980s, moved to finfish farming in the 1990s and 2000s and is currently moving towards a more sustainable and integrated approach of cooperative farming. Korea's demand for aquaculture products has steadily increased due to consumer preference (Yun et al., 2015).

As of 2013, aquaculture was responsible for more than 49% of total fisheries production in Korea (Yun *et al.*, 2015). Seaweed accounted for 74.7% followed by molluscs (19.2%), finfish (4.8%) and crustaceans (0.3%), (Table 6-34) (Yun et al., 2015). Mollusc aquaculture ranked second to seaweed farming based on the volume of production in Korean waters during 2013, which is a decline of 18% compared to 2010 findings (Yun et al., 2015). The most recent evaluation of the sector in 2018 indicates that that aquaculture production has 46% of the market share (Fisheries and Aquaculture in Korea, 2021).

The most commercially valuable mollusc species in Korea is the Pacific cupped oyster (*Crassostrea gigas*), Korean mussel (*Mytilus coruscus*), abalone (*Haliotis discus*), ark shell (*Scapharca broughtonii),* and blood cockle (*Tegillarca granosa*) (Yun et al., 2015). Crustacean aquaculture in Korea has primarily focused on cultivating whitetail shrimp (*Letopenaeus vannamei*) and a few crab species, predominantly along the west coast of the region (Yun et al., 2015).

Table 6-34: Marine aquaculture production in Korea from 1975-2013 (Yun et al., 2015).

Species	Year					
	1975	*1985*	*1995*	*2005*	*2010*	*2013*
Seaweeds	162	397	649	621	901	1,131
Molluscs	189	378	334	331	356	291
Finfish	-	2	8	81	80	73
Crustaceans	-	-	-	1	3	4
Other	1	10	4	6	15	16
Total	**352**	**787**	**995**	**1,040**	**1,355**	**1,515**

The level of marine finfish aquaculture production in Korea has increased steadily from 0.8% in 1995 to 4.8% in 2013 (Yun *et al.,* 2015). Marine finfish aquaculture (Table 6-35) in Korea is dominated by olive flounder (*Paralichthys olivaceus*), Korean rockfish (*Sebastes schlegeli*), mullet (*Aldrichetta forsteri*), seabass (*Lateolabrax latus*), red seabream (*Pagrus major*), black seabream (*Acanthopagrus schlegelii*) and rock seabream (*Oplegnathus fasciatus*) which accounted for 73,108 tons of product in 2013 (KOSTAT, 2014; Park et al., 2012).

The most important commercial species, the olive flounder, is typically cultivated in land-based tank culture systems with seawater being pumped directly into tanks (Yun *et al*., 2015). Although land-based culture systems dominate the Korean finfish aquaculture market, floating pens and nets are occasionally used to cultivate Korean rockfish, sea bass, sea bream species, and mullet. The olive flounder contributed to 50% of the total finfish production in 2013, followed by Korean rockfish (32.5%), sea bass (1.7%), black sea bream (1.2%), red sea bream (3.8%), rock sea bream (1.2%), mullet (6.5%) and other (2.5%) (Yun *et al*., 2015; KOSTAT, 2014). Aquaculture farms are most often found along the west and southern coasts of the Korean peninsula, due to the fact these locations are relatively protected compared to the eastern coast (Yun *et al*., 2015).

Table 6-35: Marine fish culture production in Korea from 1975-2013 (Yun et al., 2015).

Species	Year					
	1975	*1985*	*1995*	*2005*	*2010*	*2013*
Olive Flounder	-	-	6,733	40,075	40,925	36,944
Korean Rockfish	-	-	985	21,297	20,918	23,757
Sea Bass	-	-	193	2,600	1,952	1,248
Black Sea Bream	-	23	9	2,671	2,254	913
Red Sea Bream	-	-	25	5,816	6,300	2,755
Rock Sea Bream	-	-	16	2,048	902	884
Mullet	-	1	34	5,500	4,657	4,788
Others	-	-	365	1,430	2,202	1,819
Total	**0**	**24**	**8,360**	**81,437**	**80,110**	**73,108**

Seaweed production remains a key component of the Korean aquaculture sector (Table 6-36) accounting for 74.7% of total 2013 production (KOSTAT, 2014). Laver (*Porphyra* spp*.),* Japanese kelp (*Laminaria* spp*.)* and sea mustard (*Undaria* spp*.)* has dominated seaweed production in the region from 1975-2013 (Table 6-36). Similar to crustacean aquaculture, seaweed is typically farmed along the more sheltered western edge of Korea's southern coast (Yun et al., 2015).

Table 6-36: Seaweed aquaculture by species in Korea from 1975-2013 (Yun et al., 2015).

Species	Year					
	1975	*1985*	*1995*	*2005*	*2010*	*2013*
Sea Mustard	111	256	386	281	393	327
Japanese Kelp	3	12	27	108	241	373

Laver	44	109	192	197	235	405
Brown Seaweeds	-	8	37	30	21	20
Green Laver	1	10	4	1	5	5
Others	1	1	1	2	6	1
Total	**162**	**397**	**650**	**621**	**901**	**1,131**

6.8.1.4 Project Relevant Aquaculture Activities

Although the west coast of the Korean Peninsula is home to the vast majority of aquaculture farms, Figure 6-25 shows the presence of about 30 farms in close proximity to the export cable route (Yun et al., 2015). Combined, cooperative and village sea farming practices are dominant in the area. Of the sites located within 1 km from the offshore export cable corridor, village sea farming is found along the coastline, three sites are cooperative sea farming sites and one site is a shellfish farming.

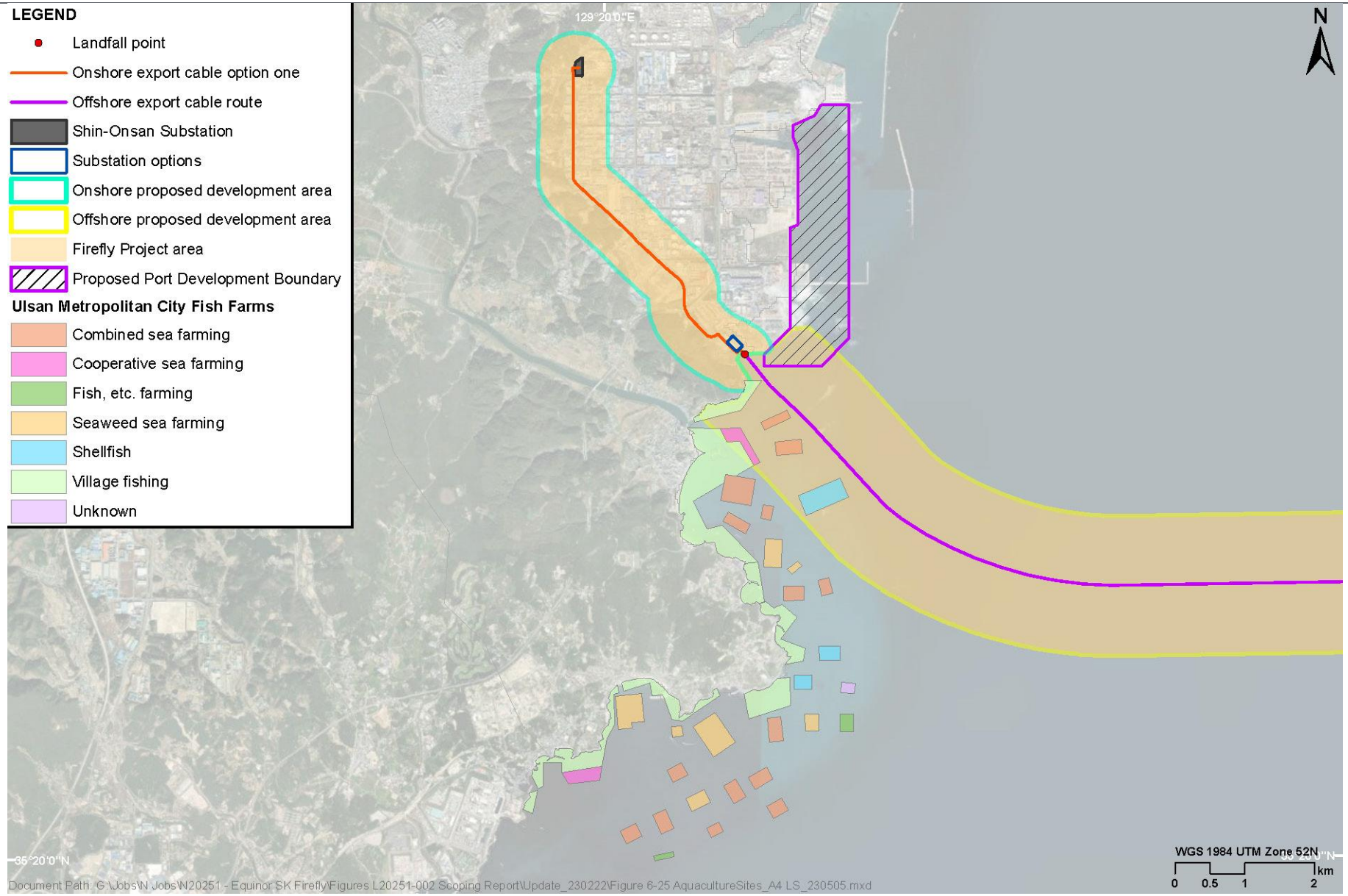


Figure 6-25: Aquaculture farms and nearshore project infrastructure south of Ulsan Harbour.

6.8.2 Proposed Additional Data Collection

Based on the baseline data / information identified above, additional information will need to be collected to inform the ESIA. Table 6-37 provides a summary of the data that the ESIA team will attempt to collect, including survey design, parameters. The quality of the data will also be evaluated in context of whether representative of activity and catches and aquaculture production within the Project area and applied to inform potential array design and displacement studies, scope of mitigation and key development activities during construction, operation and decommission phases. Depending on the relationship between Equinor and its fisheries consultation lead and the local fishing industry representatives, much of this dataset will be collected during consultation for the local-EIA or generated during the Fishery Loss Impact Assessment (or "Local Acceptability Enhancement Plan").

Table 6-37: Proposed data collection for commercial fisheries and aquaculture activities.

Data category	Source of data	Data Parameters
Commercial marine capture fisheries	Ulsan Federation of Fisheries Cooperatives Organisation Other Producer Organisations	Composition by members and vessel owners (LoA and gear type) and respective catches. Distribution of quota / quota management system. Contribution to local economy: direct and indirect
Commercial marine capture fisheries	Ulsan Federation of Fisheries Cooperatives Organisation Other Producer Organisations	Monitoring data from fishers for rationalisation of catch and effort in the area AIS – automatic identification system – typically used by marine traffic Logbook data Sales records
Commercial marine capture fisheries	Regulators	Data from fishers for rationalisation of catch and effort in the area. Monitoring data: VMS iVMS – inshore VMS typically on vessels <15m Logbook data catch and effort Sales records Surveillance data: Vessel sightings/inspections.
Aquaculture fisheries	Industry representatives	Composition by members and organisation Breakdown by group if relevant: Finfish Shellfish Seaweed Confirmation of operation locations and type. Associated capacity, production figures and values over 3-5 year period. Type of species involved and their respective biological requirements / sensitivities.
Seafood processors	Industry representatives Regulators	Composition by members and organisation Breakdown by group if relevant: Finfish Shellfish Seaweed Confirmation of operation locations and type. Confirmation of supply chain, associated capacity, production figures and values over 3-5 year period. Type of species involved and their respective biological requirements / sensitivities.
Spawning and nursery grounds of commercially important species	Industry representatives Regulators	By species Temporal and spatial description Their respective biological requirements / sensitivities.

Data category	Source of data	Data Parameters
	Rep of Korea national competent authority	

6.8.3 Potential Project Impacts

A range of potential impacts on commercial fisheries and aquaculture have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-38.

Table 6-38: Impacts Proposed to be Scoped Into the Project Assessment for Commercial Fisheries and Aquaculture.

Potential impact	Phase			Justification
	C	O	D	
Loss, damage and/or restricted access to fishing grounds	✓	✓	✓	**Construction and decommissioning phase** • During the construction and decommissioning stages of the Project, vessel presence, partially installed infrastructure, unprotected/unburied subsea cable could lead to temporary loss or restricted access of historical fishing grounds. **Operational and maintenance phase** • Short-term and long-term loss or restricted access to fishing grounds may occur within the array area during operation and maintenance stages. • Fishing vessels may be restricted from historical fishing grounds due to statutory exclusions, safety zones, buffer zones, or avoidance by fishing vessels to due to increased concerns over marine safety.
Displacement of fishing activity into other areas increasing competition	✓	✓	✓	**Construction and decommissioning phase** • The loss in available fishing grounds due to project infrastructure could displace fishing activities to other areas resulting in increased competition between the industry for potentially valuable grounds. **Operational and maintenance phase** • Any loss of or restricted access to grounds during the operational and maintenance phase could result in increased competition as noted above.
Interference with active fishing vessels.	✓	✓	✓	**All phases** • During all stages of Project, there may be potential for vessels associated with the project to cause interference with vessels actively engaged in fishing practices.
Increased steaming times to fishing grounds.	✓	✓	✓	**Construction and decommissioning phase** • Vessel avoidance of restricted areas due to construction and decommissioning could result in increased steaming distances and times. This impact would significantly depend on the location of fishing grounds, preferred transit routes and turbine spacing. **Operational and maintenance phase** • The presence of infrastructure associated with the Project could result in increased steaming distances and times.
Effects on commercially valuable species	✓	✓	✓	**All phases** • Activities associated with all stages of the Project could potentially affect commercially valuable fish and shellfish species, whether caught with traditional fishing gear or farmed. These are further discussed in the Fish, Shellfish and Sea Turtles Section 6.5 of this report.
Potential for snagging gear	✓	✓	✓	**All phases** • The potential snagging of fishing gear and manoeuvrability issues may cause fishing activities to become displaced. Subsea infrastructure within the array area may lead to a loss of fishing grounds due to safety and gear concerns. Navigational safety issues have been further discussed in the Shipping and Navigation chapter (Section 6.9).
Contamination of fish stocks	✓	✗	✓	**Construction and decommissioning phase** • Installation methods associated with the Project could potentially result in an increase of suspended sediment causing sediment plumes which have could impact water quality and consequently fish stocks.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.8.4 Proposed Assessment Methodology

The commercial fisheries assessment will be focused on key fishing fleets active in areas relevant to the Project. These will be identified through detailed analysis of available fisheries data (i.e. landings and VMS data) and information collected through consultation with fisheries stakeholders, through the Korean EIA process, the Fishery Loss Impact Assessment, and the Fisheries Loss and Damages Study.

For each potential impact the assessment will be undertaken on a fleet-by-fleet basis following the standard methodology approach. An exception to this is the assessment of safety issues for fishing vessels (i.e. potential snagging of gear), which will consider potential risks and propose adequate measures to ensure that the safety

of fishing vessels remains within acceptable limits. The assessment of safety issues will take account of the findings of the Shipping and Navigation ESIA chapter.

The commercial fisheries assessment will be undertaken with reference to relevant guidance, including but not limited to: International Cable Protection Committee (2009) Fishing and Submarine Cables - Working Together.

6.9 Shipping and Navigation

This section considers the potential impacts of the Project on Shipping and Navigation during the construction, operational and maintenance and decommissioning phases.

The Shipping and Navigation Study Area has been defined as the Project area plus a 10 nm buffer, which encompasses the offshore export cable routes.

The following desktop and site-specific data sources have been used to inform the baseline conditions (Table 6-39).

Table 6-39: Key sources of information for the shipping and navigation baseline.

Data	Description	Source
AIS Vessel Data	Satellite and terrestrial AIS data from Ulsan Harbour and the Korea strait from 1 September 2020 to 31 August 2021	AIS Marine Traffic, 2021

It should be noted that not all vessels are required to carry an Automatic Identification System (AIS) onboard, including recreational vessels, small-scale fishing vessels and naval vessels. However, the International Maritime Organisation (IMO) requires AIS to be used by all marine vessels >500 GT, for any vessel >300 GT moving through international waters, and all passenger vessels (Lee et al., 2019). There may be limited downtime in AIS coverage on occasion, although this is not expected to be significant or affect the completeness of the vessel traffic baseline. Based on desktop studies, Korea has not set a limit on mandatory AIS coverage for fishing vessels.

Additionally, Maritime Traffic Safety Assessment (MTSA) under the Maritime Safety Act is to be conducted by Equinor through consultation with MOF and Korea Maritime Transportation Safety Authority (KOMSA), together with the developers of adjacent floating offshore wind projects. the results of MTSA will further inform the ESIA Shipping and Navigation chapter.

6.9.1 Baseline Environment

6.9.1.1 Vessel Traffic

According to current AIS data, the number of annual vessel movements within the array area average approximately 30 per 0.15 km^2 per year. Within central sections of the offshore cable route vessel movements are approximately 100 per 0.15 km^2 per year while in nearshore area vessel movements exceed 500 per 0.15 km^2 per year associated with the traffic entering and existing the Port of Ulsan (Figure 6-26).

The Port of Ulsan is an important economic port in Korea and is solely responsible for transporting 37% of national cargo every year, with 81% of that comprising hazardous goods and materials (Jeong et al., 2010). Additionally, Ulsan has the greatest number of vessels boarded by pilots among Korean pilot districts due to a high degree of congestion from the proximity of piers along the route (Choi and Lee, 2011). The main types of vessels identified within the Study Area during 2020/2021 were tankers (41%), offshore tugboats, supply and/or dredging vessels (25%), vessels denoted as other (21%), and cargo vessels (8%) (Figure 6-27).

On average, 271 unique vessels per day were recorded through Port of Ulsan call data (Figure 6-28). Monthly vessel port calls were highest during June (8,705) and July (9,214) and lowest during the month of February (7,187) and September (7,415) (Figure 6-28). Vessels arriving and departing the Port of Ulsan are concentrated in the mornings (Figure 6-29).

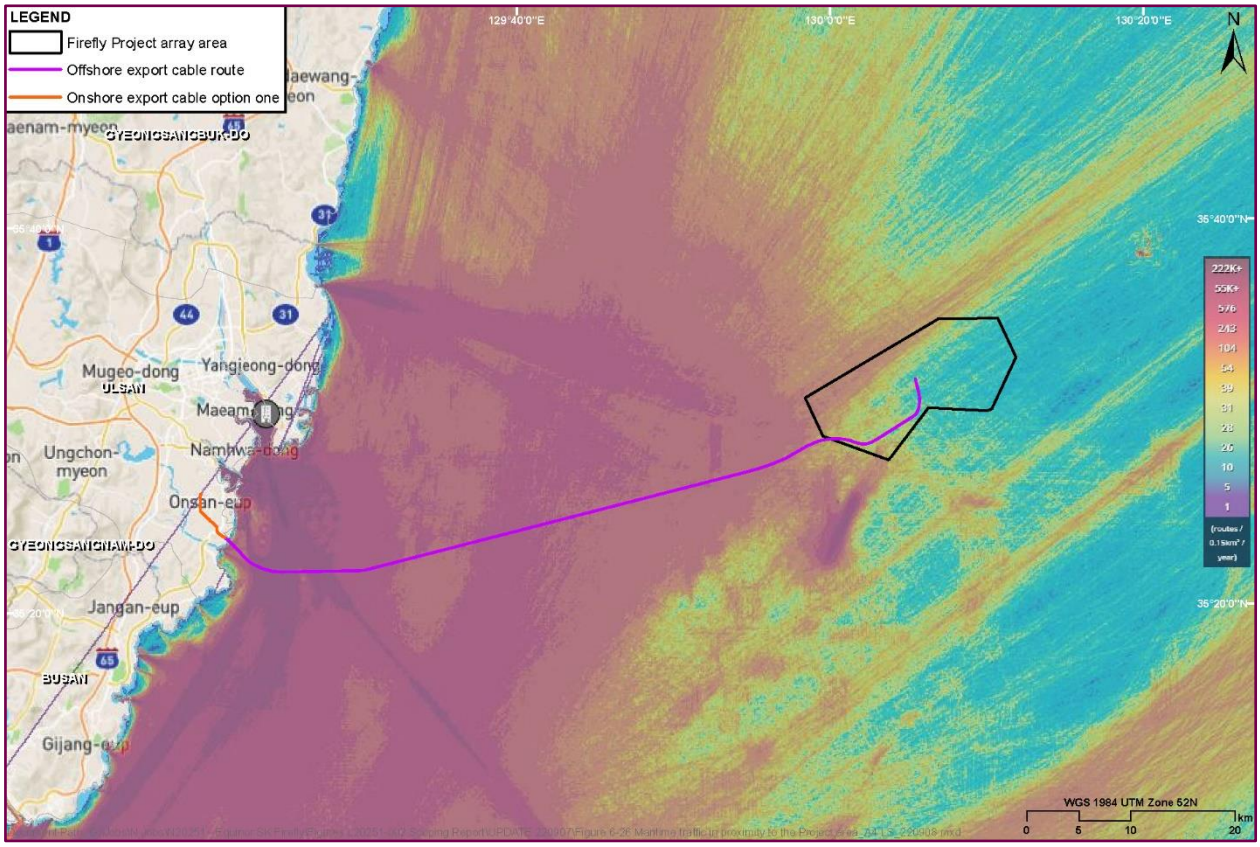


Figure 6-26: Maritime traffic in proximity to the Project area.

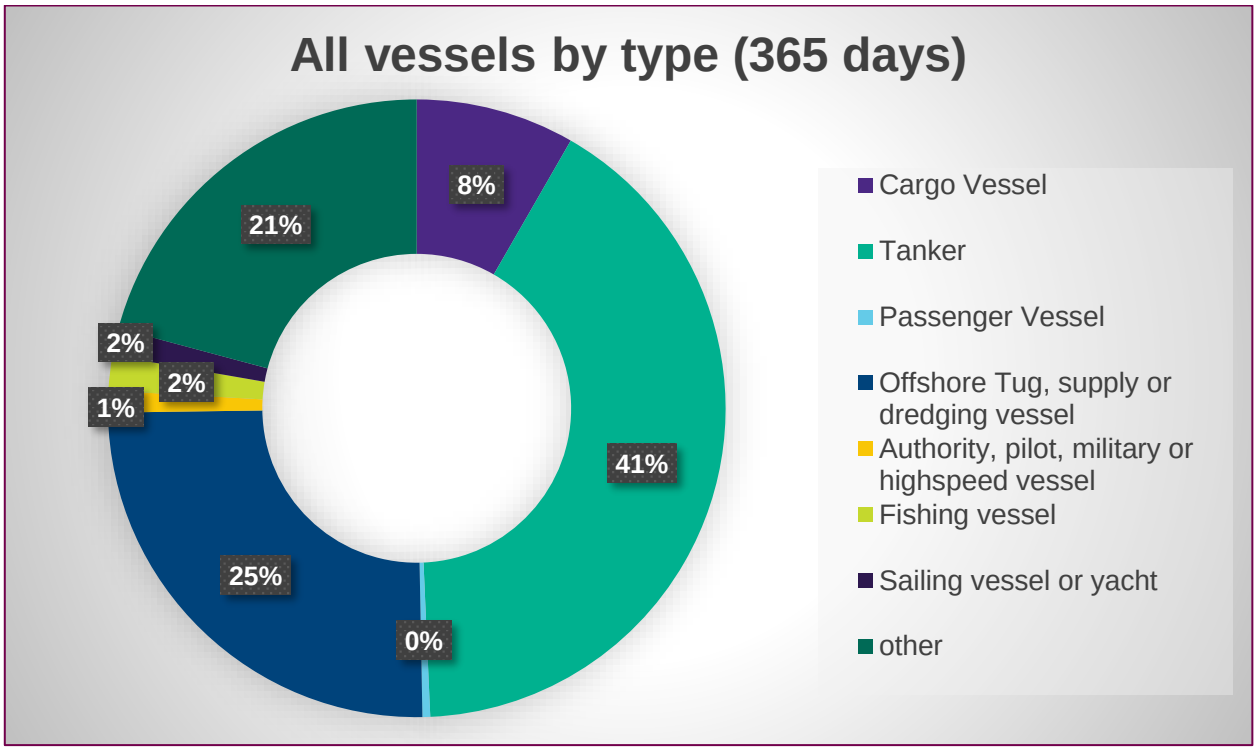


Figure 6-27: Distribution by vessel type within the Study Area from August 2020 to July 2021.

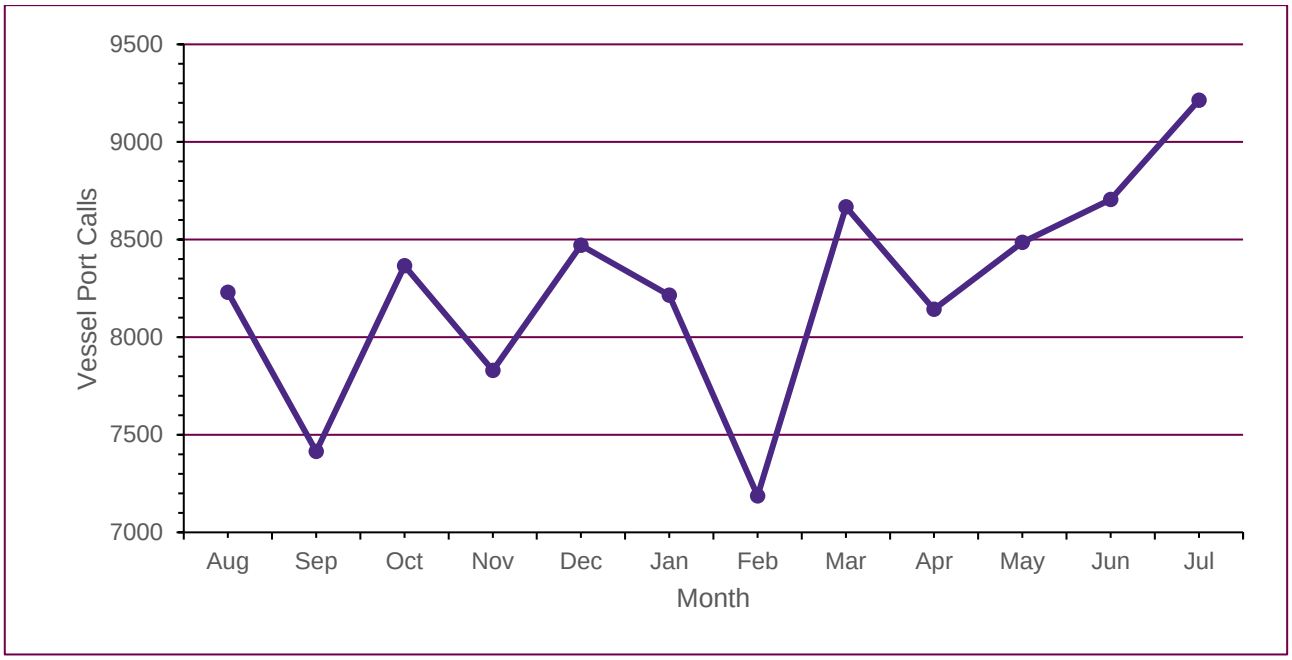


Figure 6-28: Number of monthly port calls of all vessels in the Port of Ulsan during 2020-2021 (AIS Marine Traffic, 2021).

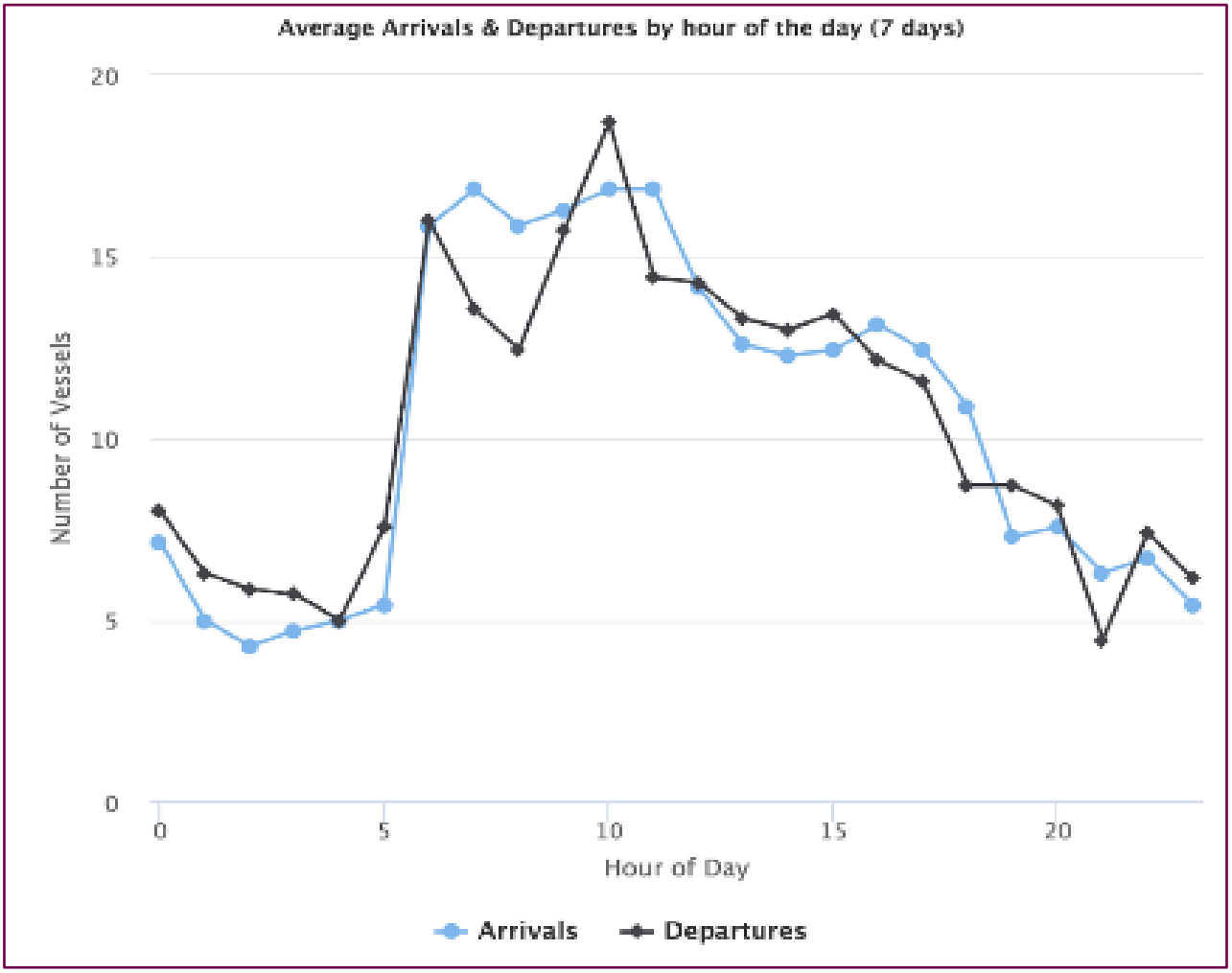


Figure 6-29: Vessels arriving and departing the Port of Ulsan over a 7-day (AIS Marine Traffic, 2021).

6.9.1.2 Navigation Features

The array area is located in water depths that range from -143 m to -325 m approximately. The array area is also located within and adjacent to a military practice and exercise area.

The Donghae-1 gas platform is located to the south-west of the array area. A gas pipeline connects to the gas platform to which the export cable runs parallel with to shore. A waste disposal ground overlaps with the array area to the south-west. Recent disposal activities have mainly been associated with placement of dredge material although the waste disposal ground, has a history with dumping of organic wastes since 2001 (Section 6.13).

Navigational aids and anchoring locations are found frequently throughout the Port of Ulsan port limits providing suitable anchorage for the large numbers of vessel that await an opportunity for berthing at the port (Figure 6-30). The cable landfall location is found approximately 3 km to the south of the main Port Ulsan anchorage areas.

Due to the frequency of coastal infrastructure, berthing areas and anchorages along the coast, which is also used as the key route for vessel entering and disembarking from the Port of Ulsan there is heightened risk of vessel collision at multiple locations along route. Therefore, due to the increased collision risk, pilot boarding is compulsory for the following vessels entering and disembarking the Port of Ulsan and is conducted using assisted tugboats:

- All vessels 500 gross tonnage or more not registered with the Republic of Korea.
- All vessels 500 gross tonnage or more which are registered with the Republic of Korea and are actively engaged in international navigation.
- Vessels larger than 2,000 gross tonnage which have been registered with the Republic of Korea without being engaged in international navigation.

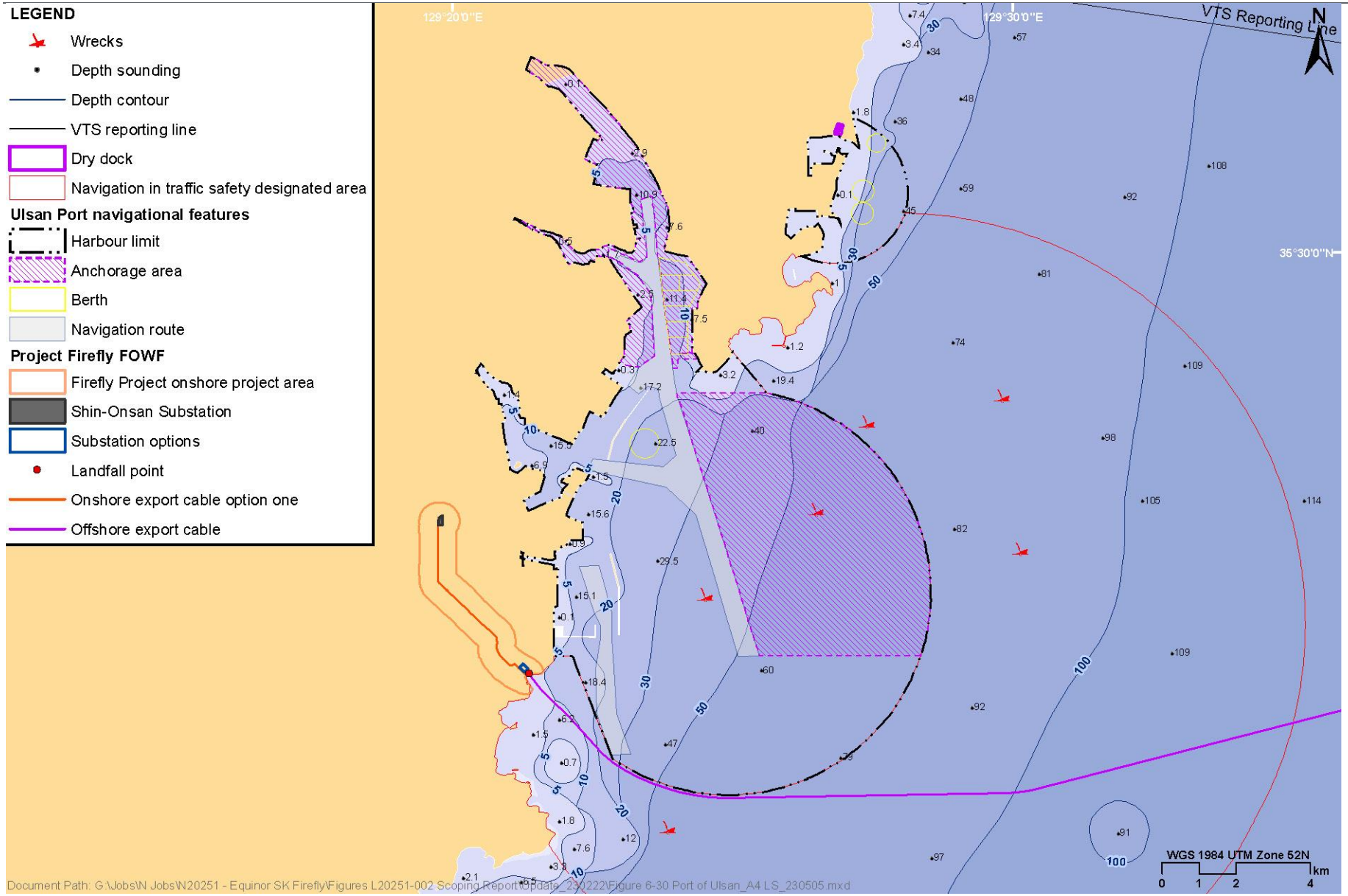


Figure 6-30: Navigational features in proximity to the Project.

6.9.1.3 Historical Incidents

From 2014-2018, the number of marine accidents along Korea's coastal waters has increased continuously from 1,330 in 2014 to 2,671 occurring in 2018 (Korea Maritime Safety Tribunal, 2018). The most common cause of marine accidents in Korean coastal waters from 2014-2018 was found to be engine trouble (31.8%), followed by instances of collision which include contact, stranding and grounding (18.9%) (Korea Maritime Safety Tribunal, 2018). The possibility of vessel collision risk along the southeast coast of Korea, and more specifically Ulsan is highest within Port of Ulsan due to increased vessel traffic and infrastructure (Figure 6-31). As vessels move from the Port into coastal and deep-sea waters, the potential for vessel collision risks decrease significantly.

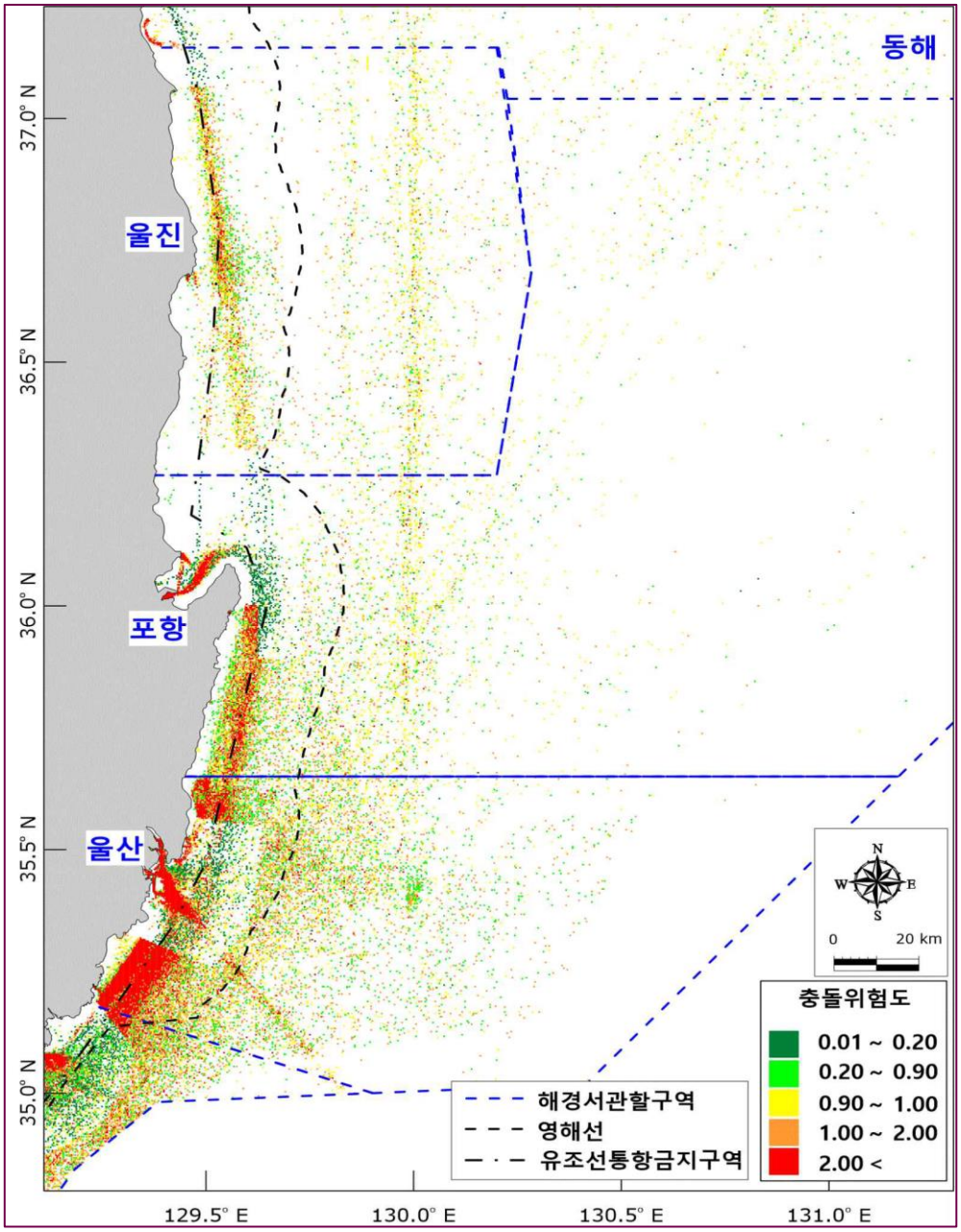


Figure 6-31: Vessel collision risk in proximity to Ulsan Harbour (Marine Accident Risk Assessment (2021).

6.9.2 Proposed Additional Data Collection / Analysis

Based on the baseline data / information identified above additional data will need to be collected to inform the ESIA.

A desk-based analysis of AIS data will be carried out incorporating satellite AIS data. The data will be used to identify the following parameters:

- Number of vessels crossing the cable landfall options;
- Number of vessels transiting through the offshore array;
- Vessel type distributions;
- Vessel size distributions;
- Vessel speeds (including for fishing vessels to indicate if active or in transit);
- Vessel destination to identify main routes;
- Regular vessels using specific routes / ports; and
- Vessels at anchor (based on navigation status but also a review of track behaviour / speed as AIS broadcasts are not always reliable);

This will help characterise the main shipping routes and navigational issues of potential concern to the project ahead of the ESIA.

Vessel traffic data are collected as part of other surveys where appropriate. This can be done by connecting to the AIS and potentially radar of the vessel, and log forms can also be provided to the crew for logging.

Relevant information from the Maritime Traffic Safety Assessment (MTSA) will also be collected and reviewed.

6.9.3 Potential Project Impacts

A range of potential impacts on shipping and navigation have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-40.

Table 6-40: Impacts Proposed to be Scoped Into the Project Assessment for Shipping and Navigation.

Potential impact	Phase			Justification
	C	O	D	
Displacement of vessel traffic	✓	✓	✓	**All phases** • During construction vessel routes through the array and export cable corridor will be displaced due to the presence of a buoyed construction area including 500 m advisory safety zones around structures undergoing construction and advisory clearance distances around vessels. • The presence of the array infrastructure (turbines, moorings and OSP) during operation phase has the potential to displace vessel routes through the array area. The number of structures installed and final positions will affect the magnitude of the impact • During the decommissioning phase effects associated with the removal of offshore infrastructure are envisaged to be the same or similar to those described for the construction phase
Port access restrictions due to vessel intensity and installation of offshore export cable	✓	✓	✓	**Construction and decommissioning phase** • During construction and decommissioning, there may be an increased intensity of activities within the port. Therefore, port access may be affected as the presence of installation and deconstruction vessels may restrict port access for other vessels. **Operational and maintenance phase** • Port and harbour access will likely be affected with the increase in frequency of service vessels supporting Project. Consultation will need to be carried out with appropriate personnel at Port of Ulsan.
Increased collision risks	✓	✓	✓	**Construction and decommissioning phase** • Vessels utilised during the construction and decommissioning phases of Project could displace other passing vessels and lead to the potential increase in risk of vessel-to-vessel collisions. Certain vessels used during these phases of the Project are large and extremely limited in their ability to manoeuvre, increasing the risk of potential collisions. **Operational and maintenance phase** • The presence of the array during operation may displace vessels causing potential increased collision risk due to an increase in rate of encounters between vessels.

Potential impact	Phase C	Phase O	Phase D	Justification
				• The presence of vessels during maintenance periods may lead to an increase in the risk of vessel-to-vessel collision in the array area between development and third-party works. Major maintenance works would require the use of large vessels, limited in their manoeuvrability, which could increase collision risk.
Increased collision risks with project infrastructure	✓	✓	✓	**Construction and decommissioning phase** • The physical presence of completed structures, or partially completed structures within the Project area could potentially increase vessel to structure allision risks. This includes vessels at drift or underpower. **Operational and maintenance phase** • The physical presence of the WTGs within the FOWF would create additional risk to passing vessels within the Project Area. These risks are applicable to vessels at drift or underpower for the duration of the Project lifetime.
Interaction with subsea cables and subsea mooring systems within the area	✗	✓	✗	**Operational and maintenance phase** • Vessel fishing gear and anchoring devices have the potential to snag and become caught up in mooring lines within the array area if fishing activities are permitted.
Diminished emergency response capabilities	✓	✓	✓	**Construction and decommissioning phase** • Activities associated with the proposed Project during all development stages have the potential to diminish emergency response capabilities (including Search and Rescue (SAR) and pollution response) by increasing potential incidents and dispersing valuable resources. **Operational and maintenance phase** • The non-grid layout of the array may complicate the search for casualties within the array area • The presence of the Project could result in an increase in the number of incidents within the array area that require an emergency response, specifically during times of major project maintenance.
Navigational safety	✗	✓	✗	**Operational and maintenance phase** • Potential installation of export cable protection in nearshore regions could reduce navigable water depths.
Displacement of current anchorages	✓	✓	✓	**All phases** • The displacement of informal anchorages due to the Project and subsea infrastructure could result in interruptions for the fishing industry, increase anchor drag for vessels in general if alternatives are not identified which could in turn potentially increase congestion, collision risk and port access for vessels.
Collision risk due to floating hazard		✓		**Operational and maintenance phase** • The loss of station due to mooring system failure may lead to a floating hazard remote from the chartered area causing collision risk from the turbine or floating platform

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.9.4 Proposed Assessment Methodology

The following guidance is considered to be relevant for the shipping and navigation assessment:

- Revised Guidelines for Formal Safety Assessment (FSA) in the IMO (International Maritime Organization) Rule-Making Process (IMO, 2018);
- Recommendation O-139 On the Marking of Man-Made Offshore Structures (IALA, 2013);
- Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (MCA, 2013).

The Marine Traffic Safety Assessment (MTSA) needs to be reviewed to fully inform the assessment methodology.

A Navigational Risk Assessment will also be completed and summarised in the ESIA.

6.10 Military and Civil Aviation

This chapter will consider the potential impacts of the Project on military and civil aviation during the operational and maintenance phases. The assessment will be informed by the Military Operations Review (or Radar Impact Assessment; RIA), which is an assessment of issues related to malfunction of military radar caused by the electromagnetic waves generated from rotating wind turbine blades.

In the Korean regulation, Military Operations Review refers to the examination of impact and resolutions on the protection of military bases and facilities and military operations. For the Review, a developer needs to request the preparation of a military operation examination report to a specialized agency, and then submit the report to an approval authority. Head of the approval authority then shall request consultation to the Minister of National Defense. The result of the review is classified into agreement, disagreement, and conditional agreement.

The Review (or RIA) is required by the Korean regulation pursuant to the following Korean legislation:

- Military Telecommunications Act;
- Military Base and Military Facility Protection Act;
- Directive on Processing Government Development Plan Consultation Tasks.

6.10.1 Baseline Environment

The Military and Civil Aviation Study Area has been determined by the range of the aviation receptors that could potentially be affected, specifically, Air Traffic Control (ATC) and military radar systems. The Military and Civil Aviation Study Area covers radars along the southeast coast of the Korean peninsula near Ulsan, that could potentially detect the wind turbines associated with the array area. The Military and Civil Aviation Study Area encompasses airspace designations that include low flying and Military Operation Areas (MOA) which intersect or are adjacent to the array area, and airspace used by helicopters that are on route from Donghae-1 Gas Field, located 4.9 km from the array area in the East Sea. Key data sources that have been reviewed and have provided information on the baseline environment are listed in Table 6-41, noting that this list is not exhaustive.

Table 6-41: Key sources of information for the military and civil aviation baseline.

Data	Description	Source
Airspace use along the coast of Ulsan, South Korea	Depicts the military operation area (MOA), prohibited and restricted airspace off the Ulsan coast in proximity to the array area.	Ministry of Land, Infrastructure and Trade (MOLIT), 2021
Operational navigation charts for South Korea	the KOREA ADIZ, MOA, Ulsan International Airport, and vertical obstructions present along the Ulsan coast	National Imagery and Mapping Agency (NIMA), 2000
Civil Aviation charts for South Korea and Specifically Ulsan International Airport	The Civil Aviation charts provided from the South Korean Office of Civil Aviation outline the KOREA ADIZ, MOA, prohibited and restricted airspaces as well as defining the class of controlled and uncontrolled airspace in the Project vicinity.	International Civil Aviation Organisation (ICAO), 2013
FAA Global Standards	Provides specific height data with which aircraft pilots must adhere to given specific airspace classes and airport designations.	Federal Aviation Administration (FAA) Airspace Standards, 2021
L-Band Radar Systems	Micro-Doppler analysis of Korean offshore wind turbines of the L-Band Radar systems.	Jung *et al*., 2013
X-Band Tracking Radar Systems	Analysis of the effect of Korean offshore wind farms on the accuracy of X-Band Tracking Radar.	Jung *et al*., 2014

6.10.1.1 Military Aviation

South Korea employs a highly sophisticated, long-range Terminal High Altitude Area Defence (THAAD) X-Band radar system that aims to provide protection against North Korean ballistic missiles (Swain, 2017; Sankaran and Fearey, 2017). This radar system is located along the North Korean and South Korean borders, approximately 415 km north-east of the array area.

The array area is situated 45.57 km off the coast of Ulsan, adjacent to and within a MOA and Military Training Area (MTA) (Figure 6-32). Both the MOA and MTA are considered Special Use Military Airspace, wherein limitations are imposed on civil aircraft operations.

The MOA encompasses all of Ulsan and extends approximately 50 km offshore. The north-western most part of the array area overlaps the MOA boundary. The MOA has been established for national defence training activities and exists to separate Instrument Flight Rules (IFR) from military flight activities. Unlike restricted airspace, MOAs do not prohibit civil aviation aircraft. MOAs have defined vertical airspace that separates military training activities from IFR traffic. The MOA has controlled airspace from the surface to 2,743 m AMSL (ICAO, 2013). Pilots operating in this area typically use Class E Airspace, from 2,590 m to the base of Class A Airspace, 6,000m (FAA Airspace Standards, 2021). Class E Airspace is predominantly used along populated coastal areas, comparable to Ulsan, South Korea.

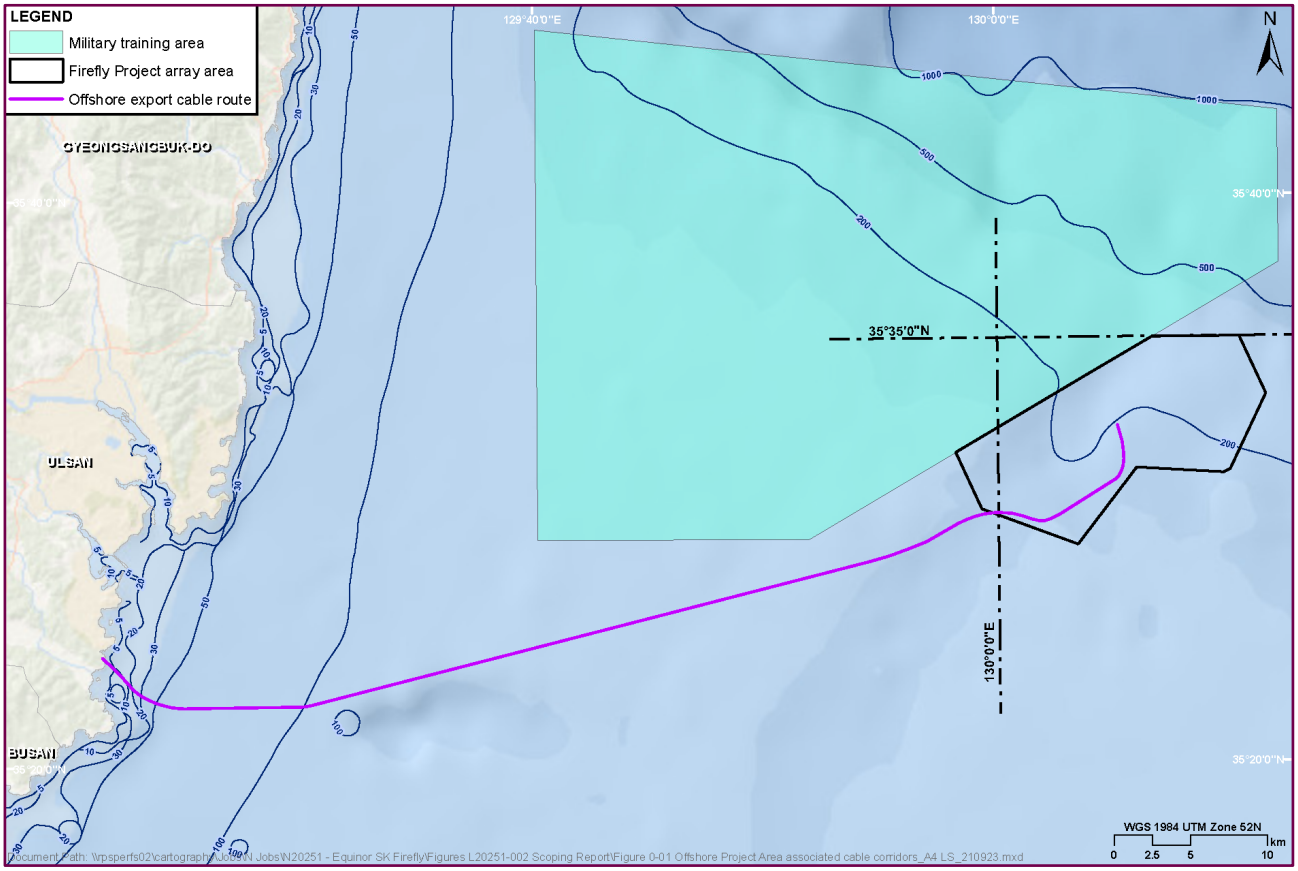


Figure 6-32: Military Training Area (MTA) adjacent to the Project's array area.

The array area also overlaps restricted airspace associated with a MTA (Figure 6-33). This restricted airspace excludes civilian aviation aircraft, predominantly due to reasons concerning national security and invisible hazards such as aerial gunnery, guided missiles, and artillery firing (ATMO, 2021). The MTA is referred to as 'R119' on official aviation maps (Figure 6-33Figure 6-33) and is a controlled airspace from the surface to 762 m Above Mean Sea Level (AMSL).

WTGs that comprise the array area have a maximum blade tip height of 261 m above Lowest Astronomical Tide (LAT), and therefore are located 467 m below controlled airspace associated with the MTA and 2,448 m below controlled airspace associated with the MOA.

6.10.1.2 Search and Rescue (SAR)

The Korea Coast Guard, which is responsible for all Search and Rescue (SAR) missions in Korea, has six Maritime Rescue Coordination Centres (MRCC) and nine Marine Search and Rescue Centres (MSRC) (Choi *et al.*, 2020). The closest MRCC to the array area is in Busan (approx. 100 km from the array area) and the nearest MSRC team is located in Ulsan (approx. 45 km from the array area).

6.10.1.3 Civil Aviation

Civil aviation maps show that Ulsan International Airport is located approximately 80 km from the array area with prohibited airspace to the north and south of the airport's location due to increased air traffic in the immediate vicinity (Figure 6-33). Ulsan International Airport is classified as a civil airport with Class D airspace extending 5 NM boundary east to the coastline. Class D airspace is established from the surface up to a height of 914 m AMSL with operations conducted under IFR, Visual Flight Rules, or Special Visual Flight Rules (Arblaster, 2018). Flights within Class D are subject to ATC clearance and are typically used for medium sized airports, such as Ulsan International Airport.

The nearest confirmed flight path that occurs in proximity to the array area is designated as route A586 and travels northeast from Ulsan International Airport. Route A586 is located approximately 45 km northwest of the array area due to the presence of the restricted airspace associated with the MTA described above (Figure 6-33).

According to Civil aviation maps provided, the Korea Air Defence Identification Zone (ADIZ) is the only other aviation boundary feature that currently transects the array area (ICAO, 2013). The Korea ADIZ is best defined as airspace in which control, location and identification of civil aircraft is implemented by national authorities in the interest of national security (Abeyratne, 2012). Although the Korea ADIZ was established in 1951, non-military, civil aircraft are still required to submit flight plans to the Minister of Land Affairs, Infrastructure and Transportation prior to crossing the Korea ADIZ boundary (Dyahtaryani, 2021). The majority of the array area is located outside of the Korea ADIZ (Figure 6-33).

The south-eastern most corner of the array area is also located along the Incheon Fir / Fukuoka Fir boundary. This boundary essentially delineates South Korean and Japanese airspace (Figure 6-33).

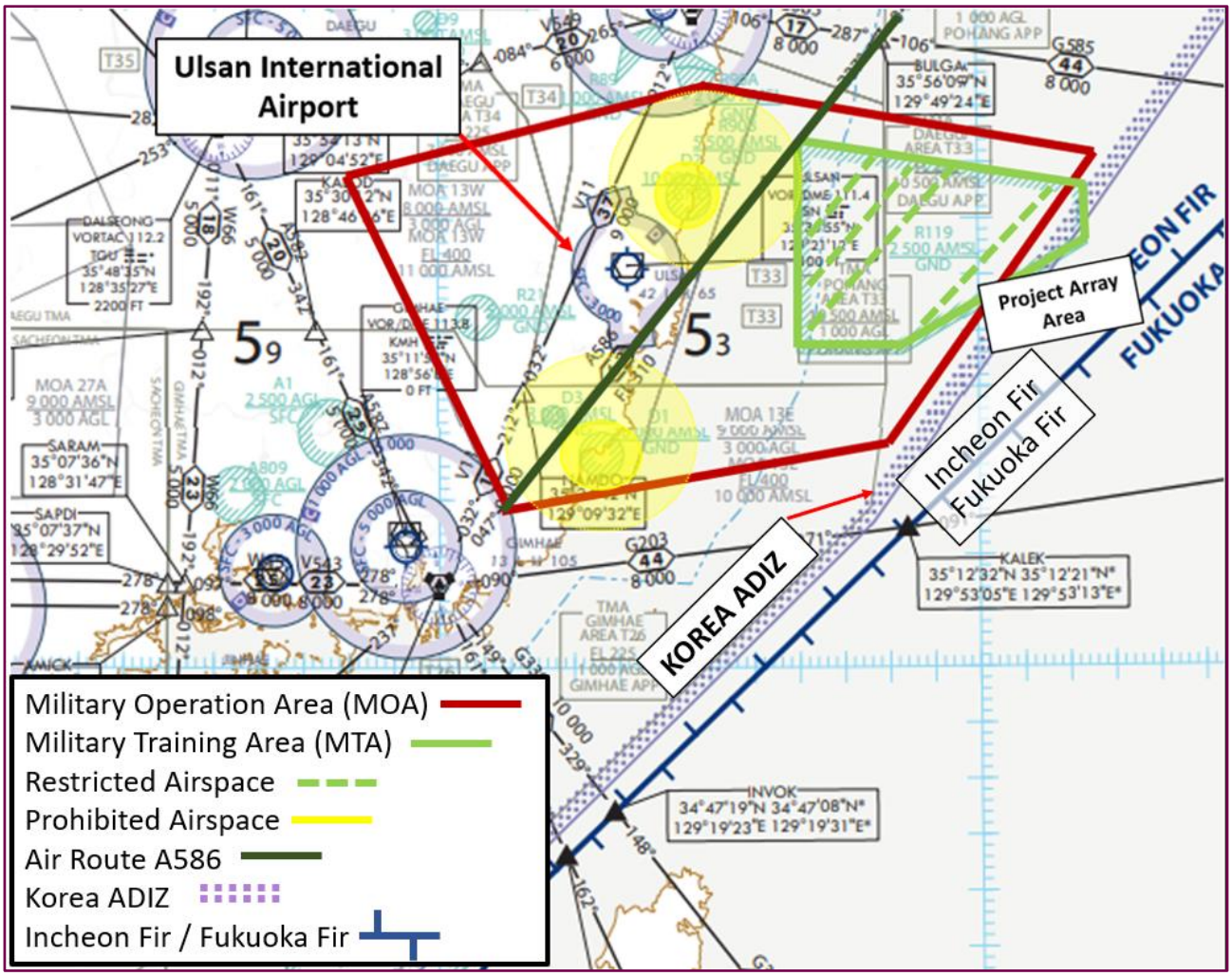


Figure 6-33: Airspace use in proximity to the array area, adapted from enroute charts through the Office of Civil Aviation, Republic of Korea (ICAO, 2013).

6.10.2 Proposed Additional Data Collection

Based on the baseline data / information identified above additional data will need to be collected to inform the ESIA.

The following additional data will be collected:

- Instrument Flight Procedures (IFP) and ATC Surveillance Minimum Altitude Chart: This will be utilised to examine the effect that obstacles might have on IFP and minimum levels of tolerance under airport radar control.
- Radar Line of Sight: This will look at radar line of sight to determine whether the array area is likely to produce returns on radar and it will additionally assess the potential impacts on communications and navigational equipment.
- Operational Unit Identification: This will take the results of the radar line of sight assessment and progress them to the operational units that utilise the assets. Following the assessment, the unit assessors will decide if the array area will have an impact on specific operational criteria.

This will help characterise the main aviation routes and navigational issues of potential concern to the Project ahead of the ESIA. Additional engagement with relevant stakeholders will be required (Section 4.3).

No project-specific surveys are proposed with respect to Military and Civil Aviation.

6.10.3 Potential Project Impacts

A range of potential impacts on civil and military aviation have been identified which may occur during the operational and maintenance phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-42.

Table 6-42: Impacts Proposed to be Scoped Into the Project Assessment for Military and Civil Aviation.

Potential impact	Phase			Justification
	C	O	D	
Creation of physical obstacles affecting the local air traffic	✗	✓	✗	**Operational and maintenance phases** • Aircraft which operate at low levels are required to set a Minimum Safe Altitude (MSA). The MSA is the lowest altitude established in specific areas to ensure safe operation between known obstacles (array area) and the aircraft. In poor weather, the MSA for aircraft enables it to maintain a minimum of 305 m (1,000 ft) clearance between the aircraft and known obstacles. The PDE includes WTGs with a maximum tip height of c. 274 m (899 ft) above Mean High Water. Therefore, the MSA in the Project area will need to be 579 m (274 m + 305 m) to maintain at least 305 m of vertical separation between Project WTGs and aircraft.
Interference with civil and military Primary Surveillance Radar (PSR) systems	✗	✓	✗	**Operational and maintenance phase** • WTGs have been found to have detrimental effects on the performance of PSRs. These can include the desensitisation of radar within the vicinity of WTGs, shadowing and the creation of unwanted returns. The desensitisation of radar could potentially result in aircraft going undetected by radar and therefore not visible to aircraft controllers. Air traffic controllers use the radar to differentiate between aircraft and maintain situational awareness. Unwanted returns displayed on the radar due to WTGs creates additional work for both aircrews and controllers. Furthermore, actual aircraft returns can potentially be obscured by WTG radar returns, which could lead to conflicting data resulting in tracking difficulties. • WTGs from the array area could potentially disrupt and distort the PSR radar systems which are used for both military and civil airport security practices. This could potentially cause foreign missile strikes to go undetected.
Interference with L-Band military surveillance radar systems	✗	✓	✗	**Operational and maintenance phase** • WTGs have been found to have detrimental effects on the performance of L-Band military surveillance radar systems. L-band military radars are used to survey air and maritime targets for national security purposes, and WTGs have the potential to interfere with radar views. Rotating and stationary WTGs can alter the micro-Doppler frequencies and distort radar signals. These distortions can be viewed as a moving target which potentially causes confusion, panic, and waste of military resources.

Potential impact	Phase C	O	D	Justification
				• WTGs from the array area could potentially disrupt and distort the L-Band radar systems which are used to survey aerial and maritime targets to protect national security interests. This could potentially cause foreign missile strikes to go undetected.
Interference with X-Band military surveillance tracking radar systems	✗	✓	✗	**Operational and maintenance phase** • WTGs have been found to have detrimental effects on X-Band military surveillance tracking radar systems. Operational wind farms have the potential to cause electromagnetic waves to reflect off individual WTGs which result in interference with X-band tracking radars located in nearby military bases. The large amplitude caused by the radar cross section of the wind turbine on electromagnetic waves has the potential to distort radar tracking signals, either locking onto the turbine itself or causing the radar to fail in tracking aerial objects. • South Korea employs a long range THAAD X-Band radar system to track and destroy incoming North Korean ballistic missile strikes. WTGs from the array area could potentially disrupt and distort the X-Band radar system due to its proximity (415 km) to the array area and cause issues relating to national security.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.10.4 Proposed Assessment Methodology

The assessment will be carried out with reference to the following published guidance:

- How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors (Eurocontrol, 2014);
- Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms) / Wind Monitoring Towers (Australian Government Aviation, 2021);
- International Civil Aviation Organisation (ICAO) Annex 19, which is the foundation of aviation safety and includes the Aviation Safety Management System (ASMS);
- 2nd Aviation Policy Basic Plan in accordance with the Aviation Act of 2015 which outlines strategic priority tasks in various fields that are selected and implemented to prevent future aviation accidents;
- ICAO Technical Guidelines, Doc 9134 (Aerodrome Operations Manual), part 6 (Obstacle Management) and Doc 9734 (Safety Supervision Manual);
- CAA Policy and Guidelines on Wind Turbines (CAA, 2016); and
- CAA Visual Flight Rules Chart (CAA, 2020).
- Preliminary analysis report on the impacts of radio waves to establish the Firefly floating offshore wind farm (Jung, 2022)

6.11 Seascape Visual Amenity

This chapter will consider the potential impacts of the Project on the Seascape Visual Amenity during the construction, operational and maintenance and decommissioning phases.

6.11.1 Baseline Environment

The Seascape Visual Amenity Study Area is defined as a 50 km radius around the array area in line with referenced guidance: “Guidelines for Landscape and Visual Impact Assessment”, Third Edition (2013). The Seascape Visual Amenity Study Area and extent of baseline receptors to be considered in the assessment will be refined based on the finding of the Zone of Theoretical Visibility (ZTV) which is will be undertaken as part of the ESIA. The Seascape Visual Amenity Study Area comprises the coastal waters of Ulsan, Dong-Gu and the Korea Strait in the East Sea. The Seascape Visual Amenity Study Area features large bays, ports, and coastal waters associated with Ulsan, South Korea.

Information regarding seascape visual amenity near Ulsan, South Korea and the array area has been collated through a detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 6-43, noting that this list is not exhaustive.

Table 6-43: Key sources of information for the seascape visual amenity baseline.

Data	Description	Source
Marine Cultural Heritage Assets in South Korea	The Gray whale migration off the coast of Ulsan, South Korea has been a designated seascape Natural Monument (No. 126) since 1962.	Tatar, 2017
Intangible Cultural Heritage (ICH) and its marketability in the tourism industry	Intangible Cultural Heritage, specifically regarding the Gray whale migration route which is designated Natural Monument No. 126 in Ulsan, South Korea provides unique marketability in the tourism sector and is a prime example of a seascape resource.	Kim *et al*., 2019
Generating an appropriated Zone of Theoretical Visibility (ZTV)	To manage and mitigate seascape impacts from offshore infrastructural developments, multiple methods have been developed to evaluate and quantify potential visual impacts and the effects on their receptors effectively and efficiently.	Ioannidis *et al*., 2020

The baseline seascape visual amenity environment will focus on views from a range of viewpoint locations representing a range of viewer types. The main viewer types likely to be affected by the Project related to seascapes include:

- Recreational users of the marine environment; and
- Recreational visitors whose attention is focused on the seascape.

The baseline visual amenity within the ESIA will also consider seascape Visual Reference Points (VRP) and Intangible Cultural Heritage (ICH) documented in the assessment prepared for the ESIA as follows:

- VRP 1: Swimming waters at Ilsan Beach, Ilsan-dong, Ulsan
- VRP 2: Jangsaengpo whale watching cruises which can travel 20 km into the East Sea
- VRP 3: Swimming waters at Gyeongju National Park – north east of Ulsan
- VRP 4: Port and harbour waters in Ulsan, Onsan and Mipo
- VRP 5: Recreational fishing and water-sport activities occurring along the Ulsan coast
- VRP 6: Gray whale migration zone along the Ulsan coast (Natural Monument No.126)
- VRP 7: The Korea Strait, up to a distance of 60 km from the array area – East of Ulsan
- VRP 8: The East Sea, up to a distance of 60 km from the array area – East of Ulsan

6.11.2 Proposed Additional Data Collection

The following data collection would be undertaken to characterise the seascape visual amenity baseline:

- Establishment of the Seascape and Visual Resources Study Area (including the generation of a ZTV) through computer-generated tools that aim to identify the likely or theoretical extent of the visibility of a development from various locations within the sea;
- Conducting digital representation in Geographic Information Systems (GIS) and wireline methods to calculate the extent of the affected areas (Ioannidis, 2020);
- The representative viewpoints consider a human's normal field of vision and are observed from a range of locations incorporating near, middle and long views. Representative viewpoints will be taken from public areas and vantagepoints, including from sensitive receptors within designated landscapes; and
- Consult with the public as recommended in the Stakeholder Engagement Plan (Section 4.3) to gather important information on local seascape visual amenity locations and how to best manage their potential impacts from the Project.

6.11.3 Potential Project Impacts

A range of potential impacts on seascape visual amenity have been identified which may occur during the construction, operational and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-44.

Table 6-44: Impacts Proposed to be Scoped Into the Project Assessment for Seascape Visual Amenity.

Potential impact	Phase C	O	D	Justification
Temporary changes to the local seascape visual amenity	✓	✗	✓	**Construction and decommissioning phase** • The presence of vessels and project equipment, foundations, WTGs and OSPs within the array area and along the offshore export cable route during installation and decommissioning will result in effects on the seascape visual amenity of the surrounding area. • The aforementioned activities and elements are the main features of the construction and decommissioning phases which will be apparent from the surrounding area of the local and regional seascapes. • The required construction and decommissioning activities will be seen by viewers as a series of intermittent activities.
Changes to seascape visual amenity	✗	✓	✗	**Operation and maintenance phase** The presence of offshore WTGs, OSPs with required navigational lighting, and the intermittent sea vessel traffic in order to perform maintenance operations, will impact the seascape visual amenity of the area, potentially causing adverse visual impacts to the local community, visitors and tourists from the seascape.
Visual impacts experienced by receptors in recreational pursuits	✓	✓	✓	**All phases** • The construction, operation and decommissioning of the Project could be visible to multiple visual receptors occupied in recreational marine pursuits.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.11.4 Proposed Assessment Methodology

The assessment approach and methodology will be informed by published guidance as follows:

- Landscape Institute and Institute of Environmental management and Assessment, Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, (2013);
- Cumulative Impact Assessment and Management: Guidance for Emerging Markets, (2013);
- Environmental, Health and Safety Guidelines for Wind Energy including visual impacts on the physical environment and those associated with wind energy projects (IFC World Bank Group, 2015).

The assessment of effects on seascape visual resources and assessment of effects on visual amenity are separate but interconnected. Established guidance, referenced above, makes a distinction between seascape effects and visual effects.

Seascape receptors include physical elements, features and characteristics that may be affected by the Project. Visual receptors include the public or community at large and residents and visitors to the area.

The assessment will involve the following key steps:

- The maximum design scenario will be identified, and the Seascape Visual Amenity Study Area will be confirmed;
- A ZTV of the proposed offshore wind turbines will be generated covering the Seascape Visual Amenity Study Area defined for the assessment from identified viewpoints/ receptor locations;
- The seascape baseline within the ZTV will be identified and documented with reference to published seascape character assessments;
- Designated seascape features (gray whale migration route) within the East Sea will be identified and described (Tartar, 207; Kim *et al*., 2019);
- The visual baseline will be recorded with reference to the viewpoints listed above. Detail on these viewpoints will be presented including a description of existing views and the different groups of people who experience these views;

- Visualisations (wirelines) will be generated based on 3D modelling of the offshore wind turbines and OSPs; and
- An assessment of potentially significant effects will be undertaken as follows:
  - Seascape character;
  - Designated seascapes and seascape features; and
  - Viewers at selected viewpoint locations,

The assessment will be supported by figures illustrating the baseline seascape viewpoint locations and ZTV prepared to technical standards detailed in the guidance.

The Seascape and Visual Impact Assessment (SVIA) will consider effects upon several sensitive visual receptors:

- Seascape character and resources, including effects on the physical and aesthetic value of coastal and marine seascapes caused by alterations in elements and qualities resulting from offshore WTGs and OSPs;
- Designated landscapes, including effect on the specific characteristics of designated areas, resulting from offshore WTGs and OSPs; and
- Visual amenity, including effects upon viewing groups, such as residents, tourists and visitors caused by alterations in the appearance of seascapes resulting from offshore WTGs and OSPs.

6.12 Marine Archaeology

This chapter will consider the potential impacts of the Project on marine archaeology during the construction, operational and maintenance and decommissioning phases. The assessment will be informed by the Korean Cultural Heritage Assessment (CHA), which is an assessment conducted before the construction of a project to identify and preserve cultural heritage buried within the planned project site.

For CHA under the Korean regulation, a developer selects and contracts a ground surface survey contractor for buried cultural heritage inspection before construction, separately from the project construction contract. The designated survey contractor shall then conduct the survey after submitting a declaration of commencement to the head of a local government and the head of Cultural Heritage Administration. After the survey, the result is written into a report and submitted by the developer to the head of the local government and the head of Cultural Heritage Administration. Once receiving the report, head of Cultural Heritage Administration who has received the report implements Cultural Heritage Committee deliberation and attach opinions of (Metropolitan) City Mayor and Governor of the Do Province, to be sent to the head of relevant City/Do/Gun. The head of City/Do/Gun then notifies the results to the developer.

CHA is required by the Korean regulation pursuant to the following Korean legislation:

- Cultural Heritage Protection Act;
- Protection and Inspection of Buried Cultural Heritage Act;
- Enforcement Decree of the Protection and Inspection of Buried Cultural Heritage Act; and
- Regulations on Methods, Procedures, etc., of Ground Surface Inspection.

6.12.1 Baseline Environment

Information regarding marine archaeology near Ulsan, South Korea and the Proposed Area has been collated through a detailed and comprehensive review of currently accessible studies and datasets. To provide context, the desktop review will also consider marine archaeology within the wider area of the East Sea, specifically within the Korea Strait. Key data sources are listed in Table 6-45, noting that this list is not exhaustive.

Table 6-45: Key sources of information for the marine archaeology baseline.

Data	Description	Source
Underwater Cultural Heritage Protection	Analysing the Korean statutes of Underwater Cultural Heritage protection through the 2001 Underwater Heritage Convention.	National Research Institute of Maritime Cultural Heritage, 2011

Cultural Heritage Administration online database	Searchable online database in line with designations listed in Table 6-46 and Table 6-47.	Cultural Heritage Administration, 2009
Buried Cultural Heritage Act (Article 43)	Provides relevant laws, heritage classification and overall mission of Korea's Cultural Heritage Administration.	Cultural Heritage Administration, 2021
Journal Articles	As listed in the references section.	See References

The Cultural Heritage Administration in South Korea classifies archaeology and cultural heritage under a number of state designations, further details of designations relevant to the marine environment can be found in Table 6-46.

Table 6-46: Archaeological and Cultural Heritage state designations.

Designation	Description	Number of designated sites/artefacts
National Treasure– state designated	Heritage of a rare and significant value in terms of human culture and with an equivalent value to "Treasure" described below	330
Treasure– state designated	Tangible material cultural that may be associated with shipwreck sites or submerged prehistoric settlement sites of important value, such as historic ship architecture, ancient books and documents, paintings, sculpture, handicraft, archaeological materials and armoury	2039
Historic Site– state designated	Places and facilities of great historic and academic values that are especially memorable (e.g., prehistoric sites, shell mounds and shipwrecks)	496

Additionally, archaeology and cultural heritage can be designated at a city or province level under the following designations:

Table 6-47: Archaeological and Cultural Heritage city or province designations.

Designation	Description
Tangible Cultural Heritage	Tangible cultural products of great historic and artistic values, such as material culture that was on board a ship e.g. classical records and books, ancient documents, paintings, sculpture and handicraft; and archaeological materials corresponding thereto.
Monument	Historic site of great historic or academic values, such as submerged prehistoric settlements, shell mounds, relic sites and ship wrecks
Folklore Heritage	Clothing, implements and houses used for daily life, religious or annual events and so on, that are indispensable for the understanding of the transition in people's lifestyles and more. All of these materials may be found associated with shipwreck sites or submerged prehistoric settlement sites.

6.12.1.1 Submerged Prehistoric Archaeology

Evidence of Lower Palaeolithic stone tools have been excavated from Seokjang-ri, an archaeological site near Gongju, Chungcheongnam-do Province suggesting that the earliest hominid occupation of the Korean Peninsula may be as early as 500,000 Before Present (BP). (Yi and Clark, 1983). The Korean Peninsula was originally settled by Homo Sapiens 40,000 BP (Yoo, 2018). The Last Glacial Maximum (LGM) ended approximately 12,500 BP and is marked by the melting of ice sheets that covered much of the Korean Peninsula, this led to significant sea level rise particularly in the Yellow Sea Basin to the west which had previously been a completely exposed land mass joining China to Korea. The effects are also evident on the east coast where sea levels rose, submerging areas of land along the eastern coast that would have been previously inhabitable by prehistoric people exploiting the marine environment (Park and Yi, 1995). There is therefore potential for submerged prehistoric landscapes to be located within or close to the Project area.

6.12.1.2 Maritime Archaeology

From 8000-3500 BC, during the Mesolithic period, also known as the Jeulmum Pottery Period, and prior to *Homo sapiens* in Korea adopting agriculture, exploitation of marine resources was the main subsistence strategy for people living in the south and eastern areas of the country (Choe and Bale, 2002). It stands to reason that seafaring craft would have been used for fishing. Sea-faring craft would have also been prevalent throughout the Neolithic (1500-800 BC), Bronze Age (800-100 BC) and Iron Age (100 BC – AD 400) as a means of transportation of goods and people. These craft would have been constructed from organic materials and surviving examples of such are rare worldwide, although some do exist. There is therefore low potential

for surviving evidence of prehistoric occupation and maritime craft to be located within or close to the Project area, particularly in the landfall and nearshore areas of the export cable routes for occupational evidence.

The Korean historical period began in the 4th and 5th centuries during the Three Kingdoms period (57 BC – AD 935) which coincides with the origins of Koreas' military naval history. Due to numerous coastal attacks by the Wa Japanese and other barbarian tribes, Korean shipbuilding advanced and expanded to counter these threats. During the Unified Silla period (AD 668-935), Jang Bogo, a merchant, rose as an admiral and initiated the first maritime trading within East Asian countries. During the Goryeo dynasty (AD 918-1392), wooden ships were built and used to fight pirates. Korean shipbuilding again expanded during the Imjin war (1592-1598), when Admiral Yi defeated the advancing Japanese fleets (Ch'oe, 2006).

Navy and maritime operations fell into disuse during the Joseon Dynasty (1392-1897) while fishing ships continued to operate and prosper. In 1903, the government of the Korean Empire purchased its first modern military vessel, the Yangmu. Korean naval tradition was disrupted after Korea was annexed by the Empire of Japan in 1910. During the Japanese occupation period (1910-1945), the Imperial Japanese Navy built a naval base at modern day Jinhae, on the south eastern coast of Korea approximately 50 km south-west of Ulsan.

In the present, South Korea is the world's largest shipbuilding nation with the Port of Ulsan located in close proximity to the Project area. The Port of Ulsan is home to Hyundai Heavy Industries operating as the largest ship building port in the world. In 1592, during the Imjin War, a major battle occurred at the location of the now Port of Ulsan when monks and citizens alike joined forces to resist Japanese invasion. Records from 1642 show that the Joseon Dynasty ordered the first shipping complex to be built in the Port of Ulsan, establishing the first known connection with shipbuilding in the area. During WWII the Japanese made the Port of Ulsan a major industrial site.

South Korea's rich maritime history and extensive connections of shipbuilding and naval warfare with the Port of Ulsan indicate that there is a high potential for maritime archaeology to be located within or close to the Project area.

6.12.1.3 Project Area

The array area is located in water depths ranging from -143 m to -325 m and encompasses an area of 152.3 km^2, 60 km off the coast of Ulsan, Korea in the East Sea. The substrate in proximity to the array predominantly consists of mud and fine silty sediment which decrease in size as distance from the coastline increases.

A summary of known archaeological features within the Project area is provided below:

- No designations in relation to submerged landscaped have been identified within the Project area.
- No designations in relation to maritime archaeology have been identified within the Project area.

It can be assumed that a lack of designated sites is due to a lack of marine archaeological investigation in the Study Area and is therefore not indicative of the marine archaeological resource. At present, only 11 shipwrecks have been successfully excavated from 18 different sites in Korean territorial waters (National Research Institute of Maritime Cultural Heritage, 2011). This number is exceptionally low and indicates a lack of marine archaeological investigation carried out to date in Korea.

Geophysical survey was conducted approximately 20-30 km east of the array area, this data was interpreted in order to identify shallow gas deposits in 2020, however the data used appears to be around 20 years old and would not be considered suitable for archaeological purposes (Kim et al, 2020).

Navigation charts associated with the Study Area include 6 wrecks within the vicinity of the Port and the offshore export cable corridor with the nearest wreck located approximately 2 km to the south of the offshore export cable corridor (Figure 6-30). No wrecks were identified within the offshore export cable corridor or the array area.

The marine archaeological resource within the remaining Project area is however undefined and therefore the survey recommendations below will be required to fully characterise the marine archaeological environment.

6.12.2 Proposed Additional Data Collection

An Underwater Cultural Heritage assessment will be completed under the assessment requirements for Korea. This however will not cover the proportion of the project based in the Exclusive Economic Zone (EEZ), where the array sits. Additional assessment will be required for the ESIA to consider the risk of impacts to maritime archaeology in this area. Table 6-48 provides a summary of the surveys that will be conducted for Marine Archaeology, in accordance with the requirements of the Procedure and Methodology for Surveying Buried

Cultural Heritage under the Protection and Inspection of Buried Cultural Heritage Act. Data collected by Equinor's geophysical surveys planned for Q3 2022, will be assessed and the requirement for additional surveys assessed at that time.

Table 6-48: Proposed data collection for marine archaeology.

Stages	Survey Type	Survey Methodology
Pre-survey	Desktop studies	• Detailed literature review and scoping studies
Field Survey (Stage 1)	Position measurement and survey ship operation	• Before the survey, track in planned survey area and location of surface of survey peak confirmed by high-precision DGPS. • Survey vessel projects planned survey survey line on computer monitor and travels along it, while receiving actual track and position coordinates of vertex in seconds and inputting them to dedicated computer. • Survey vessel operates at 2-3 knots per hour (4-5 km/h) to obtain high-quality data by minimizing noise effect on survey equipment.
	Underwater topography survey	• Measure position along planned track within study area and at same time create an underwater bottom topographical map through continuous bathymetry to understand formation mechanism of topography. • Calibration by performing a bar check or sound velocity measurement for underwater sound velocity correction of sonar equipment more than twice a day. • Final topographic (water depth) map prepared according to general charting method by referring to tidal data of base port at point closest to survey area.
	Underwater seabed survey	• Side-scan sonar with fundamental frequency of 200 kHz or higher used. • Distance between side lines maintained between 25 m and 50 m, and range adjusted according to water depth. • Side-scan acoustic image probe towed with towing cable at regular intervals from stern (or bow) to maintain optimal height from seabed and to minimize influence of noise from survey vessel. • Tow depth and scan range adjusted according to water depth so that entire seabed of survey area can be scanned, and overlapping underwater bottom acoustic image drawing is obtained. • After analyzing image data in the field, for the distribution area of an abnormal object, the numerical data is reprocessed and analyzed precisely.
	Strata survey	• High-resolution seismic layer probe (Sub-Bottom Profiler) for shallow areas with main frequency band of 3.5 kHz or higher. • In principle, survey interval is 20 m. However, if possibility of buried underwater relics is high and sediment deposition rate of the survey area is rapid, the exploration interval can be changed. • In the case of stratum investigation, numerical data and image data should be acquired at the same time, so that image data can be used for on-site investigation and numerical data can be used for precise analysis through computer processing. • Strata survey can be conducted by utilizing recently acquired data for project design by project operator, if available, and supplementing the parts lacking for the purpose of the ground survey.
	Underwater geomagnetic survey	• In principle, the interval for sub-bottom magnetic profiling is 50 m, but the exploration interval can be changed in areas with high possibility of burial of metallic relics based on pre-surveyed literature or traditional legends. • The geomagnetic survey must be able to be used for precise analysis through computer processing of numerical data, but it may not be conducted if it is judged that there is no metal containing iron through a preliminary survey.
	Sediment survey	• In order to predict the possibility of burial of cultural assets, the vertex is determined, and samples are collected from the survey vessel using a grab sampler, and position of the vertex is confirmed using DGPS.

		• The following characteristics are analyzed according to the general sediment analysis methods: – composition ratio of sediment components (gravel: sand: silt: clay) – sediment phase according to composition ratio, average particle size and particle size characteristics, etc.
Field Survey (Stage 2)	Diving	• Only where existence of cultural heritage is identified/confirmed in shallower water depths (i.e. <40 m).
Field Survey (Stage 3)	Detailed survey of identified sites	• Only where existence of cultural heritage is identified/confirmed.

While multibeam and sidescan sonar allow for the interpretation of physical expressions on the seabed they are most effective when used in conjunction with seismic survey which allows penetration beneath the seabed, which is particularly recommended for the interpretation of deposits and stratigraphy. Magnetometry survey should also be used in conjunction with multibeam and sidescan sonar to identify the presence of ferrous metals commonly used in shipbuilding.

Geophysical data should be collected to a specification appropriate to achieve the following interpretation requirements;

- Magnetometer: identification of anomalies > 5 nT;
- Sidescan sonar (SSS): ensonification of anomalies > 0.3 m;
- Sub-bottom profiler (SBP): penetration > 10 m; and
- Multibeam bathymetry (MBES): ensonification of anomalies < 1.0 m.

Geotechnical survey should be carried out in order to ground truth areas of palaeo-landscape potential identified through the geophysical survey, this is recommended to be conducted using boreholes or vibrocores.

It is also recommended that data held by national or local curators (eg. National Research Institute of Maritime Cultural Heritage and Cultural Heritage Administration) is requested.

6.12.3 Potential Project Impacts

Potential impacts on marine archaeology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-49 together with a description of any additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts.

Table 6-49: Impacts Proposed to be Scoped into the Project Assessment for Marine Archaeology.

Potential impact	Phase			Justification
	C	O	D	
Direct damage to known marine submerged prehistoric landscapes and /or maritime archaeological assets	✓	✓	✓	**Construction and decommissioning phase** • Construction activities could affect any submerged prehistoric landscapes and/ or maritime archaeological assets present within the Project area (if identified) and lead to adverse and irreversible degradation. The effects from decommissioning are likely to be similar to those effects during construction. **Operational and maintenance phase** • Maintenance operations have the potential to directly affect submerged prehistoric landscapes (if identified) within the Project area and lead to adverse and irreversible damage and degradation.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.12.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project within the Marine Archaeology Study Area. The assessment will follow the methodology previously identified, and will be conducted in line with the following legislative procedures and guidelines:

- UNESCO Convention on the Protection of Underwater Cultural Heritage;
- The World Heritage Convention 1972;
- United Nations Convention on the Law of the Sea 1982;
- International Council of Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage 1996 (the Sofia Charter)
- Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC) 2006)
- Protection and Inspection of Buried Cultural Heritage Act; and
- Cultural Heritage Protection Act.

The assessment will be informed by the Marine Processes chapter of the ESIA, which will rely on numerical modelling to represent the potential impacts of the Project (see Section 6.3).

6.13 Marine Infrastructure and Other Users (Material Assets)

This chapter will consider the potential impacts of the Project on infrastructure and other users during the construction, operational and maintenance and decommissioning phases.

6.13.1 Baseline Environment

The Infrastructure and Other Users Study Area includes the infrastructure and other users receptors within an area which has the potential to be affected by the Project (onshore and offshore).

Information regarding marine infrastructure and other sea users within the East Sea, and more specifically off the coast of Ulsan in the Korea Strait, has been collated through a detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 6-50, noting that this list is not exhaustive.

Table 6-50: Key sources of information for the infrastructure and other users baseline.

Data	Description	Source
Port of Ulsan	This article assessed the historic growth of the Port of Ulsan using the Contextualised Model of Urban-Regional Development and detailed the infrastructural components within the port.	Jacobs, 2011
East Sea-Jung Dumping Grounds	Song et al., assessed the governance system for the management of the East Sea-Jung dumping site and described the responsibility zones off the coast of Ulsan.	Song et al., 2015
Port of Ulsan Description	Comprehensively details the shipping, trading and storage capabilities of the Port of Ulsan, South Korea	Port of Ulsan, 2021
South Korea's Resource Potential	The U.S. Energy Information Administration is responsible for collecting, analysing, and disseminating energy information through statistical means.	U.S. Energy Information Administration, 2010

6.13.1.1 Dredging and Dredge Disposal

Ongoing maintenance dredging is undertaken within the port berths and vessel approach areas, ensuring sufficient draught for safe and efficient vessel access. The East Sea-Jung dumping grounds, located 3.4 km from the array area, is the Port of Ulsan licenced dredge disposal dumping grounds (Figure 6-34) with an average water depth of 150 m (Song et al., 2015). The East Sea-Jung dumping grounds have an approximate area of 1,064 km^2 and are located along the continental shelf, with a seabed dominated by mud and sand (Song et al., 2015; Chough 1984).

6.13.1.2 Ports

Ulsan's manufacturing and trade are supported by the city's extensive port system, which comprises three ports (each one located between 2 km and 16 km from the nearshore area of the export cable route). Together, the ports have historically handled 16% of the nation's cargo tonnage, 50% of their crude oil imports, more than 40% of their shipbuilding exports, and nearly 50% of their automobile exports (Jacobs, 2011).

The Port of Ulsan is currently home to the largest dockyard and shipbuilder (Hyundai Heavy Industries) in the world, with the capacity to manufacture a variety of marine vessels (Jacobs, 2011). Ulsan port has several terminals for varying loads such as liquid chemicals, iron ore, steel, coal, wood, and oil. The port consists of Ulsan Main, Onsan and Mipo ports, which collectively have 96 berths with capacity for cargo vessels up to 50,000 tons and moorings to handle crude oil tankers up to 350,000 tons (Port of Ulsan, 2021). Water depths in the Port of Ulsan vary from 4 to 27 m and the area experiences a small tidal range of 0.5 m (Port of Ulsan, 2021). The port contains several breakwaters, measuring 1.8 km, 1 km, 650 m long and a 1.3 km breakwater and 1.5 km seawall are under construction (MOF, 2021).

6.13.1.3 Communications Infrastructure

Communications infrastructure to be considered within this chapter will include satellite communication, VHF radio, UHF communication, offshore microwave fixed links and television. Communication receptors in the vicinity of the Project will be identified through future consultation.

6.13.1.4 Military Training Area

Scarcely overlapping the array area, South Korea has a military submarine training area located 18.9 km from the coast of Ulsan covering an approximate are of 1,198.5 km^2. South Korea's military naval training area is located along the continental slope, north-east of Ulsan in waters ranging from 100 to 400 m deep.

6.13.1.5 Other Offshore Wind Energy Projects

Six offshore wind projects are currently being planned located 55-90 km off the Ulsan coastline, within the Korean EEZ (Table 6-51 and Figure 6-34). All projects are in the planning stage and would range in distance from 4.9 km (Donghae-1) to 39.7 km (Shell-Coens Hexicon 3) from the array area boundary.

Table 6-51: Ulsan third party offshore wind farm project developers.

Developer	Capacity (MW)	Minimum distance from array area (km)
KNOC, Korea East-West Power, Equinor	200	4.9
GIG	1,500	3
Shell-Coens, Hexicon	1,300	23
CIP, SK E&S	1,200 - 1,500	18.6
KFWind	1,200	5

The Korean government has divided the Korean offshore area into 12 Oil and Gas licence blocks with some blocks currently licensed to carry out exploration activities and investigations. Block 6-1 overlaps the array area and in 1998 a commercially viable gas reserve was identified known as Donghae-1. The gas field was developed by Korea National Oil Cooperation (KNOC) in 2004 through installation of topside platform which is located approximately 4.9 km from the array area. The platform has extracted gas and condensate from the Donghae-1 gas field and exported the gas and condensate to shore via a pipeline. IN 2014, KNOC initiated Donghae-2 gas project to develop a near field discovery which was tie-backed to Donghae-1 platform in 2016. At this point, the development of the two platforms has has ended when its gas production came to an end on 31 December 2021.

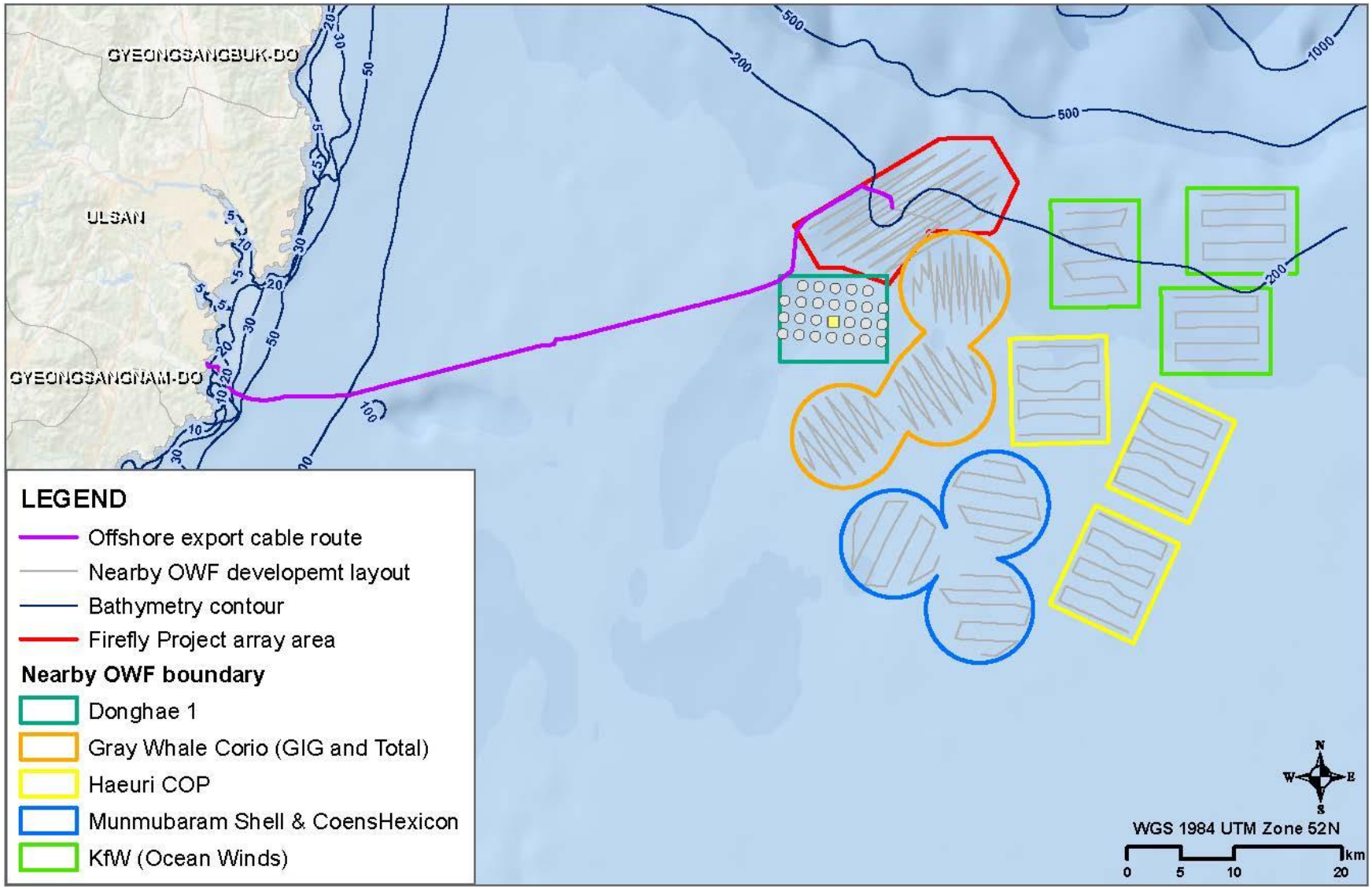


Figure 6-34: Offshore infrastructure Identified within the infrastructure and other users study area.

6.13.1.6 Unexploded Ordnance (UXO)

There are currently limited data available on the amount, type, and distribution of UXO in the Study Area apart from the disused ammunition dump to the north of the array area in around 750 to 1200 m water depth (Figure 6-34). However, due to South Korea's tense relationship with North Korea, including the most militarised zone on earth separating the two nations, the potential for UXO off the Korean peninsula should not be overlooked (Rhodes, 2020). As part of the EIA characterisation surveys, magnetometer data will be obtained and assessed for potential UXO disruption.

Should UXOs be discovered the requirement for noise modelling of disposal activities will need to be considered to inform the ESIA.

6.13.2 Proposed Additional Data Collection

Based on the baseline data / information identified above no additional data will need to be collected to inform the ESIA other than further desktop review to collect further information on planned projects to determine potential for cumulative effects or update based on change to development phases such as planned construction or decommissioning phases.

6.13.3 Potential Project Impacts

A range of potential impacts on infrastructure and other users have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-52 together.

Table 6-52: Impacts Proposed to be Scoped Into the Project Assessment for Infrastructure and Other Users.

Potential impact	Phase			Justification
	C	O	D	
Restrictions and disruptions to port operations and users	✓·	✓·	✓·	**All phases** • The installation, presence and decommissioning of offshore WTGs and the offshore export cable route could impact the Port of Ulsan and its activities, including vessel movement and dredging activities.
Impact on communications infrastructure	✖	✓·	✖·	**Operational and maintenance phase** • The presence and operation of WTGs within the Project area may potentially affect communications infrastructure (satellite communication, VHF radio, UHF communication, offshore microwave fixed links and television signals).
Disruptions to existing Military activity	✓·	✓·	✓·	**All phases** • The installation, presence and decommissioning of offshore WTGs could potentially interfere with South Korean military activities and operations.
Interactions with Unexploded Ordinance (UXO)	✓·	✓	✓·	**All phases** • Potential interaction with UXO from project activities that cause disturbance to the seabed during all project phases could cause risk to life and damage to environmental receptors.
Disruptions to planned marine renewable energy projects	✓·	✓·	✓·	**All phases** • There are potential impacts to other pre-planned marine renewable energy projects and exploration activities occurring withing the Project area.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.13.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project within the Infrastructure and other users Study Area. The assessment will follow the methodology previously identified, and will be conducted in line with the following guidelines:

- International Cable Protection Committee (ICPC) Recommendations (ICPC, 2019);
- Environmental Health and Safety Guidelines for Wind Energy (World Bank Group, 2015);

6.14 Marine Tourism and Recreation

This chapter will consider the potential impacts of the Project on marine tourism and recreation during the construction, operational and maintenance and decommissioning phases.

6.14.1 Baseline Environment

The Marine Tourism and Recreation Study Area encompasses the array area plus a 4 km buffer, the submerged export cable corridor. Information regarding marine tourism and recreation within the East Sea, and more specifically off the coast of Ulsan in the Korea Strait, has been collated through a detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 6-53, noting that this list is not exhaustive.

Table 6-53: Key sources of information for the marine tourism and recreation baseline.

Data	Description	Source
Marketing for developing marine leisure in South Korea	The south Koran government aims to use its coastline to promote marine tourism and recreation, providing an uptick in local economies.	Jang and Cho, 2018
Whale-watching in South Korea	Turning from harvesting to eco-tourism, South Korea aims to protect in marine mammals and promote eco-tourism and conservation for the future.	Choi, 2017
South Korea promotes marine leisure tourism impacting the yachting sector	The South Korean government has recently suggested innovative ways to promote domestic marine leisure activities.	Kwon *et al*., 2014
Water-sports in South Korea	Evaluation of popular water-sports newly introduced in South Korea.	Kim *et al*., 2014
Coastal Tourism for Post-COVID-19	This report understands the importance of domestic recreation and tourism opportunities while dealing with the COVID-19 Pandemic.	Sohn *et al.,* 2021

To create economic growth, the South Korean government has shown significant interest in investing in their marine leisure market, both domestically and internationally (Jang and Cho, 2018).

Over 14 water-sport activities have been identified along the Korean peninsula (Kim *et al*., 2014). Within the Ulsan region, fishing, sailing and motor cruising, kite surfing, surfing, windsurfing, diving, whale-watching, kayaking, and canoeing are some of the most well-known forms of marine tourism and recreation.

Surfing and other recreational activities that take place in coastal areas are primary drivers of local domestic and international tourism (Reineman and Ardoin, 2017). Marine recreational use and tourism in and around the array area is likely to be limited due to its distance offshore (45.57 km) and water depths exceeding 150 m. Kite surfing, surfing, windsurfing, diving, kayaking, canoeing, fishing and sailing and motor cruising activities are often carried out in the coastal and nearshore zones, as these areas tend to be easier to access by shore.

6.14.1.1 Sailing, Boating and Motor Cruising

The government has supported a plan to develop the recreation boating culture in Korea. Coastal regions were opened for recreational activity in 2009 and the number of boat users, particularly personal yachting, has increased substantially (Kwon *et al*., 2014). Following the COVID-19 Pandemic, international travel has been non-existent and there has been a significant shift towards utilising domestic locations and the recreational and tourism opportunities that they provide (Sohn *et al.,* 2021).

Recreational vessels that are found in the Study area are likely to be predominantly local vessels, operating out of one of the many ports and harbours along the Ulsan coast.

There has not been any general sailing or racing areas identified in proximity to the offshore Project area through the initial desktop study. Further consultation with appropriate stakeholders will verify the most popular recreational boating routes.

Medium use recreational boating routes typically run perpendicular to the coastline and cross the offshore export cable routes close to the coast, although this area is predominantly used by commercial and industrial shipping vessels (AIS Marine Traffic, 2021).

6.14.1.2 Recreational Fishing

Recreational shore angling marks have been identified predominantly in brackish water environments along the Taehwa River located inland, north west of the Project export cable route. Fishing charters typically operate out of Busan and Jejudo South Korea, located south west of Ulsan and the array area.

There are six wrecks located within the Study Area between the Port of Ulsan and the array area (Figure 6-30), which may offer suitable offshore recreational fishing marks, although this will be confirmed through the detailed baseline characterisation presented in the ESIA.

6.14.1.3 Recreational Diving

No diving locations have been identified within the Marine Tourism and Recreation Study Area, potentially due to the industrialised nature of the port and its increased presence of marine traffic. While there are six wrecks located within the Study Area between the Port of Ulsan and the array area (Figure 6-30), these are in deep water (mostly > 50 m deep) and therefore out of the range of most recreational divers. This will be confirmed through the detailed baseline characterisation presented in the ESIA.

6.14.1.4 Surfing, Kite Surfing and Windsurfing

Surfing locations were identified near Busan, approximately 9 km south west and Jeju Island, approximately 315 km south west of the export cable route. Although the sport is growing in popularity, South Korea lacks reliable, year-round surfing conditions.

The city of Ulsan and nearby Jinha beach are potentially some of the most popular and sought-after areas for kite surfing and windsurfing. Jinha beach is located approximately 2 km to the south west of the Ulsan Industrial Complex and the landfall location of the Project's export cable route.

6.14.1.5 Whale-watching

Whale-watching has increased in popularity over the years in South Korea as the country makes a transition from hunting to protection through eco-tourism (Choi, 2017). The gray whale migration route located off the coast of Ulsan, South Korea has been designated as a Natural Monument since 1962.

6.14.2 Proposed Additional Data Collection

The following data collection would be undertaken to characterise the marine tourism and recreation baseline:

Local and regional marine tourism and recreational organisations will be consulted at an early stage of the ESIA process as part of the Stakeholder Engagement Plan to effectively:

- Gather information on existing activities in the proposed Study Area;
- Identify potential impacts via the proposed Project; and
- Identify appropriate mitigation measures.

Based on feedback and targeted meetings, a comprehensive list of potential impacts will be identified and utilised as the basis of the assessment.

6.14.3 Potential Project Impacts

A range of potential impacts on tourism and recreation have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-54.

Table 6-54: Impacts Proposed to be Scoped Into the Project Assessment for Marine Tourism and Recreation.

Potential impact	Phase C	O	D	Justification
Increased suspended sediment concentrations and deposition	✓	✓	✓	***All phases*** • There is the potential for increased suspended sediment concentrations and deposition which arise from Project installation, maintenance and decommissioning activities to temporarily affect recreational diving and snorkelling (if sites are identified).
Increased levels of airborne noise	✓	✗	✓	**Construction and decommissioning phase** • There is potential for heightened levels of airborne noise exhibited during the construction and decommissioning phases of the Project. These levels of airborne noise could interfere with recreational sailing, motor cruising, recreational fishing and other recreational activities within the local community and tourists/visitors.
Obstruction, alteration, and displacement to recreational vessel activity	✓	✗	✓	**Construction and decommissioning phase** • The offshore nature of the Project could create potential impacts for recreational vessel activities (sailing, angling, diving, wildlife trips). These impacts could result in the alterations of regular recreational routes, obstructions to anchorages, marinas and slipways and vessel displacement due to log term or temporary safety zones during all phases of the Project.
Disruption and reduced access to coastal recreational users	✓	✗	✓	**Construction and decommissioning phase** • The proposed landfall and nearshore cable installation works could create disruptions during construction and decommissioning phases of the Project. These disruptions could lead to reduced access to preferred areas that coastal recreational users (surfers, swimmers, divers) are able to utilise.
Disruptions to coastal tourism	✓	✗	✓	• Construction and decommissioning phase Temporary visual impacts are expected during the construction and decommissioning phases of the Project.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.14.4 Proposed Assessment Methodology

The following guidance documents will be considered to inform the impact assessment on marine tourism and recreation:

- International Cable Protection Committee (ICPC) Recommendations (ICPC, 2019); and

6.15 Geology, Hydrogeology and Ground Conditions

This chapter will consider the potential impacts of the Project on geological and hydrogeological resources in addition to ground conditions during the construction, operational and decommissioning phases.

The Geology, Hydrogeology, and Ground Conditions Study Area will include the temporary and permanent land take areas plus a buffer of up to 1 km.

6.15.1 Baseline Conditions

Information regarding the Geology, Hydrogeology, and Ground Conditions Study Area has been collated through a review of currently accessible studies and datasets. Key data sources are listed in Table 6-55, noting that this list is not exhaustive.

Table 6-55: Key sources of information for the geology, hydrogeology, and ground conditions.

Data	Description	Source
Seismic Surface Deformation case study of Ulsan, South Korea	Ulsan city and the industrial components of the area lie on reclaimed land due to the presence of the Ulsan Fault Line. This study further assesses the geology of Ulsan.	Yun *et al*., 2019
Evaluating Urban Water Management in South Korea	Ulsan Metropolitan City relies heavily on abstracting water from nearby rivers for their domestic and industrial needs.	Jeong and Park, 2020

Residential Water Quality Improvement in Ulsan, South Korea	Nakdong River currently provides Ulsan Metropolitan City with their potable water needs; however, plans are being made to modify the water source, providing cleaner residential water.	Lee, 2014
Soil contamination of heavy metals in national industrial complexes in South Korea	Soil contamination via heavy metals is a serious environmental concern within Ulsan National Industrial Complex. Results showed that Ulsan National Industrial Complex had high contamination levels in their surrounding soils.	Jeong *et al*., 2015

6.15.1.1 Geology

Ulsan city is located along the south-eastern portion of the Korean peninsula. The Ulsan region is connected to a fault line (Figure 6-35), resulting in the central city and its industrial components being built on reclaimed land (Yun *et al*., 2019). These reclaimed lands in the south of Ulsan are the predominant location of the city's industrial infrastructure and the proposed onshore Project area.

The general geology of the Ulsan area has been evidenced to predominantly consist of sedimentary rocks of the Ulsan formation with fine-grained volcanic sediment and granite rocks. The Ulsan formation is subdivided into three formations which include predominantly reddish and grey to greyish green shale, sandstone, and tuffaceous sandstone with thin conglomerates (Park and Yoon, 1986; Yun *et al*., 2019). The area is also composed of granite and volcanic rocks from the Cretaceous age, sandstone, and mudstone (Kim *et al*., 1971).

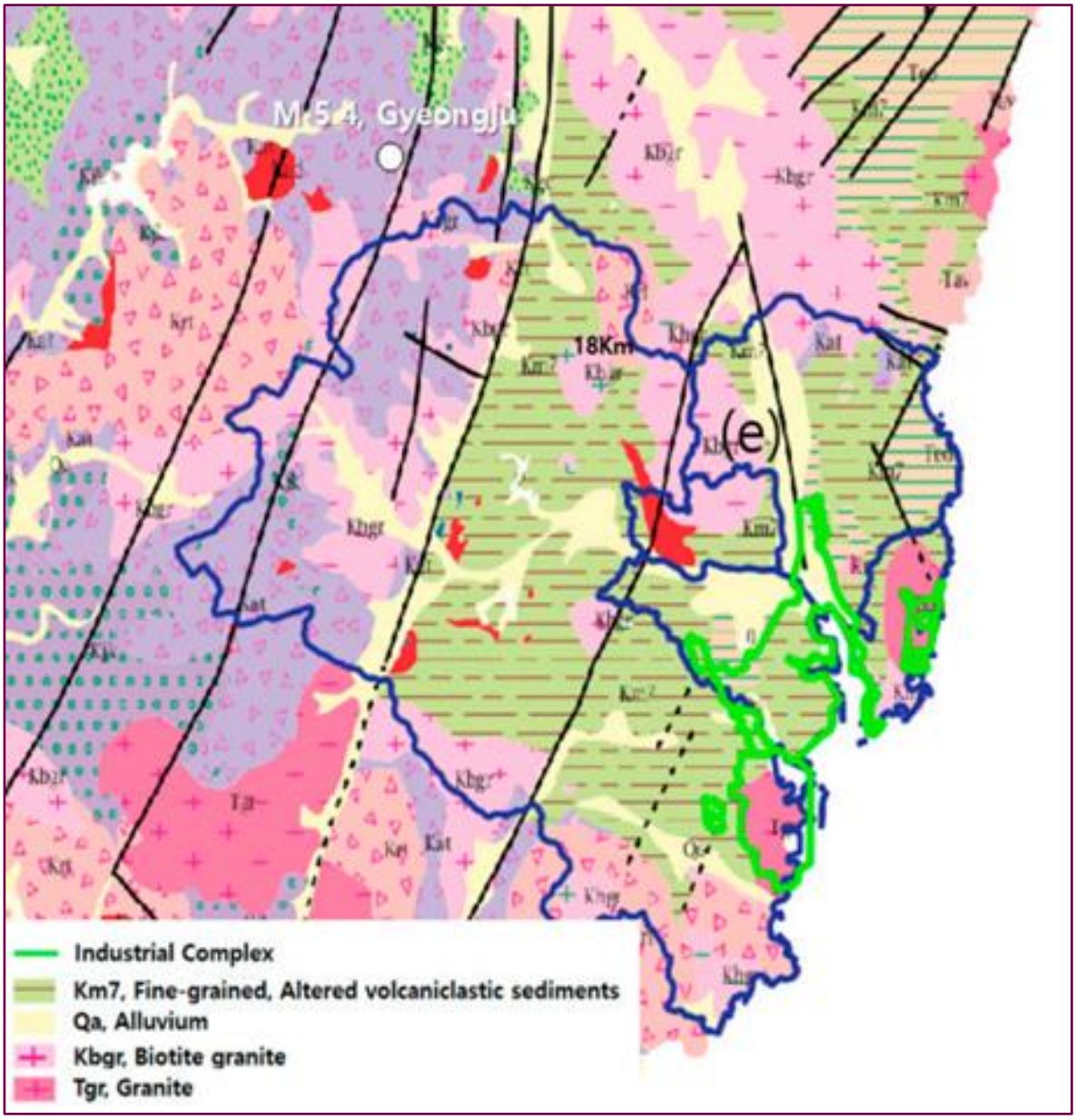


Figure 6-35: Geology of Ulsan in relation to the industrial complexes present (Yun *et al*., 2019).

There are currently 26 Cultural Heritage designations in Ulsan, South Korea. However, none of these designations refer to geological or hydrogeological sites and/or designations within the vicinity of the onshore Project components. Most of the area along the onshore export cable corridor and substation location has previously been disturbed and built upon, as it is located within a heavily industrialised development complex that has grown exponentially since 1962 (Jacobs, 2011).

6.15.1.2 Hydrogeology

The main source of potable drinking water in Ulsan is the Nakdong River, a major river situated approximately 34.29 km from onshore Project components at its nearest point. However, the Ulsan Metropolitan Government has made plans to modify the current water-collecting area in order to supply cleaner residential water resources to its population (Lee, 2014). Although Ulsan relies on abstracting river water, decreased availability of water from the local rivers has made Ulsan's water system vulnerable to climatic risks (Jeong and Park, 2020).

The Ulsan formation does not provide an important groundwater resource for local residents and therefore, is not utilised for potable abstractions. According to data collected and reported from the Korea Water Resources Corporation, 2011 ground water quantities were reported to be 114,299,724 m^3 /year with useable amounts reaching 29,992,881 m^3 /year (Kim *et al*., 2003).

6.15.1.3 Ground Conditions

Land use along the onshore export cable route and substation sites is predominantly industrial and is likely to have included activities with the potential to cause contamination to soils. Soil contamination resulting from the deposition of heavy metals is a current environmental problem, specifically in the Ulsan National Industrial Complex, where industrial processing is a one of the foremost sources of heavy metal contamination (Jeong et al., 2015). According to studies investigating soil contamination levels within the Ulsan National Industrial Complexes, all three complexes illustrated high levels of target heavy metals including Cd, Cu, As, Hg, Pb, Cr, Zn and Ni in their respective soils (Jeong *et al*., 2015). The Ulsan National Industrial Complexes was found to have high levels of contamination, concluding that soils may be significantly affected by heavy metals resulting from the Ulsan industrial complex emissions (Jeong *et al*., 2015).

The long-term use and irregular maintenance associated with onshore infrastructure that may exist within the Ulsan National Industrial Complex could potentially lead to further soil contamination and industrial pollution within the immediate area (Shin *et al*., 2018).

6.15.2 Proposed Additional Data Collection

Depending on the data contained within he Korean EIA, additional desk-based data may be needed to further characterise the baseline ground conditions and inform the ESIA. A summary of the data requirements is set out below:

- Further review of Geological maps and published descriptions;
- Groundwater vulnerability maps or equivalent;
- Groundwater depth monitoring from published records (if available);
- Details of groundwater abstractions including location and use; and
- Results from currently unidentified site investigations (if available) undertaken in the vicinity of the Project, in particular records from boreholes.
- Results from soil and groundwater contamination assessments.

6.15.3 Potential Project Impacts

A range of potential impacts on geology, hydrogeology and ground conditions have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined Table 6-56 together with details of supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts.

Table 6-56: Impacts Proposed to be Scoped Into the Project Assessment for Geology, Hydrogeology and Ground Conditions.

Potential impact	Phase		Justification
	O	D	
Disturbance of existing contamination	✓·	✓·	• Excavation associated with development of trenches for cable installation or construction of onshore substation related to the onshore cable route and groundworks for substation infrastructure may mobilise existing contaminants in the soil and lead to migration of contaminants through the soil profile and affect the quality of groundwater resources.
Deterioration of groundwater quality from release of contaminants	✓	✓	• Indirect effects may occur from the accidental release of fuels or chemicals during use or storage, that leads to the deterioration of groundwater quality.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.15.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project within the geology, hydrogeology and ground conditions study area. The assessment will follow the source-pathway-receptor approach to identify potential sources of contamination within the study area, the type and location of environmental receptors and the pathways by which the receptors may be affected. The IFC EHS General Guidelines: Contaminated Land guidance document will be taken into account during the ESIA.

6.16 Cultural Heritage

This chapter will consider the potential impacts of the Project on cultural heritage during construction, operational and maintenance and decommissioning phases.

The Cultural Heritage Study Area will include the temporary and permanent land take areas required for the onshore elements of the Project landward of MHWS plus a 1km buffer around the onshore cable route and a radius of up to 10km around the onshore substation within which any potential temporary or permanent impacts on the settings of designated assets will be assessed. Potential temporary and permanent impacts on buried archaeology will be assessed within a 1km buffer around the onshore cable route.

The assessment will be informed by the Korean Cultural Heritage Assessment (CHA), which is an assessment conducted before the construction of a project to identify and preserve cultural heritage buried within the planned project site.

For CHA under the Korean regulation, a developer selects and contracts a ground surface survey contractor for buried cultural heritage inspection before construction, separately from the project construction contract. The designated survey contractor shall then conduct the survey after submitting a declaration of commencement to the head of a local government and the head of Cultural Heritage Administration. After the survey, the result is written into a report and submitted by the developer to the head of the local government and the head of Cultural Heritage Administration. Once receiving the report, head of Cultural Heritage Administration who has received the report implements Cultural Heritage Committee deliberation and attach opinions of (Metropolitan) City Mayor and Governor of the Do Province, to be sent to the head of relevant City/Do/Gun. The head of City/Do/Gun then notifies the results to the developer.

CHA is required by the Korean regulation pursuant to the following Korean legislation:

- Cultural Heritage Protection Act;
- Protection and Inspection of Buried Cultural Heritage Act;
- Enforcement Decree of the Protection and Inspection of Buried Cultural Heritage Act; and
- Regulations on Methods, Procedures, etc., of Ground Surface Inspection.

6.16.1 Baseline Environment

Information regarding cultural heritage near Ulsan, South Korea and the onshore Project components has been collated through a review of currently accessible studies and datasets. Key data sources are listed in Table 6-57, noting that this list is not exhaustive.

Table 6-57: Key sources of information for the cultural heritage baseline

Data	Description	Source
Cultural Heritage Administration online database	Searchable online database to find state-designated, city-designated, and registered cultural heritage sites and monuments.	Cultural Heritage Administration, 2009
Cultural Heritage Protection Act (Act No. 8346, April 11, 2007)	Provides relevant laws, cultural heritage classification and actively promotes and develops Korea's Cultural Heritage.	Cultural Heritage Administration, 2021
Location analysis and distributional forecast of prehistoric sites in Ulsan, South Korea using GIS	Analysis and distributional forecasting through GIS illustrated the optimum locations of prehistoric sites within Ulsan Metropolitan City, thus helping determine potential sites of archaeological importance and cultural heritage.	Lee and Kim, 2012

The Cultural Heritage Administration in South Korea classifies archaeology and cultural heritage under a number of state designations, further details of designations can be found in Table 6-58.

Table 6-58: Archaeological and Cultural Heritage State designations.

Designation	Description	Number of designated sites/artefacts
National Treasure	Heritage of a rare and significant value in terms of human culture and with an equivalent value to "Treasure"	330
Treasure	Tangible cultural heritage of important value, such as historic architecture, ancient books and documents, paintings, sculpture, handicraft, archaeological materials and armory	2039
Historic Site	Places and facilities of great historic and academic values that are especially memorable (e.g., prehistoric sites, fortresses, ancient tombs, kiln sites, dolmens, temple sites and shell mounds)	496

Additionally, archaeology and cultural heritage can be designated at a city or province level under the following designations (Table 6-59):

Table 6-59: Archaeological and Cultural Heritage city or province designations.

Designation	Description
Tangible Cultural Heritage	Tangible cultural products of great historic and artistic values, such as classical records and books, ancient documents, paintings, sculpture and handicraft; and archaeological materials corresponding thereto.
Monument	Historic site of great historic or academic values, such as shell mounds, ancient tombs, fortress sites, palace sites and relic sites; scenic sites of great artistic or aesthetic values; and animals (including habitats, breeding places and resting places), plants (including natural growing sites), minerals and caves of great academic values.
Folklore Heritage	Clothing, implements and houses used for daily life, religious or annual events and so on, that are indispensable for the understanding of the transition in people's lifestyles and more.

Resulting from economic expansion in the 1990's, there have been extensive infrastructural developments in South Korea that have exposed and lead to continuous discoveries regrading cultural heritage sites and historic settlements (Bale, 2015).

Assessments conducted using location analysis and distributional forecast in Geographic Information Systems (GIS) found that historic factors including slope, distance from water, elevation, soil drainage, geological features, land use and subsoil were critical in determining the optimum location of prehistoric sites in Ulsan, South Korea (Lee and Kim, 2012). The geology of Ulsan Metropolitan city was predominantly found to be composed of Quaternary alluvium and as a result, prehistoric sites showed a higher possibility of presence near the downstream regions where the Dongcheon and Taehwa River connect (Lee and Kim, 2012).

While this study does not definitively conclude the exact areas that prehistoric sites could potentially be found within the onshore Project area, it does help to reiterate that the Ulsan National Industrial Complex has not

been known for, nor is it expected to produce sites of archaeological and cultural heritage importance (Lee and Kim, 2012). It is worth noting that the onshore Project area is located approximately 23.21 km from where the Dongcheon River and Taehwa River connect.

The Ulsan National Industrial Complex and most of the surrounding city is built on reclaimed land and sedimentary valleys which correspond to the Ulsan active fault line (Yun et al., 2019). The Ulsan/Onsan Industrial Complex covers approximately 18.77 km of reclaimed land from north to south and the area is heavily modified. In terms of buried archaeology, the majority of the area has been used for industrial activities since 1962 and is either occupied by commercial buildings and assorted structures or has been previously developed and disturbed (Jacobs, 2011). On this basis, the potential for buried archaeological remains to be present is relatively low. However, in areas where land has not been disturbed, the potential is higher, particularly given the proximity of several cultural heritage designations.

According to the Cultural Heritage Administration, there are 26 Cultural Heritage assets located in Ulsan, South Korea. Of these 26 assets, two are classified as National Treasure, seven are classified as Treasure, five are classified Historic Sites, one is a Scenic Site, three are Natural Monuments, two are National Folklore Cultural Heritage designations and six are denoted as National Registered Cultural Heritage (CHA, 2021).

The 26 aforementioned Cultural Heritage assets range in distance from 2.48 km to 114.64 km from the onshore Project components. Situated closest to the onshore Project components are the Seosaengpo Manhojin Fortress, registered as City Monument Number 35 and the Seosaengpo Japanese Fortress, registered as Heritage Material Number 8 and (CHA, 2021) which are located 2.48 km from and 2.64 km from the Project (at the nearest point) respectively.

6.16.2 Proposed Additional Data Collection

Based on the baseline data / information identified above additional desktop data will need to be collected to inform the ESIA. A summary of the data is set out below

- Review historic records held by the Cultural Heritage Administration of South Korea;
- Review of historic mapping;
- Desk based study of heritage assets.

Targeted geophysical survey and trial trenching may be required depending on the final onshore cable route. The requirement for field studies would be determined following a due diligence desktop assessment and analysis of the risk of impacts to cultural heritage.

6.16.3 Potential Project Impacts

A range of potential impacts on cultural heritage have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-60.

Table 6-60: Impacts Proposed to be Scoped into the Project Assessment for Cultural Heritage.

Potential impact	Phase			Justification
	C	O	D	
Direct impacts on buried assets	✓	✗	✓	Construction works at the landfall, cable route and onshore substation could result in permanent loss or damage to, buried archaeological assets.
Impacts on the settings of heritage assets	✓	✓	✓	The onshore elements of the Project (including temporary compounds and access roads) could result in impacts on the settings of heritage assets.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.16.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the proposed project within the Cultural Heritage Study Area. The assessment will be conducted in line with the following legislative procedures and guidelines:

- The World Heritage Convention 1972;
- Protection and Inspection of Buried Cultural Heritage Act; and
- Cultural Heritage Protection Act.

6.17 Hydrology and Flood Risk

This chapter will consider the potential impacts of the Project on hydrological receptors and flood risk during the construction, operational and maintenance, and decommissioning phases.

The Hydrology and Flood Risk Study Area is defined as the temporary and permanent land take areas required for the onshore elements of the Project plus a buffer up to 1 km.

6.17.1 Baseline Conditions

Information regarding the Hydrology and Flood Risk Study Area has been collated through a review of currently accessible studies and datasets. Key data sources are listed in Table 6-61, noting that this list is not exhaustive.

Table 6-61: Key sources of information for the hydrology and flood risk baseline.

Data	Description	Source
Residential Water Quality Improvement in Ulsan, South Korea	Nakdong River currently provides Ulsan Metropolitan City with their potable water needs; however, plans are being made to modify the water source, providing cleaner residential water.	Lee, 2014
Novel Solutions for Water Resources Management in South Korea	Discusses the Taehwa Riverbank filtration facilities and their purpose to deliver clean water for domestic use and prolonged environmental stability.	Choi, 2020
Assessment of the Vulnerability of Industrial Parks in South Korea	This assessment focuses on Ulsan Mipo National Industrial Park and its vulnerability to increased flood risks through climate change and severe weather.	Ryu *et al*., 2016
Modelled Flood Risk within Ulsan National Industrial Complex	The figures provided by Ulsan Metropolitan City Corporation (UMCC) illustrate the potential areas most susceptible to flooding risk within the industrial complex.	Ulsan Metropolitan City Corporation (UMCC), 2008

6.17.1.1 Hydrology

The Nakdong River is the longest river in South Korea and flows from the Taebaek Mountains to the Korean Strait. The Nakdong River is a major river situated approximately 34.3 km north west of the onshore Project area and its nearest tributary is located approximately 1.4 km from onshore Project area (Nakdong River Tributary) (Figure 6-36). The Nakdong River flows into Jung-ri lake which then moves southeast towards Jinha beach and the onshore Project components. The Nakdong River is the predominant source of potable water for both domestic and industrial use in Ulsan, although it is considered one of the most polluted rivers in South Korea (Lee, 2014).

Taehwa River is located approximately 12.3 km north of the Project area (Figure 6-36) and is home to riverbank filtration facilities. These facilities were constructed to increase water quality for both domestic use and overall environmental sustainability in the area (Choi, 2020). Toxic metals such as arsenic (As) were monitored along the Taehwa River in Ulsan, South Korea at 18 different stations (Park and Choi, 2021). Results illustrated that concentrations of trace metals were relatively high and exceeded World Health Organisation standards near industrial areas, further exemplifying the need of regional filtration facilities (Park and Choi, 2021; Choi, 2021).

Figure 6-36 also shows numerous drainage lines that the onshore Project area intersects. Typically these drainage lines extend south and west from the boundary of the substation site and onshore export cable corridor flowing into Nakdong River. The drainage lines are likely to be ephemeral and would only flow during substantial rainfall events.

Figure 6-36: Illustrates main river distribution network in relation to the onshore export cable route and Project substation.

6.17.1.2 Flood Risk

A flood risk vulnerability study for the Ulsan National Industrial Complex was conducted in 2016 and focused on better understanding the flood risk impacts on Ulsan Mipo Port, located approximately 13.5 km north of the onshore Project area. This study found that Ulsan Mipo National Industrial Park has had the highest climate exposure in recent years, and it is expected to continue into the 2020's (Ryu *et al*., 2016). Similarly, Ulsan Mipo National Industrial Complex was found to have the highest vulnerability against torrential downpours (Ryu *et al*., 2016). Given the proximity between Ulsan, Mipo and Onsan ports within the greater area of Ulsan city, it could potentially be expected that climate exposure and torrential downpours could affect the ports located further south.

As discussed above, Figure 6-36 illustrates the main river distribution network near the onshore Project components. On this basis, the Project will fall outside the flood zones of these rivers, however there is a risk of flooding from marine waters due to storm surge and/ or tides within the Project area associated with coastal sections of the onshore export cable corridor and substation locations as shown in Figure 6-37 (Ulsan Metropolitan City Corporation, 2008).

Figure 6-37: Illustrates the flood estimate point in relation to the location of the onshore substation (Adapted from UMCC, 2008).

6.17.2 Proposed Additional Data Collection and Analysis

Depending on the information available in the Korean EIA and the (local) Disaster Impact Assessment under the Countermeasures Against Natural Disasters Act, additional desktop data collection may be needed to further characterise the baseline hydrological conditions and inform the ESIA. A summary of the data requirements is set out below:

- Further characterisation of watercourses within the study area;
- Topographical survey of the proposed substation;
- Record of licenced watercourse abstractions;
- Review of published flood modelling data;
- Location of pipelines and drainage infrastructure located within the Project area;
- Details of the flood defences present; and
- Desk based flood risk of the onshore substation, cable route and surrounding area.

6.17.3 Potential Project Impacts

A range of potential impacts on hydrology and flood risk have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-62.

Table 6-62: Impacts Proposed to be Scoped Into the Project Assessment for Hydrology and Flood Risk.

Potential impact	Phase			Justification
	C	O	D	
Potential increase in flood risk	✓	✓	✓	The construction of low permeability areas could directly impact on the flood risk of adjoining land.
Potential to increase temporary flood risk	✓	✘	✘	Impacts of flood risk could occur as a result of an increase in runoff from third party onshore infrastructure such as laydown areas and roads.
Damage to existing flood defences	✓	✘	✘	Direct impacts on flood defences may occur if open trench methods are used.
Deterioration in water quality watercourse	✓	✘	✓	Direct impacts to water quality as a result of the onshore cable corridor and temporary access roads crossing watercourses and drains,
Damage to water pipeline	✓	✘	✓	Direct impacts to water pipelines from construction activities.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.17.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project within the hydrology and flood risk study area. The assessment will assess the likelihood of harm occurring, taking into account potential sources of flooding and receptors that may be affected. The guidance provided as part of the Methods in Flood Hazard and Risk Assessment (World Bank 2015) will be considered as part of the assessment.

6.18 Airborne Noise and Vibration

This chapter will consider the potential impacts of the Project on airborne noise and vibration during the construction, operational and decommissioning phases.

The Airborne Noise and Vibration Study Area will comprise noise sensitive receptors located within 500 m of the onshore Project area. The Airborne Noise and Vibration Study Area will be confirmed once the PDE has been refined further.

6.18.1 Baseline Environment

The onshore export cable route and substation sites are located in an existing industrial complex with multiple users, some of which may operate on a 24-hour basis (Figure 6-38). The western edge of the industrial complex is bordered by Dangwol-Ri Road along which the onshore export corridor follows, located within the industrial complex area, adjacent to the S-Oil petrol station and a primary bus route. The intersection of Dangwol-Ri Road and Gongdan-ro Road is approximately 1 km from the onshore cable landfall location and between 0.4 km and 1.15 km from the nearest Project onshore substation (Figure 6-38). North of the onshore Project area are a number of other industrial businesses and small settlements. The nearest residential neighbourhood is situated approximately 3 km north-west to the onshore Project components. However, there are minor residential facilities in closer proximity to the onshore Project components: Keumeosa Temple, a military compound, and a residential house all within 500m to the south-west to the substation cable.

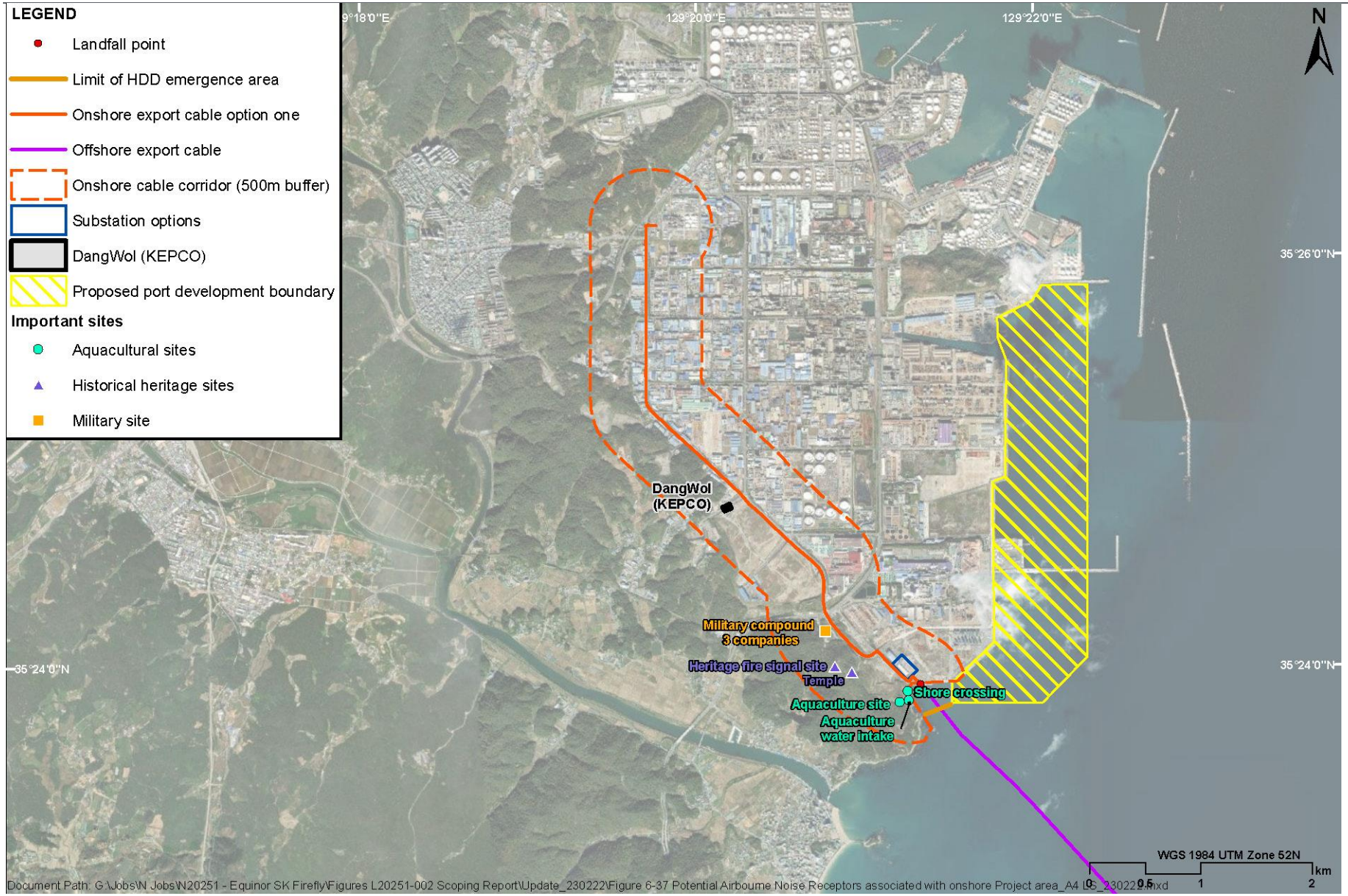


Figure 6-38: Potential Airbourne Noise Receptors associated with onshore Project area.

6.18.2 Proposed Additional Data Collection

Baseline data collection on ambient noise will be undertaken as part of the Korean EIA.Two baseline sound monitoring events (winter and spring) have been undertaken in the area of the proposed works to date. It is anticipated that no further baseline data collection is required as part of the ESIA, only a review of data and impact assessment. .

6.18.3 Potential Project Impacts

A range of potential impacts on traffic and transport have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-63.

Table 6-63: Impacts Proposed to be Scoped Into the Project Assessment for Noise and Vibration.

Potential impact	Phase			Justification
	C	O	D	
Temporary increase in noise and vibration which could impact on identified receptors	✓	✗	✓	The construction and decommissioning of the onshore elements of the Project has the potential to directly affect sensitive receptors.
Temporary increase in noise and vibration due to traffic generation on the local road network which could impact on identified receptors	✓	✗	✓	The construction and decommissioning traffic associated with the Project could cause an increase in noise and vibration levels.
Noise from the operation of the onshore substation	✗	✓	✗	The operation of the substation could directly affect sensitive receptors.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.18.4 Proposed Assessment Methodology

The ESIA will consider the potential noise and vibration impacts from the construction, operation and maintenance and decommissioning phases of the Project within the noise and vibration study area.

The magnitude of the noise impacts will however be identified using semantic scales following guidance from BS 5228-2: Code of Conduct for Noise and Vibration Control on Construction and Open Sites (2009), and the semantic scales in the Design Manual for Roads and Bridges (DMRB Volume 11, Section 3, Part 7, HD 213/11 Revision 1, Chapter 3, paragraph 3.37) would be used for impact magnitude related to change in road traffic noise.

Noise levels produced from the project will be calculated through summing structure-borne noise and airborne noise from the Project. Noise levels will also be modelled using impulsive noise modelling procedures at identified receptor sites in accordance with IFC EHS Guidelines: Environmental Noise Management guidance used to determine level of impact significance on these receptors including the use the Noise Level Guidelines for Community Noise, World Health Organization (WHO, 1999) as noise threshold levels for both residential, institutional, educational, industrial, and commercial receptors.

6.19 Air Quality

This chapter will consider the potential air quality impacts of the Project on receptors during construction, operational and maintenance and decommissioning phases.

The Air Quality Study Area is based on the temporary and permanent land take for the onshore elements of the Project plus a 500m buffer from the boundary of the onshore cable corridor or within 50 m of the routes used by construction vehicles, up to 500 m from site entrances (Figure 6-39). The study area for vehicle emissions would encompass human-health receptors within 200 m of the affected road links.

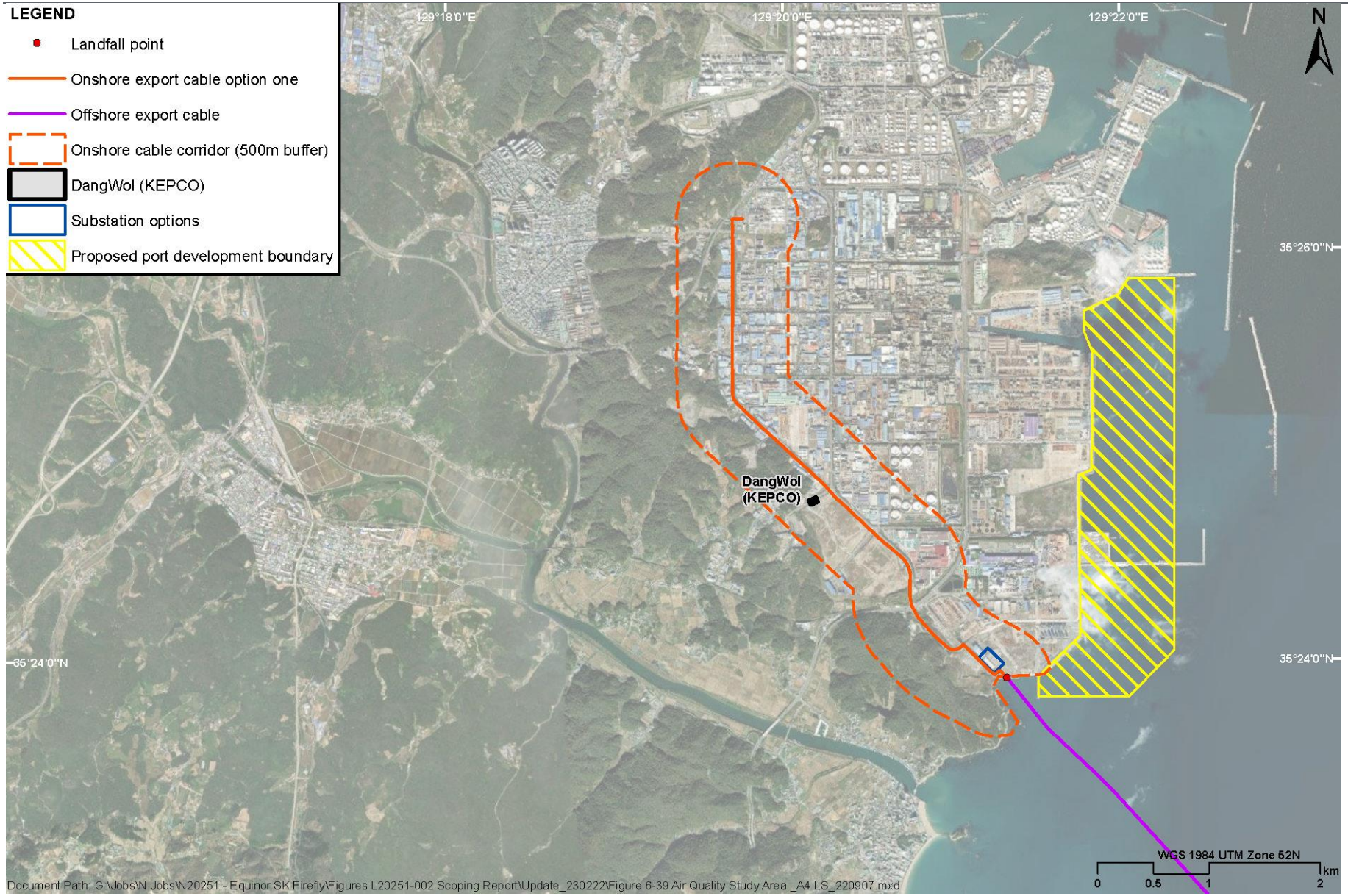


Figure 6-39: Air Quality Study Area showing 500 m buffer around onshore Project components.

6.19.1 Baseline Environment

Information regarding offshore air quality in South Korea, and more specifically, near Ulsan, has been collated through a review of currently accessible studies and datasets. Key data sources are listed in Table 6-64, noting that this list is not exhaustive.

Table 6-64: Key sources of information for the air quality baseline.

Data	Description	Source
Air quality observations from 2019-2020 near the Shin-Onsan Substation in South Korea	Air quality observations were collected from Hwasan-ri and Deoksin-ri survey locations near the Shin-Onsan Substation in Ulsan South Korea. Data was collected from 2019-2020 and includes meteorological data and air quality concentrations of SO_2, CO, O_3, NO_2, PM-2.5 and PM-10.	Korea Air, 2019
Policies, regulatory framework and enforcement for air quality management in South Korea	Korea has one of the highest percentages of their population to be exposed to PM-2.5 concentration levels, warranting the need for increased air quality management and appropriate environmental countermeasures.	Trnka, 2020

South Korea, like other East Asian countries is known to have some of the worst air pollution in the world, requiring urgent countermeasures which are necessary to improve regional air quality (Koo *et al*., 2020). South Korea's economy is concentrated on manufacturing and technology, with the government strongly influenced by the automobile industry, a sector that is known to cause high levels of Greenhouse Gas Emissions (Choi *et al*, 2020; Fernandez, 2019).

Regional air quality observations were collected from Hwasan-ri and Deoksin-ri in close proximity to the Shin-Onsan Substation located within the Ulsan National Industrial Complex. Hwasan-ri is situated approximately 1.0 km northeast of Shin-Onsan Substation, while Deoksin-ri is located approximately 1.3 km west. The Shin-Onsan Substation is located approximately 2.9 km from the Project's proposed onshore substation locations and approximately 4.4 km from the Project's onshore export cable landfall location.

General air quality observation results collected near the Shin-Onsan Substation from 2019-2020 are shown in Table 6-65. These observations were collected four times per year and illustrate the average temperature, monthly precipitation, average wind speed and direction, and monthly daylight hours (Table 6-65).

Table 6-65: Air quality observation results near Shin-Onsan Substation from 2019 to 2020 (Air Korea, 2019).

Year	Quarter	Avg. Temperature (℃)	Total Precipitation per month (mm)	Average Wind Speed (m/s)	Predominant Wind Direction (16 Directions)	Monthly Total sunshine (hrs)
2019	Q1	6.2	95.0	2.4	1,020.0	683.1
	Q2	17.7	371.4	1.9	1,020.0	742.6
	Q3	24.5	689.7	1.9	900.0	584.5
	Q4	11.3	294.0	2.1	1,020.0	595.6
2020	Q1	6.9	273.9	2.3	1,020.0	602.3
	Q2	17.7	343.3	2.0	780.0	780.1
	Q3	23.6	878.4	2.1	900.0	507.8
	Q4	10.1	62.3	2.2	1,000.0	657.4

Sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), and particulate matter with particles less than 10 micrometres in diameter (PM-10) and less than 2.5 micrometres in diameter (PM-2.5) were collected from Hwasan-ri and Deoksin-ri (Table 6-66) survey locations near the Shin-Onsan Substation (Air Korea, 2019).

Table 6-66: Air quality observation results near Shin-Onsan substation from 2019 to 2020 (Air Korea, 2019)

Year	Quarter	Hwasan-ri						Deoksin-ri					
		SO_2	CO	O_3	NO_2	PM-10	PM-2.5	SO_2	CO	O_3	NO_2	PM-10	PM-2.5
		(ppm)				µg/m³		(ppm)				µg/m³	
2019	Q1	0.004	0.645	0.032	0.024	43.340	26.309	0.006	0.652	0.030	0.024	53.600	22.660
	Q2	0.007	0.518	0.039	0.016	38.287	22.147	0.011	0.623	0.039	0.025	49.641	21.323
	Q3	0.007	0.493	0.027	0.010	29.242	17.910	0.010	0.655	0.027	0.020	37.700	19.393
	Q4	0.004	0.448	0.023	0.021	27.220	14.907	0.006	0.528	0.023	0.024	39.250	14.610
2020	Q1	0.004	0.511	0.030	0.021	28.368	18.168	0.006	0.601	0.027	0.020	36.060	17.416

Year	Quarter	Hwasan-ri						Deoksin-ri					
		SO_2	CO	O_3	NO_2	PM-10	PM-2.5	SO_2	CO	O_3	NO_2	PM-10	PM-2.5
		(ppm)				µg/m³		(ppm)				µg/m³	
	Q2	0.006	0.491	0.044	0.014	33.468	18.124	0.011	0.607	0.036	0.020	40.736	19.209
	Q3	0.006	0.547	0.030	0.011	26.906	12.504	0.009	0.691	0.026	0.019	32.265	18.140
	Q4	0.003	0.493	0.025	0.018	27.683	15.568	0.005	0.556	0.029	0.021	32.791	14.763

Carbon monoxide, nitrogen dioxide, PM-2.5 and PM-10 have been found to be related to industrial activities and traffic (Ju *et al*., 2021).

Results from the Hwasan-ri and Deoksin-ri survey locations, approximately 3.1 km and 3.6 km from the onshore Project substation locations, showed that sulphur dioxide, carbon monoxide, ozone, and nitrogen dioxide were within standard levels of Korean air quality parameters (Trnka, 2020). PM-2.5 and PM-10 levels were found to be outside of the Korean air quality standard levels, reiterating the fact that high levels of particulate matter are often found in areas dominated by industrial facilities (Trnka, 2020; Ju *et al*., 2021).

6.19.2 Proposed Additional Data Collection

Baseline information on air quality data along the onshore part of the project will be collected seasonally during the local EIA studies over a period of 12 months. The assessment will review the air pollutants generated during construction and potential impacts, as well as predicted changes in the level of greenhouse gases during construction and operation. The ESIA will build on this assessment, and characterise background air quality by drawing on information from public sources such as pollutant concentrations in 1 km grid squares; and local studies of air quality, including local monitoring and modelling studies. Other information that will be collected includes:

- A review of mapping data of residential settlements and businesses to identify receptors;
- Construction traffic flow data for road links that exceed the adopted guideline criteria thresholds for assessment; and
- Annual-mean NOx and PM10 concentrations would be predicted at selected sensitive receptors using data gathered.

6.19.3 Potential Project Impacts

A range of potential impacts on air quality and environment have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-67.

Table 6-67: Impacts Proposed to be Scoped Into the Project Assessment for Air Quality

Potential impact	Phase C	Phase O	Phase D	Justification
Effects on air quality from dust and emissions to human health and ecological receptors	✓	✗	✓	**Construction and decommissioning phase** • There is potential for dust particles to be created during the construction of the onshore substation and onshore export cable route and from plant/traffic emissions. Ecological receptors, including those that are sensitive to nitrogen and/or acid deposition may be impacted during onshore construction. The majority of the Project relates to the construction of semi-submersible offshore infrastructure located approximately 45.57 m from land, therefore any impact will likely be dispersed, and significant air quality impacts are unlikely.
Direct and indirect emissions of greenhouse gases (GHG)	✓	✓	✓	**All phases** • There is the potential for both direct and indirect GHG emissions from construction, operation and decommissioning of the proposed Project.
Indirect positive impacts in the reduction of GHG emissions	✗	✓	✗	**Operational and maintenance phase** • There is the potential for indirect positive impacts resulting from the reduction in GHG emissions from the national grid due to the operation of the proposed renewable Project Development.

Potential impact	Phase C	O	D	Justification
Temporary increase in dust	✓	✗	✓	**Construction and decommissioning** • Construction and/or decommissioning works that include dust generating activities have the potential to affect receptors sensitive to dust.
Temporary impact on air quality due to construction traffic	✓	✗	✓	**Construction and decommissioning** • During construction and decommissioning, there is likely to be an increase in traffic volume which would affect air quality.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.19.4 Proposed Assessment Methodology

The ESIA will consider the potential air quality impacts from the construction, operational and maintenance and decommissioning phases of the Project within the Air Quality Study Area. The assessment of air quality impacts for the ESIA will be based on the following guidance:

- IFC EHS Guidelines: Air Emissions and Air Quality (IFC 2016);
- WHO Ambient Air Quality Guidelines (WHO 2005);
- Guidance on the assessment of dust from demolition and construction (IAQM, 2014);
- Comprehensive Plan of Fine Dust Management (CPFDM);
- Guidance from the Convention on Long-Range Transboundary Air Pollution and North-East Asia (COM/ENV/EPOC/GOV/RPC ((2018)1);
- Guidance from the regulatory framework for air quality management in Japan (ENV/WKP ((2020)3);
- 1st and 2nd editions for Comprehensive Plans for Air Quality Improvement (2006-2015 and 2016-2024);
- Clean Air Conservation Act of Korea (MOE, 2013).

Consideration will be given to specific measures associated with the Project and the greenhouse gas emissions that may arise during the construction phase. Emissions of GHG may arise from the following sources:

- Direct emissions from plant machinery/equipment; and
- Transport emissions from vehicles and vessels importing/exporting material to and from the Project.

The reduction in greenhouse gas emissions from the national grid associated with the operational phase of the Project will be calculated using the following formula:

- Tonnes CO2eq = (A x B x C x D) / 1000

Where: A = The rated capacity of the wind energy development in MW; B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc. A capacity factor of 40% will be assumed for the Project. C = The number of hours in a year, 8,760 hours. D = Carbon load in grams per kWh (kilowatt hour) of electricity generated and distributed via the national grid. Date from 2021 shows that the emissions intensity of power generation was 478 gCO2/kWh (GIR, 2022).

6.20 Terrestrial Ecology

This chapter will consider the potential impacts of the Project on onshore habitats and terrestrial species during construction, operational and maintenance, and decommissioning phases.

The onshore Terrestrial Ecology Study Area will include the temporary and permanent land take areas required for the onshore elements of the Project landward of MHWS, plus a buffer of up to 500m.

6.20.1 Baseline Environment

Information regarding the Terrestrial Ecology Study Area has been collated through a detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 6-68, noting that this list is not exhaustive.

Table 6-68: Key sources of information for the terrestrial ecology baseline.

Data	Description	Source
National Natural Environmental Surveys	The MOE conducted surveys on the flora and fauna of species located in proximity to Ulsan National Industrial Complex and presented their findings.	Ministry of Environment (MOE), 2019
Designated status of wildlife protected by city in South Korea	Through survey and analysis, the designated status of protected wildlife in different cities and ordinances within South Korea were compared. Specific to the Project, Ulsan City wildlife protection was assessed based on 2019 surveys undertaken.	Chu *et al*., 2019
IUCN Red List Species	The IUCN Red List is a critical indicator of the health and status of world biodiversity.	International Union for the Conservation of Nature (IUCN), 2021

6.20.1.1 Designated Sites

A review of onshore designated sites was undertaken to identify their location in relation to the onshore Project area. There are no Species Protected Areas within the vicinity of the Project. The nearest Species Protected Area is Seonam Lake Park located approximately 13.2 km from the onshore export cable landfall location, 12 km from the Project substation location and 9.2 km from the Shin-Onsan Substation (Figure 6-41). These protected areas are denoted as ecology and scenery conservation areas located within a larger Wildlife Sanctuary which incorporates large portions of the Taehwa River.

Three Ramsar Sites have been designated in South Korea with an additional 38 potential Ramsar Sites being identified (MOE, 2015). The closest potential Ramsar Site, which is also an Important Bird and Biodiversity Area (IBA) to onshore Project area is located in Busan, approximately 51 km from onshore Project area.

6.20.1.2 Onshore Habitats Overview

The onshore Project area are located within or adjacent to the Ulsan National Industrial Complex which is considered a highly modified environment due to previous and existing anthropogenic activities. Habitat promoting terrestrial biodiversity within these land uses are likely to be typically limited, however bordering the onshore cable route to the south and west are areas that areas of vegetation and woodland (Figure 6-40).

Figure 6-40: A) Substation site No. 2 looking south, B) Substation site No. 1 looking south, C) Substation site No. 1 looking towards Ulsan Industrial Area, D) Substation site No. 2 looking towards Ulsan Industrial Area.

A desktop study was also undertaken to identify the flora and fauna that have been recorded in the vicinity of the onshore Project area. The Ministry of the Environment carried out several Natural Environment surveys in 2019 based on the grid system shown in Figure 6-41.

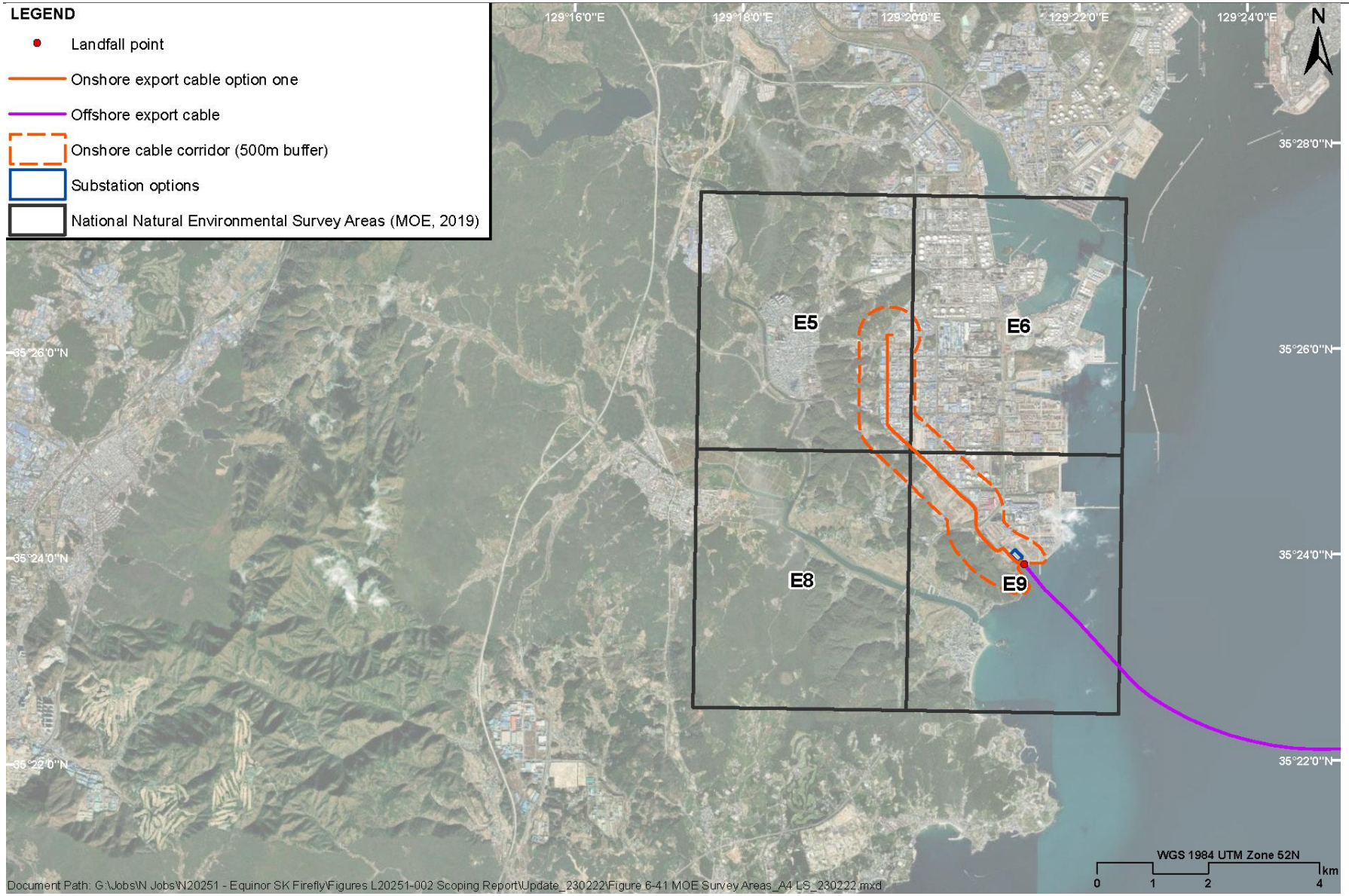


Figure 6-41: Illustrates the protected areas related to regional terrestrial ecology and defines locations (E1-E9) of the National Natural Environmental Surveys (MOE, 2019).

6.20.1.3 Terrestrial Flora

Information collected from the MOE during the National Natural Environmental Survey in 2019 found 34 plant species that were present within a 5 km radius of the onshore export cable corridor shore crossing and Project substations (MOE, 2019).

A separate survey analysing the designated status of Protected Wildlife by Ulsan City found 12 species of plant that were listed as protected within the city ordinance (Chu *et al*., 2019). Of those protected species identified within Ulsan, only beach silvertop (*Glenhia littoralis)*, was identified from the survey within 5 km of the onshore Project area. Beach silvertop is typically found between 30 m from the MHWS and 3 m above sea level, specifically near sand dunes and coastal areas (Kim et al., 2005). Beach silvertop is currently not listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2021).

6.20.1.4 Terrestrial Fauna

6.20.1.4.1 Amphibians and Reptiles

Fifteen species of amphibian and reptile were found within a radius of 13 km from the onshore Project area during 2019 National Natural Environmental Surveys (MOE, 2019). 11 of the 15 (73.3%) amphibian and reptile species were found in agricultural, forested, and wetland areas (MOE, 2019).

Surveys conducted in Ulsan in 2019 found five amphibian and reptile species that had protected wildlife status in South Korea (Chu et al., 2019). Three of the five protected amphibian and reptile species were found within 13 km of the onshore Project components during the 2019 MOE surveys. These species comprised the Korean brown frog (*Rana coreana*), mountain grass lizard (*Takydromus wolteri*), and Chinese garter snake (*Oocatochus rufodorsatus*) (Chu *et al*., 2019).

The IUCN currently classifies the Korean brown frog, mountain grass lizard, and Chinese garter snake as a species of Least Concern (IUCN, 2021).

6.20.1.4.2 Mammals

Eleven mammal species were found within a 10 km radius of the onshore Project area during the 2019 National Natural Environmental Surveys (MOE, 2019). Of these 11 species observed, six were found within quadrants E5, E6, E8 and E9 (Table 6-69) . Five species were found within quadrant overlapping the Shin-Onsan Substation, two species in quandrant E6, four species in E8 and three species were found in quadrant E9 (Table 6-69), the location of the onshore export cable corridor shore crossing and onshore substations (MOE, 2019).

Table 6-69: Terrestrial mammal species found within a 10 km radius of the onshore export cable corridor (MOE, 2019).

Species		Mammals Appearing in each Survey Grid				IUCN Conservation Status	Korean Conservation Status
Common Name	Taxonomic Name	E5	E6	E8	E9		
Large mole	*Mogera robusta*	✓	✓	✓	✓	LC	-
Leopard cat	*Prionailurus bengalensis*	✓	X	✓	X	LC	Endangered Wildlife I (MOE)
Raccoon dog	*Nyctereutes procyonoides*	X	X	✓	X	LC	-
Eurasian otter	*Lutra lutra*	✓	X	X	✓	NT	Endangered Wildlife I (MOE) & Designated Natural Monument No. 330 (CHA)
Water deer	*Hydropotes inermis*	✓	✓	✓	✓	VU	-
Eurasian harvest mouse	*Micromys minutus*	✓	X	X	X	LC	-

Total		5	2	4	3		

The six mammal species observed in quadrants E5, E6, E8 and E9 were the large mole (*Mongera robusta*), leopard cat (*Prionailurus bengalensis*), raccoon dog (*Nyctereutes procyonoides*), Eurasian otter (*Lutra lutra*), water deer (*Hydropotes inermis*), and Eurasian harvest mouse (*Micromys minutus*) (MOE, 2019). None of the six species of terrestrial mammal that were encountered are considered protected wildlife under Korean legislation specific to Ulsan City (Chu et al., 2019).

According to the IUCN, the Eurasian otter is considered Near Threatened, the water deer is considered Vulnerable and the leopard cat, Eurasian harvest mouse, raccoon dog and large mole are considered species of Least Concern (IUCN, 2021).

6.20.1.4.3 Invertebrates

Four species of protected invertebrates were found within Ulsan City limits as part of the 2019 survey on designated status wildlife (Chu et al., 2019). These four species include the tadpole shrimp (*Triops longicaudatus*), firefly (*Pyrocoelia rufa*), firefly (*Luciola lateralis*), firefly (*Luciola unmunsana*). None of these four species of invertebrates are registered on the IUCN Red List.

6.20.1.5 Birds

Ulsan City occupies a river valley and adjacent low-lying country but is set in a hilly to mountainous landscape with limited development. Because of this terrain, there are extensive forested and wooded areas but few wetlands (some water reservoirs are present), although the Taehwagang (Taehwa River) that passes through Ulsan City has some areas of remnant floodplain vegetation that have been protected, and a braided river channel upstream of the estuary and port. Bird species found in South Korea are listed in (Appendix A.5).

Bird surveys were conducted at Taehwa River, Ulsan Bay, Hoeya Lake, the Busan-Ulsan Coast and Jinha Beach in 2019 (Figure 6-42) (MOE, 2019). The 2019 survey divided the Ulsan National Industrial Complex into nine quadrants (E1-E9) to assess the status of terrestrial birds appearing within a radius of 13 km from onshore Project components (Figure 6-41) (MOE, 2019).

These surveys collected and analysed avian occurrence data specific to quadrants E5 and E8. The distance between the onshore Project substation located in quadrant E9 and quadrant E5 is approximately 3.1 km. The distance of onshore Project components (onshore export cable route and substation) from quadrant E9 to the Shin-Onsan Substation in quadrant E5 ranges from 2.9 km – 4.4 km.

The MOE bird surveys found 25 species comprising 263 individuals in quadrant E5 and 25 species comprising 183 individuals in quadrant E8 (MOE, 2019). Two species with Korean Protected Wildlife designations were encountered in quadrant E5 and include the grey-backed thrush (*Turdus hortulorum*) and the black-naped oriole (*Oriolus chinensis*) (Chu et al., 2019). Only 1 Korean Protected Wildlife species was found in quadrant E8, the common kestrel (*Falco tinnunculs*) (Chu et al., 2019).

The three Korean protected species encountered in quadrants E5 and E8, those closest to onshore Project components, are classified by the IUCN as species of Least Concern (IUCN, 2021).

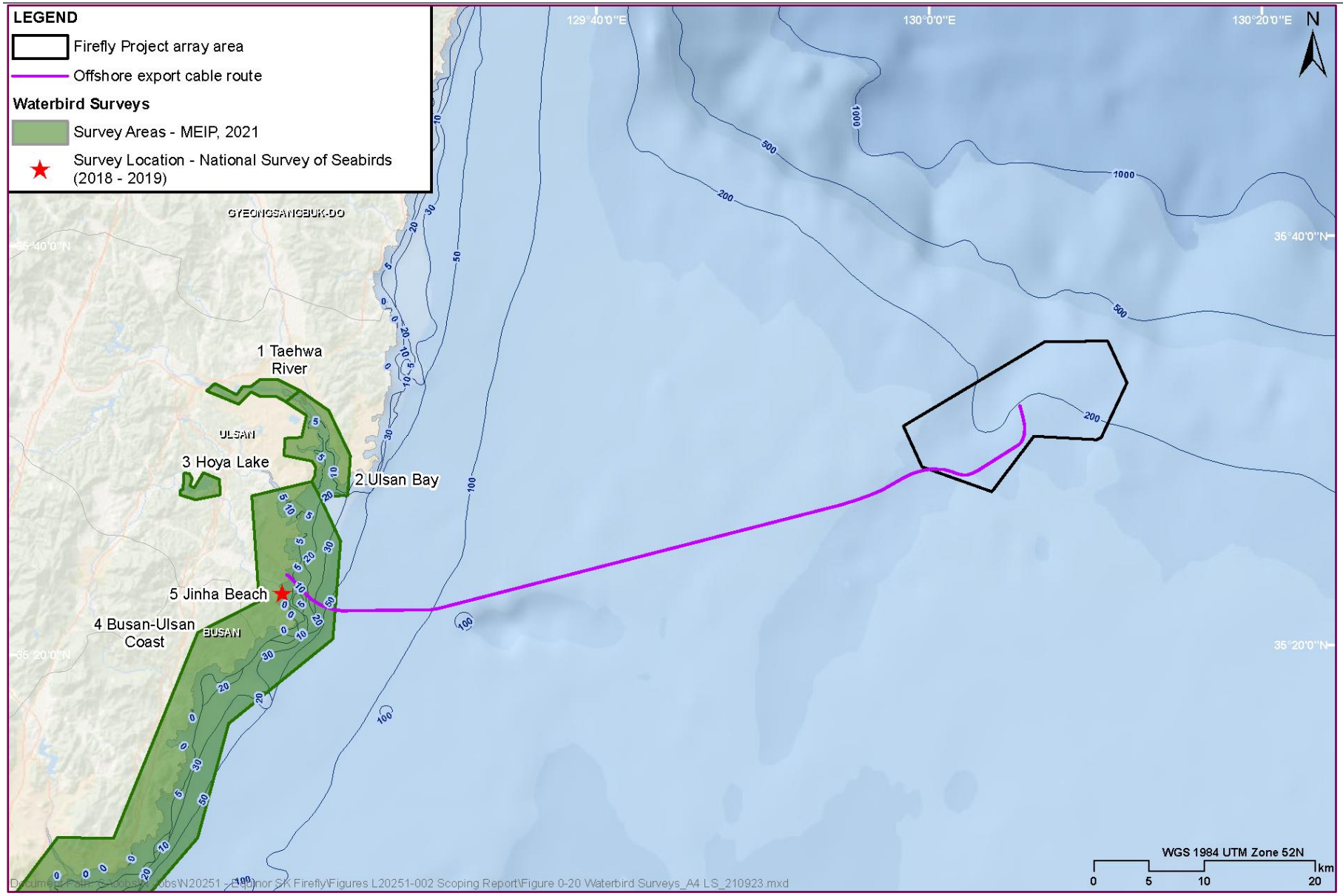


Figure 6-42: Five survey areas identified for shorebird species in proximity to onshore Project components.

The shorebird surveys conducted by Local Wildlife Conservation Ordinances along Taehwa River, Hoeya Lake, Ulsan Bay, the Busan-Ulsan Coast and Jinha Beach, of which a large portion of the Ulsan National Industrial Complex overlaps (Figure 6-42), assessed population numbers between 2018 and 2019 (Chu *et al.,* 2019). Population numbers collected between the two survey events showed a significant population decline evidenced in Taehwa River, Ulsan Bay, and the Busan-Ulsan Coast, where numbers decreased by 61.6%, 81.1% and 74.4% respectively.

Of the terrestrial species identified the tundra bean goose (*152 pprox serrirostris*), white-tailed eagle (*Haliaeetus albicilla*), Eurasian sparrowhawk (*Accipiter nisus*), Steller's sea eagle (*Haliaeetus pelagicus*), black kite (*Milvus migrans*) and Brant goose (*Branta bernicla)* are classified as Endangered species according to Korean conservation status and were encountered at Hoeya Lake and the Busan-Ulsan Coast (Chu *et al*., 2019). According to the IUCN, of the six aforementioned species, the Steller's sea eagle is classified as vulnerable while the remaining five are species of Least Concern (IUCN, 2021).

6.20.2 Proposed Additional Data Collection

Terrestrial ecology surveys are being conducted as part of the Korean EIA, the results of which will be used to inform the ESIA assessment.

Additional onshore bird surveys began in June 2022 following EIA Council's Deliberation Review comment on the project. The Council recommend that bird survey areas be extended to consider migratory bird habitat along the shoreline ear the project area (EIA Council, 2022).

Table 6-70: Onshore ecology data collection

Data Parameters	Number of Sampling locations / Length of transects	Survey Frequency/ Duration	Sampling Equipment
Onshore ecosystem	There is no specific number of survey points for sampling and transect areas within 500m radius of the onshore cable route and substation randomly and take survey or sampling when meeting different species.	Seasonally (4 survey events)	*Binoculars, camera, GPPS, measuring tape (or ruler), capture net, cast net*
Onshore birds	8 survey points near the onshore cable route	1 survey per month for 24 months	*Binoculars, camera*

6.20.3 Potential Project Impacts

A range of potential impacts on Terrestrial Ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-71.

Table 6-71: Impacts Proposed to be Scoped into the Project Assessment for Terrestrial Ecology.

Potential impact	**Phase**			**Justification**
	C	**O**	**D**	
Disturbance of damage to habitats	✓	✗	✓	Protected or important habitats/species could be damaged or disturbed as a result of an increase in noise, vibration, light and other activities associated with the construction of the onshore elements.
Temporary displacement of species	✓	✗	✓	Temporary construction/decommissioning activities and land take may result in temporary displacement of species
Habitat loss and disturbance/	✓	✗	✓	Permanent land take required for the onshore substation may result in the permanent loss of habitats. Disturbance of species as a result of light and noise.

Potential impact	Phase C	O	D	Justification
displacement of species				
Spread of invasive non-native species	✓	✖	✓	There is potential for the presence of invasive and non-native species which could be spread during construction and decommissioning phases.
Disturbance to species as a result of release of pollutants	✓	✓	✓	Construction and maintenance activities may result in the accidental release of pollutants.
C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.				

6.20.4 Proposed Assessment Methodology

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Proposed Development on terrestrial ecological receptors. The proposed approach will follow best practice guidelines (South Korean and international) for undertaking ecological impact assessment such as:

- Korean EIA Guidance Manual (2021);
- IFC (2019) International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. January 1, 2012 (updated June 27, 2019); and
- Guidelines for Preliminary Ecological Appraisals (CIEEM, 2017);

For the purposes of undertaking the ESIA, all terrestrial species that have the potential to occur in the vicinity of the Project will be identified as VECs. Where it is appropriate to do so, and particularly where there are large numbers of species characterising a community, the VECs may be defined as a broad community ecotype with representative species highlighted. Each VECs will then be evaluated based on their legislative status together with the relative importance of the species/ecotypes present in the vicinity of the Project compared to the ecology of terrestrial species in the wider region. Consideration will also be given to commercial importance of the relevant VECs. Impacts on VECs will be described in terms of their magnitude and correlated against the sensitivity of each VECs to each impact to define the significance.

A Biodiversity Risk Assessment will be undertaken in accordance with IFC PS 6 which will include determination of the presence of Critical Habitat that could be affected by the Project. Critical Habitat is habitat that is defined based on 5 criteria set out by IFC PS6 requirements and is considered to be of significant importance to certain species, threatened or unique ecosystems, or key evolutionary processes (further details are provided in Appendix A-4).

6.21 Population, Human Rights and Human Health

This chapter will consider the potential impacts of the Project on population (employment), human rights and human health during the construction, operational and maintenance and decommissioning phases. The selection of the Study Area for the population and human health analysis will take account of the spatial scale at which impacts upon different receptors are likely to materialise. This is likely to vary across receptors.

A separate Human Rights Due Diligence (HRDD) process was undertaken jointly by Equinor and a specialist human rights and social performance consultancy between Q4 2020 and Q1 2021. The HRDD process focused primarily on the national context for human rights in South Korea and the proposed Firefly project off the coast of Ulsan with the intension that it may also inform future offshore wind development in South Korea.

The key principles of the process was to ensure of the HRDD was undertaken in a collaborative, proactive and comprehensive manner. The HRDD process identified the following outcomes:

1. The right to information and consultation, particularly for vulnerable community members who are not represented by the Ulsan Fishermen Committee (Ulsan FC). In response, Equinor developed the internal capability and processes to appropriately engage with Ulsan FC and other stakeholders, including the development of a grievance mechanism that can reinforce stakeholder engagement efforts for community members. Continued stakeholder engagement throughout the Project enables the identifications of specific risk and potential impacts on vulnerable community members, and strengthens the Project's "early warning systems" for potential human rights issues. Furthermore, the EIA/ESIA process provides the opportunity to (a) gather more information about potential vulnerable groups; and (b) ensure that community members' (and the general public's) rights to information are respected through an appropriate level of informed consultation and participation of affected stakeholders throughout the EIA/ESIA process.
2. Protecting the rishts of contractor workers. In particular, Equinor has identified risks related to workers' rights to safe and healthy working conditions and continues to take a hands-on approach to mitigate potential impacts. Equinor continues to engage subject matter experts (SMEs) to reinforce a positive safety culture and to encourage an open dialogue about workers' rights priorities and challenges.
3. Protecting the rights of Equinor employees. Equinor's direct workforce will have strong protections for workers' rights through Equinor's global human resources policies and procedures, as well as in the specific terms of the employment contracts in South Korea ensuring workers' rights are met (and/or exceeded) in terms of national and international standards.

Of primary consideration to Equinor as the Project develops will be:

- Potential impacts on community members in the offshore environment, notably in terms of marine livelihoods ranging from commercial fishing operations and their supply chains to vulnerable groups who get their livelihoods from the sea.
- Potential impacts on community members in the onshore environment, notably in terms of potential land-related impacts for the onshore route for the project's electrical transmission lines and infrastructure.
- Potential impacts on workers' rights for future contractors or supply chain workers. Equinor will actively promote worker safety and due diligence regarding the engagement of contractors and suppliers, and encourage an open dialogue about other workers' rights priorities and challenges.
- Anti-discrimination and equal opportunity in the workplace; and
- Workforce freedom of association.

The Project predominantly relates to offshore infrastructure, but the employment impacts will affect onshore receptors. The Population and Human Health Study Area will generally cover Ulsan County, but national level impacts will also be considered where relevant. It will be linked to the selection of construction and operational and maintenance ports and the supply of a range of inputs and services for the Project.

A larger Regional Population and Human Health Study Area will also be defined to reflect the wider reach of South Korea Gross Value Added (GVA) and employment impacts that are likely to materialise through the supply chain and provision of labour.

Information regarding the Population and Human Health Study Area and the Regional Population and Human Health Study Area has been collated through a review of currently accessible studies and datasets. Key data sources are listed in Table 6-72, noting that this list is not exhaustive.

Table 6-72: Key sources of information for the population and human health baseline.

Data	Description	Source
Ulsan population demographics and employment	Yearly breakdowns of Ulsan's population and employment numbers are analysed to determine the potential workforce in the area.	Ulsan Statistical Yearbook, 2020

6.21.1 Baseline Environment

6.21.1.1 Population Demographics

The most recent report distributed by the Ulsan Statistical Yearbook, 2020, identified the population of Ulsan, South Korea as 1,168,469 people – a 0.6% decrease from the previous year (Table 6-73). Of the population in 2019, 51.5% identified as male and 48.4% (Table 6-73) identified as female (Ulsan Statistical Yearbook, 2020). The 2019 population was based on 468,659 individual households which equated to 2.5 persons per household (Table 6-74). The overwhelming majority of the population in Ulsan were Korean Nationals (98.2%) while a small percentage were considered foreigners (1.7%) (Table 6-73).

Table 6-73: Population trends in Ulsan from 2015-2019 (USY, 2020).

Year	No. households	Registered Population								
		Total	Male	Female	Korean	Male	Female	Foreigner	Male	Female
2015	451,688	1,199,717	621,515	578,202	1,173,534	604,889	568,645	26,183	16,626	9,557
2016	455,352	1,195,761	618,071	577,690	1,172,304	603,797	568,507	23,457	14,274	9,183
2017	458,547	1,185,645	611,668	573,977	1,165,132	599,480	565,652	20,513	12,188	8,325
2018	461,756	1,175,625	605,694	569,931	1,155,623	593,819	561,804	20,002	11,875	8,127
2019	468,659	1,168,469	602,050	566,419	1,148,019	589,712	558,307	20,450	12,338	8,112

In terms of age, individuals 65 years old and over accounted for 11.3% of the total population during 2019 (Table 6-74). This is an increase from 8.6% during 2015 which highlights that Ulsan has a gradual increase in its ageing population.

The population density is a measurement of population per unit area (km^2) and has been steadily declining since 2015 when it was 1,130.8 persons/km^2 to 2019 when it was 1,100.2 persons/km^2 (Table 6-74).

Table 6-74: Population trends from 2015-2019 (USY, 2020).

Year	Population increase rate (%)	Person per household	Person 65 years old & over	Population density
2015	0.6	2.7	103,205	1,130.8
2016	-0.3	2.6	108,768	1,127.2
2017	-0.8	2.6	116,633	1,117.3
2018	-0.8	2.5	123,919	1,107.6
2019	-0.6	2.5	132,565	1,100.2

6.21.1.2 Employment

Statistics from 2019 illustrate that, of the entire population of Ulsan aged 16-65 years old, 61.7% are working or actively seeking work (Table 6-75). The employment population rate, or the extent to which available labour resources (people available and willing to work) was 59.1%. The unemployment rate in Ulsan was found to be 4.2% during the 2020 Ulsan Statistical Yearbook Report.

Table 6-75: Economic participation and unemployment rates in Ulsan, South Korea during 2019 (USY, 2020).

Year/ Quarter	Economic Participation Rate (%)	Employment Population Rate (%)	Unemployment Rate (%)
2019	61.7	59.1	4.2
¼	60.8	57.6	5.3
2/4	62.1	59.3	4.5
¾	61.8	59.6	3.5
4/4	61.9	59.8	3.4

Data showed that during 2019, 5.14% of the Korean population worked in the agricultural sector, 24.58% worked in the industry sector and 70.28% were employed in the services sector (Statista, 2021).

6.21.1.3 Gross Value Added (GVA)

Gross value added (GVA) is a widely used term utilised to measure economic impact. GVA is defined as the contribution to the economy, through the value of goods or services, of each producer, industry and sector. GVA can therefore be used as an indicator of economic performance for a specific industry or sector by totalling the output and income of an economy (Cai and Leung, 2020). In 2020, The Republic of Korea's GVA was 1,690,898,500 million won, corresponding to ~32,979,000 won per head. This would approximately be the equivalent of USD25,000.

6.21.2 Proposed Additional Data Collection

The primary data set that will be accessed to inform the ESIA will be publicly available socio-economic baseline data.

The purpose of access and collation of qualitative and quantitative socio-economicl data for the voluntary ESIA will be to provide the base of the socio-economic baseline in order to develop a comprehensive understanding of socio-economic conditions and trends comprising the onshore Project area. The data gathered will provide the benchmark against which the impacts of the Project can be assessed and assist in aiding informed decision-making by the Project on community benefits that could be provided in the region. The qualitative and quantitative socio-economic data serve as a multidimensional instrument for collecting comprehensive information on the socio-economic characteristics of the population comprising the Project area.

Socio-economic data will be collected within the Project area and the Area of Influence which is most likely to be most affected by the Project's construction works and operations. Household demographic data will comprise (where available):

- Population socio-demographic characteristics;
- Housing conditions and standards of living;
- Business conditions; and
- Population perception about the impacts of the Project construction and operation on their daily lives and economy.

Data access and collation will also look at Income Generating Activities (IGA) within the Project area, collecting primary data on:

- IGA characteristics within the Project area;
- IGA production conditions and employment; and
- Perceived impacts of Project activities on IGAs.

Data will also be collated on the basic infrastructures available to the residents and businesses within the Project area.

6.21.3 Potential Project Impacts

A range of potential impacts on population and human health have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-76 together with a description of any additional data collection (e.g. site-specific surveys) and/or supporting analyses (e.g. modelling) that will be required to enable a full assessment of the impacts.

Table 6-76: Impacts Proposed to be Scoped Into the Project Assessment for Population and Human Health.

Potential impact	Phase			Justification
	C	O	D	
Impact on employment in the supply chain	✓	✓	✓	• Potential for expenditure on the Project to support employment in companies that are directly engaged in the supply chain. The construction/decommissioning of the Project could also support employment indirectly in the wider supply chain.

Potential impact	Phase C	O	D	Justification
Impact on the amount of GVA supported by the Project	✓	✓	✓	• Potential for expenditure on the Project to support GVA in companies directly engaged in the supply chain. The Project could also support employment indirectly in the wider supply chain.
Impact on access to Project related employment amongst local residents	✓	✓	✓	• The direct and indirect employment associated with the Project could increase the range and supply of employment opportunities that are accessible to residents.
Impact on the demand for housing, accommodation and local services	✓	✓	✓	• Direct and indirect employment generated during construction/operation/ decommissioning phase could increase the demand for housing, accommodation and local services
Impact on the performance of the renewable energy sector	✓	✓	✓	• Any additional economic activity associated with the construction/operation/ decommissioning of the Project could support the creation of wider benefits for the renewable energy sector that could be sustained.
Impacts on human health	✓·	✓·	✓·	**Construction and decommissioning phase** • During construction and decommissioning phases of the Project, human health could potentially be impacted through activities associated with the movement of materials and workforce connected with the Project Development. • Potential impacts on coastal water quality that may indirectly impact on human health (e.g., impacts on local bathing water quality). **Operational and maintenance phase** • Potential positive impacts on human health, through increased local employment opportunities during operational and maintenance phases of the Project.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

6.21.4 Proposed Assessment Methodology

It is proposed that population and human health impacts at the national level will be quantified as part of the ESIA exercise where relevant (e.g. GVA); furthermore known or envisaged manufacturing, procurement and logistical matters may have impacts beyond local and regional.

The assessment will be based on a desktop review of existing relevant studies and national datasets and indicators. The economic impacts and benefits of the Project will be quantified in terms of Korean GVA and expected jobs in Korea.

Social impacts will also be considered on a qualitative basis and will complement the economic impact assessment. In the context of an offshore wind farm, the definition of “community” needs to be examined at a local, regional, and national level. Qualitative factors will be examined to see how the Project is likely to impact on people, considering: Community Structure and Infrastructure, Community Behaviour and Perceptions, Social Equity, and Individuals.

Impacts will vary considerably depending on the technology deployed, type of structures, contracting strategy and other factors such as the availability and capacity of the supply chain. A range of scenarios will be considered.

Human health impacts will be considered by drawing on the results of the other impact assessments in the ESIA.

The economic impacts and benefits of the Project will be quantified in terms of GVA and expected jobs in South Korea.

Social impacts will also be considered on a qualitative basis and will complement the economic impact assessment. In the context of an offshore wind farm, the definition of “community” will be examined at a local, regional, and national level.

6.22 Landscape and Visual Amenity

This chapter will consider the potential impacts of the Project on landscape and visual receptors during construction, operational and maintenance and decommissioning phases.

The Landscape and Visual Amenity Study Area is defined as a 50 km radius around the onshore Project components in line with the referenced guidance: “Guidance for Landscape and Visual Impact Assessment”, Third Edition (2013). The Landscape and Visual Amenity Study Area and extent of baseline receptors to be considered in the assessment will be refined based on the finding of the Zone of Theoretical Visibility (ZTV) which will be undertaken as part of the EISA.

The Landscape Visual Amenity Study Area comprises the coastline of Ulsan, scenery and destinations landward of the Ulsan National Industrial Complex and will include the temporary and permanent land take areas required for the onshore elements of the Project landward of MHWS.

6.22.1 Baseline Environment

Information regarding the Landscape and Visual Amenity Study Area has been collated through a detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 6-77, noting that this list is not exhaustive.

Table 6-77: Key sources of information for the landscape and visual amenity baseline.

Data	Description	Source
Generating an appropriated Zone of Theoretical Visibility (ZTV)	To manage and mitigate seascape impacts from offshore infrastructural developments, multiple methods have been developed to evaluate and quantify potential visual impacts and the effects on their receptors effectively and efficiently.	Ioannidis *et al*., 2020
Cultural Heritage Administration online database	Searchable online database to find state-designated, city-designated, and registered cultural heritage sites and monuments.	Cultural Heritage Administration, 2009

There is potential for visual impacts from the onshore Project components. The maximum height of the onshore substation will be approximately 20 m with lightning protection reaching 30 m, and the proposed footprint is currently estimated to be 150 x 100 m.

The baseline landscape visual amenity environment will focus on views from a range of viewpoint locations representing a range of viewer types. The main viewer types likely to be affected by the onshore Project components include:

- Recreational users of the terrestrial environment;
- Recreational visitors whose attention is focused on the surrounding landscape;
- People travelling along road and rail routes;
- Residents of settlements and individual dwellings; and
- Visitors staying or travelling within the area.

The baseline visual amenity within the ESIA will consider some of the most popular locations regarding local Ulsan scenery. The landscape Visual Reference Points (VRP) are documented for the ESIA as follows:

- VRP 1: Taehwanang National Garden (158pprox.. 17.21 km from onshore Project area)
- VRP 2: Daewangam Park (158pprox.. 12.87 km from onshore Project area)
- VRP 3: Sinbul Mountain (158pprox.. 30.90 km from onshore Project area)
- VRP 4: Gajisan Mountain (158pprox.. 40.11 km from onshore Project area)
- VRP 5: Cape Ganjeolgot (158pprox.. 4.48 km from onshore Project area)
- VRP 6: Petroglyphs of Bangudae Terrace (158pprox.. 27.84 km from onshore Project area)

- VRP 7: Ulsan Grand Park (159pprox.. 15.76 km from onshore Project area)
- VRP 8: Ulsan Bridge Observatory (159pprox.. 12.27 km from onshore Project area)
- VRP 9: Jangsaengpo Whale Culture Village (159pprox.. 12.08 km from onshore Project area)
- VRP 10: Oegosan Ongii Village (159pprox.. 7.81 km from onshore Project area)
- VRP 11: Naewonam Valley (159pprox.. 11.20 km from onshore Project area)
- VRP 12: Ulsan Museum (159pprox.. 14.7 km from onshore Project area)

The immediate landscape around the Project site located in Ulsan is dominated by large industrial facilities and its associated infrastructure. Hills vegetated by trees and plants border the west of the onshore Project area with intermittent industrial buildings extending from the industrial site. Small settlements and agricultural fields are located adjacent to the road network and onshore Project area.

More than 50% of the area comprising the Korean peninsula is considered to have complex terrain, defined as regions having irregular topography that predominantly includes mountains, coastlines, irrigated and unirrigated lands in urban and rural areas (Park *et al.*, 2015). The area proposed to facilitate onshore Project components has an elevation ranging from 26-34 m. The surrounding hills vegetated by trees and plants which provide a natural border to the west have an elevation ranging from 62-113 m illustrating the low-lying nature of onshore Project area (Ulsan Topographic Map, 2021). Therefore, there is potential for the onshore Project components to be partially, if not fully screened from surrounding viewpoint locations.

6.22.2 Proposed Additional Data Collection

The following data collection would be undertaken to characterise the landscape baseline:

- Establishment of the landscape and visual resources study area (including the generation of a ZTV);
- Further desk studies to identify and characterise landscape resources (e.g physical elements and features) and visual receptors (e.g. resident, visitors to the area, business users);
- Desk top analysis of mapping to identify location of receptors; and
- Field surveys including the selection of representative viewpoints.

6.22.3 Potential Project Impacts

A range of potential impacts on Landscape and Visual Resources have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-78.

Table 6-78: Impacts Proposed to be Scoped into the Project Assessment for Landscape and Visual Resources.

Potential impact	Phase			Justification
	C	O	D	
Impacts upon the landscape character	✓	✓	✓	The construction, operation and decommissioning of the Project could cause direct and indirect impacts upon the landscape character
Visual impacts experienced by residents	✓	✓	✓	The construction, operation and decommissioning of the Project could be visible to a number of visual receptors within residential properties
Visual impacts experienced by dynamic receptors	✓	✓	✓	The construction, operation and decommissioning of the Project could be visible to a number of visual receptors travelling on roads and railway.

Potential impact	Phase			Justification
	C	O	D	
Visual impacts experienced by receptors occupied in recreational pursuits	✓	✓	✓	The construction, operation and decommissioning of the Project could be visible to a number of visual receptors occupied in recreational pursuits,
Visual impacts experienced by people at their place of work	✓	✓	✓	The construction, operation and decommissioning of the Project could be visible to a number of visual receptors at their place of work.

6.22.4 Proposed Assessment Methodology

The assessment approach and methodology will be informed by published guidance as follows:

- Landscape Institute and Institute of Environmental management and Assessment, Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, (2013);
- Cumulative Impact Assessment and Management: Guidance for Emerging Markets, (2013);
- Environmental, Health and Safety Guidelines for Wind Energy including visual impacts on the physical environment and those associated with wind energy projects (IFC World Bank Group, 2015).

The assessment of effects on landscape visual resources and assessment of effects on visual amenity are separate but interconnected. Established guidance, referenced above, makes a distinction between landscape effects and visual effects.

Landscape receptors include physical elements, features and characteristics that may be affected by the onshore Project components. Visual receptors include the public or community at large and residents and visitors to the area.

The assessment will involve the following key steps:

- The maximum design scenario will be identified, and the Landscape Visual Amenity Study Area will be confirmed;
- A ZTV of the proposed onshore Project components will be generated covering the Landscape Visual Amenity Study Area defined for the assessment from identified viewpoints/ receptor locations;
- The landscape baseline within the ZTV will be identified and documented with reference to published landscape character assessments;
- Designated landscape features (such as Petroglyphs of Bangudae Terrace) will be identified and described to show their distance from the Project;
- The visual baseline will be recorded with reference to the viewpoints listed above. Detail on these viewpoints will be presented including a description of existing views and the different groups of people who experience these views;
- Visualisations (wirelines and photomontages) will be generated based on 3D modelling of the onshore Project components; and
- An assessment of potentially significant effects will be undertaken as follows:
  - Landscape character;
  - Designated landscapes and landscape features; and
  - Viewers at selected viewpoint locations.

The assessment will be supported by figures illustrating the baseline landscape viewpoint locations and ZTV together with photomontages prepared to technical standards detailed in the guidance.

The Landscape and Visual Impact Assessment (SVIA) will consider effects upon several sensitive visual receptors:

- Landscape character and resources, including effects on the physical and aesthetic value of coastal and terrestrial landscapes caused by alterations in elements and qualities resulting from onshore Project components;
- Designated landscapes, including effect on the specific characteristics of designated areas, resulting from offshore WTGs and OSPs; and
- Visual amenity, including effects upon viewing groups, such as residents, tourists and visitors caused by alterations in the appearance of landscapes resulting from onshore Project components.

6.23 Land Use, Infrastructure and Material Assets

This chapter will consider the potential impacts of the Project on land use, infrastructure, and material assets during the construction, operational and maintenance and decommissioning phases.

The Land Use, Infrastructure and Material Assets Study Area will comprise landward aspects of the Project, coinciding with the areas assessed in Section 6.20 (Terrestrial Ecology), preferred landfall sites, onshore export cable routes, onshore substation locations, and infrastructure and other users' receptors.

6.23.1 Baseline Environment

Information regarding the Land Use, Infrastructure and Material Assets Study Area has been collated through a review of currently accessible studies and datasets. Key data sources are listed in Table 6-79, noting that this list is not exhaustive.

Table 6-79: Key sources of information for the land use, Infrastructure and material assets baseline.

Data	Description	Source
Variations of organic compounds in the multi-industrial city of Ulsan, South Korea	Ulsan, South Korea is the largest multi-industrial city in Korea. High spatial resolution data was utilised to assess regional emissions.	Kim et al., 2019
Restoration and degradation of forests and woodlands near Ulsan National Industrial Complex	The emissions from Ulsan National Industrial Complex have degraded plant communities and local habitats over time, resulting in the need for restoration practices.	Lee and Cho, 2008
Agricultural areas near Ulsan National Industrial Complex	Rice paddy fields near Pohang and Ulsan industrial complexes were mapped and assessed to determine contamination potential.	Park et al., 2021
Developing the national economy through industry in South Korea	Land use in South Korea in regard to National Industrial Complexes.	Sonn, 2019

Land use in the Study Area can be broadly defined into the following categories:

- Settlements;
- Industrial; and
- Agriculture.

The onshore export cable route options and substation sites are located within the Ulsan National Industrial Complex which is the largest multi-industrial city in South Korea and comprises automobile, petrochemical, coal, non-ferrous and shipbuilding industries (Seo *et al.,* 2020; Kim *et al*., 2019). The onshore cable route and substation sites are located on the edge of this industrial zone on the outskirts of Ulsan. The majority of the land has been disturbed by industrial or infrastructure activities since the area's inception in 1962 (Jacobs, 2011).

The immediate area to the west of the onshore Project area (approximately 3-5 km) comprises of sporadic individual industrial companies, local petrol stations, vacant areas of reclaimed land and residential settlements.

The onshore cable corridor aligns with the Dangwol-Ri Road which borders the western boundary of the Ulsan National Industrial Complex (Figure 6-43). To the west of the road are areas of fragmented wood and grass habitat. Fragmented by a number of other industrial businesses and small settlements. The nearest residential neighbourhood to the onshore Project area is situated approximately 3 km to the north west.

Agricultural areas that are predominantly used for rice cultivation were mapped and analysed in the cities of Pohang and Ulsan. 40 sites were denoted between the two cities in proximity to their respective industrial complexes. The closest agricultural land utilised for rice cultivation are located approximately 2.9 km south from onshore Project components (Figure 6-43) (Park *et al*., 2021).

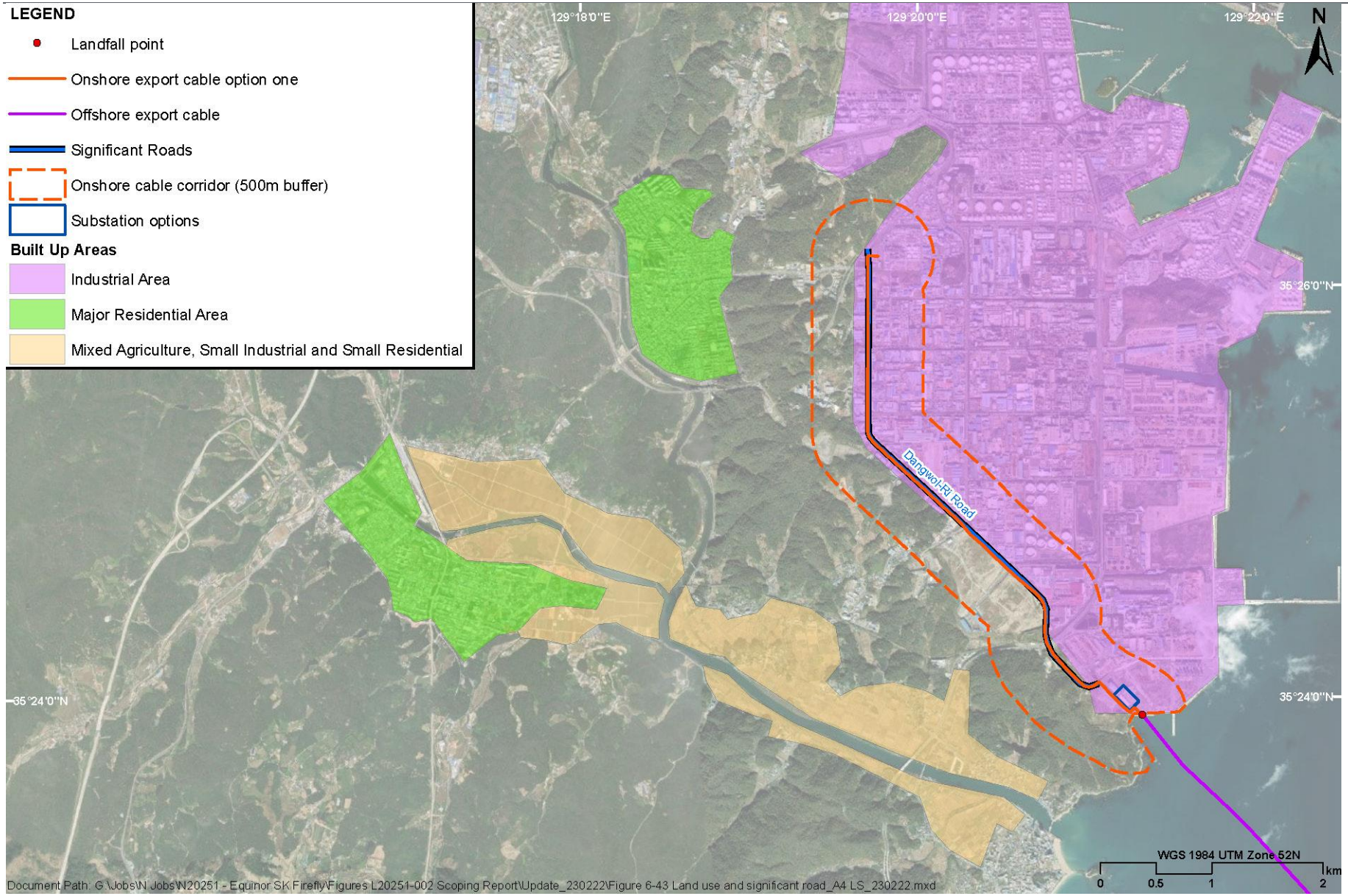


Figure 6-43: Land use and significant road in proximity to onshore Project components.

6.23.2 Proposed Additional Data Collection

Based on the baseline data / information identified above additional desktop data will need to be collected to inform the ESIA together with the data collected for the Korean EIA. A desktop review of mapping will be undertaken to identify land use, infrastructure and material asset receptors (e.g. agricultural receptors). Consultation will be undertaken with local landowners, business developers and local communities as per Section 6.21.2 to better understand any future uses for the land and ensure the Project limits its overall potential adverse effects and impacts on the general area.

6.23.3 Potential Project Impacts

A range of potential impacts on land use, infrastructure and material assets have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-80. Impacts proposed to be scoped out of further assessment are provide in Table 6-81.

Table 6-80: Impacts Proposed to be Scoped into the Project Assessment for Land Use, Infrastructure and Material Assets.

Potential impact	Phase			Justification
	C	O	D	
Disturbance or limiting development to industrial facilities through the installation of onshore cables and/or substation siting	✓	✗	✓	**Construction and decommissioning phases** • There is the potential for existing industrial infrastructure to be affected by Project activities during construction and decommissioning given the location of the identified industrial complex.
Restrictions and disruptions to port and industrial complex operations and users	✓	✓	✓	**All phases** • The installation, presence and decommissioning of onshore Project components could impact the Ulsan National Industrial Complex and its activities, including future development and onshore planning activities.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

Table 6-81: Impacts Proposed to be Scoped out the of Project Assessment for Land Use, Infrastructure and Material Assets.

Potential impact	Phase			Justification
	C	O	D	
Disturbance or limiting development to agricultural areas through the installation of onshore cables and/or substation siting	✓	✓	✗	**Construction and operation phases** • It is not anticipated that during the construction and operation phases of the Project that onshore components will affect any agricultural areas. The onshore Project components are situated in a heavily industrialised site away from agricultural areas and have a relatively small footprint within the Ulsan National Industrial Complex.
Disturbance or limiting development to settlements through the installation of onshore cables and/or substation siting	✓	✓	✗	**Construction and operation phases** • It is not anticipated that during the construction and operation phases of the Project that onshore components will affect any settlements. The onshore Project components are situated in a heavily industrialised site away from residential dwellings.

6.23.4 Proposed Assessment Methodology

Engagement with landowners and asset owners to determine the level of impact from the project on their activities. The engagement with stakeholders will be undertaken in accordance with the Section 6.21.2.

The ESIA will consider the potential impacts of the construction, operational and maintenance and decommissioning phases of the Project within the Infrastructure and other users Study Area. The assessment will follow the methodology previously identified, and will be conducted in line with the following guidelines:

- Environmental Health and Safety Guidelines for Wind Energy (World Bank Group, 2015).

6.24 Traffic and Transport

This chapter will consider the potential impacts of the Project on traffic and transport receptors during the construction, operational and maintenance, and decommissioning phases.

The Traffic and Transport Study Area is based on the onshore export cable corridor and substation sites and all domestic and industrial roads within it. Upon finalisation of the onshore export cable corridor, the Traffic and Transport Study Area will be refined to include particular focus on minor roads that are likely to be affected more directly by traffic generated during the construction phase and to consider what additional temporary roads/access may be needed to be installed to mitigate these impacts. The Traffic and Transport Study Area also includes areas in proximity to the onshore substation locations and the connection from the substation to the grid connection at the existing KEPCO sub-station site.

6.24.1 Baseline Environment

Information regarding the Traffic and Transport Study Area has been collated through a review of currently accessible studies and datasets. Key data sources are listed in Table 6-82, noting that this list is not exhaustive.

Table 6-82: Key sources of information for the traffic and transport baseline.

Data	Description	Source
Impact of traffic volumes on roadside soils.	This study confirms Ulsan National Industrial Complex as the industrial capital of South Korea and assesses the traffic volume and composition at 10 differing locations in Ulsan.	Kim *et al*., 2019
Road networks and transport corridors from 2015-2019	This data details the Ulsan road networks comprised of highways, general roads, metropolitan city roads and township roads from 2015-2019 while providing current transport corridor locations and names.	Ulsan Metropolitan City Government (UMCG), 2021
Contamination characteristics collected from traffic in Ulsan, South Korea	Ulsan is the largest industrial city in South Korea and is home to multiple petrochemical, non-ferrous, automobile and shipbuilding industries. These industries require vehicles and machinery to meet operational goals.	Seo *et al*., 2020

A strategic assessment of the onshore road network has been conducted for this Scoping Report and it is acknowledged that additional assessments may be required if the onshore cable routes alter.

To support the local supply chain, it is anticipated that a majority of the Project infrastructure will be shipped to Ulsan Port, before being taken offshore. Some elements of infrastructure may be delivered to Ulsan Port by road and more detailed planning will be required as the Project specifics are confirmed.

Ulsan is considered the industrial capital of South Korea and automobile, shipbuilding, petrochemical and non-ferrous industries are located within the city (Seo *et al*., 2020). In 2018, there were more than 500,000 registered vehicles in Ulsan (Kim *et al*., 2019).

An initial desk-based review of data sources has identified the different categories of the road networks in Ulsan from 2015-2019 and the names of the surrounding transport corridors (Table 6-83 and Table 6-84). As of 2019, Ulsan was home to 158 highways, 124 general roads, 187 metropolitan city roads, and 189 Gu/Gun (local town) roads (Table 6-83). Busan, Gyeongju, Ynagsan and Milyang/Chungdo Corridors (Table 6-84) refer to the railway and expressway lines which create a boundary and delimit Ulsan from other metropolitan cities.

Studies conducted in 2018 illustrated that most of the traffic located within Ulsan Port National Industrial Complex was comprised of vehicles classified as car, truck and bus (Kim *et al*., 2019). More specifically, in an area located within the industrial complex, approximately 18 km north of onshore Project components along a major industrial road, 52,392 vehicles were observed per day. Of these vehicles, 73% were cars, 24% were trucks and 3% were buses (Kim *et al*., 2019). Comparatively, when the study assessed the traffic outside of the immediate industrial complex in a residential area surrounded by apartments, 21,866 vehicles were observed per day. Of those vehicles, 81% were cars, 17% were trucks and 2% were buses (Kim *et a*l., 2019).

Table 6-83: Ulsan road networks from 2015-2019 (UMCG, 2021).

Category		2015	2016	2017	2018	2019
Highway	Number	144	134	135	167	158
	Extension(m)	14,678.00	15,468.10	15,478.10	16,434.50	15,171.30
General road	Number	116	120	115	119	124
	Extension(m)	12,620.30	12,547.60	12,247.50	12,713.40	12,728.90
Metropolitan city road	Number	109	127	156	186	187
	Extension(m)	15,117.80	20,052.40	22,129.50	23,362.40	23,732.30
Gu, Gun road	Number	265	166	168	168	189
	Extension(m)	10,378.00	7,055.00	7,039.50	7,125.20	7,830.60
State-sponsored regional map	Number	3	3	3	4	4
	Extension(m)	150.4	148	148	161	161
Total	Number	637	550	577	644	662
	Extension(m)	52,944.50	55,271.10	57,042.60	59,796.50	59,624.10

Table 6-84: Current status of the transport corridors in Ulsan (UMCG, 2021).

Category	Route name
Busan Corridor	Expressway Line No. 65 (Donghae Line, National Road 7, National Road 14, National Road 31)
Gyeongju Corridor	Expressway Line No. 1 (Gyeongbu Line), National Road 7, National Road 14, National Road 31, National Road 35
Yangsan Corridor	Expressway Line No. 1 (Gyeongbu Line), National Road 35
Milyang, Chungdo Corridor	National Road 24, State-supported local road 69

Primary access to the onshore Project area is via Gangyang-Ri road. This road would service transportation to Ulsan National Industrial Complex and the onshore export cable and substation locations. Gangyang-Ri road would additionally give access to Dangwol-Ri road which passes multiple bus stops and petrol stations as it transects Ulsan National Industrial Complex.

6.24.2 Proposed Additional Data Collection

Based on the baseline data / information identified above additional data will need to be collected to inform the ESIA. A summary of the data is set out below

- Existing traffic flow information will be obtained to identify the current capacity and potential constraints of the road network;
- Personal Injury Accident data if available;
- Records of existing bus service routes, cycle paths and train surveys;
- New traffic surveys will be undertaken to supplement the data provided; and
- Modelling for anticipated construction traffic generation in terms of workers and Heavy Goods Vehicles.

6.24.3 Potential Project Impacts

A range of potential impacts on traffic and transport have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are outlined in Table 6-85.

Table 6-85: Impacts Proposed to be Scoped into the Project Assessment for Traffic and Transport.

Potential impact	Phase			Justification
	C	O	D	
Temporary highways network impacts from deliveries and staff movements	✓	✗	✓	The construction and decommissioning of the onshore elements of the Project has the potential to affect the strategic and local road networks through the delivery of machinery, materials, cabling and the movements generated by construction workers.
Temporary highways network impacts from the movement of wastes	✓	✗	✓	Wastes generated from offshore construction and decommissioning could come ashore and need to be transported. Waste would also be generated from onshore construction works.
Temporary delays to public transport services	✓	✗	✓	Construction and decommissioning activities have the potential to cause temporary delays to public transport services.

C = Construction phase, O = Operational and maintenance phase, D = Decommissioning phase.

It is proposed that the impacts from traffic during the operation and maintenance are scoped out of the ESIA as the trips generated from undertaking routine maintenance activities are unlikely to have a significant effect on the local transport network.

6.24.4 Proposed Assessment Methodology

The onshore export cable corridor may need to interact with several roads dependent on the onshore export cable. Transport movements associated with the onshore works will also be identified once the onshore export cable corridor has been finalised. A desktop review will then be undertaken to identify the key locations where transport issues may be raised. These baseline studies will identify potential road network constraints and inform potential routes for delivery and construction and decommissioning vehicles (types and numbers). The highways authorities will be consulted during this period to ascertain any potential issues with the proposed access routes. The assessment of impacts on the local road network will assess the flows predicted as a result of the onshore construction of the Project against existing baseline flows. The scope and duration of predicted impacts will be quantified in terms of phases of delivery, construction and operation. A precautionary approach will be adopted for the traffic and transport ESIA in relation to assumptions about the proportion of the haul road and construction compounds that will require aggregate surfacing and the timescale and phasing of

construction. The ESIA will outline a high-level construction compound strategy, which will be further developed once the route is finalised, to indicate the potential size and broad spread of construction compounds that are likely to be required.

6.25 Major Accidents and Natural Disasters

A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned will be undertaken.

The ESIA will address the vulnerability of the Project to risks of major accidents and/or disasters and the subsequent potential for the Project to cause risks to the environment. The chapter will draw on the relevant ESIA topic chapters, as well as the Disaster Impact Assessment prepared for the project. For example, the potential for major accidents regarding local traffic and transport would be assessed in the Traffic and Transport chapter (see Section 6.24), seismic friction due to presence of the existing fault line and exposure to flooding from tidal waters and storm surge would be addressed in Geology, Hydrogeology, Ground conditions (see Section 6.15) and Hydrology and Flood Risk (see Section 6.17) chapters respectively. Details of site security, project resilience and emergency response protocols would also be set out as part of the Project Description.

6.26 Waste

Recently, South Korea has initiated a 15-year, 3-phase plan with support from the Ministry of Commerce, Industry and Energy to convert existing industrial parks into eco-industrial parks through energy, material, and inter-industry waste exchange, specifically within Ulsan National Industrial Complexes (Park et al., 2008).

Wastes generated from the construction, operation and decommissioning of the Project will be managed through a Site Waste Management Plan that will be prepared following completion of the ESIA and prior to construction post-consent. The operation and maintenance phase of the Project will generate minimal waste; the types of waste and their management will be captured in the Project Description of the ESIA.

Waste materials are expected to be excavated and removed during the construction phase of the Project. During the operational phase of the Project, the WTGs could potentially produce wastes through upkeep (oil changes and refurbishment).

6.27 Climate Change

Climate change will be considered throughout the ESIA and Equinor's policies on climate change action will be reflected in the ESIA. South Korea's commitment to net-zero emissions by 2050 will be described in the context of the Project.

Climate Change Resilience (CCR) to future climate change will be considered during the design process. The design of the Project will take into account potential future climate change scenarios, for example, future flood risk and resilience to extreme weather events. The drainage strategy for the onshore substation will be designed to take flood risk into account, with an allowance for climate change. The ESIA would set out details of the proposed development's resilience to climate change in the Project Description.

Consideration of predicted changes in baseline environmental conditions, including changes resulting from climate change, will be set out within each ESIA topic chapter where robust information is available at the time of writing. The assessment of effects for each topic will take into account identified trends or changes predicted to arise as a result of climate change.

Greenhouse Gas (GHG) emissions can occur throughout the lifecycle of a development, including during construction and operation of a proposed development. This can be affected by factors such as material use and energy demand. The design of the proposed development would consider measures to minimise and mitigate greenhouse gas emissions, where possible, such as measures to control energy demand and improve energy efficiency. Such measures would be summarised in the Project Description of the ESIA.

Overall, there is anticipated to be a positive effect on climate change as the Project will help decrease South Korea's reliance on imported fossil fuels and establish the country as an area with high resource potential regarding future offshore wind developments.

No further assessment of GHG emissions, beyond the air quality assessment, is considered necessary or appropriate at this stage.

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Appendix A-1: Transboundary Impacts Screening Assessment

The screening assessment of potential transboundary impacts associated with the Project is presented in two main sections below, 'Physical and Biological Environment' and Human Environment'.

A series of matrices for potential transboundary impacts associated with the Project are presented in Apx Table 1 for physical and biological receptors and Apx Table 2 for human activities respectively. The information presented in these matrices is based on the impacts identified to be scoped into the ESIA based on The Project presented in Section 3 of this Scoping Report.

The matrices consider all potential transboundary impacts that may occur from all phases of the Project (i.e. construction, operational and maintenance, and decommissioning). The matrices also address the predicted spatial and temporal scale of potential transboundary impacts for those interests that are proposed to be screened into the assessment within the ESIA.

The nearest transboundary that exists for the Project is the EEZ of Japan located 28.6 km east of the array.

1. Physical and Biological Environment

A matrix considering the potential for significant transboundary effects for the physical and biological environment is illustrated in Apx Table 1 below.

The conclusions for each physical and biological environment topic are presented, together with the additional justification, in the following sections.

Apx Table 1: Matrix for the identification of potential significant transboundary effects for the Project – Physical and Biological environment.

Criteria	Marine Processes	Benthic Ecology	Fish, Shellfish and Sea Turtle Ecology	Marine Mammals	Seabirds and Migratory Birds
Characteristics of the Project	For a detailed description of the characteristics of the Project, see Section 3 of this Scoping Report. The Project is a floating offshore wind farm comprising up to 54 wind turbines and one Offshore Substation Platforms (OSP) with an overall generating capacity of up to 810 MW. The turbine models being considered have a maximum blade tip height of c. 261 m above LAT. The platform location has not yet been selected and will be identified through detailed design consideration. Inter-array cables and up to two offshore export cables (using the consented offshore export cable routes) will be installed to connect the turbines to the OSPs and the OSPs to the landfall. Cable protection may also be installed. The Project Description in the ESIA will provide further detail on the proposed cable installation methodology and potential cable protection measures				
Geographical Area	The array area is located 45.57 km off the coast of Ulsan, South Korea in the East Sea. The closest EEZ (medial line) border is 28.6 km east of the Area (Japan).				
Location of the Project	The Project covers 282.43 km^2 (comprising the combined footprint areas of the Onshore and Offshore Project Areas. The Area is approximately 20.4 km long and 9.21 km wide, covers an area of 152.3 km^2 and is located, at its closest point, approximately 60 km off the coast of the city of Ulsan, South Korea in the East Sea. The Project offshore export cable corridor has a single corridor option 73.77 km long and includes a 1 km buffer across the cable. The Onshore Project Area will cover 5.87 km^2 (comprising the Project onshore substation and Project onshore cable corridor). The Project onshore cable corridor will be approximately 5.30 km long and include a 500 m buffer either side of the cable.				
Potential Impacts and Pathways	No significant transboundary impacts are predicted.	No significant transboundary impacts are predicted.	See Section A1.1.3	See Section A1.1.4	See Section A1.1.5
Environmental Importance					
Extent	See Section A1.1.1	See Section A1.1.2			
Magnitude	The magnitude of the impacts will be subject to the assessment to be undertaken for the EIA and have, therefore, not been determined at this stage.				
Probability	No significant transboundary impacts are predicted.	No significant transboundary impacts are predicted.	See Section A1.1.3	See Section A1.1.4	See Section A1.1.5
Duration					
Frequency					
Reversibility					
Cumulative Impacts	The potential cumulative impacts with other projects and plans will be assessed in the ESIA, as stated in Section 5.6 of this Scoping Report.				

1.1 Marine Processes

The marine processes baseline for the Project is set out in Section 6.3 of this Scoping Report.

The array area and offshore export cable routes are located entirely within South Korean territorial waters. It is anticipated, based on an understanding of the baseline environment (e.g. tidal regime and sediment types), that impacts from sediment disturbance as a result of the installation and maintenance of foundations, moorings and cables are likely to be localised and temporary in nature. Any impacts on marine processes from the presence of the foundation structures will be confined to the localised area of the footprint of the Project infrastructure. Transboundary impacts are therefore not expected.

It is therefore proposed that transboundary impacts upon marine processes are screened out of the ESIA.

1.2 Benthic Ecology

The benthic ecology baseline for the Project is set out in Section 6.4 of this Scoping Report.

It is considered that there is no pathway (direct or indirect) by which effects arising from the Project could significantly affect benthic subtidal and intertidal ecology receptors of Japan. The extent of any predicted impacts on benthic subtidal and intertidal ecology receptors are expected to be limited in extent to:

- The footprint of the array area and offshore export cable routes for any subtidal habitat loss or disturbance; colonisation of hard structures or removal of hard substrates; increased risk of introduction and spread of invasive and non-native species; and alteration of seabed habitats arising from changes in physical processes; and
- One tidal excursion for increased suspended sediment concentrations and associated deposition and accidental pollution.

It is therefore proposed that transboundary impacts upon benthic ecology are screened out of the ESIA.

1.3 Fish, Shellfish and Sea Turtle Ecology

The fish, shellfish and sea turtle ecology baseline for the Project is set out in Section 6.5 of this Scoping Report.

There is potential for transboundary impacts on fish, shellfish and sea turtle ecology due to potential impacts arising from the construction, operational and maintenance and decommissioning phases of the Project.

These impacts include underwater noise from piling activities during the construction phase; injury/disturbance to whale shark and sea turtle from vessel activities; changes in EMF from subsea electrical cabling during the operational and maintenance phase; habitat loss/disturbance (temporary and long term); increased suspended sediment concentrations and associated deposition; accidental pollution during all phases, and alteration of seabed habitats arising from changes in physical processes during the operational and maintenance phase.

These activities have the potential to affect migratory fish species that are listed as species that are of commercial importance for fishing fleets of other states or species that are of international conservation importance (whale shark and sea turtles). Potential effects may include direct effects on individuals (e.g. mortality, injury or disturbance) or indirect effects due to loss/disturbance of important habitats (e.g. fish spawning and nursery habitats.

The probability of impacts during the construction phase is high, although the extent cannot be determined at this stage and will be subject to assessment in the ESIA. The majority of impacts during construction however are considered to be short term and temporary. The operational and maintenance phase is considered less likely to result in significant impacts, although the effects associated with EMF and long-term habitat loss would be, inherently, longer term effects. These effects however may be reversible, depending on the decommissioning strategy. The decommissioning phase is considered low risk for significant impacts, and any effects will be short term.

Therefore, it is proposed that transboundary impacts on fish, shellfish and sea turtle receptors and their nature conservation interests are screened into the ESIA.

1.4 Marine Mammals

The marine mammal baseline for the Project is set out in Section 6.6 of this Scoping Report.

There is the potential for transboundary impacts upon marine mammals due to the mobile nature of marine mammal species and the proximity of the array area to the EEZ boundary of Japan. Marine mammal species likely to be present in the vicinity of the Project include common minke whale, Pacific white-sided dolphin, short-beaked common dolphin, finless porpoise, bottlenose dolphin, Risso's dolphin, spotted seal, northern fur seal and stellar sea lion.

Direct impacts include injury/disturbance to marine mammals arising from elevations in underwater noise from piling activities during the construction phase of the OSP. Increased disturbance and collision risk to marine mammals could arise as a result of vessel activities during all phases of the Project whilst changes in EMF from subsea cabling may directly impact marine mammals during the operational and maintenance phase. Effects of accidental pollution could impact marine mammals directly during all phases of the Project. Indirect impacts to marine mammals include changes in prey availability (fish and shellfish community) during all phases of the Project.

The probability of impacts to marine mammals occurring during construction, particularly as a result of underwater noise from piling, is high. The extent cannot be determined at this stage and will be subject to assessment in the ESIA. The majority of impacts during construction are however considered likely to be short term and temporary. The operational and maintenance phase is considered less likely to result in significant impacts, although any effects (e.g. injury and/or disturbance to marine mammals from vessel activities, changes in fish and shellfish community affecting prey resources and changes in EMF) are, inherently, longer term effects. These effects however may be reversible, depending on the decommissioning strategy. The decommissioning phase is considered low risk for significant impacts, and any effects will be short term.

Therefore, it is proposed that transboundary impacts on marine mammal receptors and their nature conservation interests are screened into the ESIA.

1.5 Seabirds and Migratory Birds

The seabirds and migratory birds baseline for the Project is set out in Section 6.7 of this Scoping Report.

There is potential for transboundary impacts upon offshore ornithological receptors due to the wide foraging and migratory ranges of typical bird species in South Korea and more specifically, the East Sea. The bird species likely to be present in the vicinity of the Project include a range of seabirds which may be present in one or more seasons and could be included as features of designated sites in other countries (e.g. at breeding colonies in Japan and elsewhere) which pass through the East Sea on migration. This may also include terrestrial migrants (e.g. wildfowl and waders) which winter in South Korea and breed in other countries.

The key direct impacts for ornithological receptors are likely to arise during the operational and maintenance phase. These impacts include direct mortality of individuals arising from potential collisions with rotating turbine blades and barrier effects caused by the physical presence of structures, which may inhibit clear transit of birds between breeding and foraging grounds, or on migration. Direct impacts may also arise as a result of temporary and/or long-term habitat loss/disturbance during the construction, operational and maintenance and decommissioning phases. Indirect impacts may include changes in prey availability (fish and shellfish communities) due to changes to physical processes and habitat as a result of the presence of operational infrastructure.

The probability of impacts during the construction and decommissioning phases are high (although species-specific) and are likely to be short term and temporary. The probability of impacts during the operational and maintenance phase is high, and impacts are likely to be long term, continuous and of varying spatial extent, depending on the species. The magnitude of these impacts is not known at this time and will be subject to assessment in the ESIA. These effects however may be reversible, depending on the decommissioning strategy.

Therefore, it is proposed that transboundary impacts on offshore ornithology receptors and their nature conservation interests are screened into the ESIA.

2. Human Environment

A matrix considering the potential for significant transboundary effects for the human environment is illustrated in Apx Table 2 below.

The conclusions for each human environment topic are presented, together with the additional justification, in the following sections.

Apx Table 2: Matrix for the identification of potential significant transboundary effects for the Project – human environment.

Screening Criteria	Commercial Fisheries and Aquaculture	Shipping and Navigation	Military and Civil Aviation	Seascape, Landscape and Visual Amenity	Marine Archaeology	Infrastructure and Other Marine Users	Population and Human Health
Characteristics of the Project	For a detailed description of the characteristics of the Project, see Section 3 of this Scoping Report. The Project is a floating offshore wind farm comprising up to 54 wind turbines and one Offshore Substation Platforms (OSP) with an overall generating capacity of up to 810 MW. The turbine models being considered have a maximum blade tip height of c. 261 m above LAT. The platform location has not yet been selected and will be identified through detailed design consideration. Inter-array cables and up to two offshore export cables (using the consented offshore export cable routes) will be installed to connect the turbines to the OSPs and the OSPs to the landfall. Cable protection may also be installed. The Project Description in the ESIA will provide further detail on the proposed cable installation methodology and potential cable protection measures						
Geographical Area	The array area is located approximately 60 km off the coast of Ulsan, South Korea in the East Sea. The closest EEZ (medial line) border is 26.8 km east of the array area (Japan).						
Location of the Project	The Project covers 282.43 km^2 (comprising the combined footprint areas of the Onshore and Offshore Project Areas. The Area is approximately 20.4 km long and 9.21 km wide, covers an area of 152.3 km^2 and is located, at its closest point, approximately 60 km off the coast of the city of Ulsan, South Korea in the East Sea. The Project offshore export cable corridor has a single corridor option 73.77 km long and includes a 1 km buffer across the cable. The Onshore Project Area will cover 5.87 km^2 (comprising the Project onshore substation and Project onshore cable corridor). The Project onshore cable corridor will be approximately 5.30 km long and include a 500 m buffer either side of the cable.						
Potential Impacts and Pathways	No significant transboundary impacts are predicted	See section A1.2.2	See section A1.2.3	No significant transboundary impacts are predicted	No significant transboundary impacts are predicted	See section A1.2.6	See section A1.2.7
Environmental Importance							
Extent				See section A1.2.4	See section A1.2.5		
Magnitude	The magnitude of the impacts will be subject to the assessment to be undertaken for the EIA and have, therefore, not been determined at this stage.						
Probability	No significant transboundary impacts are predicted	See section A1.2.2	See section A1.2.3	No significant transboundary impacts are predicted	No significant transboundary impacts are predicted	See section A1.2.6	See section A1.2.7
Duration							
Frequency							
Reversibility							
Cumulative Impacts	The potential cumulative impacts with other projects and plans will be assessed in the ESIA, as stated in Section 5.6 of this Scoping Report.						

2.1 Commercial Fisheries and Aquaculture

The commercial fisheries and aquaculture likely to be operating in the vicinity of the Project are outlined in section 6.8 of this Scoping Report.

It is considered that there is no pathway (direct or indirect) by which effects arising from the Project could significantly affect commercial fisheries of another nation, such as Japan based upon the Korea-Japan Fisheries Agreement and demarcated boundary lines.

In terms of sea-based receptors, the commercial fisheries and aquaculture baseline (outlined in section 6.8 of this Scoping Report) indicates that the Korea-Japan Fisheries Agreement separates the nations fishing grounds and the array area is not within proximity to this demarcated line. Potential significant impacts would therefore be limited to commercial fisheries and aquaculture receptors within South Korea.

Project could significantly affect commercial fisheries and aquaculture receptors of South Korea. Temporary changes to commercial fisheries and aquaculture during the construction, operational and maintenance, and decommissioning phases, are expected to arise mainly in areas within close proximity to the Project.

Due to the static nature of aquaculture, it is not anticipated that there will be any potential for transboundary impacts upon aquaculture receptors of other nations, such as Japan.

Therefore, it is proposed that transboundary impacts upon commercial fisheries and aquaculture are screened out of the ESIA.

2.2 Shipping and Navigation

The shipping and navigation baseline, including navigational features and vessel traffic, is outlined in Section 6.9 of this Scoping Report.

The array area is located approximately 24.6 nm from shore. Charted water depths within the Project area range between 0 m at Lowest Astronomical Tide and -325 m approximately. The main types of vessels recorded in the vicinity of the Project are tanker vessels, offshore tug, supply and dredge vessels cargo vessels and vessels denoted as other.

There is the potential for transboundary impacts upon shipping routes which transit to/from other countries including the potential effects on shipping routes to/from Japan. Any effects on ship routing to Japan is not expected to be significant considering the overall voyage distance and pre-existing routes.

The probability of impacts occurring during the operational and maintenance phase, particularly as a result of the presence of the offshore infrastructure associated with the Project, is likely to be high. The extent of the impact will be subject to assessment in the ESIA. Although impacts during the operational and maintenance phase are likely to be long term, it is likely that any impacts from the Project would be reversible following decommissioning, as it is anticipated that all structures above the seabed will be completely removed. The construction phase is considered less likely to result in significant impacts although the effects associated with the interference caused by the presence of infrastructure on shipping and navigation will progressively increase as the development is progressed.

Therefore, it is proposed that transboundary impacts upon shipping and navigation (considering shipping routes to/from Japan) are screened into the ESIA.

2.3 Military and Civil Aviation

The military and civil aviation baseline for the Project is outlined in Section 6.10 of this Scoping Report.

The Project is located along the Incheon Fir / Fukuoka Fir boundary. This boundary essentially delineates South Korean and Japanese airspace. Therefore, there is potential for transboundary impacts upon aviation routes which transit to/from other countries including the potential effect on aviation routes to/from Japan. Any effects on aviation routing to Japan is not expected to be significant considering the overall voyage distance and pre-existing routes.

The potential for transboundary impacts may arise from the presence of wind turbines during the operational and maintenance phase disrupting military and civil radar coverage from Japan is also considered to be very unlikely. The probability of impacts occurring during the operational and maintenance phase as a result of the offshore infrastructure associated with the Project is likely to be very low, although the extent of the impact will

be determined in the ESIA. Although such impacts would be long term, it is likely that they would be reversible after decommissioning, as it is anticipated that all structures above the seabed will be completely removed.

Therefore, it is proposed that transboundary impacts upon military and civil aviation (considering aviation routes to/from Japan and military radar obstructions) are screened into the ESIA.

Additionally, academic results have been identified that suggest potential impacts of offshore wind farms to weather radars. As this may also induce transboundary as well as in-country impacts, it is proposed that the potential impact in Firefly project is further verified in the ESIA stage.

2.4 Seascape and Visual Amenity

The baseline conditions for seascape, landscape and visual amenity are set out in Section 6.11 of this Scoping Report. This includes landscape, seascape and land based visual receptors within the Seascape, Landscape and Visual Impact Assessment Study Area, initially defined as a 50 km radius from the array area, which extends into Japanese waters.

It is considered that there is no pathway (direct or indirect) by which effects arising from the Project could significantly affect seascape, landscape and visual amenity receptors of another state. Temporary change to seascape, landscape and visual amenity during the construction and decommissioning phases, and changes to seascape and landscape character and visual amenity for the duration of the operational and maintenance phase, are expected to arise mainly within the landscape and seascape of the south eastern coast of South Korea.

In terms of sea-based receptors, the shipping and navigation baseline (outlined in Section 6.9 of this Scoping Report) indicates that cargo vessels, tanker vessels and ferries transiting to/from South Korea pass within 6 nm of the array area. These are not expected to experience significant visual impacts. Potential significant impacts would therefore be limited to landscape, seascape and visual receptors within South Korea.

Therefore, it is proposed that transboundary impacts upon seascape, landscape and visual amenity are screened out of the ESIA.

2.5 Marine Archaeology

The marine archaeology baseline for the Project is set out in Section 6.12 of this Scoping Report.

It is considered that there is no pathway (direct or indirect) by which effects arising from the Project could significantly affect marine archaeology receptors of another nation, specifically Japan. The extent of any predicted impacts on marine archaeology receptors are expected to be limited to:

- The footprint of the array area and offshore export cable routes for impacts associated with direct physical seabed disturbance; and
- One tidal excursion for impacts associated with sediment deposition on the seabed.

Therefore, it is proposed that transboundary impacts upon marine archaeology are screened out of the ESIA.

2.6 Infrastructure and Other Marine Users

The infrastructure and other marine users baseline for the Project is set out in Section 6.13 of this Scoping Report.

Potential impacts upon infrastructure and other marine users of other nations are limited to potential effects on communications infrastructure such as satellite communication and VHF radio, during the operational and maintenance phase of the Project. The extent of the potential impact will be assessed within the ESIA following consultation with relevant communications receptors. Although such impacts would be long term, they would be reversible following decommissioning, as it is anticipated that all structures above the seabed will be removed.

Therefore, it is proposed that transboundary impacts upon infrastructure and other users are screened into the ESIA.

2.7 Population and Human Health

The population and human health baseline for the Project is set out in Section 6.21.1 of this Scoping Report.

Potential impacts identified in Section 6.21 of this Scoping Report include increase in employment and demand for services during all phases of the Project. The extent of this impact will be assessed in the ESIA. There is potential for transboundary impacts on other states relating to increase in employment and demand for services, through the purchase of project components, equipment and the sourcing of labour from companies based outside South Korea. The probability of impacts occurring at all phases of the Project is high. Impacts related to the construction and decommissioning phases would be temporary and short term. Impacts related to the operational and maintenance phase would be long term.

Therefore, it is proposed that transboundary impacts upon Population and Human Health are screened into the ESIA.

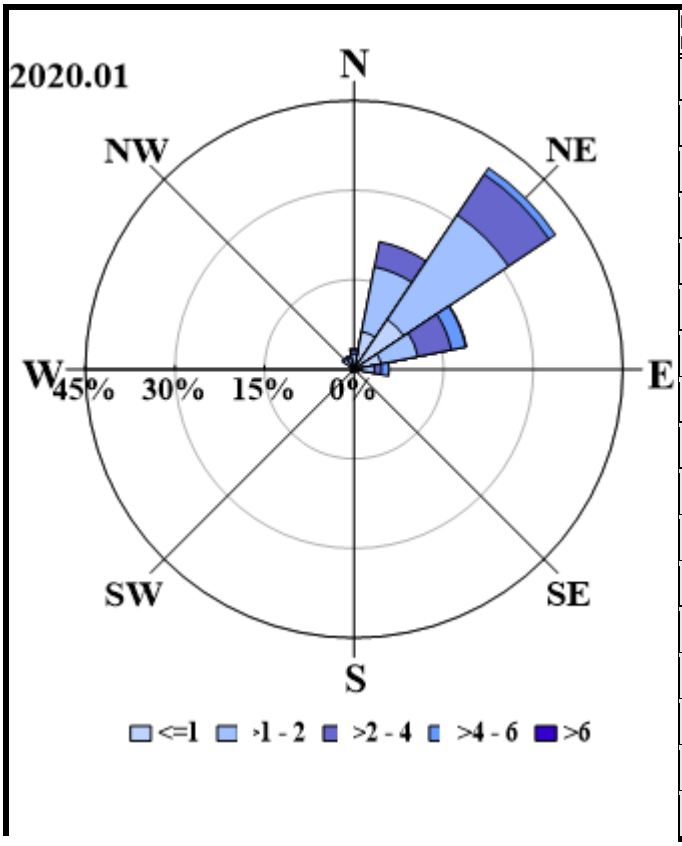
3. Conclusions

This Appendix has been prepared to provide an assessment of the potential for transboundary impacts on other states arising from the Project.

On the basis of the information available, as detailed within this Scoping Report, there is the potential for the Project to have significant transboundary effects in other states. Transboundary impacts have been screened into the ESIA for the following topics:

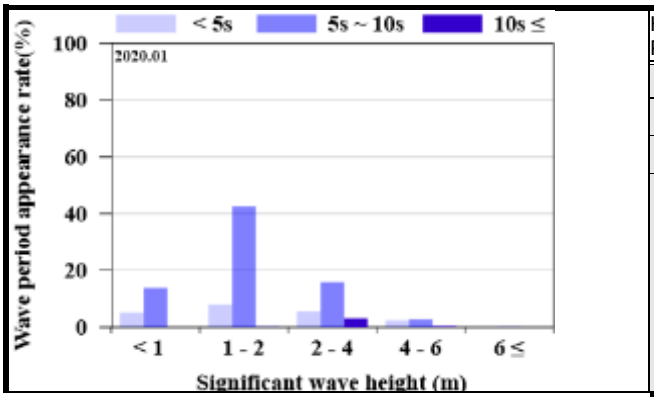
- Fish and sea turtle ecology;
- Marine mammals;
- Seabirds and migratory birds;
- Shipping and navigation;
- Military and civil aviation;
- Infrastructure and other users; and
- Population and human health.

Appendix A-2: Wave Height and Direction Data from within the Marine Processes Study Area



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	0.7	1.9	0.7	0.1	0.0	3.4
NNE	4.7	12.3	4.7	0.0	0.0	21.8
NE	7.6	21.9	9.6	1.4	0.0	40.5
ENE	3.4	7.3	5.9	2.4	0.1	19.2
E	1.1	2.3	1.0	1.4	0.0	5.9
ESE	0.0	0.9	0.0	0.0	0.0	0.9
SE	0.0	0.3	0.3	0.0	0.0	0.6
SSE	0.0	0.1	0.1	0.0	0.0	0.3
S	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.1	0.0	0.4	0.0	0.0	0.6
SW	0.1	0.0	0.6	0.0	0.0	0.7
WSW	0.4	0.0	0.1	0.0	0.0	0.6
W	0.3	0.0	0.0	0.0	0.0	0.3
WNW	0.0	0.0	0.4	0.0	0.0	0.4
NW	0.3	1.7	0.4	0.0	0.0	2.4
NNW	0.1	2.0	0.3	0.0	0.0	2.4
Total	19.1	50.7	24.6	5.4	0.1	100.0

Apx Figure 1: January 2020 significant wave height appearance rate by wave direction (unit: %).

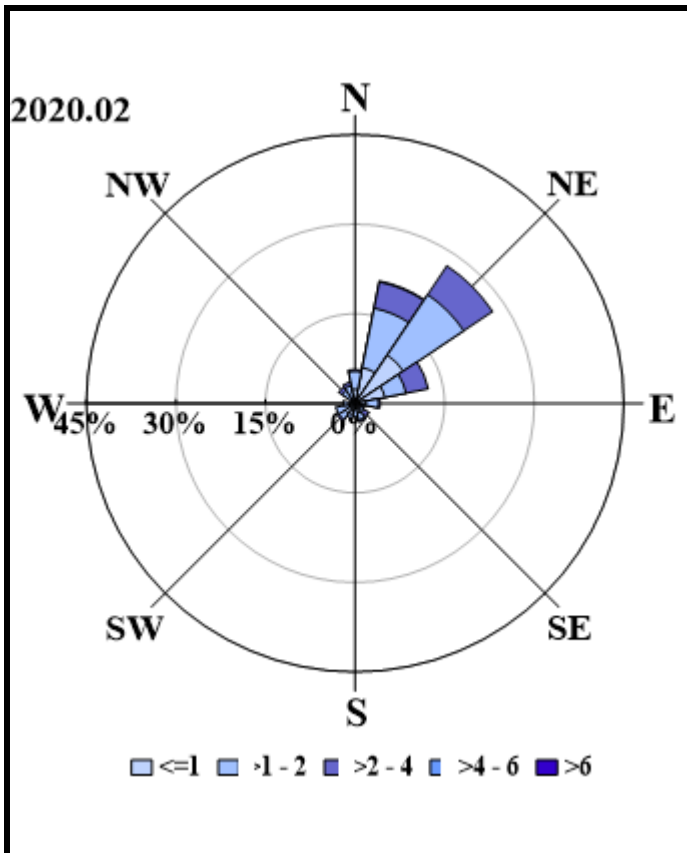


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6<	Total
<5.0	5.2	8.0	5.6	2.4	0.0	21.2
5.0 ~ 10.0	13.9	42.6	15.9	2.7	0.1	75.2
10.0 ≤	0.0	0.1	3.2	0.3	0.0	3.6
Total	19.1	50.7	24.6	5.4	0.1	100.0

Apx Figure 2: January 2020 significant wave height appearance rate by wave period (unit: %).

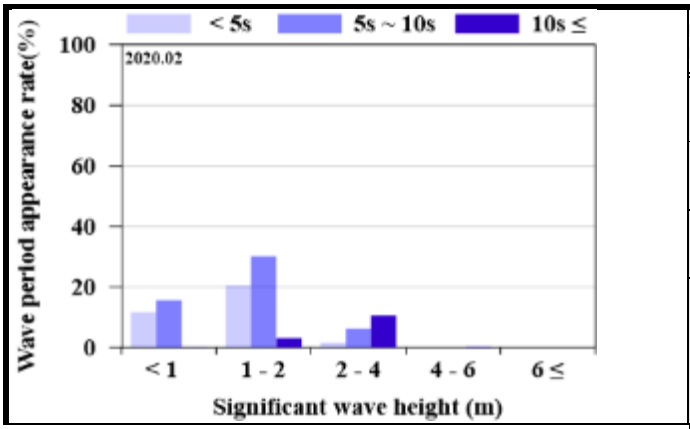
In January, the significant wave height appearance rates of the NNE ~ ENE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (40.5%), NNE (21.8%), and ENE (19.2%).

As for significant wave height appearance rate by wave period, the wave of 5 to 10 seconds were predominant at 75.2%, and the significant wave height of 1~2m was the most dominant at 50.7%. In addition, the wave height of 2 m or higher was 30.1%, and the wave height of 4 m or higher was 5.5%



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	1.9	3.5	0.3	0.0	0.0	5.7
NNE	4.3	11.7	4.6	0.1	0.0	20.9
NE	7.2	14.2	6.1	0.1	0.0	27.7
ENE	3.6	4.8	4.1	0.0	0.0	12.5
E	1.6	2.3	0.3	0.0	0.0	4.2
ESE	1.2	0.3	0.1	0.0	0.0	1.6
SE	0.9	1.0	0.9	0.0	0.0	2.8
SSE	1.6	1.3	0.3	0.0	0.0	3.2
S	0.7	1.6	0.0	0.0	0.0	2.3
SSW	1.3	1.3	0.0	0.0	0.0	2.6
SW	1.0	2.3	0.3	0.0	0.0	3.6
WSW	0.7	2.6	0.0	0.0	0.0	3.3
W	0.4	1.6	0.0	0.0	0.0	2.0
WNW	0.0	0.6	0.1	0.0	0.0	0.7
NW	0.6	2.0	0.7	0.0	0.0	3.3
NNW	0.3	2.8	0.6	0.0	0.0	3.6
Total	27.4	53.9	18.4	0.3	0.0	100.0

Apx Figure 3: February 2020 significant wave height appearance rate by wave direction (unit: %).

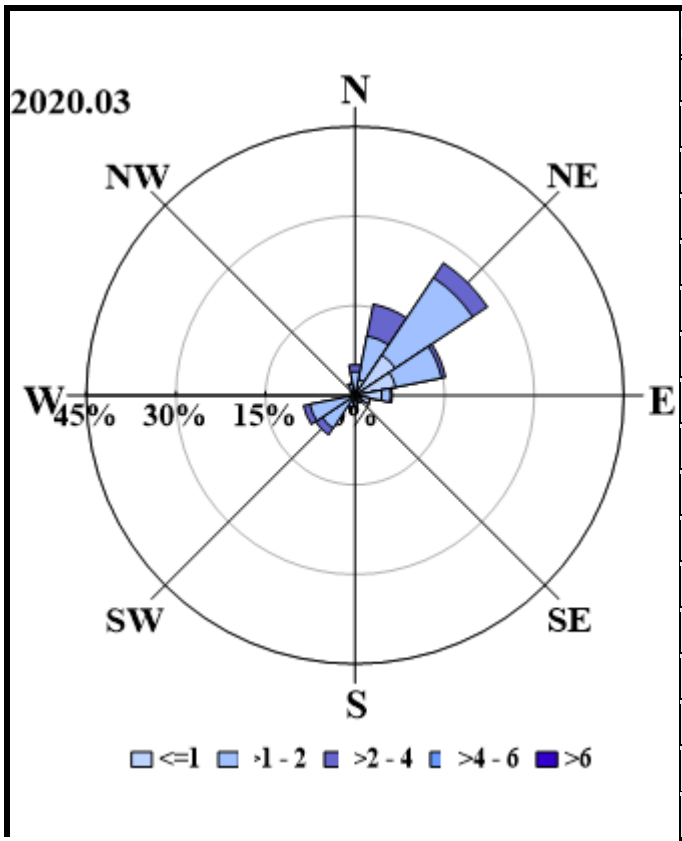


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	11.6	20.6	1.6	0.0	0.0	33.8
5.0 ~ 10.0	15.7	30.1	6.2	0.0	0.0	52.0
10.0 ≤	0.1	3.2	10.6	0.3	0.0	14.2
Total	27.4	53.9	18.4	0.3	0.0	100.0

Apx Figure 4: February 2020 significant wave height appearance rate by wave period (unit: %).

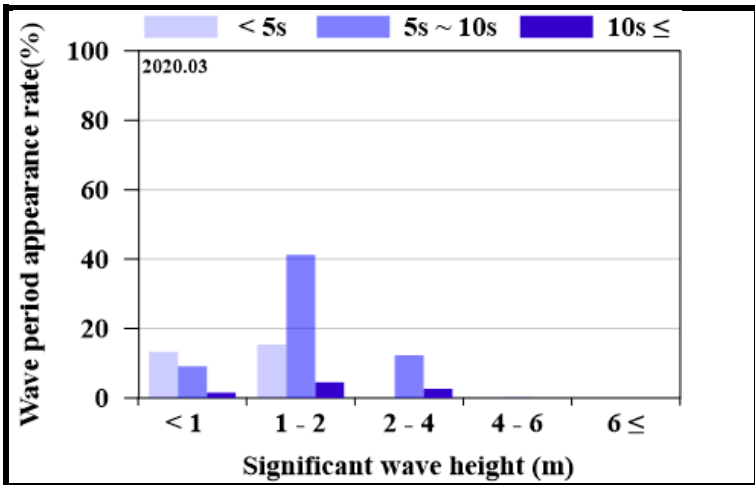
In February, the significant wave height appearance rates of the NNE ~ ENE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (27.7%), NNE (20.9%), and ENE (12.5%).

As for significant wave height appearance rate by wave period, the wave of 5 to 10 seconds was predominant at 52.0%, and the significant wave height of 1~2m was the most dominant at 53.9%. In addition, the wave height of 2 m or higher was 18.7%, and the wave height of 4 m or higher was 0.3%.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	0.1	3.7	1.4	0.0	0.0	5.1
NNE	1.9	8.1	5.5	0.0	0.0	15.6
NE	6.4	16.6	3.5	0.1	0.0	26.7
ENE	5.3	9.5	0.7	0.0	0.0	15.4
E	4.1	1.9	0.3	0.0	0.0	6.2
ESE	2.6	0.1	0.0	0.0	0.0	2.7
SE	1.4	0.1	0.1	0.0	0.0	1.6
SSE	0.7	0.7	0.0	0.0	0.0	1.4
S	0.4	1.4	0.1	0.0	0.0	1.9
SSW	0.8	1.1	0.4	0.0	0.0	2.3
SW	0.3	6.2	1.5	0.0	0.0	8.0
WSW	0.0	7.6	1.2	0.0	0.0	8.8
W	0.0	0.5	0.0	0.0	0.0	0.5
WNW	0.0	0.5	0.0	0.0	0.0	0.5
NW	0.0	1.1	0.0	0.0	0.0	1.1
NNW	0.0	2.0	0.1	0.0	0.0	2.2
Total	23.8	61.2	14.9	0.1	0.0	100.0

Apx Figure 5: March 2020 significant wave height appearance rate by wave direction (unit: %).

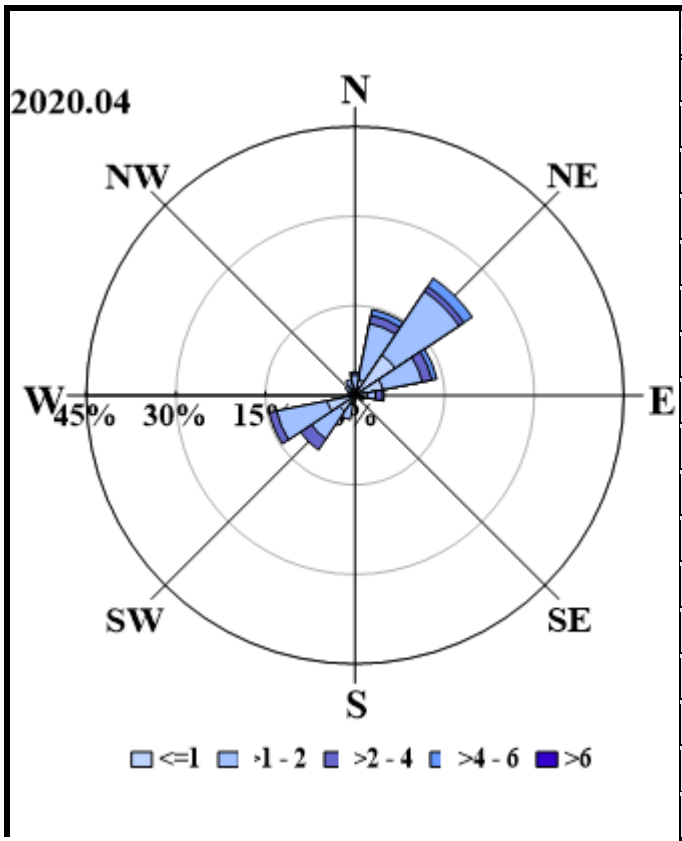


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	13.3	15.4	0.0	0.0	0.0	28.7
5.0 ~ 10.0	9.1	41.3	12.3	0.1	0.0	62.8
10.0 ≤	1.5	4.5	2.6	0.0	0.0	8.5
Total	23.8	61.2	14.9	0.1	0.0	100.0

Apx Figure 6: March 2020 significant wave height appearance rate by wave period (unit: %).

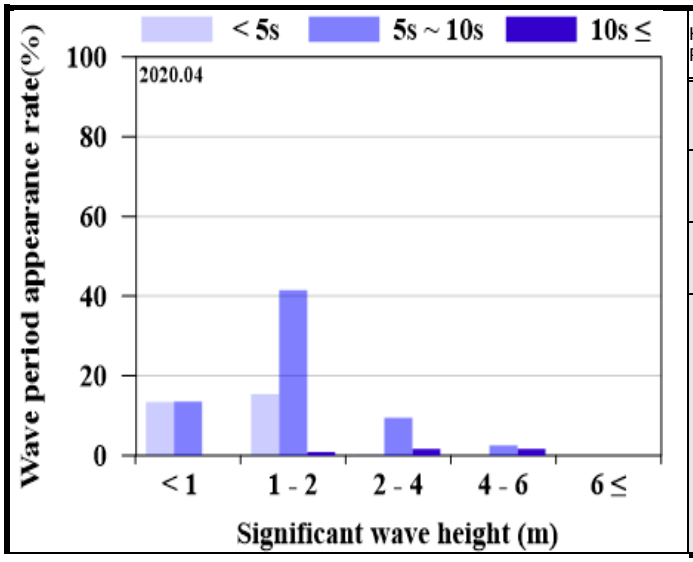
In March, the significant wave height appearance rates of the NNE ~ ENE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (26.7%), NNE (15.6%), and ENE (15.4%).

As for significant wave height appearance rate by wave period, the wave of 5 to 10 seconds was predominant at 62.8%, and the significant wave height of 1~2 m was the most dominant at 61.2%. In addition, 15.0% of wave heights over 2m were found and 0.1% of wave heights over 4m high.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	0.7	2.5	0.6	0.1	0.0	3.9
NNE	2.1	9.6	2.0	1.0	0.0	14.6
NE	6.0	14.5	1.3	1.8	0.0	23.6
ENE	4.2	7.0	2.0	0.8	0.0	13.9
E	2.1	1.3	1.3	0.3	0.0	4.9
ESE	1.1	0.3	0.1	0.0	0.0	1.5
SE	0.0	0.0	0.0	0.0	0.0	0.0
SSE	0.0	0.1	0.0	0.0	0.0	0.1
S	0.1	0.7	0.0	0.0	0.0	0.8
SSW	1.3	2.9	0.0	0.0	0.0	4.2
SW	2.8	5.6	2.6	0.0	0.0	11.0
WSW	3.9	9.3	1.4	0.0	0.0	14.6
W	0.3	0.4	0.0	0.0	0.0	0.7
WNW	0.6	0.6	0.0	0.1	0.0	1.3
NW	0.8	1.0	0.1	0.0	0.0	2.0
NNW	1.0	1.8	0.0	0.0	0.0	2.8
Total	26.9	57.6	11.3	4.2	0.0	100.0

Apx Figure 7: April 2020 significant wave height appearance rate by wave direction (unit: %).

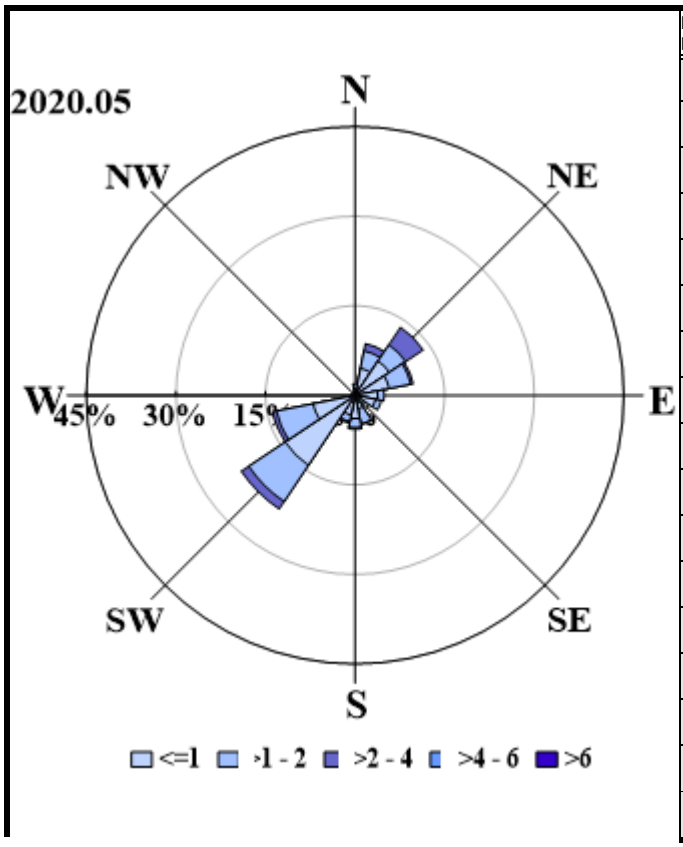


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	13.4	15.3	0.1	0.0	0.0	28.9
5.0 ~ 10.0	13.5	41.4	9.5	2.5	0.0	66.9
10.0 ≤	0.0	0.8	1.7	1.7	0.0	4.2
Total	26.9	57.6	11.3	4.2	0.0	100.0

Apx Figure 8: April 2020 significant wave height appearance rate by wave period (unit: %).

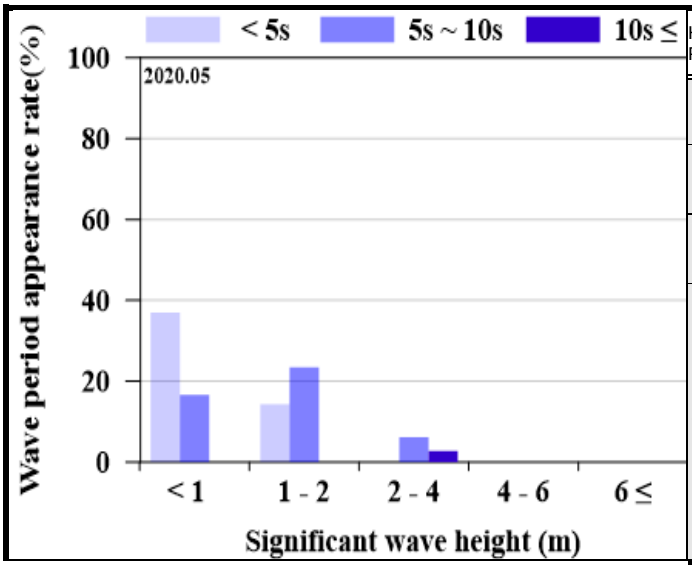
In April, the significant wave height appearance rates of the NNE ~ NE and WSW series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (23.6%), NNE (14.6%), and WSW (16.6%).

As for significant wave height appearance rate by wave period, the wave of 5 to 10 seconds was predominant at 66.9%, and the significant wave height of 1~2 m was the most dominant at 57.6%. In addition, the wave height of 2 m or higher was 15.5%, and the wave height of 4 m or higher was 4.2%.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	0.8	1.1	0.0	0.0	0.0	1.9
NNE	3.9	3.7	1.2	0.0	0.0	8.8
NE	6.6	3.4	3.7	0.0	0.0	13.7
ENE	5.4	4.1	0.4	0.0	0.0	9.9
E	3.4	1.5	0.0	0.0	0.0	4.9
ESE	3.3	1.2	0.0	0.0	0.0	4.5
SE	1.4	0.7	0.0	0.0	0.0	2.0
SSE	1.6	3.1	0.3	0.0	0.0	5.0
S	3.7	1.6	0.4	0.0	0.0	5.7
SSW	3.3	1.2	0.3	0.0	0.0	4.7
SW	12.5	8.7	1.8	0.0	0.0	22.9
WSW	6.2	7.0	0.8	0.0	0.0	14.1
W	0.7	0.0	0.0	0.0	0.0	0.7
WNW	0.1	0.0	0.0	0.0	0.0	0.1
NW	0.3	0.3	0.0	0.0	0.0	0.5
NNW	0.4	0.1	0.0	0.0	0.0	0.5
Total	53.5	37.7	8.8	0.0	0.0	100.0

Apx Figure 9: May 2020 significant wave height appearance rate by wave direction (unit: %).

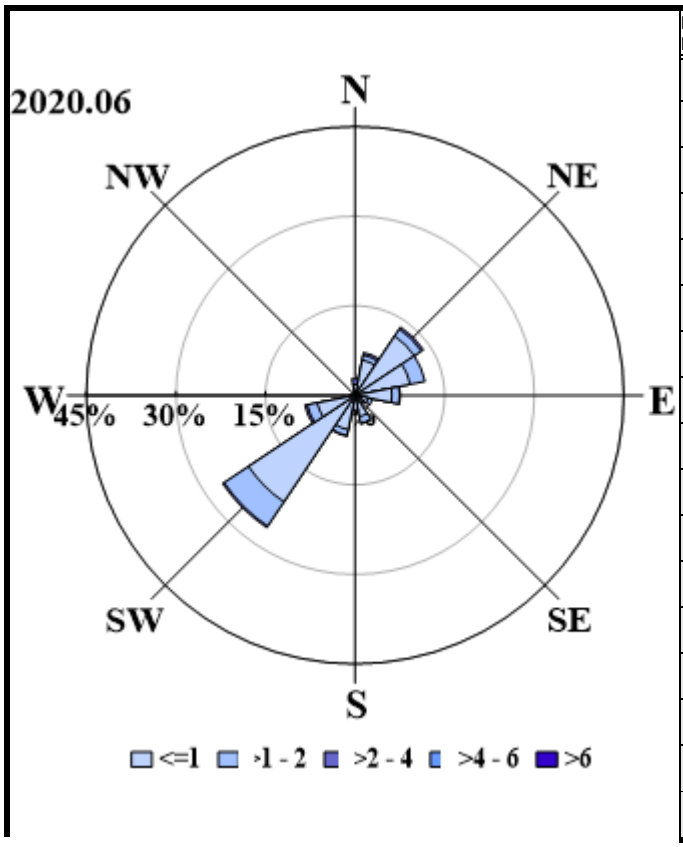


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	36.9	14.2	0.0	0.0	0.0	51.2
5.0 ~ 10.0	16.6	23.5	6.1	0.0	0.0	46.1
10.0 ≤	0.0	0.0	2.7	0.0	0.0	2.7
Total	53.5	37.7	8.8	0.0	0.0	100.0

Apx Figure 10: May 2020 significant wave height appearance rate by wave period (unit: %).

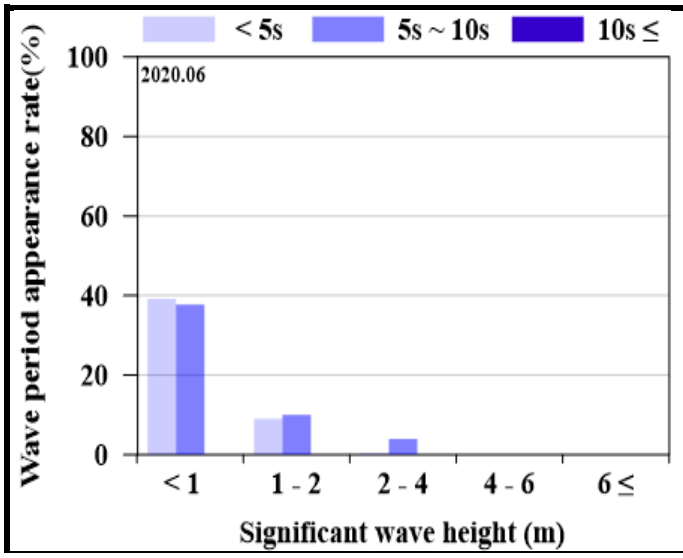
In May, the significant wave height appearance rates of SW ~ WSW and NE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of SW (22.9%), WSW (14.1%), and NE (13.7%).

As for significant wave height appearance rate by wave period, the significant wave of less than 5 seconds was predominant at 21.2%. and the significant wave height of less than 1 m was the most dominant at 53.5%. In addition, the wave height of 2 m or higher was 8.8%, and wave heights higher than 4 m did not appear.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	1.8	0.0	1.0	0.0	0.0	2.8
NNE	6.0	0.6	0.7	0.0	0.0	7.3
NE	11.1	2.1	0.6	0.0	0.0	13.7
ENE	8.8	2.8	0.3	0.0	0.0	11.9
E	6.2	1.3	0.1	0.0	0.0	7.6
ESE	2.1	0.8	0.0	0.0	0.0	2.9
SE	1.5	0.1	0.1	0.0	0.0	1.8
SSE	3.6	1.1	0.1	0.0	0.0	4.9
S	2.5	0.0	0.3	0.0	0.0	2.8
SSW	5.6	1.3	0.1	0.0	0.0	7.0
SW	19.6	6.6	0.4	0.0	0.0	26.6
WSW	5.9	2.2	0.4	0.0	0.0	8.6
W	0.8	0.0	0.0	0.0	0.0	0.8
WNW	0.3	0.0	0.0	0.0	0.0	0.3
NW	0.1	0.0	0.0	0.0	0.0	0.1
NNW	0.7	0.0	0.0	0.0	0.0	0.7
Total	76.9	18.9	4.2	0.0	0.0	100.0

Apx Figure 11: June 2020 significant wave height appearance rate by wave direction (unit: %).

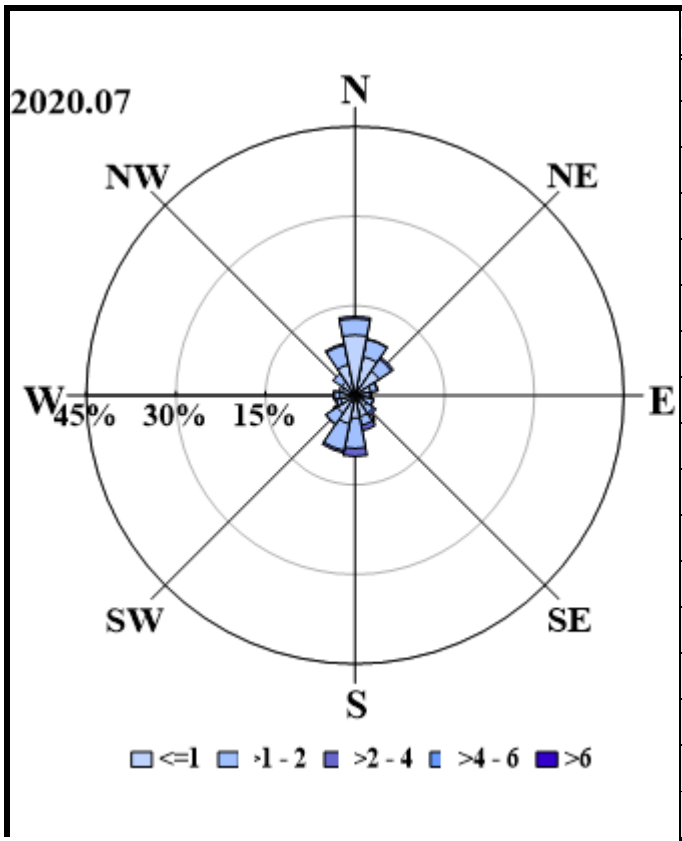


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	39.1	9.0	0.3	0.0	0.0	48.4
5.0 ~ 10.0	37.7	10.0	3.9	0.0	0.0	51.6
10.0 ≤	0.0	0.0	0.0	0.0	0.0	0.0
Total	76.9	18.9	4.2	0.0	0.0	100.0

Apx Figure 12: June 2020 significant wave height appearance rate by wave period (unit: %).

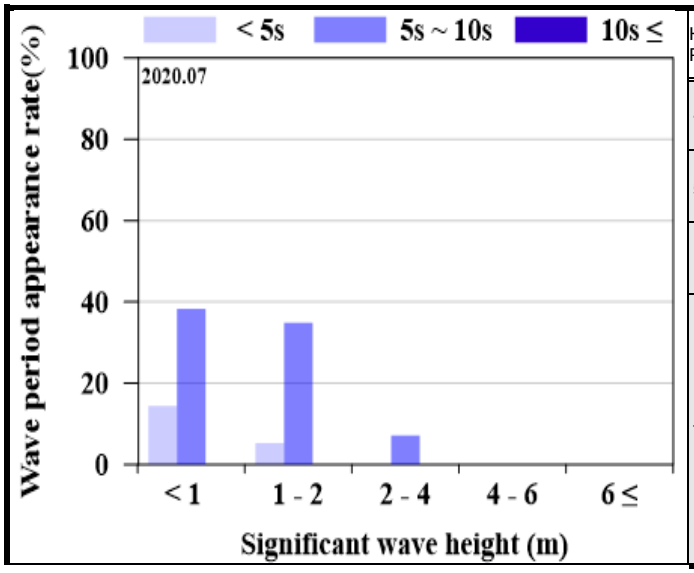
In June, the significant wave height appearance rates of SW and NE ~ ENE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of SW (26.6%), NE (13.7%), and ENE (11.9%).

As for significant wave height appearance rate by wave period, the significant wave of 5 to 10 seconds were predominant at 51.6%, and the significant wave height of less than 1 m was the most dominant at 76.9%. In addition, the wave height of 2 m or higher was 4.2%, and wave heights higher than 4 m did not appear.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	8.0	4.9	0.4	0.0	0.0	13.2
NNE	5.4	3.8	0.5	0.0	0.0	9.7
NE	4.3	3.0	0.4	0.0	0.0	7.7
ENE	2.7	0.9	0.3	0.0	0.0	3.9
E	0.8	1.8	0.3	0.0	0.0	2.8
ESE	1.3	1.6	0.3	0.0	0.0	3.2
SE	2.3	0.8	1.1	0.0	0.0	4.2
SSE	3.5	1.6	0.9	0.0	0.0	6.1
S	3.5	5.3	1.5	0.0	0.0	10.2
SSW	4.4	4.9	0.5	0.0	0.0	9.8
SW	3.6	2.0	0.3	0.0	0.0	5.9
WSW	2.3	0.9	0.1	0.0	0.0	3.4
W	2.6	0.9	0.1	0.0	0.0	3.6
WNW	2.2	0.7	0.0	0.0	0.0	2.8
NW	2.4	2.0	0.0	0.0	0.0	4.4
NNW	3.4	5.1	0.4	0.0	0.0	8.9
Total	52.7	40.2	7.1	0.0	0.0	100.0

Apx Figure 13: July 2020 significant wave height appearance rate by wave direction (unit: %).

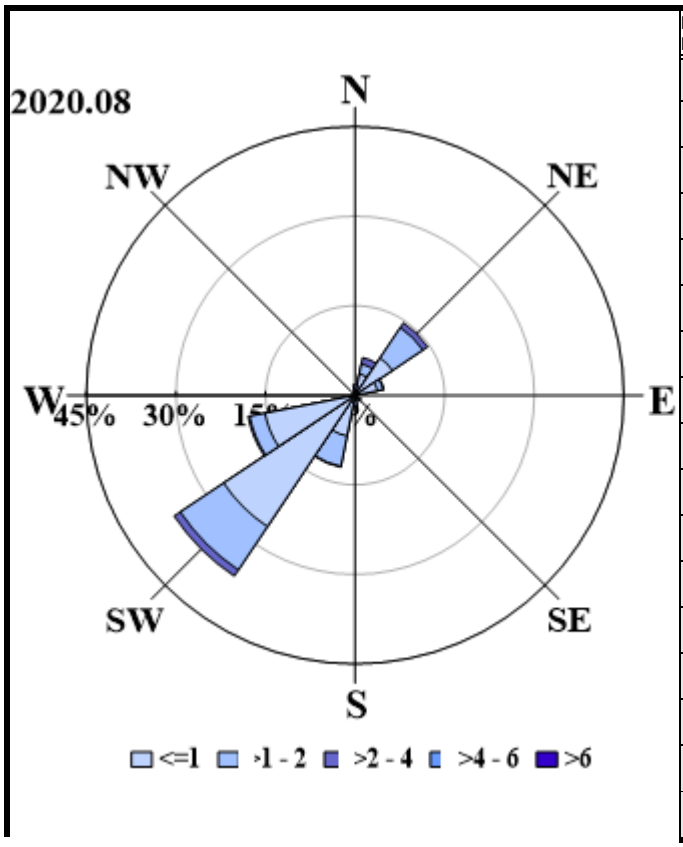


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	14.4	5.3	0.0	0.0	0.0	19.7
5.0 ~ 10.0	38.3	34.9	7.1	0.0	0.0	80.3
10.0 ≤	0.0	0.0	0.0	0.0	0.0	0.0
Total	52.7	40.2	7.1	0.0	0.0	100.0

Apx Figure 14: July 2020 significant wave height appearance rate by wave period (unit: %).

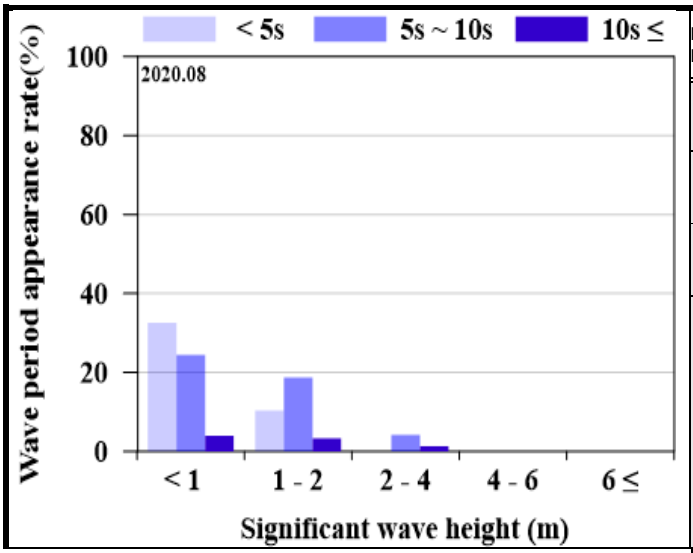
In July, the significant wave height appearance of the N and S ~ SSW series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of N (13.2%), S (10.2%), and SSW (9.8%).

As for significant wave height appearance rate by wave period, the significant wave of 5 to 10 seconds were predominant at 80.3%, and the significant wave heights less than 1 m were the most dominant at 52.7%. In addition, the wave height of 2 m or higher was 7.1%, and wave heights higher than 4 m did not appear.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	0.8	0.1	0.8	0.0	0.0	1.8
NNE	2.9	2.5	1.1	0.0	0.0	6.4
NE	7.0	6.5	1.1	0.0	0.0	14.6
ENE	3.8	1.0	0.1	0.0	0.0	4.9
E	0.1	0.0	0.0	0.0	0.0	0.1
ESE	0.0	0.4	0.0	0.0	0.0	0.4
SE	0.4	0.7	0.1	0.0	0.0	1.2
SSE	0.1	0.4	0.0	0.0	0.0	0.5
S	0.7	1.1	0.1	0.0	0.0	1.9
SSW	6.4	5.6	0.3	0.0	0.0	12.3
SW	23.9	10.9	1.6	0.0	0.0	36.4
WSW	14.5	3.5	0.3	0.0	0.0	18.3
W	0.4	0.0	0.0	0.0	0.0	0.4
WNW	0.1	0.0	0.0	0.0	0.0	0.1
NW	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.5	0.0	0.0	0.0	0.0	0.5
Total	61.7	32.7	5.6	0.0	0.0	100.0

Apx Figure 15: August 2020 significant wave height appearance rate by wave direction (unit: %).

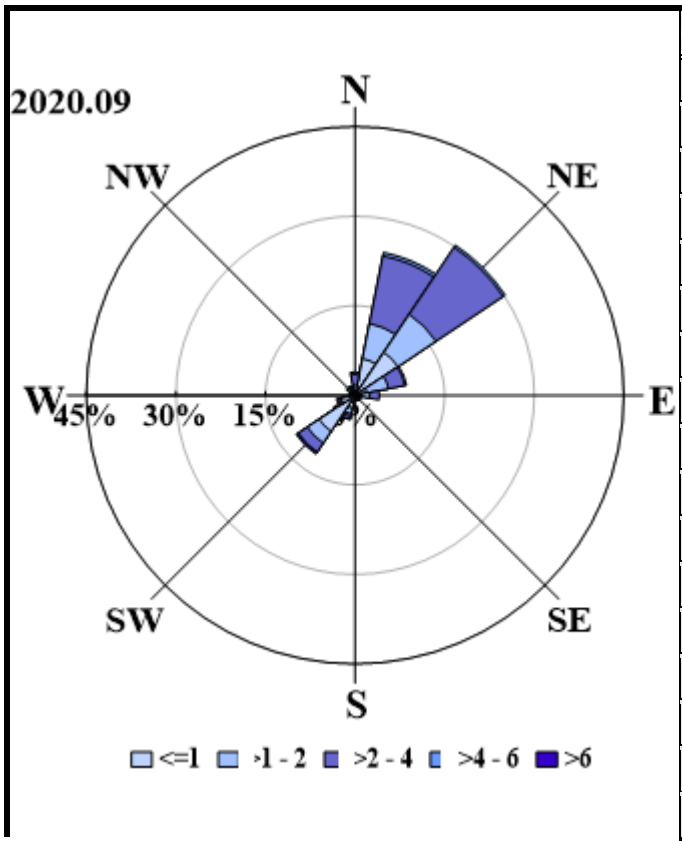


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	33.0	10.5	0.0	0.0	0.0	43.5
5.0 ~ 10.0	24.7	19.0	4.2	0.0	0.0	47.9
10.0 ≤	4.0	3.3	1.4	0.0	0.0	8.6
Total	61.7	32.7	5.6	0.0	0.0	100.0

Apx Figure 16: August 2020 significant wave height appearance rate by wave period (unit: %).

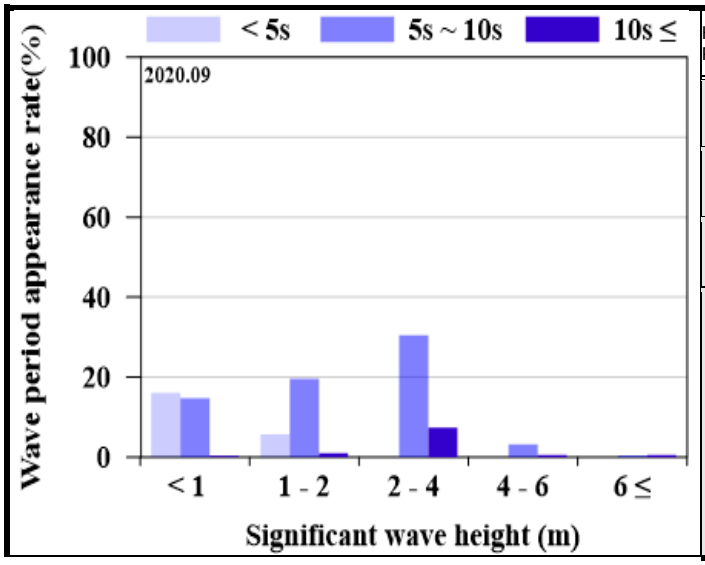
In August, the significant wave height appearance rates of SW ~ WSW and NE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of SW (36.4%), WSW (18.3%), and NE (14.6%).

As for significant wave height appearance rate by wave period, the significant wave of 5 to 10 seconds was predominant 47.9%, and the wave height less than 1 m was the most dominant at 61.7%. In addition, the wave height of 2 m or higher was 7.1%, and wave heights of 4 m or higher did not appear.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	0.4	1.1	1.9	0.4	0.0	3.9
NNE	5.0	6.4	12.4	0.6	0.0	24.4
NE	6.7	8.6	14.3	0.6	0.0	30.2
ENE	1.8	3.9	2.8	0.3	0.0	8.8
E	0.8	1.7	1.5	0.0	0.0	4.0
ESE	0.6	0.1	0.4	0.0	0.0	1.1
SE	0.1	0.1	0.3	0.1	0.4	1.1
SSE	0.4	0.0	0.4	0.1	0.0	1.0
S	0.4	0.1	0.0	0.1	0.1	0.8
SSW	1.9	1.3	0.4	0.4	0.1	4.2
SW	6.8	2.6	1.9	0.1	0.3	11.8
WSW	2.4	0.1	0.4	0.3	0.0	3.2
W	0.8	0.0	0.0	0.0	0.0	0.8
WNW	1.0	0.0	0.1	0.0	0.0	1.1
NW	1.3	0.1	0.0	0.4	0.0	1.8
NNW	0.6	0.0	0.8	0.3	0.0	1.7
Total	31.1	26.3	37.9	3.8	1.0	100.0

Apx Figure 17: September 2020 significant wave height appearance rate by wave direction (unit: %).

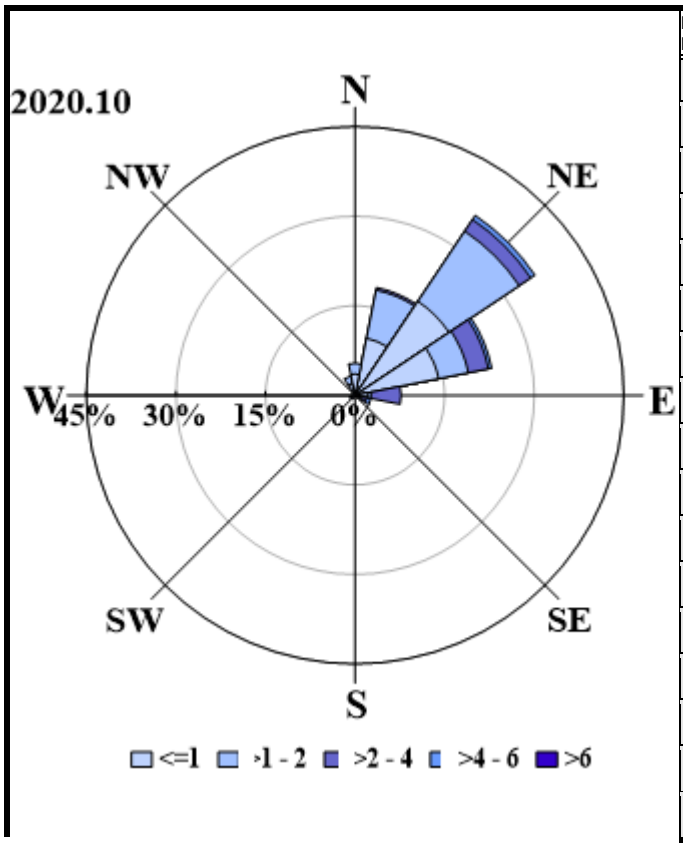


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	16.0	5.7	0.0	0.0	0.0	21.7
5.0 ~ 10.0	14.8	19.6	30.5	3.2	0.4	68.5
10.0 ≤	0.3	1.0	7.4	0.6	0.6	9.7
Total	31.1	26.3	37.9	3.8	1.0	100.0

Apx Figure 18: September 2020 significant wave height appearance rate by wave period (unit: %).

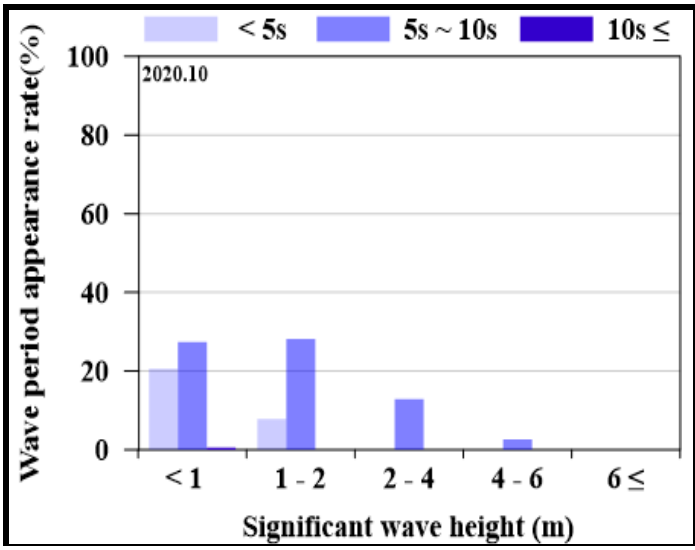
In September, the significant wave height appearance rates of the NNE ~ NE and SW series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (30.2%), NNE (24.4%), and SW (11.8%).

As for significant wave height appearance rate by wave period, the significant wave of 5 to 10 seconds was predominant at 68.5%, and the wave height of 2 m to 4 m was the most dominant at 37.9%. In addition, the wave height of 2 m or higher was 42.7%, and wave heights of 4 m or higher was 4.8% .



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	3.4	1.9	0.0	0.0	0.0	5.3
NNE	7.5	10.0	0.8	0.0	0.0	18.4
NE	17.4	14.8	3.2	0.8	0.0	36.2
ENE	12.8	6.6	3.4	0.5	0.0	23.3
E	2.2	0.4	4.8	0.3	0.0	7.7
ESE	1.1	0.3	0.5	0.8	0.0	2.7
SE	0.3	0.0	0.0	0.1	0.0	0.4
SSE	0.0	0.0	0.0	0.0	0.0	0.0
S	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.0	0.0	0.1	0.0	0.0	0.1
SW	0.5	0.1	0.0	0.0	0.0	0.7
WSW	0.5	0.4	0.0	0.0	0.0	1.0
W	0.4	0.0	0.0	0.0	0.0	0.4
WNW	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.3	0.1	0.0	0.0	0.0	0.4
NNW	2.1	1.2	0.0	0.0	0.0	3.3
Total	48.6	35.9	12.9	2.6	0.0	100.0

Apx Figure 19: October 2020 significant wave height appearance rate by wave direction (unit: %).

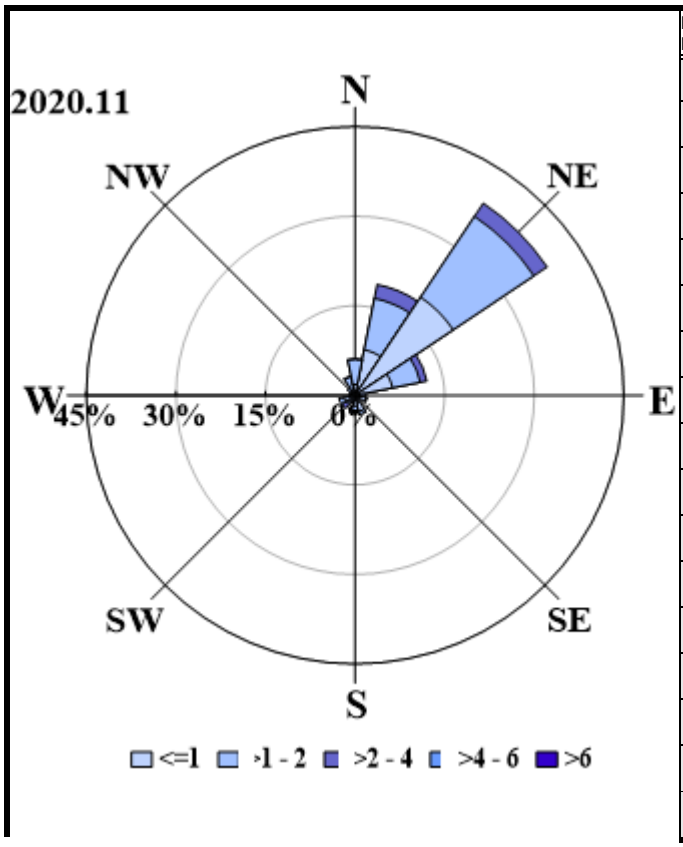


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	20.6	7.8	0.0	0.0	0.0	28.4
5.0 ~ 10.0	27.4	28.1	12.9	2.6	0.0	71.1
10.0 ≤	0.5	0.0	0.0	0.0	0.0	0.5
Total	48.6	35.9	12.9	2.6	0.0	100.0

Apx Figure 20: October 2020 significant wave height appearance rate by wave period (unit: %).

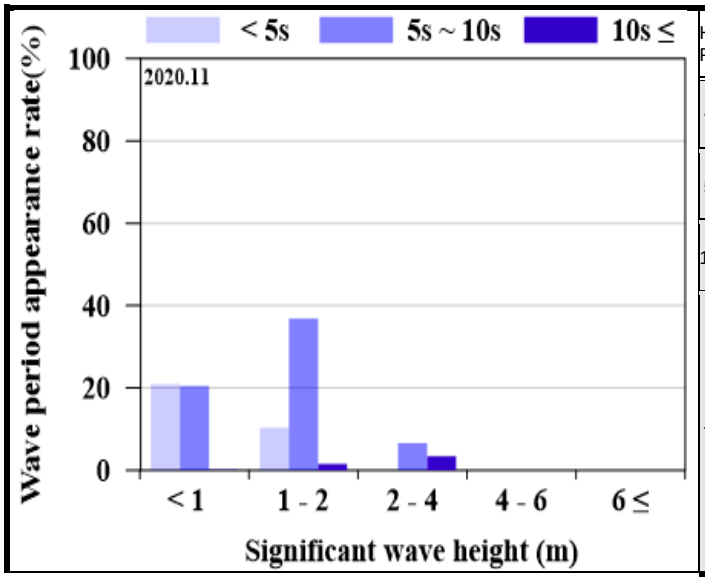
In October, the significant wave height appearance rates of the NNE ~ ENE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (36.2%), ENE (23.3%), and NNE (18.4%).

As for significant wave height appearance rate by wave period, the significant wave of 5 to 10 seconds was predominant at 71.1%, and the wave height less than 1 m was the most dominant at 48.6%. In addition, the wave height of 2 m or higher was 15.5%, and wave heights of 4 m or higher was 2.6%.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	1.5	4.2	0.4	0.0	0.0	6.1
NNE	6.1	9.9	2.9	0.0	0.0	18.9
NE	16.1	19.2	3.3	0.0	0.0	38.7
ENE	5.8	5.1	1.3	0.0	0.0	12.2
E	0.6	1.1	0.0	0.0	0.0	1.7
ESE	1.9	0.1	0.0	0.0	0.0	2.1
SE	0.3	0.1	0.0	0.0	0.0	0.4
SSE	2.2	1.1	0.0	0.0	0.0	3.3
S	1.1	1.5	0.3	0.0	0.0	2.9
SSW	0.1	0.7	0.6	0.0	0.0	1.4
SW	1.4	0.4	0.8	0.0	0.0	2.6
WSW	1.7	1.1	0.0	0.0	0.0	2.8
W	0.7	0.3	0.0	0.0	0.0	1.0
WNW	0.6	0.4	0.0	0.0	0.0	1.0
NW	0.6	0.8	0.1	0.0	0.0	1.5
NNW	0.7	2.5	0.1	0.0	0.0	3.3
Total	41.4	48.7	9.9	0.0	0.0	100.0

Apx Figure 21: November 2020 significant wave height appearance rate by wave direction (unit: %).

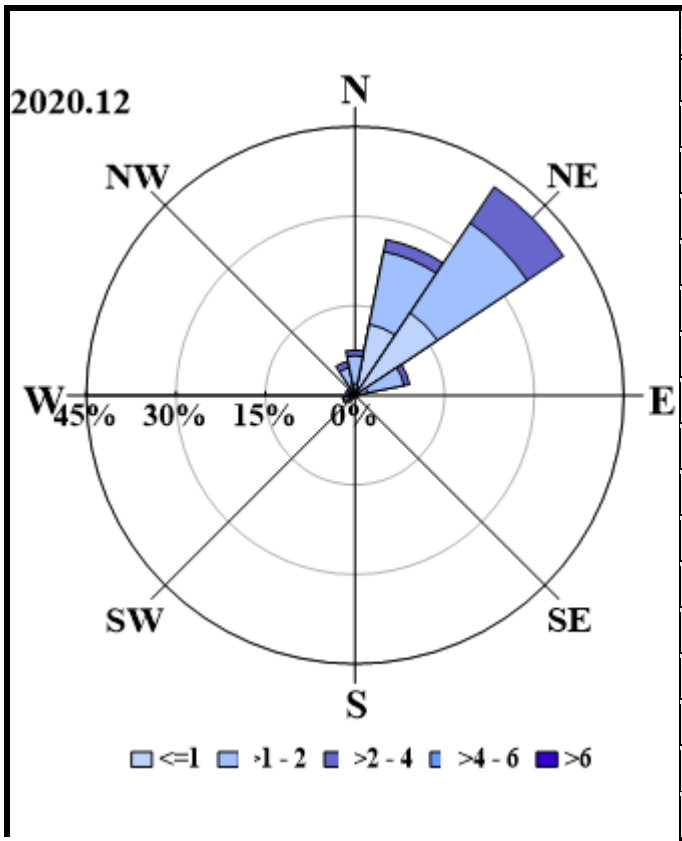


Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	20.9	10.3	0.0	0.0	0.0	31.2
5.0 ~ 10.0	20.4	36.9	6.5	0.0	0.0	63.8
10.0 ≤	0.1	1.5	3.3	0.0	0.0	5.0
Total	41.4	48.7	9.9	0.0	0.0	100.0

Apx Figure 22: November 2020 significant wave height appearance rate by wave period (unit: %).

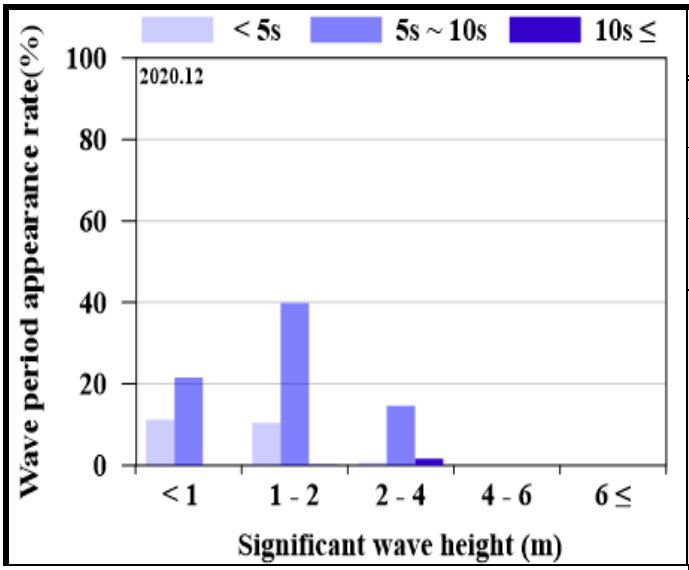
In November, the significant wave height appearance rates of the NNE ~ ENE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (38.7%), NNE (18.9%), and ENE (12.2%).

As for significant wave height appearance rate by wave period, the significant wave of 5 to 10 seconds were predominant at 63.8%, and the wave height of 1 to 2 m was the most dominant at 48.7%. In addition, the wave height of 2 m or higher was 9.9%, and wave heights higher than 4m did not appear.



Height(m) Direction	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	>6	Total
N	1.6	4.6	1.3	0.0	0.0	7.6
NNE	10.8	13.0	2.8	0.0	0.0	26.6
NE	14.0	19.4	8.5	0.0	0.0	42.0
ENE	1.5	6.7	1.1	0.0	0.0	9.3
E	0.0	0.7	0.0	0.0	0.0	0.7
ESE	0.3	0.0	0.0	0.0	0.0	0.3
SE	0.5	0.0	0.0	0.0	0.0	0.5
SSE	0.1	0.0	0.0	0.0	0.0	0.1
S	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.3	0.0	0.0	0.0	0.0	0.3
SW	0.5	0.9	0.0	0.0	0.0	1.5
WSW	0.9	0.8	0.4	0.0	0.0	2.2
W	0.1	0.0	0.0	0.0	0.0	0.1
WNW	0.7	0.0	0.9	0.0	0.0	1.6
NW	0.1	0.8	0.5	0.0	0.0	1.5
NNW	1.2	3.4	1.2	0.0	0.0	5.8
Total	32.8	50.3	16.9	0.0	0.0	100.0

Apx Figure 23: December 2020 significant wave height appearance rate by wave direction (unit: %).



Height(m) Period(sec)	≤ 1	1 ~ 2	2 ~ 4	4 ~ 6	6 <	Total
<5.0	11.2	10.4	0.7	0.0	0.0	22.3
5.0 ~ 10.0	21.6	39.8	14.6	0.0	0.0	76.0
10.0 ≤	0.0	0.1	1.6	0.0	0.0	1.8
Total	32.8	50.3	16.9	0.0	0.0	100.0

Apx Figure 24: December 2020 significant wave height appearance rate by wave period (unit: %).

In December, the significant wave height appearance rates of the NNE ~ ENE series were largely predominant, and the significant wave height appearance rate by wave direction was highest in the order of NE (42.0%), NNE (26.6%), and ENE (9.3%).

As for significant wave height appearance rate by wave period, the significant wave of 5 to 10 seconds were predominant at 76.0%, and the wave height of 1 m to 2 m was the most dominant at 50.3%. In addition, the wave height of 2 m or higher was 16.9%, and wave heights higher than 4m did not appear.

Appendix A-3: Baseline Survey Coordinates

Marine mammal coordinates of encounters near the proposed Project Site.

Common name	WGS-84		Common name	WGS-84	
	Latitude	Longitude		Latitude	Longitude
Pacific White-sided Dolphin	35°44’6.84”N	129°40’24.01”E	Common Bottlenose Dolphin	35°21’14.47”N	129°48’24.22”E
	35°36’44.05”N	129°35’41.57”E		35°41’29.87”N	130° 3’1.36”E
	35°35’18.49”N	129°32’19.15”E	Risso’s dolphin	35°21’14.47”N	129°48’24.22”E
	35°33’5.60”N	129°32’39.29”E	Common Dolphin	35° 8’24.65”N	129°34’33.63”E
	35°29’22.11”N	129°32’0.99”E		35°14’11.52”N	129°17’45.80”E
	35°26’31.54”N	129°30’30.28”E		35°19’42.87”N	129°27’26.89”E
	35°26’16.29”N	129°34’57.95”E		35°20’2.91”N	35°20’2.91”N
	35°24’45.68”N	129°33’39.96”E		35°25’10.28”N	129°25’27.52”E
	35°18’42.91”N	129°28’15.07”E		35°25’34.22”N	129°31’49.00”E
	35°14’52.97”N	129°23’16.49”E		35°27’1.20”N	129°38’10.25”E
	35°14’57.71”N	129°20’59.52”E		35°32’48.00”N	129°30’47.47”E
	36°17’1.56”N	129°26’14.52”E		35°30’5.07”N	129°38’43.32”E
	36°26’11.78”N	129°31’23.53”E		35°31’21.43”N	129°48’1.46”E
	36°28’15.24”N	129°30’6.10”E		35°32’29.33”N	130° 2’15.58”E
	36°31’18.59”N	129°27’18.70”E		35°34’11.61”N	129°35’14.27”E
Minke Whale	35° 7’7.70”N	129°16’10.55”E		35°31’58.04”N	129°38’18.96”E
	35°15’19.51”N	129°24’48.73”E		35°33’31.28”N	129°44’48.94”E
	35°15’59.66”N	129°27’54.02”E		35°36’37.68”N	129°52’9.04”E
	35°17’50.84”N	129°34’12.46”E		35°36’40.87”N	129°30’48.62”E
	35°18’2.64”N	129°38’35.61”E		35°40’10.19”N	129°33’2.25”E
	35°16’42.99”N	129°38’25.15”E		35°38’33.97”N	129°41’47.52”E
	35°18’48.26”N	129°48’3.42”E		35°42’49.28”N	129°37’14.61”E
	35°20’45.21”N	130° 0’53.16”E		35°41’54.65”N	129°45’34.44”E
	35°22’55.24”N	130° 9’23.49”E		35°41’6.62”N	130°14’49.38”E
	35°24’56.34”N	129°32’5.23”E	Finless Porpoise	35°28’25.80”N	129°24’0.76”E
	35°27’9.53”N	129°35’54.03”E		35°38’9.28”N	129°29’59.89”E
	35°25’44.39”N	129°42’19.77”E		35°39’31.08”N	129°28’18.91”E
	35°25’40.39”N	129°47’7.40”E		35°40’24.71”N	129°31’14.24”E
	35°18’48.26”N	129°48’3.42”E	Spotted Seal	35°11’1.96”N	129°12’38.35”E
	35°25’42.16”N	129°53’32.36”E		35°28’18.64”N	129°24’50.68”E
	35°20’45.21”N	130° 0’53.16”E		35°32’4.35”N	129°26’43.05”E
	35°22’55.24”N	130° 9’23.49”E		35°33’53.78”N	129°27’19.26”E
	35°32’3.93”N	129°34’54.23”E			
	35°30’49.42”N	129°38’37.83”E			
	35°33’45.11”N	129°46’9.38”E			
	35°35’9.96”N	129°49’41.40”E			
	35°37’50.82”N	129°53’33.37”E			
	35°38’14.02”N	129°35’54.76”E			
	35°43’10.34”N	129°48’52.68”E			

Coordinates for marine mammal acoustic logger positioning and survey transects.

Coordinate System: WGS 1984 UTM Zone 52N		
Logger ID	**Latitude (DMS)**	**Longitude (DMS)**
L01	35° 21’ 34.673” N	129° 21’ 46.543” E
L02	35° 24’ 6.880” N	129° 21’ 47.225” E

L03	35° 21’ 34.552” N	129° 22’ 26.168” E
L04	35° 26’ 59.151” N	129° 22’ 27.668” E
L05	35° 28’ 45.883” N	130° 2’ 2.141” E

Coordinate System: WGS 1984 UTM Zone 52N				
Location	**Transect ID**	**Order**	**Latitude (DMS)**	**Longitude (DMS)**
Nearshore transect	NS01	Start	35° 21’ 34.673” N	129° 21’ 46.543” E
Nearshore transect	NS01	End	35° 24’ 6.880” N	129° 21’ 47.225” E
Nearshore transect	NS02	Start	35° 21’ 34.552” N	129° 22’ 26.168” E
Nearshore transect	NS02	End	35° 26’ 59.151” N	129° 22’ 27.668” E
Nearshore transect	NS03	Start	35° 21’ 34.427” N	129° 23’ 5.792” E
Nearshore transect	NS03	End	35° 26’ 59.026” N	129° 23’ 7.336” E
Nearshore transect	NS04	Start	35° 21’ 34.299” N	129° 23’ 45.417” E
Nearshore transect	NS04	End	35° 26’ 58.898” N	129° 23’ 47.005” E
Nearshore transect	NS05	Start	35° 21’ 34.168” N	129° 24’ 25.041” E
Nearshore transect	NS05	End	35° 26’ 58.766” N	129° 24’ 26.674” E
Offshore transect	OS01	Start	35° 24’ 3.940” N	129° 59’ 47.539” E
Offshore transect	OS01	End	35° 33’ 55.760” N	129° 54’ 21.450” E
Offshore transect	OS02	Start	35° 24’ 30.580” N	130° 0’ 59.842” E
Offshore transect	OS02	End	35° 34’ 22.451” N	129° 55’ 33.873” E
Offshore transect	OS03	Start	35° 24’ 57.207” N	130° 2’ 12.158” E
Offshore transect	OS03	End	35° 34’ 49.130” N	129° 56’ 46.309” E
Offshore transect	OS04	Start	35° 25’ 23.822” N	130° 3’ 24.487” E
Offshore transect	OS04	End	35° 35’ 15.797” N	129° 57’ 58.759” E
Offshore transect	OS05	Start	35° 25’ 50.425” N	130° 4’ 36.829” E
Offshore transect	OS05	End	35° 35’ 42.451” N	129° 59’ 11.221” E
Offshore transect	OS06	Start	35° 26’ 17.015” N	130° 5’ 49.184” E
Offshore transect	OS06	End	35° 36’ 9.093” N	130° 0’ 23.696” E
Offshore transect	OS07	Start	35° 26’ 43.593” N	130° 7’ 1.552” E
Offshore transect	OS07	End	35° 36’ 35.723” N	130° 1’ 36.185” E
Offshore transect	OS08	Start	35° 27’ 10.159” N	130° 8’ 13.933” E
Offshore transect	OS08	End	35° 37’ 2.340” N	130° 2’ 48.687” E
Offshore transect	OS09	Start	35° 27’ 36.713” N	130° 9’ 26.326” E
Offshore transect	OS09	End	35° 37’ 28.945” N	130° 4’ 1.202” E
Offshore transect	OS10	Start	35° 28’ 3.254” N	130° 10’ 38.733” E
Offshore transect	OS10	End	35° 37’ 55.538” N	130° 5’ 13.730” E
Offshore transect	OS11	Start	35° 28’ 29.782” N	130° 11’ 51.153” E
Offshore transect	OS11	End	35° 38’ 22.118” N	130° 6’ 26.271” E
Offshore transect	OS12	Start	35° 28’ 56.299” N	130° 13’ 3.585” E
Offshore transect	OS12	End	35° 38’ 48.685” N	130° 7’ 38.825” E
Offshore transect	OS13	Start	35° 29’ 22.803” N	130° 14’ 16.031” E
Offshore transect	OS13	End	35° 39’ 15.241” N	130° 8’ 51.392” E
Offshore transect	OS14	Start	35° 29’ 49.294” N	130° 15’ 28.489” E
Offshore transect	OS14	End	35° 39’ 41.784” N	130° 10’ 3.972” E

Offshore transect	OS15	Start	35° 30’ 15.774” N	130° 16’ 40.961” E
Offshore transect	OS15	End	35° 40’ 8.314” N	130° 11’ 16.565” E
Cable route transect	CR01	Start- A	35° 22’ 30.718” N	129° 24’ 25.325” E
Cable route transect	CR01	B	35° 22’ 21.592” N	129° 30’ 12.589” E
Cable route transect	CR01	C	35° 24’ 19.261” N	129° 33’ 3.111” E
Cable route transect	CR01	D	35° 25’ 33.375” N	129° 52’ 4.665” E
Cable route transect	CR01	E- End	35° 27’ 56.458” N	129° 56’ 41.765” E

Marine Processes Survey Coordinates

Point	**Coordinate**		**Point**	***Coordinate***	
	Longitude	**Latitude**		**Longitude**	**Latitude**
SC, CTD, SW, GS-1	129°23’56.88”E	35°22’33.56”N	SC, CTD, SW, GS-21	129°57’36.05”E	35°33’37.10”N
SC, CTD, SW, GS-2	129°26’42.60”E	35°22’22.03”N	SC, CTD, SW, GS-22	130° 1’13.72”E	35°33’33.98”N
SC, CTD, SW, GS-3	129°30’24.21”E	35°22’23.02”N	SC, CTD, SW, GS-23	130° 4’51.47”E	35°33’32.50”N
SC, CTD, SW, GS-4	129°34’8.79”E	35°24’34.42”N	SC, CTD, SW, GS-24	130° 8’28.78”E	35°33’32.10”N
SC, CTD, SW, GS-5	129°37’52.59”E	35°24’44.77”N	SC, CTD, SW, GS-25	130°12’7.39”E	35°33’31.80”N
SC, CTD, SW, GS-6	129°41’35.76”E	35°24’55.89”N	SC, CTD, SW, GS-26	129°57’35.75”E	35°36’46.58”N
SC, CTD, SW, GS-7	129°45’19.74”E	35°25’6.80”N	SC, CTD, SW, GS-27	130° 1’14.69”E	35°36’47.83”N
SC, CTD, SW, GS-8	129°49’3.43”E	35°25’16.99”N	SC, CTD, SW, GS-28	130° 4’52.97”E	35°36’45.31”N
SC, CTD, SW, GS-9	129°52’47.99”E	35°25’36.87”N	SC, CTD, SW, GS-29	130° 8’30.49”E	35°36’44.19”N
SC, CTD, SW, GS-10	129°54’58.97”E	35°26’52.59”N	SC, CTD, SW, GS-30	130°12’7.66”E	35°36’44.71”N
SC, CTD, SW, GS-11	129°57’32.62”E	35°27’40.39”N			
SC, CTD, SW, GS-12	130° 1’10.35”E	35°27’37.90”N			
SC, CTD, SW, GS-13	130° 4’48.83”E	35°27’34.95”N			
SC, CTD, SW, GS-14	130° 8’27.49”E	35°27’36.86”N			
SC, CTD, SW, GS-15	130°12’4.14”E	35°27’35.22”N			
SC, CTD, SW, GS-16	129°57’32.96”E	35°30’37.52”N			
SC, CTD, SW, GS-17	130° 1’11.17”E	35°30’34.46”N			
SC, CTD, SW, GS-18	130° 4’49.75”E	35°30’35.50”N			
SC, CTD, SW, GS-19	130° 8’26.35”E	35°30’32.33”N			
SC, CTD, SW, GS-20	130°12’4.58”E	35°30’34.18”N			

Point	Coordinate	
	Longitude	Latitude
SS-1	129°23’56.88”E	35°22’33.56”N
SS-2	129°43’23.71”E	35°25’1.78”N
SS-3	130° 4’51.37”E	35°32’2.67”N
W-1	129°23’56.88”E	35°22’33.56”N
W-2	130° 4’51.37”E	35°32’2.67”N
PC-1	129°23’56.88”E	35°22’33.56”N
PC-2	129°43’23.71”E	35°25’1.78”N
PC-3	130° 4’51.37”E	35°32’2.67”N
T-1	129°23’56.88”E	35°22’33.56”N

Appendix A-4: Biodiversity Risk Assessment

In line with the IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012), the Firefly project must identify whether a project is located in modified, natural or critical habitats, or in a legally protected or internationally recognised area, and whether the project may potentially impact on or is dependent on ecosystems services over which the project has direct management control or significant influence (as defined by the International Finance Corporation's PS6 Biodiversity Conservation and Sustainable Natural Resource Management).

Within PS6, high biodiversity value is identified through the concept of 'Critical Habitat', which is based on five criteria and an additional two "scenarios" where these criteria might be applicable. Critical Habitat is designated when it is of significant importance to certain species, threatened or unique ecosystems, or key evolutionary processes. For developments within Critical Habitat, adherents must demonstrate mitigation actions which achieve net gains of biodiversity values for which the Critical Habitat is designated.

For Criteria 1 through 3, the IFC PS6 Guidance Notes states that a project should determine a sensible boundary which defines the area of habitat to be considered for the Critical Habitat Assessment. This is called the "discrete management unit" and for the purposes of the IFC-compliant Biodiversity Risk Assessment, we will cover the same area which will be considered for the offshore and onshore environmental baseline surveys (EBS) for the project.

Apx Table 3: Details of the International Finance Corporation's Performance Standard 6 (IFC PS6) Criteria.

IFC PS6 criteria and scenarios
Criterion 1: Habitats of significant importance to Critically Endangered (CE) and/or Endangered (EN) species Tier 1 sub-criteria for Criterion 1 are defined as follows: • Habitat required to sustain ≥ 10% of the global population of an IUCN Red-listed CR or EN species where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species; and • Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species. Tier 2 sub-criteria for Criterion 1 are defined as follows: • Habitat that supports the regular occurrence of a single individual of an IUCN Red-listed CR species and/or habitat containing regionally important concentrations of an IUCN Red-listed EN species where that habitat could be considered a discrete management unit for that species; • Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species; and • As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.
Criterion 2: Habitats of significant importance to endemic and/or restricted-range species An endemic species is defined as one that has ≥95% of its global range inside the country or region of analysis, but this definition mainly refers to plants. A restricted-range species is defined as follows: extent of occurrence of 100,000 km2 or less for marine systems. Tier 1 sub-criterion for Criterion 2 is defined as follows: • Habitat known to sustain ≥ 95% of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic). • Tier 2 sub-criterion for Criterion 2 is defined as follows: • Habitat known to sustain ≥ 1% but < 95% of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.
Criterion 3: Habitats supporting globally significant concentrations of migratory species and/or congregatory species Tier 1 sub-criterion for Criterion 3 is defined as follows: • Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95% of the global population of a migratory or congregatory species at any point of the species' life cycle where that habitat could be considered a discrete management unit for that species. Tier 2 sub-criteria for Criterion 3 are defined as follows:

IFC PS6 criteria and scenarios

- Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1% but < 95% of the global population of a migratory or congregatory species at any point of the species' life-cycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment;
- For birds, habitat that meets BirdLife International's criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance;
- For species with large but clumped distributions, a provisional threshold is set at ≥ 5% of the global population for both terrestrial and marine species; and
- Source sites that contribute ≥ 1% of the global population of recruits.

Criterion 4: Highly threatened and/or unique ecosystems

Highly threatened or unique ecosystems are those:

- That are at risk of significantly decreasing in area or quality;
- With a small spatial extent; and/or
- Containing unique assemblages of species including assemblages or concentrations of biome-restricted species.

Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally-recognized Non-Governmental Organizations NGOs) or that are recognized as such in existing regional or national plans, such as the NBSAP , would also qualify as Critical Habitat per Criterion 4.

An example of a unique ecosystem would be one that occurs in very limited numbers in the region, such as the only lowland dipterocarp forest.

An example of a highly threatened ecosystem would be one that is losing a high percentage of its area each year.

Highly threatened or unique ecosystems are defined by a combination of factors that determine their importance for conservation action. The prioritization of rare and endangered ecosystems employs similar factors to those used for the IUCN Red List of Threatened Species. The ecosystem prioritization factors include long-term trend, rarity, ecological condition, and threat. All of these values contribute to the relative biodiversity and conservation value of the particular ecosystem.

Criterion 5: Areas associated with key evolutionary processes

This criterion is defined by:

- The physical features of a landscape that might be associated with particular evolutionary processes; and/or
- Subpopulations of species that are phylogenetically or morpho-genetically distinct and may be of special conservation concern given their distinct evolutionary history. The latter includes Evolutionarily Significant Units (ESUs) and Evolutionarily Distinct and Globally Endangered (EDGE) species.

Scenario A: Other recognized high biodiversity values that might also support a Critical Habitat designation

Examples:

- Areas required for the reintroduction of CR and EN species and refuge sites for these species (e.g. habitat used during periods of stress such as flood, drought or fire);
- Ecosystems of known special significance to EN or CR species for climate adaptation purposes;
- Concentrations of Vulnerable (VU) species in cases where there is uncertainty regarding the listing, and the actual status of the species may be EN or CR;
- Areas of primary/ old growth/ pristine forests and/ or other areas with especially high levels of species diversity;
- Landscape and ecological processes, such as water catchments, areas critical to erosion control, disturbance regimes (e.g., fire, flood), that are required for maintaining Critical Habitat;
- Habitat necessary for the survival of keystone species; and
- Areas of high scientific value such as those containing concentrations of species new and/or little known to science.

Scenario B: Internationally and/or nationally recognized areas of high biodiversity value that in general will likely qualify as Critical Habitat

Examples:

- Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites;
- UNESCO natural World Heritage sites that are recognized for their Global Outstanding Value;
- The majority of Key Biodiversity Areas (KBAs), which encompass inter alia Ramsar Sites, Important Bird Areas (IBA), Important Plant Areas (IPA) and AZE;
- Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally recognized NGOs); and

IFC PS6 criteria and scenarios

- Areas identified by the client as High Conservation Value (HCV) using internationally recognized standards, where criteria used to designate such areas is consistent with the high biodiversity values listed in the five Critical Habitat criteria.

Appendix A-5: Cumulative list of bird species present in Korea

Data on column “Max count” shows maximum counts of migratory waterbird species in the Ulsan Taehwa River Flyway Network site, 2014-2020 (EAAFP 2021). Species are listed if they have been recorded in the Ulsan Taehwa River area in the avibase database. Shaded species were recorded >1% of their population (EAAFP2021).

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
Accipitridae (Hawks, Eagles)	*Accipiter gentilis*	Northern Goshawk	LC		M		2, 4
	Accipiter gularis	Japanese Sparrowhawk	LC		M		2, 4
	Accipiter nisus	Eurasian Sparrowhawk	LC		M		2, 4
	Accipiter soloensis	Chinese Sparrowhawk	LC		M		2, 4
	Aegypius monachus	Cinereous Vulture	NT		M		2, 4
	Aquila chrysaetos	Golden Eagle	LC		M		2, 4
	Aquila heliaca	Eastern Imperial Eagle	VU		M		2, 4
	Butastur indicus	Grey-faced Buzzard	LC		M		2
	Buteo hemilasius	Upland Buzzard	LC		M		2
	Buteo japonicus	Japanese Buzzard	LC		M		2, 4
	Buteo lagopus	Rough-legged Buzzard	LC		M		2, 4
	Circus cyaneus	Hen Harrier	LC		M		2, 4
	Circus melanoleucos	Pied Harrier	LC		M		2
	Circus spilonotus	Eastern Marsh-Harrier	LC		M		4
	Haliaeetus albicilla	White-tailed Sea-Eagle	LC		M		2, 4
	Haliaeetus pelagicus	Steller's Sea-Eagle	VU		M		2
	Milvus aegyptius	Yellow-billed Kite	LC				2
	Milvus migrans	Black Kite	LC		M		2, 4
	Pernis ptilorhynchus	Oriental Honey-Buzzard	LC		M		2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
Acrocephalidae (Reed-warblers)	*Acrocephalus bistrigiceps*	Black-browed Reed-Warbler	LC				2, 4
	Acrocephalus orientalis	Oriental Reed-Warbler	LC		M		2, 4
	Arundinax aedon	Thick-billed Warbler	LC				2
Aegithalidae (Long-tailed Tits)	*Aegithalos caudatus*	Long-tailed Tit	LC				4
Alaudidae (Larks)	*Alauda arvensis*	Eurasian Skylark	LC				2, 4
	Alaudala cheleensis	Asian Short-toed Lark					4
	Galerida cristata	Crested Lark	LC				2, 4
Alcedinidae (Kingfishers)	*Alcedo atthis*	Common Kingfisher	LC				2, 4
	Halcyon coromanda	Ruddy Kingfisher	LC				2, 4
	Halcyon pileata	Black-capped Kingfisher	LC				2, 4
Alcidae (Auks)	*Brachyramphus perdix*	Long-billed Murrelet	NT			0	4
	Cepphus carbo	Spectacled Guillemot	LC			0	2, 4
	Cerorhinca monocerata	Rhinoceros Auklet	LC	Marine protected species (MOF)		0	4
	Fratercula cirrhata	Tufted Puffin	LC				2
	Synthliboramphus antiquus	Ancient Murrelet	LC	Marine protected species (MOF)	M	0	4
	Synthliboramphus wumizusume	Japanese Murrelet	VU	Marine protected species (MOF)& Endangered Wildlife II (MOE) & Designated Natural Monument No. 450 (CHA)	M	0	4
	Uria aalge	Common Murre	LC	Marine protected species (MOF)			2
Anatidae (Ducks, Geese, Swans)	*Aix galericulata*	Mandarin Duck	LC	Designated Natural Monument No. 327 (CHA) & Protected Species (Ulsan City)		11	2, 4, 5

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Anas acuta	Northern Pintail	LC		M	414	2, 4
	Anas crecca	Common Teal	LC		M	66	2, 4, 5
	Anas platyrhynchos	Mallard	LC		M	3,825	2, 4, 5
	Anas zonorhyncha	Chinese Spot-billed Duck	LC			138	2, 4, 5
	Anser albifrons	Greater White-fronted Goose	LC		M	0	2, 4, 5
	Anser anser	Greylag Goose	LC		M		2
	Anser caerulescens	Snow Goose	LC				2, 5
	Anser cygnoid	Swan Goose	VU	Endangered Wildlife II (MOE) & Designated Natural Monument No. 325-1 (CHA)	M	0	2, 3, 4, 5
	Anser erythropus	Lesser White-fronted Goose	VU	Endangered Wildlife II (MOE)	M	0	2, 3, 4, 5
	Anser fabalis	Bean Goose	LC		M	73	2, 4, 5
	Aythya baeri	Baer's Pochard	CR		M		3, 5
	Aythya ferina	Common Pochard	VU		M	6,057	2, 4, 5
	Aythya fuligula	Tufted Duck	LC		M	1,482	2, 4, 5
	Aythya marila	Greater Scaup	LC		M	2,769	2, 4, 5
	Aythya nyroca	Ferruginous Duck	NT		M		5
	Branta bernicla	Brant Goose	LC	Endangered Wildlife II (MOE) & Designated Natural Monument No. 325-2 (CHA)	M	0	2, 4, 5
	Branta hutchinsii	Cackling Goose	LC			0	4, 5
	Bucephala albeola	Bufflehead	LC				5
	Bucephala clangula	Common Goldeneye	LC		M	204	2, 4, 5
	Clangula hyemalis	Long-tailed Duck	VU		M		2, 3, 5
	Cygnus columbianus	Tundra Swan	LC	Endangered Wildlife I (MOE) & Designated Natural Monument No. 201-1 (CHA)		0	2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Cygnus cygnus	Whooper Swan	LC	Endangered Wildlife II (MOE) & Designated Natural Monument No. 201-2 (CHA)	M	0	2, 4, 5
	Cygnus olor	Mute Swan	LC		M		2, 5
	Histrionicus histrionicus	Harlequin Duck	LC			2,403	2, 4, 5
	Mareca falcata	Falcated Duck	NT			615	2, 4, 5
	Mareca penelope	Eurasian Wigeon	LC			3,891	2, 4, 5
	Mareca strepera	Gadwall	LC			174	2, 4, 5
	Melanitta americana	Black Scoter	NT			0	2, 4, 5
	Melanitta deglandi	White-winged Scoter	LC				5
	Melanitta stejnegeri	Siberian Scoter	LC				2
	Mergellus albellus	Smew	LC		M	1,827	2, 4, 5
	Mergus merganser	Goosander or Common Merganser	LC		M	213	2, 4, 5
	Mergus serrator	Red-breasted Merganser	LC		M	621	2, 4, 5
	Mergus squamatus	Scaly-sided Merganser	EN				2, 3, 5
	Netta rufina	Red-crested Pochard	LC		M		5
	Polysticta stelleri	Steller's Eider	VU		M		3
	Sibirionetta formosa	Baikal Teal	LC		M	0	2, 4, 5
	Somateria spectabilis	King Eider	LC		M		5
	Spatula clypeata	Northern Shoveler	LC			33	2, 4, 5
	Spatula querquedula	Garganey	LC		M	0	2, 4
	Tadorna cristata	Crested Shelduck	CR				2
	Tadorna ferruginea	Ruddy Shelduck	LC		M		2, 5
	Tadorna tadorna	Common Shelduck	LC		M	674	2, 4, 5
Apodidae (Swifts)	*Apus pacificus*	Pacific Swift	LC		M		2, 4
	Hirundapus caudacutus	White-throated Needletail	LC		M		2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
Ardeidae (Herons)	*Ardea alba*	Great White Egret	LC		M	465	2, 4, 5
	Ardea cinerea	Grey Heron	LC	Protected Species (Ulsan City)		23	2, 4, 5
	Ardea intermedia	Intermediate Egret	LC			246	2, 4, 5
	Ardeola bacchus	Chinese Pond-Heron	LC			0	2, 4, 5
	Botaurus stellaris	Eurasian Bittern	LC		M		2, 5
	Bubulcus ibis	Cattle Egret	LC	Protected Species (Ulsan City)		0	2, 4, 5
	Butorides striata	Green-backed (Striated) Heron	LC			0	2, 4, 5
	Egretta eulophotes	Chinese Egret or Swinhoe's Egret	VU	Marine protected species (MOF) & Endangered Wildlife I (MOE) & Designated Natural Monument No. 361 (CHA)	M		2, 3, 5
	Egretta garzetta	Little Egret	LC	Protected Species (Ulsan City)		26	2, 4, 5
	Egretta sacra	Pacific Reef-Egret	LC			0	2, 4, 5
	Gorsachius goisagi	Japanese Night-Heron	VU		M		2, 3
	Gorsachius magnificus	White-eared Night-Heron	EN				3
	Ixobrychus cinnamomeus	Cinnamon Bittern	LC				2
	Ixobrychus eurhythmus	Schrenck's Bittern	LC	Endangered Wildlife II (MOE)		0	2, 4
	Ixobrychus sinensis	Yellow Bittern	LC			0	2, 4
	Nycticorax nycticorax	Black-crowned Night-Heron	LC	Protected Species (Ulsan City)		3	2, 4, 5
Bombycillidae (Waxwings)	*Bombycilla garrulus*	Bohemian Waxwing	LC				2, 4
	Bombycilla japonica	Japanese Waxwing	NT				2, 4
Calcariidae (Longspurs)	*Calcarius lapponicus*	Lapland Longspur	LC				2, 4
	Plectrophenax nivalis	Snow Bunting	LC				2
Campephagidae (Cuckoo-shrikes)	*Pericrocotus divaricatus*	Ashy Minivet	LC				2

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
Caprimulgidae (Nightjars)	*Caprimulgus jotaka*	Grey Nightjar	LC				2, 4
Charadriidae (Plovers)	*Charadrius alexandrinus*	Kentish Plover	LC		M	0	1, 2, 4, 5
	Charadrius dubius	Little Ringed Plover	LC		M	6	2, 4, 5
	Charadrius hiaticula	Common Ringed Plover	LC		M		5
	Charadrius leschenaultii	Greater Sand-Plover	LC		M		2
	Charadrius mongolus	Lesser Sand-Plover	LC		M		1, 2, 5
	Charadrius placidus	Long-billed Plover	LC	Endangered Wildlife II (MOE)		42	2, 4, 5
	Pluvialis fulva	Pacific Golden Plover	LC		M		2
	Pluvialis squatarola	Grey Plover	LC		M	0	1, 2, 4, 5
	Vanellus vanellus	Northern Lapwing	NT		M	6	2, 4, 5
Ciconiidae (Storks)	*Ciconia boyciana*	Oriental Stork	EN	Designated Natural Monument No. 199 (CHA)	M	54	2, 3, 4, 5
	Ciconia nigra	Black Stork	LC	Endangered Wildlife I (MOE) & Designated Natural Monument No. 200 (CHA)	M	0	2, 4, 5
	Leptoptilos dubius	Greater Adjutant	EN		M		3
Cinclidae	*Cinclus pallasii*	Brown Dipper	LC				4
Cisticolidae	*Cisticola juncidis*	Zitting Cisticola	LC				4
Columbidae (Pigeons, Doves)	*Columba janthina*	Japanese Woodpigeon	NT				2, 4
	Columba livia	Rock Pigeon	Introduced				4
	Streptopelia decaocto	Eurasian Collared-Dove	LC				4
	Streptopelia orientalis	Oriental Turtle-Dove	LC				2, 4
	Treron sieboldii	White-bellied Green-Pigeon	LC				2
Coraciidae (Rollers)	*Eurystomus orientalis*	Oriental Dollarbird	LC				2, 4
Corvidae (Crows and jays)	*Corvus corone*	Carrion Crow	LC				2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Corvus dauuricus	Daurian Jackdaw	LC				2, 4
	Corvus frugilegus	Rook	LC				2, 4
	Corvus macrorhynchos	Large-billed Crow	LC				4
	Cyanopica cyanus	Azure-winged Magpie	LC				4
	Garrulus glandarius	Eurasian Jay	LC				4
	Nucifraga caryocatactes	Eurasian Nutcracker	LC				4
	Pica pica	Eurasian Magpie	LC				4
	Pica serica	Oriental Magpie					4
Cuculidae (Cuckoos)	*Cuculus canorus*	Common Cuckoo	LC				2, 4
	Cuculus micropterus	Indian Cuckoo	LC				2, 4
	Cuculus optatus	Oriental Cuckoo	LC		M		2, 4
	Cuculus poliocephalus	Lesser Cuckoo	LC				2, 4
	Hierococcyx hyperythrus	Northern Hawk-Cuckoo	LC				2, 4
Diomedeidae (Albatrosses)	*Phoebastria albatrus*	Short-tailed Albatross	VU		M	0	2
	Phoebastria nigripes	Black-footed Albatross	NT		M	0	2
Emberizidae (Buntings, American sparrows and allies)	*Emberiza aureola*	Yellow-breasted Bunting	CR		M		2
	Emberiza chrysophrys	Yellow-browed Bunting	LC				2
	Emberiza cioides	Meadow Bunting	LC				4
	Emberiza elegans	Yellow-throated Bunting	LC				4
	Emberiza fucata	Chestnut-eared Bunting	LC				2, 4
	Emberiza leucocephalos	Pine Bunting	LC				2, 4
	Emberiza pallasi	Pallas's Bunting	LC				2, 4
	Emberiza pusilla	Little Bunting	LC				2

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Emberiza rustica	Rustic Bunting	VU				2, 4
	Emberiza rutila	Chestnut Bunting	LC				2
	Emberiza schoeniclus	Reed Bunting	LC				2
	Emberiza spodocephala	Black-faced Bunting	LC				2
	Emberiza sulphurata	Yellow Bunting	VU		M		2, 4
	Emberiza tristrami	Tristram's Bunting	LC				2
	Emberiza variabilis	Grey Bunting	LC				2
	Emberiza yessoensis	Ochre-rumped Bunting	NT				2
Falconidae (Falcons, Caracaras)	*Falco amurensis*	Amur Falcon	LC		M		2
	Falco columbarius	Merlin	LC		M		2, 4
	Falco peregrinus	Peregrine Falcon	LC		M		2, 4
	Falco subbuteo	Eurasian Hobby	LC		M		2, 4
	Falco tinnunculus	Common Kestrel	LC		M		2, 4
Fringillidae (Finches and Hawaiian honeycreepers)	*Acanthis flammea*	Redpoll	LC				2, 4
	Carpodacus roseus	Pallas's Rosefinch	LC				2, 4
	Carpodacus sibiricus	Long-tailed Rosefinch	LC				2, 4
	Chloris sinica	Oriental Greenfinch	LC				2, 4
	Coccothraustes coccothraustes	Hawfinch	LC				2, 4
	Eophona migratoria	Chinese Grosbeak	LC				2, 4
	Eophona personata	Japanese Grosbeak	LC				2
	Fringilla montifringilla	Brambling	LC				2, 4
	Leucosticte arctoa	Asian Rosy-finch	LC				2, 4
	Pyrrhula pyrrhula	Eurasian Bullfinch	LC				2, 4
	Spinus spinus	Eurasian Siskin	LC				2, 4
Gaviidae (Loons/Divers)	*Gavia adamsii*	Yellow-billed Loon	NT			0	2, 5

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Gavia arctica	Arctic Loon	LC		M	0	2, 4, 5
	Gavia pacifica	Pacific Loon	LC			0	4, 5
	Gavia stellata	Red-throated Loon	LC	Marine protected species (MOF) & Protected Species (Ulsan City)	M	8	2, 4, 5
Glareolidae (Coursers, Pratincoles)	*Glareola maldivarum*	Oriental Pratincole	LC		M	0	2, 4
Gruidae (Cranes)	*Grus canadensis*	Sandhill Crane	LC				2, 5
	Grus grus	Common Crane	LC		M		2, 5
	Grus japonensis	Red-crowned or Japanese Crane	EN		M		2, 3, 5
	Grus monacha	Hooded Crane	VU		M		2, 3, 5
	Grus vipio	White-naped Crane	VU				2, 3, 5
	Leucogeranus leucogeranus	Siberian Crane	CR		M		3, 5
Haematopodidae (Oystercatchers)	*Haematopus ostralegus*	Eurasian Oystercatcher	NT	Marine protected species (MOF) & Endangered Wildlife II (MOE) & Designated Natural Monument No. 326 (CHA)		0	1, 2, 4, 5
Heliornithidae (Finfoots)	*Heliopais personatus*	Masked Finfoot	EN				3
Hirundinidae (Swallows and Martins)	*Cecropis daurica*	Red-rumped Swallow	LC				2, 4
	Delichon dasypus	Asian House Martin	LC				2, 4
	Delichon lagopodum	Eastern House Martin	LC				2, 4
	Hirundo rustica	Barn Swallow	LC		M		2, 4
	Riparia riparia	Collared Sand Martin	LC				2
Hydrobatidae (Northern Storm-petrels)	*Hydrobates monorhis*	Swinhoe's Storm-Petrel	NT	Marine protected species (MOF)	M	0	2, 4
Laniidae (Shrikes)	*Lanius bucephalus*	Bull-headed Shrike	LC				2, 4
	Lanius cristatus	Brown Shrike	LC				2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Lanius sphenocercus	Chinese Grey Shrike	LC				2, 4
	Lanius tigrinus	Tiger Shrike	LC				2
Laridae (Gulls, Terns, Skimmers)	*Chlidonias hybrida*	Whiskered Tern	LC				2
	Chlidonias leucopterus	White-winged Tern	LC		M		2
	Chroicocephalus ridibundus	Black-headed Gull	LC			0	4
	Gelochelidon nilotica	Gull-billed Tern	LC		M	0	4
	Ichthyaetus relictus	Relict Gull	VU			0	4
	Larus argentatus	Herring Gull	LC			1,888	4
	Larus cachinnans	Caspian Gull	LC			0	4
	Larus canus	Mew Gull	LC			5,237	2, 4, 5
	Larus crassirostris	Black-tailed Gull	LC			384	2, 4, 5
	Larus fuscus	Lesser Black-backed Gull	LC			0	4
	Larus fuscus heuglini	Heuglin's Gull	LC				5
	Larus glaucescens	Glaucous-winged Gull	LC				5
	Larus hyperboreus	Glaucous Gull	LC			0	2, 4, 5
	Larus michahellis	Yellow-legged Gull	LC			0	4
	Larus relictus	Relict Gull	VU		M		2, 3, 5
	Larus ridibundus	Black-headed Gull	LC				2, 5
	Larus schistisagus	Slaty-backed Gull	LC			2	2, 4, 5
	Larus smithsonianus	Arctic Herring Gull	LC				2, 5
	Larus thayeri	Thayer's Gull	LC				5
	Onychoprion aleuticus	Aleutian Tern	VU		M	0	4
	Onychoprion fuscatus	Sooty Tern	LC				2
	Rissa tridactyla	Black-legged Kittiwake	VU			0	2, 4, 5
	Saundersilarus saundersi	Saunders's Gull	VU				2, 3, 5
	Sterna acuticauda	Black-bellied Tern	EN				3

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Sterna hirundo	Common Tern	LC		M	0	2, 4
	Sternula albifrons	Little Tern	LC	Endangered Wildlife II (MOE)	M	0	2, 4
	Thalasseus bernsteini	Chinese Crested Tern	CR		M		2, 3
Locustellidae (Grasshopper-warblers and grassbirds)	*Helopsaltes fasciolatus*	Gray's Grasshopper Warbler	LC				4
	Helopsaltes ochotensis	Middendorff's Grasshopper-Warbler	LC				4
	Locustella certhiola	Pallas's Grasshopper-Warbler	LC				2
	Locustella lanceolata	Lanceolated Warbler	LC				2, 4
	Locustella ochotensis	Middendorff's Grasshopper-Warbler	LC				2
	Locustella pleskei	Pleske's Grasshopper-Warbler	VU				2
	Locustella pryeri	Marsh Grassbird	NT				2
Monarchidae (Monarchs)	*Terpsiphone atrocaudata*	Japanese Paradise-Flycatcher	NT				2, 4
Motacillidae (Wagtails and pipits)	*Anthus cervinus*	Red-throated Pipit	LC				2
	Anthus gustavi	Pechora Pipit	LC				2
	Anthus hodgsoni	Olive-backed Pipit	LC				2, 4
	Anthus richardi	Richard's Pipit	LC				2, 4
	Anthus roseatus	Rosy Pipit	LC				2
	Anthus rubescens	Buff-bellied Pipit	LC				2, 4
	Anthus spinoletta	Water Pipit	LC				2, 4
	Dendronanthus indicus	Forest Wagtail	LC				2, 4
	Motacilla alba	White Wagtail	LC				2, 4
	Motacilla cinerea	Grey Wagtail	LC		M		2, 4
	Motacilla grandis	Japanese Wagtail	LC				2
Muscicapidae (Chats and Old World flycatchers)	*Calliope calliope*	Siberian Rubythroat	LC				2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Cyanoptila cyanomelana	Blue-and-white Flycatcher	LC				2, 4
	Ficedula albicilla	Taiga Flycatcher	LC				4
	Ficedula mugimaki	Mugimaki Flycatcher	LC				2
	Ficedula narcissina	Narcissus Flycatcher	LC				2
	Ficedula zanthopygia	Yellow-rumped Flycatcher	LC				2, 4
	Larvivora cyane	Siberian Blue Robin	LC				2, 4
	Larvivora sibilans	Rufous-tailed Robin	LC				2
	Monticola gularis	White-throated Rock-Thrush	LC				2
	Monticola solitarius	Blue Rock-thrush	LC				2, 4
	Muscicapa dauurica	Asian Brown Flycatcher	LC				2, 4
	Muscicapa griseisticta	Grey-streaked Flycatcher	LC				2
	Muscicapa sibirica	Dark-sided Flycatcher	LC				2
	Oenanthe pleschanka	Pied Wheatear	LC				2
	Phoenicurus auroreus	Daurian Redstart	LC				2, 4
	Saxicola stejnegeri	Amur Stonechat					4
	Saxicola torquatus	Common Stonechat	LC				2, 4
	Tarsiger cyanurus	Orange-flanked Bush-robin	LC				2, 4
Oriolidae (Orioles and figbirds)	*Oriolus chinensis*	Black-naped Oriole	LC				2, 4
Pandionidae (Osprey)	*Pandion haliaetus*	Osprey	LC	Endangered Wildlife II (MOE)	M	0	2
Paridae	*Parus minor*	Japanese Tit					4
	Periparus ater	Coal Tit	LC				4
	Poecile palustris	Marsh Tit	LC				4
	Sittiparus varius	Varied Tit	LC				4
Passeridae	*Passer cinnamomeus*	Russet Sparrow	LC				4
	Passer montanus	Eurasian Tree Sparrow	LC				4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
Pelecanidae (Pelicans)	*Pelecanus crispus*	Dalmatian Pelican	VU		M		3
	Pelecanus onocrotalus	Great White Pelican	LC		M		2
Phalacrocoracidae (Cormorants)	*Phalacrocorax capillatus*	Japanese Cormorant	LC			1	2, 4, 5
	Phalacrocorax carbo	Great Cormorant	LC	Protected Species (Ulsan City)		1,761	2, 4, 5
	Urile pelagicus	Pelagic Cormorant	LC	Marine protected species (MOF)		0	2, 4, 5
Phasianidae (Pheasants and allies)	*Coturnix japonica*	Japanese Quail	NT				2, 4
	Phasianus colchicus	Ring-necked Pheasant	LC				4
Phylloscopidae (Leaf-warblers)	*Phylloscopus borealoides*	Sakhalin Leaf-Warbler	LC				2
	Phylloscopus coronatus	Eastern Crowned Warbler	LC				2, 4
	Phylloscopus examinandus	Kamchatka Leaf-Warbler	LC				2
	Phylloscopus fuscatus	Dusky Warbler	LC				2, 4
	Phylloscopus inornatus	Yellow-browed Warbler	LC				2, 4
	Phylloscopus plumbeitarsus	Two-barred Warbler	LC				2, 4
	Phylloscopus proregulus	Pallas's Leaf-warbler	LC				2, 4
	Phylloscopus tenellipes	Pale-legged Leaf-warbler	LC				2, 4
Picidae (Woodpeckers)	*Dendrocopos leucotos*	White-backed Woodpecker	LC				4
	Dendrocopos major	Great Spotted Woodpecker	LC				4
	Dryobates minor	Lesser Spotted Woodpecker	LC				4
	Jynx torquilla	Eurasian Wryneck	LC				2
	Picus canus	Gray-headed Woodpecker	LC				4
	Yungipicus canicapillus	Gray-capped Pygmy Woodpecker	LC				4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Yungipicus kizuki	Japanese Pygmy Woodpecker	LC				4
Pittidae (Pittas)	*Pitta nympha*	Fairy Pitta	VU				2
Podicipedidae (Grebes)	*Podiceps auritus*	Horned Grebe	VU		M		2, 5
	Podiceps cristatus	Great Crested Grebe	LC			195	2, 4, 5
	Podiceps grisegena	Red-necked Grebe	LC		M	0	2, 4, 5
	Podiceps nigricollis	Black-necked Grebe	LC			66	2, 4, 5
	Tachybaptus ruficollis	Little Grebe	LC			0	2, 4, 5
Procellariidae (Petrels, Shearwaters)	*Ardenna carneipes*	Flesh-footed Shearwater	NT		M	0	2, 4
	Ardenna tenuirostris	Short-tailed Shearwater	LC		M		2
	Calonectris leucomelas	Streaked Shearwater	NT	Marine protected species (MOF)	M	0	2, 4
Prunellidae (Accentors)	*Prunella collaris*	Alpine Accentor	LC				2
	Prunella montanella	Siberian Accentor	LC				2, 4
Pycnonotidae (Bulbuls)	*Hypsipetes amaurotis*	Brown-eared Bulbul	LC				2, 4
	Pycnonotus sinensis	Light-vented Bulbul	LC				2, 4
Rallidae (Rails, Gallinules, Coots)	*Amaurornis phoenicurus*	White-breasted Waterhen	LC				2
	Coturnicops exquisitus	Swinhoe's Rail	VU			0	2, 3, 4
	Fulica atra	Common Coot	LC		M	20,886	2, 4, 5
	Gallicrex cinerea	Watercock	LC	Endangered Wildlife II (MOE) & Designated Natural Monument No. 446 (CHA)		0	2, 4
	Gallinula chloropus	Common Moorhen	LC			456	2, 4, 5
	Rallus indicus	Eastern Water Rail	LC			0	2, 4, 5
	Zapornia fusca	Ruddy-breasted Crake	LC		M	0	2, 4
	Zapornia paykullii	Band-bellied Crake	NT				2

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Zapornia pusilla	Baillon's Crake	LC		M		2
Recurvirostridae (Avocets, Stilts)	*Himantopus himantopus*	Black-winged Stilt	LC		M	1	2, 5
	Recurvirostra avosetta	Pied Avocet	LC		M		2, 5
Regulidae (Kinglets and firecrests)	*Regulus regulus*	Goldcrest	LC				2, 4
Remizidae (Penduline-tits)	*Remiz consobrinus*	Chinese Penduline-tit	LC				2, 4
Scolopacidae (Sandpipers, Snipes, Phalaropes)	*Actitis hypoleucos*	Common Sandpiper	LC		M	66	2, 4, 5
	Arenaria interpres	Ruddy Turnstone	LC		M		1, 2, 5
	Calidris acuminata	Sharp-tailed Sandpiper	VU		M	0	1, 2, 4
	Calidris alba	Sanderling	LC		M	9	1, 2, 5
	Calidris alpina	Dunlin	LC		M	174	1, 2, 4, 5
	Calidris canutus	Red Knot	NT		M		1, 2, 3
	Calidris falcinellus	Broad-billed Sandpiper	LC		M		1, 2, 5
	Calidris ferruginea	Curlew Sandpiper	NT		M		2, 3
	Calidris melanotos	Pectoral Sandpiper	LC		M		2
	Calidris pugnax	Ruff	LC		M		2
	Calidris pygmaea	Spoon-billed Sandpiper	CR	Marine protected species (MOF) & Endangered Wildlife I	M		1, 2, 3
	Calidris ruficollis	Red-necked Stint	NT		M	0	1, 2, 4, 5
	Calidris subminuta	Long-toed Stint	LC		M		2
	Calidris temminckii	Temminck's Stint	LC		M		2, 5
	Calidris tenuirostris	Great Knot	EN		M		1, 2, 3
	Gallinago gallinago	Common Snipe	LC		M	6	4
	Gallinago megala	Swinhoe's Snipe	LC		M		2
	Gallinago nemoricola	Wood Snipe	VU				2
	Gallinago solitaria	Solitary Snipe	LC			0	2, 4, 5

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Gallinago stenura	Pintail Snipe	LC		M		2
	Limnodromus semipalmatus	Asian Dowitcher	NT		M		2, 3
	Limosa lapponica	Bar-tailed Godwit	NT		M		1, 2
	Limosa limosa	Black-tailed Godwit	NT		M	0	1, 2, 4, 5
	Lymnocryptes minimus	Jack Snipe	LC		M		2
	Numenius arquata	Eurasian Curlew	NT		M	0	1, 2, 3, 4, 5
	Numenius madagascariensis	Far Eastern Curlew	EN	Marine protected species (MOF) & Endangered Wildlife II (MOE)	M	0	1, 2, 3, 4, 5
	Numenius minutus	Little Curlew	LC		M		2
	Numenius phaeopus	Whimbrel	LC		M	0	1, 2, 4, 5
	Phalaropus lobatus	Red-necked Phalarope	LC		M	0	2, 4
	Scolopax rusticola	Eurasian Woodcock	LC			0	2, 4
	Tringa brevipes	Grey-tailed Tattler	NT		M	0	1, 2, 4, 5
	Tringa erythropus	Spotted Redshank	LC		M		2, 5
	Tringa glareola	Wood Sandpiper	LC		M		2, 5
	Tringa guttifer	Spotted Greenshank	EN	Marine protected species (MOF)& Endangered Wildlife I	M		1, 2
	Tringa nebularia	Common Greenshank	LC		M		1, 2, 5
	Tringa ochropus	Green Sandpiper	LC		M	0	2, 4, 5
	Tringa stagnatilis	Marsh Sandpiper	LC		M		2, 5
	Tringa totanus	Common Redshank	LC		M	0	2, 4, 5
	Xenus cinereus	Terek Sandpiper	LC		M		1, 2, 5
Scotocercidae (Bush-warblers)	*Horornis canturians*	Manchurian Bush Warbler	LC				4
	Horornis diphone	Japanese Bush-warbler	LC				2, 4
	Urosphena squameiceps	Asian Stubtail	LC				2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
Sittidae	*Sitta europaea*	Eurasian Nuthatch	LC				4
Stercorariidae (Skuas)	*Stercorarius longicaudus*	Long-tailed Jaeger	LC		M	0	4
	Stercorarius parasiticus	Arctic Jaeger	LC		M	0	2, 4
Strigidae (Typical Owls)	*Asio flammeus*	Short-eared Owl	LC		M		2, 4
	Asio otus	Northern Long-eared Owl	LC		M		2, 4
	Bubo bubo	Eurasian Eagle-Owl	LC				4
	Ninox japonica	Northern Boobook	LC				2, 4
	Otus semitorques	Japanese Scops-Owl	LC				4
	Otus sunia	Oriental Scops-Owl	LC		M		2, 4
	Strix nivicolum	Himalayan Owl	LC				4
	Strix uralensis	Ural Owl	LC		M		4
Sturnidae (Starlings)	*Agropsar sturninus*	Purple-backed Starling	LC				2
	Spodiopsar cineraceus	White-cheeked Starling	LC				2, 4
	Spodiopsar sericeus	Red-billed Starling	LC				4
	Sturnia sinensis	White-shouldered Starling	LC				2
Sylviidae	*Sinosuthora webbiana*	Vinous-throated Parrotbill	LC				4
Threskiornithidae (Ibises, Spoonbills)	*Platalea leucorodia*	Eurasian Spoonbill	LC	Endangered Wildlife II (MOE) & Designated Natural Monument No. 205-2	M	0	2, 4, 5
	Platalea minor	Black-faced Spoonbill	EN	Marine protected species (MOF) & Endangered Wildlife I (MOE) & Designated Natural Monument No. 205-1	M		2, 3, 5
Troglodytidae (Wrens)	*Troglodytes troglodytes*	Northern Wren	LC				2, 4
Turdidae (Thrushes)	*Geokichla sibirica*	Siberian Thrush	LC				2, 4

Family	Scientific Name	Common Name	IUCN Cons Status	Korean Cons Status	Migratory (CMS)	Max count	Sources (see reference No. in Table 6-26)
	Turdus cardis	Japanese Thrush	LC				2
	Turdus chrysolaus	Brown-headed Thrush	LC				2, 4
	Turdus eunomus	Dusky Thrush	LC				2, 4
	Turdus hortulorum	Grey-backed Thrush	LC				2, 4
	Turdus naumanni	Naumann's Thrush	LC				2, 4
	Turdus obscurus	Eyebrowed Thrush	LC				2, 4
	Turdus pallidus	Pale Thrush	LC				2, 4
	Zoothera aurea	White's Thrush	LC				2, 4
Turnicidae (Buttonquails)	*Turnix tanki*	Yellow-legged Button-quail	LC				2, 4
Upupidae (Hoopoes)	*Upupa epops*	Common Hoopoe	LC				2
Zosteropidae (White-eyes)	*Zosterops erythropleurus*	Chestnut-flanked White-eye	LC				2
	Zosterops japonicus	Warbling White-eye	LC				4

IUCN Criteria Key: LC = Least Concern; NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered; EW = Extinct in the Wild; EX = Extinct.

CMS: Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Species are shaded where their count meets the criterion of >1% of their population.

Protected Species (Ulsan City): refer to Protected Wildlife List Designated by Ulsan Metropolitan City (Ulsan City, 2013)