

## Preface

This Environmental Statement (ES) has been prepared by Moray Offshore Renewables Ltd (MORL) to accompany the consent applications under Section 36 of the Electricity Act 1989, Marine and Coastal Access Act 2009 and Marine (Scotland) Act 2010, to construct, operate and decommission three wind farm sites (Telford Offshore Wind Farm, Stevenson Offshore Wind Farm and MacColl Offshore Wind Farm). MORL has applied for a Marine Licence for each wind farm site to allow deposition of infrastructure on the seabed. A single Marine Licence application has been submitted to support the offshore aspects of MORL's Transmission Infrastructure (TI).

An application for planning permission for the onshore aspects of the TI will be submitted to the relevant authorities, supported by this ES and such further information as is required to support the planning application.

The consent applications will be determined by the Scottish Ministers, acting through Marine Scotland Licensing Operations Team (MS-LOT). Onshore consent will be determined by the Local Planning Authority (LPA) Aberdeenshire Council.

This ES comprises the following volumes:

- **Volume 1** – Non Technical Summary;
- **Volume 2** – Project Background, Project Details and Description of the Environment;
- **Volume 3** – Offshore Generating Station Environmental Impact Assessment;
- **Volume 4** – Transmission Infrastructure Environmental Impact Assessment;
- **Volume 5** – Whole Project Assessment and Cumulative Impact Assessment;
- **Volume 6** – Figures;
- **Volume 7** – Seascape, Landscape and Visual Receptor Figures and Photomontages; and
- **Volumes 8-11** – Technical Appendices.

The ES will be available to view at the following locations:

- **The Highland Council**, Planning Office, Glenurquart Road, Inverness, IV3 5NX
- **Caithness Planning Office**, Market Square, Wick, KW1 4AB
- **Moray Council**, Planning Office, High Street, Elgin, IV30 1BX
- **Peterhead Planning Office**, Aberdeenshire Council, Arbutnot House, Peterhead, AB42 1DA
- **Helmsdale Library and Service Point**, Dunrobin Street, Helmsdale, KW8 6JX
- **Buckie Library**, Cluny place, Buckie, AB56 1HB
- **Golspie Service Point**, Olsen House, Main Street, Golspie, KW10 6RA
- **Brora Library**, Gower Street, Brora, Highland, KW9 6PD

The Environmental Statement can also be viewed at the Scottish Government Library at Victoria Quay, Edinburgh, EH6 6QQ.

Copies of the Environmental Statement may be obtained from MORL (Tel: 0131 556 7602, Email: info@morayoffshorerenewables.co.uk) at a charge of £350 or on CD for £10 (including p & p). Copies of a short Non-Technical Summary may be obtained free of charge from MORL.

The ES is also available to download online at [www.morayoffshorerenewables.com](http://www.morayoffshorerenewables.com).

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## List of Acronyms and Abbreviations

%	—	Percentage
AADT	—	Average Annual Daily Traffic
AC	—	Alternating Current
AD	—	Anno Domini
AIS	—	Automatic Identification System
ALARP	—	As Low as Reasonably Practicable
ALB	—	All—Weather Lifeboat
AOD	—	Above Ordnance Datum
ASCOBANS	—	Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas
ASFB	—	Association of Salmon Fishery Boards
ASMS	—	Active Safety Management System
AtoN	—	Aid to Navigation
B	—	Magnetic field
BAP	—	Biodiversity Action Plan
BC	—	Before Christ
BERR	—	Department for Business Enterprise & Regulatory Reform
BGS	—	British Geological Survey
BMM	—	Brown and May Marine Limited
BoCC	—	Birds of Conservation Concern
BOWL	—	Beatrice Offshore Wind Farm Ltd
BP	—	Before Present
BTO	—	British Trust for Ornithology
BWEA	—	British Wind Energy Association
CA	—	Cruising Association
CAA	—	Civil Aviation Authority
CBC	—	Common Bird Census
CCTV	—	Closed Circuit Television
CEFAS	—	Centre for Environment, Fisheries and Aquaculture Science
CEMP	—	Construction Environmental Management Plan
CFPA	—	Cromarty Firth Port Authority
CI	—	Coefficient Interval
CIADD	—	Cumulative Impact Assessment Discussion Document
cm	—	Centimetre
COWRIE	—	Collaborative Offshore Wind Research into the Environment

CPA	—	Coast Protection Act 1949
CPC	—	Cable Protection Committee
CPT	—	Cone Penetration Tests
CSLVIA	—	Cumulative Seascape, Landscape and Visual Receptors Impact Assessment
CSM	—	Conceptual site model
CV	—	Coefficient of Variation
DC	—	Direct Current
dB	—	Decibel
dB <sub>ht</sub>	—	Decibel Hearing Threshold
dB <sub>ht</sub> (Species)	—	Decibel Hearing Threshold (for a particular species)
DDV	—	Drop Down Video
DECC	—	Department of Energy and Climate Change
DEFRA	—	Department for Environment, Food and Rural Affairs
DFO	—	District Fishery Office
DfT	—	Department for Transport
DSFB	—	District Salmon Fishery Board
DTI	—	Department for Trade and Industry
EA	—	Environment Agency (England)
EAR	—	Ecological Acoustic Reader
EC	—	European Commission
ECoW	—	Ecological Clerk of Works
EHO	—	Environmental Health Officer
E	—	Electric field
E <sub>i</sub>	—	Induced Electrical field
EIA	—	Environmental Impact Assessment
EMF	—	Electromagnetic field
EMP	—	Environmental Management Plan
EOWDC	—	European Offshore Wind Deployment Centre
EPS	—	European Protected Species
ERCoP	—	Emergency Response Cooperation Plan
ERRV	—	Emergency Response and Rescue Vessel
ES	—	Environmental Statement
ESAS	—	European Seabirds at Sea
FAD	—	Fish Aggregation Device
FEPA	—	Food and Environment Protection Act
FIR	—	Fishing Industry Representative

FL	—	Flight Level
FLOW	—	Fishing Liaison for Offshore Wind
FSA	—	Formal Safety Assessment
ft	—	Feet
FTE	—	Full time equivalent
Ftm	—	Fathom
GAM	—	Generalised Additive Models
GAMM	—	Generalised Additive Mixed Models
GBS	—	Gravity Base Structure
GEE	—	Generalised Estimation Equation
GIS	—	Geographical Information System
GMS	—	Goose Management Scheme
GPS	—	Global Positioning System
GSD	—	Ground Sample Distance
GVA	—	Gross Value Added
GW	—	Giga Watt
GWDE	—	Ground and Water-Dependant Terrestrial Ecosystems
ha	—	Hectare
HAT	—	Highest Astronomical Tide
HCHET	—	Highland Council Historic Environment Team
HDD	—	Horizontal Directional Drilling
HGV	—	Heavy Goods Vehicle, including Abnormal Loads
HIE	—	Highlands and Islands Enterprise
hp	—	Horsepower
hr	—	Hour
HVAC	—	High Voltage Alternating Current
HVDC	—	High Voltage Direct Current
Hz	—	Hertz
IAIP	—	Integrated Aeronautical Information Package
IALA	—	International Association of Marine Aids to Navigation and Lighthouses
ICES	—	International Council for the Exploration of the Sea
ICOMOS	—	International Council on Monuments and Sites
IEEM	—	Institute of Ecology and Environmental Management
IfA	—	Institute of Archaeologists
IHO	—	International Hydrographic Organisation
IMO	—	International Maritime Organisation

in	—	Inches
IUCN	—	International Union for Conservation of Nature
JNAPC	—	Joint Nautical Archaeology Policy Committee
JNCC	—	Joint Nature Conservation Committee
kg	—	Kilogram
kg / s	—	Kilogram per second
KIS—CA	—	Kingfisher Information Services—Cable Awareness
kJ	—	Kilojoule
km	—	Kilometres
km <sup>2</sup>	—	Square kilometres
km <sup>2</sup> -hrs	—	Square kilometres per hours
kN	—	Kilonewton
kN / m <sup>2</sup>	—	Kilonewton per square metre
kN / m <sup>3</sup>	—	Kilonewton per cubic metre
kV	—	Kilovolt
l / s	—	Litres per second
L <sub>Aeq</sub>	—	Equivalent continuous A-weighted sound pressure level
LAT	—	Lowest Astronomical Tide
LBAP	—	Local Biodiversity Action Plan
LGV	—	Light Goods Vehicle, including cars
LNR	—	Local Nature Reserve
Lw, dB	—	Sound power level
m	—	Metre
M	—	Million
m <sup>2</sup>	—	Square metres
m <sup>3</sup>	—	Cubic metres
m / h	—	Metres per hour
m / s	—	Metres per second
ms <sup>-1</sup>	—	Metres per second
m <sup>3</sup> / s	—	Cubic metres per second (often called cumecs)
MAIB	—	Marine Accident Investigation Branch
mAOD	—	Metres Above Ordnance Datum
MBES	—	Multibeam Echosounder
MCA	—	Maritime and Coastguard Agency
mCD	—	Metres Chart Datum
MCEU	—	Marine Consents and Environment Unit

MEHRA	—	Marine Environmental High Risk Area
MESH	—	Marine European Seabed Habitats
MFOWDG	—	Moray Firth Offshore Wind Developers Group
MFSTP	—	Moray Firth Sea Trout Project
mg / l	—	Milligrams per litre
MGN	—	Marine Guidance Notice
M <sub>hf</sub>	—	M-weighted Sound Exposure Level for High Frequency Cetaceans
MHWS	—	Mean High Water Springs
M <sub>lf</sub>	—	M-weighted Sound Exposure Level for Low Frequency Cetaceans
Mil AIP	—	Military Aeronautical Information Package
mm	—	Millimetre
M <sub>mf</sub>	—	M-weighted Sound Exposure Level for Mid Frequency Cetaceans
MMMP	—	Marine Mammal Mitigation Protocol
MMO	—	Marine Management Organisation
MoD	—	Ministry of Defence
MORL	—	Moray Offshore Renewables Ltd
MPCP	—	Marine Pollution Contingency Plan
MPFSPG	—	Moray and Pentland Firths Salmon Protection Group
mph	—	Miles per hour
M <sub>pw</sub>	—	M-weighted Sound Exposure Level for Pinnipeds (in water)
MRCC	—	Maritime Rescue Coordination Centre
MRSC	—	Maritime Rescue Sub-Centre
MS	—	Marine Scotland
ms <sup>-1</sup>	—	Metres per second
MSS	—	Marine Scotland Science
MSW	—	Multi—Sea Winter
mT	—	Millitesla
MtCO <sub>2</sub>	—	Metric Tonne (ton) carbon dioxide equivalent
MW	—	Megawatt
NBN	—	National Biodiversity Network
NESBReC	—	North East Scotland Biological Records Centre
NE LBAP	—	North East Scotland Local Biodiversity Action Plan
NIS	—	Non Indigenous Species
NLB	—	Northern Lighthouse Board
nm	—	Nautical mile
nm <sup>2</sup>	—	Squared nautical mile

NMRS	—	National Monument Records of Scotland
NPS	—	Natural Power Consultants
NRA	—	Navigation Risk Assessment
NSRAC	—	North Sea Regional Advisory Council
NTS	—	Non Technical Summary
NtM	—	Notice to Mariners
NUTS	—	Nomenclature of Territorial Units for Statistics
NVC	—	National Vegetation Classification
NVQ	—	National Vocational Qualifications
OFGEM	—	Office of Gas and Electrical Markets
OfTI	—	Offshore Transmission Infrastructure
OFTO	—	Offshore Transmission Owner
OnTI	—	Onshore Transmission Infrastructure
OREI	—	Offshore Renewable Energy Installations
OSP	—	Offshore Substation Platform
Pa	—	Pascal
Pa.s	—	Pascals per second
PAD	—	Protocol for Archaeological Discoveries
PAM	—	Passive Acoustic Monitoring
PAN	—	Planning Advice Note
PCH	—	Potential Collision Height
PCPT	—	Piezocone Cone Penetration Test
PEXA	—	Practice and Exercise Area
PMF	—	Priority Marine Feature
PPG	—	Pollution Prevention Guidelines
PSD	—	Particle Size Distribution
PSR	—	Primary Surveillance Radar
pSLAs	—	Proposed Special Landscape Areas
PTS	—	Permanent Threshold Shift
PVA	—	Population Viability Analysis
RAF	—	Royal Air Force
RBMP	—	River Basin Management Plan
RCAHMS	—	Royal Commission on the Ancient and Historical Monuments of Scotland
REZ	—	Renewable Energy Zone
RNLI	—	Royal National Lifeboat Institution
ROW	—	Receiver of Wreck

rpm	—	Rotation per minute
RSPB	—	Royal Society for the Protection of Birds
RYA	—	Royal Yachting Association
s	—	Second
SAC	—	Special Area of Conservation
SAR	—	Search and Rescue
SBL	—	Scottish Biodiversity List
SBP	—	Sub-Bottom Profiler
SCA	—	Scottish Canoe Association
SCADA	—	Supervisory Control and Data Acquisition
SCANS	—	Small Cetaceans in the European Atlantic and North Sea
SE	—	Scottish Enterprise
SEA	—	Strategic Environmental Assessment
SEL	—	Sound Exposure Level
SEPA	—	Scottish Environment Protection Agency
SFF	—	Scottish Fishermen's Federation
SHEP	—	Scottish Historic Environment Policy
SHETL	—	Scottish Hydro Electric Transmission Limited
SLVIA	—	Seascape, Landscape and Visual Impact Assessment
SMRU	—	Sea Mammal Research Unit (University of St Andrews)
SMS	—	Safety Management Systems
SNCA	—	Statutory Nature Conservation Agency
SNFAS	—	Salmon Net Fishing Association of Scotland
SNH	—	Scottish Natural Heritage
SPA	—	Special Protected Area
SPL	—	Sound Pressure Level
SPV	—	Special Purpose Vehicle
SSC	—	Suspended Sediment Concentration
SSE	—	Scottish and Southern Energy
SSR	—	Secondary Surveillance Radar
SSS	—	Sidescan Sonar: A sonar survey system that maps the seabed
SSSI	—	Site of Special Scientific Interest
STW	—	Scottish Territorial Waters
SuDS	—	Sustainable Urban Drainage System
SWT	—	Scottish Wildlife Trust
TCE	—	The Crown Estate

tCO <sub>2</sub>	—	Tonnes of CO <sub>2</sub>
Te	—	Tonne (as used in offshore industry)
T-POD	—	Timing Porpoise Detectors
TTS	—	Temporary Threshold Shift
TWH	—	Terawatts per hour
UK BAP	—	United Kingdom Biodiversity Action Plan
UKCS	—	United Kingdom Continental Shelf
UKHO	—	United Kingdom Hydrographic Office
UNESCO	—	United Nations Educational, Scientific and Cultural Organisation
UXO	—	Unexploded Ordnance
VC	—	Vibrocore
VER	—	Valued Ecological Receptor
VMS	—	Vessel Monitoring System
Vph	—	Vehicles per hour
WeBS	—	Wetland Bird Survey
WSI	—	Written Scheme for Investigation
WTG	—	Wind Turbine Generator
yr	—	Year
ZTV	—	Zone of Theoretical Visibility
1SW	—	One—Sea Winter
μPA	—	Micro pascal
μPa <sup>2</sup> s	—	Micro pascal squared second
μpa <sup>2</sup> Hz <sup>-1</sup>	—	Micro pascal squared per Hertz
μT	—	Micro Tesla



## Technical Terminology

**Abnormal Loads:** Loads that require oversize vehicles for transport *i.e.* turbine components, transformers. Such deliveries require special approval.

**Above Ordnance Datum: (AoD)** In the UK this is the elevation above or below the Mean Sea Level at Newlyn in Cornwall between 1915 and 1921.

**Abundance:** An ecological concept referring to the relative representation of a species in a particular ecosystem. How species abundances are distributed within an ecosystem, defined location or community is referred to as relative abundance.

**Acoustic masking:** Loss of perception of one sound source because of another louder source.

**Acoustic particle velocity:** The time rate of change of the displacement of fluid particles created by the forces exerted on the fluid by acoustic pressure in the presence of a sound wave. The units of velocity are meters per second (m / s).

**Acoustic Pressure:** The force per unit area exerted by a sound wave above and below the ambient or static equilibrium pressure is called the acoustic pressure or sound pressure. The units of pressure are pounds per square inch (psi) or, in the SI system of units, Pascals (Pa). In underwater acoustics the standard reference is one-millionth of a Pascal, called a micro-Pascal (1  $\mu$ Pa).

**Aids to Navigation:** Aid to Navigation is any device specifically intended to assist navigators in determining their position or safe course, or to warn them of dangers or obstructions to navigation.

**Ambient sound:** Normal background noise in the environment, which has no distinguishable sources.

**Anomaly survey data:** Possible manmade or target of anthropogenic origin identified in the geophysical

**Anthropogenic noise:** Production of noise above that which is naturally found in the environment, human in origin.

**A-weighting, dB(A):** The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.

**Appropriate Assessment:** Required when a development affecting a European designated site is not connected with management of the site for nature conservation, and is likely to have a significant effect on the site.

**Aquifer:** Any water: bearing strata, be this bedrock or superficial deposits.

**Aquifer-fed naturally fluctuating water bodies:** Natural water bodies with an intrinsic regime of extreme fluctuation in water level, with periods of complete or almost complete drying out as part of the natural cycle. They have no inflow or outflow streams at the surface, except at times of very high water level, when temporary out-flows may develop. Instead, they are directly connected to the underlying groundwater system and periodically empty and recharge via swallow holes or smaller openings in their beds.

**Area of sea excluded (km<sup>2</sup>-hours):** The area of sea excluded with each activity; this gives an idea of the area expected to be excluded to an animal, based on a given dBht (Species) criteria over a period of time. This means direct comparisons can be made against the area of sea excluded during a short piling operation or a dredging operation lasting all day. These results have been given as kilometres squared excluded times hours (km<sup>2</sup>-hours), for example, if 10 km<sup>2</sup>-hours of sea are excluded this could mean that 1 km<sup>2</sup> of sea is excluded for ten hours or that 10 km<sup>2</sup> of sea is excluded for 1 hour.

**Area Restricted Search:** Modelling term. When all other things are equal, organisms should spend more time in areas where resources are plentiful than in areas where resources are scarce. For example: predators may increase their turning rate and reduce their speed as a response to increased prey intake rate. When the prey has an aggregated spatial distribution, area-restricted search behaviour will tend to concentrate the search activity of the predators in areas of high prey density.

**As Low As Reasonably Practicable:** Reasonably practicable involves weighing a risk against the trouble, time and money needed to control it. Thus, ALARP describes the level to which we expect to see workplace risks controlled.

**ASCOBANS:** Concluded in 1991 as the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) under the auspices of the Convention on Migratory Species (CMS or Bonn Convention) and entered into force in 1994. In February 2008, an extension of the agreement area came into force which changed the name to "Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas". Since migrating cetaceans regularly cross national boundaries, their effective protection can only be achieved by international cooperation. ASCOBANS' aim is to promote close cooperation amongst its Parties with a view to achieving and maintaining a favourable conservation status for small cetaceans.

**Assets:** Parts of the historic environment that has local, regional and national significance, such as Designated Wrecks, aircraft losses and Listed Buildings.

**Atlantic decalcified fixed dunes:** Mature, stable dunes where the initial calcium carbonate content of the dune sand is low. The surface soil layers rapidly lose their remaining calcium carbonate through leaching, and become acidified.

**Baleen whales:** Alternative name for the cetacean sub-order, Mysticeti, characterised by having baleen plates for filtering food from water. In contrast to the toothed whales (Odontoceti). The smallest member of this sub-order is the minke whale.

**Bandwidth:** The range of frequencies over which a sound is produced or received.

**Base level:** The lowest point to which erosion by running water can occur.

**Baseflow:** The flow of groundwater within both bedrock and superficial deposits that supplies a river or stream.

**Bathymetry:** The measurement of the depth of the seabed from the water surface

**Bayesian state-space model:** Statistical model that enables probabilistic inference about parameters and trends based on summaries of posterior probability distributions (vs. null hypothesis testing), they permit the use of multiple data types collected at different scales and use of prior information, and they enable model selection and multi-model inference in a straightforward manner.

**Bedrock:** The underlying solid geology.

**Benthic:** Relating to the uppermost layers of the seabed.

**Bentonite:** A manufactured impermeable very fine clay that is often used in cement and as a well sealant.

**Biogenic:** A substance produced by life processes. It may be either constituents, or secretions of plants or animals.

**Biotope:** A specific uniform habitat type and its associated community of plants and animals.

**Blown sand:** Windblown modern deposits of sand commonly associated with beaches, sand dunes, dune slacks and raised beaches.

**British Geological Survey:** (BGS) the UK national geological survey / service.

**Broad migration front:** Migration in which the birds are spread over wide areas instead of being confined to relatively narrow 'corridors'.

**Buffer:** A fixed distance outward from the cable route corridor boundary used to create a survey area.

**Buoyage:** A distinctively shaped and coloured float, anchored to the bottom, for designating moorings, navigable channels or obstructions in a body of water.

**Carboniferous:** The period of geological time between 360 and 300 million years ago.

**Cargo Vessel:** A vessel designed to carry cargo in bulk including unitised cargo.

**Catchment:** The area from which a river, stream or burn drains both groundwater and rainwater. This is usually defined by the limit of the watershed (i.e. the limits of a river's drainage area).

**Cetacean:** Mammals belonging to the order Cetacea, which includes whales, dolphins and porpoises.

**Charted Navigational Features:** Features appearing on a nautical chart including depths of water and heights of land (topographic map), natural features of the seabed, details of the coastline, navigational hazards, locations of natural and man-made aids to navigation, information on tides and currents, local details of the Earth's magnetic field and man-made structures such as harbour's, buildings and bridges.

**Chironomid midge:** Flies within the taxonomic family Chironomidae.

**Circa:** In approximately (in the context of time or dates).

**Circalittoral:** The seabed in areas of comparatively deeper water, generally where light availability is limited.

**Classification tree analysis:** Used to predict membership of cases or objects in the classes of a categorical dependent variable from their measurements on one or more predictor variables.

**Cluttered Out:** Altering settings on marine Radar to reduce the effect of interference from occurrences such as rain.

**Collaborative Offshore Wind Research into the Environment:** (COWRIE) A registered Charity set up to advance and improve understanding and knowledge of the potential environmental impacts of offshore wind farm development in UK waters.

**COLREGS:** The International Regulations for Preventing Collisions at Sea 1972 (COLREGS) are published by the IMO and set out, inter alia, the "rules of the road" or navigation rules to be followed by ships and other vessels at sea, in order to prevent collisions between two or more vessels.

**Commercial routes:** Routes used by vessels operating commercially.

**Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland):** Transposed the Habitats Directive into national law. The Regulations came into force on 30 October 1994, and have been subsequently amended several times. They apply to land and to territorial waters out to 12 nautical miles from the coast.

**Conspecific:** Of, or belonging to, the same species.

**Construction Environmental Management Plan (CEMP):** an Environmental Management Plan (see definition) for the construction phase of the Project.

**Creeling:** The Scottish designation for potting.

**Dalradian:** The name given to a group of metamorphic bedrocks grouped due to their complex stratigraphy and mixed origins.

**DEAD Wreck:** Previously identified anomaly that has not been detected through further survey, therefore considered not to exist.

**Decibel (dB):** A customary scale most commonly used (in various ways) for reporting levels of sound. A difference of 10 dB corresponds to a factor of 10 in sound power. The actual sound measurement is compared to a fixed reference level and the "decibel" value is defined to be  $10 \log_{10}(\text{actual} / \text{reference})$ , where (actual / reference) is a power ratio. Because sound power is usually proportional to sound pressure squared, the decibel value for sound pressure is  $20 \log_{10}(\text{actual pressure} / \text{reference pressure})$ . As noted above, the standard reference for underwater sound pressure is 1 micro-Pascal ( $\mu\text{Pa}$ ). The dB symbol is followed by a second symbol identifying the specific reference value (i.e. re 1  $\mu\text{Pa}$ ).

**Decommissioning Programme:** the Department of Energy and Climate Change (DECC) require, under Section 105(2) of the Energy Act 2004, that MORL prepare a decommissioning programme for the Project prior to construction commencement. MORL has prepared a 'preliminary' Decommissioning Programme for the Project, which forms an appendix to the Environmental Statement (ES). This programme will be finalised following consent and in advance of wind farm construction starting.

**Delivery:** This is two vehicle movements, e.g. one vehicle movement to the point of interest and one vehicle movement away from the point of interest.

**Demersal:** Activities or species located near or on the sea bed.

**Density surface modelling:** Prediction of the density of animals across a site using detection function modelling and covariate data.

**Density surface:** A visual representation of predicted densities of animals across a site based on density surface models.

**Density:** A measurement of population per unit area or unit volume.

**Designated Anchorages:** Areas marked on a nautical chart where anchoring occurs, usually linked to a particular port.

**Designated Wreck:** A historic wreck, protected by law to ensure the remains are not put at risk from unauthorised access, undisciplined activities or investigation, the Protection of Wrecks Act 1973.

**Development Area:** The limits of Development Areas are charted around certain oil or gas fields. Surface vessels, subsea craft and divers may be engaged in constructing and servicing installations within these areas. Other vessels are strongly advised to keep out of the charted limits.

**Devonian:** The period of geological time between 415 and 360 million years ago.

**Diadromous:** Migratory between fresh and salt waters.

**Diffuse pollutants:** The release of potential pollutants from a range of activities that individually may have no effect on the water environment, but at the scale of a catchment can have a meaningful impact.

**Distance sampling:** A widely-used group of closely related methods for estimating the density and / or abundance of populations. The main methods of data collection are line transects and point transects.

**Dolerite:** A medium grained igneous rock intrusion.

**Domin scale:** A scale ranging from 1 to 10 which estimates the quantitative contribution of a species within a vegetation sample.

**Drinking Water Protection Zone:** These are protected areas designated under the Water Framework Directive (2000 / 60 / EC) in the UK.

**Ducted propellers:** A propeller fitted with a non-rotating nozzle. It is used to improve the efficiency of the propeller and is especially used on heavily loaded propellers or propellers with limited diameter.

**Dune Slacks:** The spaces and depressions between the peaks of a sand dune system are called the dune slack.

**Dyke:** An igneous intrusion that generally crosses vertically through the beds of the wider geology.

**Ecological Acoustic Recorder (EAR):** A digital, low power hydrophone that records ambient sounds at frequencies up to 30 kHz on a programmable schedule. Can also respond to transient acoustic events that meet specific criteria, such as signals indicating a vessel passing nearby. Advantage over C-PODs is that it has the potential to differentiate between different dolphin species.

**Ei field:** Induced electric field. An electric field induced in the medium surrounding a cable by the magnetic field emitted from the cable.

**Electromagnetic field (EMF):** A physical field produced by moving electrically charged objects.

**Embryonic shifting dunes:** Embryonic shifting of dune vegetation exists in a highly dynamic state and is dependent on the continued operation of physical processes at the dune / beach interface. It is the first type of vegetation to colonise areas of incipient dune formation at the top of a beach.

**Encounter:** An encounter can be defined as approaching vessels passing within a specified minimum distance of each other or if either vessel manoeuvres so as to prevent this critical value for the closest point of approach.

**Environmental Management Plan (EMP):** The EMP is the lead environmental management document that defines the procedures for achieving the environmental performance targets for the Project. MORL has prepared a draft EMP, which forms an appendix to the Environmental Statement (ES). The draft EMP details the commitments made in the Environmental Statement (ES). The EMP will be finalised following consent, taking into account any requirements of consent conditions, and in advance of wind farm construction starting.

**Ephemeral short perennial:** Short, patchy plant associations typical of derelict urban sites, quarries and railway ballast. The land is freely draining and usually has shallow stony soil. The vegetation typically lacks a clear dominant species, but consists of a mixture of low-growing plants, often less than 25 cm high.

**Epibenthic:** Relating to the seabed surface.

**Epifauna:** Animals living on the surface of the seabed.

**European Protected Species (EPS):** EPS are animals and plants that receive protection under the Habitats Directive under Annex IV of the Directive. This includes all species of cetacean.

**Eutrophic:** The state of a lake or pond with waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content.

**Façade:** At a distance of 1 m in front of a large sound reflecting object such as a building façade.

**Far field:** A region far enough away from a source that the sound pressure behaves in a predictable way, and the particle velocity is related to only the fluid properties and exists only because of the propagation sound wave (see Near field).

**Fast Time Weighting:** An averaging time used in sound level meters.

**Fauna:** Animals both invertebrates and vertebrates.

**Felsic:** A term used to describe igneous rocks enriched in crystalline minerals such as feldspars and quartz. The term is generally associated with granite geologies where mineral crystals are large.

**Firing Practice Area:** An area marked by floating navigational marks when the Ministry of Defence undertake firing practice exercises. Entry requirements vary and are usually annotated on the relevant nautical chart.

**First Passage Time:** The first-passage time is defined as the time required for an animal to cross a circle with a given radius. It is a measure of how much time an animal uses within a given area. First-passage time is scale dependent, and a plot of variance in first-passage time vs. spatial scale reveals the spatial scale at which the animal concentrates its search effort. It is a reasonable measure for the search effort along a pathway.

**Fitness (reduction in):** Ability to produce subsequent generations.

**Flint:** Form of quartz mineral (chert) used to make tools in prehistoric societies.

**Flora:** The plants of a particular region.

**Fluvioglacial:** The materials deposited within the flood plains, streams and rivers resulting from past glacial melt water.

**Fractured Flow:** A term given to the flow of groundwater along geological fractures, faults, fissures and other discontinuities within the bedrock.

**Free-Field:** Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m away.

**Fucoid algae:** Algae within the taxonomic order Fucales.

**Full Time Equivalent (FTE):** The number of jobs with part-time employment assessed on a pro rata basis, based on full-time work as a 30 hour week i.e. two jobs working 15 hours part-time equals 1 FTE.

**Gas Holder:** A circular structure above or below ground that is used to contain natural or historical coal gas produced by a gasworks.

**Gasometre:** Another name for a gas holder.

**Gasworks:** This is an industrial land use (now ceased) where by gas (often called coal gas or town gas) was produced by the heating of coal. This often resulted in the gasworks site becoming contaminated.



**Generalised Additive Mixed Model (GAMM):** A statistical model containing both fixed and random effects (i.e. mixed effects). Use additive, non-parametric regression to model covariate effects while accounting for correlation between observations by using random effects. GAMMs are proposed for over-dispersed and correlated data.

**Generalised Additive Models (GAM):** Statistical model that allows fitting a smooth relationship between two or more non-linear variables.

**Generalised Estimating Equation (GEE):** Semi parametric regression technique used to estimate the parameters of a generalised linear model with possible unknown correlation between outcomes.

**Geographic Information System:** (GIS) generally referring to ESRI ArcGIS v10 in this document.

**Geoparks:** A geopark status is an area of outstanding interest for its rocks and landforms designated by SNH, local communities, local authorities and / or earth scientists.

**Geophysical Survey:** A non-intrusive investigative survey method including sidescan sonar, magnetometer and sub-bottom profiler for on and below the seabed features.

**Geotechnical Survey:** An intrusive survey method that penetrates the seabed recovering samples for analysis.

**Glacial sand and gravel:** Sand and gravel deposits associated with a multitude of glacial advance and retreat processes.

**Glaciolacustrine:** A term given to deposits that were deposited within glacial lakes.

**Glass eel:** An eel in its transparent, post larval stage.

**Gley:** A type of soil formed by the absence of, or very low levels of oxygen that allows the reduction of oxides causing the soil to become white to grey coloured.

**Grab Samples:** A sample taken from the seabed sediments.

**Grey dunes:** Dune vegetation occurring mainly on the largest dune systems. These dunes typically occur inland of the zone dominated by marram on coastal dunes and represent the vegetation that replaces marram as the dune stabilises and the organic content of the sand increases.

**Gross Value Added (GVA):** Gross Value Added (GVA) is an indicator of economic prosperity. It measures the contribution to the economy of each individual producer, industry or sector. Put simply, GVA is the value of goods and services produced by an area, sector or producer minus the cost of the raw materials and other inputs used to produce them. GVA is mainly composed of the income made by employees (earnings) and the business (profits / surplus) as a result of production.

**Ground Sample Distance (GSD):** Refers to the size of the pixels in a digital photo of the ground from air or space, expressed in ground units. For example: in an image with a 1 m GSD, adjacent pixels image locations that are 1 m apart on the ground.

**Groundwater Vulnerability:** The term given to the assessment of the potential for a groundwater body to be at risk from human activity.

**Guard Vessels:** Vessels employed protect an installation or work activity at sea though its presence and current promulgation of information. A guard vessel could also be used as a means of escape in an emergency situation.

**Habitats Directive (and annexes):** Also known as the "Council Directive 92 / 43 / EEC on the Conservation of natural habitats and of wild fauna and flora", known as the Habitats Directive was adopted in 1992. The Directive is the means by which the European Union meets its obligations under the Bern Convention. The Directive applies to the UK and to its

Overseas Territory of Gibraltar. The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance. In applying these measures, Member States are required to take account of economic, social and cultural requirements, as well as regional and local characteristics. The strategy for conservation of species set out in the Directive comprises measures related to site designation for species listed in Annex II, strict protection of all populations of species listed in Annex IV, and the managed exploitation of species listed in Annex V.

**Habituate:** Being accustomed or used to a potential disturbing stimulus such as vessel noise.

**Habituation:** A decrease in response to a stimulus after repeated presentations. For example: a novel structure in the environment, such as a turbine, may initially elicit an avoidance response in birds. However, after they become accustomed to its presence, they pay less attention to it and no longer avoid it. This diminished response is habituation.

**Hertz:** The units of frequency where 1 hertz = 1 cycle per second. The abbreviation for hertz is "Hz."

**Holocene:** Period of geological time spanning from 12,000 years BP to the present day.

**Homing:** Relating to an animal's ability to return to a place or territory after travelling a distance away from it.

**Humid dune slacks:** Low-lying areas within dune systems that are seasonally flooded and where nutrient levels are low.

**Igneous Intrusion:** The name given to volcanic formations that were formed below ground which now appear at the surface due to erosion. These formations include Sills which form between beds of rock (i.e. Windsill), Batholiths which are former magma chambers (i.e. Dartmoor) and Dykes which cut vertically through rock beds.

**Igneous:** A geological term relating to the typology of a rock formed by the cooling of magma (intrusive) or lava (extrusive).

**IMO Routing Measures:** Defined by the International Maritime Authority ships' routing systems contribute to safety of life at sea, safety and efficiency of navigation and / or protection of the marine environment. Ships' routing systems are recommended for use by, and may be made mandatory for, all ships, certain categories of ships or ships carrying certain cargoes. Routing measure can include Traffic Separation Schemes, Areas to be Avoided and Deep Water Routes.

**Impulse sound:** Transient sound produced by a rapid release of energy, usually electrical or chemical such as circuit breakers or explosives. Impulse sound has extremely short duration and extremely high peak sound pressure.

**Infauna:** Animals living in seabed sediments.

**Infiltration:** The percolation of rainwater through soils.

**Infralittoral:** The seabed in areas of shallow water, generally where light availability is not limited.

**Intergranular Flow:** A term given to the flow of groundwater through the voids between permeable superficial deposits and bedrocks such as sandstone.

**Intertidal:** The area of coast / beach between low water spring tide and high water spring tide.



**J Tube:** A conduit for offshore subsea cable from the seabed to the offshore structure.

**Japanese Knotweed:** A non-native invasive plant species that typically requires special removal and treatment under development scenarios.

**L<sub>10,T</sub>:** A noise level index. The noise level exceeded for 10 % of the time over the period T. L10 can be considered to be the 'average maximum' noise level. Generally used to describe road traffic noise.

**L<sub>90,T</sub>:** A noise level index. The noise level exceeded for 90 % of the time over the period T. L90 can be considered to be the 'average minimum' noise level and is often used to describe the background noise.

**Leachate:** Percolating water affected by the elements and compounds with a soil due to physical contact during migration of water.

**L<sub>eq,T</sub>:** A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.

**LIFT Wreck:** A salvaged wreck.

**Lithic:** Stone tools that may be associated with prehistoric cultures.

**LIVE Wreck:** Wreck considered to exist.

**L<sub>max,T</sub>:** A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L<sub>eq</sub> noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

**Macrofossils:** Fossils that can be identified by eye (e.g. shell fragments).

**Main Routes:** The mean of a defined route which has high densities of traffic or is used by regular operators on a timetabled service.

**Marine Environmental High Risk Area:** MEHRAs are defined as areas having high environmental sensitivities and being at risk from shipping activity. In due course they will be marked on Admiralty charts as an encouragement to mariners to take extra care in those areas and for their existence to be taken into account during passage planning.

**Maritime Rescue Coordination Centre:** Maritime Rescue Coordination Centres (MRCCs) form a network of command and control centres for responding to reports of maritime and coastal distress. Watch keeping staff in these centres provide a 24 hour service to mariners and coastal users by receiving incoming distress calls and sending resources to their rescue.

**Marshalling Yard:** Another name for a railway yard for the storage of trains and carriages.

**Mean High Water Springs:** Highest level that spring tides (highest astronomical tide) reach on the average over a tidal period.

**Mesolithic:** Archaeological period of time of past cultures approximately 9,000 to 4,000 BC.

**Mesotrophic:** The state of a lake or pond with an intermediate level of productivity, greater than oligotrophic lakes, but less than eutrophic lakes. These lakes are commonly clear water lakes and ponds with beds of submerged aquatic plants and medium levels of nutrients.

**Metamorphic:** A geological term relating to the typology of a rock which has been changed by the application of heat and pressure during tectonic processes.

**Microfossils:** Small fossils that can only be viewed under a microscope e.g. pollen

**Natura site:** Natura 2000 is the name of the European Union-wide network of nature conservation sites established under the EC Habitats and Birds Directives. This network comprises Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

**Near field:** A region close to a sound source that, depending on the size of the source relative to the wavelength of the sound, has either irregular sound pressure or exponentially increasing sound pressure towards the source, and a high level of acoustic particle velocity because of kinetic energy added directly to the fluid by motion of the source. This additional kinetic energy does not propagate with the sound wave. The extent of the near field depends on the wavelength of the sound and / or the size of the source.

**Neolithic:** Archaeological period of time of past cultures approximately 4,000 to 2,500 BC.

**Noise Level Indices:** Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.

**Not Under Command:** Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGS), the term "vessel not under command" means a vessel which, through some exceptional circumstance, is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.

**Offshore Marine Regulations 2009:** Transposes the Habitats Directive into national law for UK offshore waters (i.e. from 12 nm from the coast out to 200 nm or to the limit of the UK Continental Shelf Designated Area).

**Oligotrophic:** The state of a lake or pond with low nutrient content, a large amount of dissolved oxygen and very clear waters due to low algal production.

**Ontogeny:** The origin and development of an individual organism from embryo to adult.

**Ordovician:** The period of geological time between 490 and 445 million years ago.

**OSPAR convention:** Current legal instrument guiding international cooperation on the protection of the marine environment of the North East Atlantic. Work under the Convention is managed by the OSPAR Commission, made up of representatives of the Governments of 15 Contracting Parties and the European Commission, representing the European Union.

**Outfall:** The discharge point of an artificial flow into a surface water body.

**Overpump flow:** The removal of silted water from a dammed work area within a river or burn.

**Palaeochannel:** Submerged former course of a fluvial feature such as a former river typically filled with sediment.

**Palaeoenvironmental:** Past environmental conditions.

**Palaeolithic:** Prehistoric era distinguished by the development of stone tools, 18,000 to 780,000 years BP.

**Pamguard:** An open-source software community, developing marine mammal acoustic detection and localisation software to benefit the marine environment.

**PAN 33:** Planning Advice Note 33 – Development of Contaminated Land (2000) issued by the Scottish Government in October 2000.

**Passerine:** Birds within the taxonomic order Passeriformes. This order includes more than half of all bird species. Passerines are sometimes known as perching birds or, less accurately, as songbirds.

**Passive Acoustic Monitoring (PAM):** Refers to the use of hydrophones (underwater microphones) to detect and monitor the presence of vocalising marine mammals.

**Peak pressure:** The highest pressure above or below ambient that is associated with a sound wave.

**Peat:** An organic material formed by decayed vegetation matter that can preserve important environmental and archaeological evidence.

**Pelagic:** Activities or species located in the water column.

**Pelite:** A term given to a metamorphosed fine grained bedrock.

**Permanent threshold shift (PTS):** A permanent loss of hearing caused by some kind of acoustic or drug trauma. PTS results in irreversible damage to the sensory hair cells of the ear and, thus a permanent loss of hearing.

**Permian:** The period of geological time between 300 and 250 million years ago.

**Pinniped:** Mammals belonging to the order Pinnipedia, which includes seals, walruses and sea lions.

**Piscivorous:** Habitually feeding on fish.

**Pleistocene:** Period of geological time spanning 1.8 million years ago to the Holocene.

**Podzol:** A type of soil with a distinct vertical structure (i.e. organic, leached and iron pan horizons) formed by the leaching of compounds. These soils are often associated with igneous / basic geologies.

**Point Source Pollution:** The release of potential pollutants from a range of activities that individually may result in an effect on the environment. These activities may include discharges regulated by the Controlled Activities Regulations (CAR)

**Population Viability Analysis (PVA):** A modelling technique which uses demographic parameters for a species, takes into account threats faced by populations of that species, and evaluates the likelihood that they will persist for a given time into the future.

**Port Approaches:** Areas with port jurisdiction and used by vessels to access a port or harbour area.

**Potential Collision Height:** (PCH) the altitude band for birds in flight which corresponds to the rotor swept area of a turbine.

**Predicted annual collision rate:** The annual number of bird collisions with wind turbines, as predicted by collision risk modelling, in which flight activity, size and speed of bird species and dimensions and rotational speed of turbine blades are analysed.

**Priority Marine Feature (PMF):** Habitats and species considered to be of greatest marine nature conservation importance in Scottish territorial waters. The draft PMF list contains 53 habitats and species and will be used to guide future research and support the advice SNH gives on marine biodiversity.

**Psammite:** A term given to metamorphosed medium grained bedrock.

**Pulse:** A transient sound wave having finite time duration. A pulse may consist of one to many sinusoidal cycles at a single frequency, or it may contain many frequencies and have an irregular waveform.

**Pupping:** Term for when seals give birth.

**Quadrat:** A square frame used to isolate a sample of vegetation (usually 1m<sup>2</sup>) to estimate cover and composition.

**Qualifications (socio-economics):** The qualifications are as follows – NVQ 4 equivalent and above: e.g. HND, Degree and Higher Degree level qualifications or equivalent; NVQ 3 equivalent: e.g. two or more A levels, advanced GNVQ, NVQ 3, two or more higher or advanced higher national qualifications (Scotland) or equivalent; NVQ 2 equivalent: e.g. five or more GCSEs at grades A-C, intermediate GNVQ, NVQ 2, intermediate two national qualification (Scotland) or equivalent; NVQ 1 equivalent: e.g. fewer than five GCSEs at grades A-C, foundation GNVQ, NVQ 1, intermediate one national qualification (Scotland) or equivalent; other qualifications; foreign qualifications and other professional qualifications not identified above

**Quartzite:** A metamorphic rock consisting mainly of quartz, formed by the alteration of sandstone by heat and pressure.

**Quaternary:** Of or belonging to the geological time, system of rocks or sedimentary deposits from the end of the Tertiary Period through to the present.

**Quota:** A measure of the quantity of a species that can legally be landed within a set period.

**Radar:** Radar is an object-detection system which uses radio waves to determine the range, altitude, direction or speed of objects.

**RAMSAR:** Sites designated under the Convention on Wetlands of International Importance. The Convention covers all aspects of wetland conservation and wise use, recognizing wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities. The Convention defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres". Wetlands "may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands".

**Receptor:** Any environmental or other defined feature that is sensitive to or has the potential to be affected by an impact.

**Recreational routes:** Routes used by any water craft engaged in a recreational activity.

**Regosol:** A type of poorly developed mineral soil.

**Resonance frequency:** The frequency at which a system or structure will have maximum motion when excited by sound or an oscillatory force.

**River flow regime:** Variability in river discharge in response to precipitation, temperature, evapo-transpiration and drainage basin characteristics.

**Rochdale Envelope:** The 'Rochdale Envelope' is the range of parameters setting out the minimum and maximum extents of Project components that have been assessed.

**Rolling Safety Zone:** A marked area of a defined size from which traffic is excluded for safety reasons; provides safe area for work to be undertaken and moves with the construction activity. Application process required.

**Ruderal:** Plant species which are the first to colonise disturbed land.

**Run-off:** Generally the overland flow of rainwater.

**Safety Zone:** A marked area of a defined size from which traffic is excluded for safety reasons; provides safe area for work to be undertaken. Application process required.

**Saturated Zone:** The portion of ground below the water table.

**SCANS / SCANS II:** European LIFE-Nature funded projects aiming to estimate small cetacean abundance in European Atlantic waters allowing the assessment and management of

bycatch through the development of improved methods for monitoring. First conducted in 1994 and repeated in 2005.

**Schedule 1 Birds:** Designated under the Wildlife & Countryside act 1981. Part 1 - Birds and their young, for which it is an offence to intentionally or recklessly disturb at, on or near an 'active' nest. Part 2 - Birds afforded special protection during the close season which is 1 February to 31 August (21 February to 31 August below high water mark) but which may be killed or taken outside this period.

**Scheduled Monument:** Nationally important archaeological sites which have legal protection assigned to them.

**Scottish Data Zones:** The data zone geography covers the whole of Scotland and nests within local authority boundaries. The 6,505 data zones are created from groups of 2001 Census output areas and have populations of between 500 and 1,000 household residents. Where possible they have been made to respect physical boundaries and natural communities. They have a regular shape and contain households with similar social characteristics.

**Sea State:** The general condition of the free surface on a large body of water; with respect to wind waves and swell at a certain location. This has been defined in the ES using the following link -<http://www.metoffice.gov.uk/weather/marine/guide/beaufortscale.html>.

**SeaZone:** SeaZone Solutions Ltd. who provide marine data supplied through the UK Hydrographic Office.

**Sedimentary:** A geological term relating to the typology of a rock which has originated from erosional and depositional processes. These rock types include sandstone, mudstone and conglomerates.

**Sedimentation:** The deposition of silt, sand and gravel within areas of low flow within rivers and lochs.

**Semipelite:** A term given to a metamorphosed fine grained bedrock including minerals such as mica.

**Set aside:** Land not used for any agricultural purpose.

**Settlement lagoons / sediment trap:** A pond where surface runoff is held for sufficient time to allow for settlement and / or treatment of solids or contaminants.

**Shock wave:** A propagating sound wave that contains a discontinuity in pressure, density, or particle velocity.

**Sidecasting:** The placement of excavated materials adjacent to the excavation at the surface.

**Silt:** A geological deposit that can contain evidence of past sea levels and landscapes.

**Site of Special Scientific Interest:** (SSSI) designated by SNH under the Nature Conservation (Scotland) Act 2004.

**Smithy(ies):** An old English name for a small blacksmith workshop.

**Smolt:** A young salmon (or trout) after the parr stage, when it becomes silvery and migrates to the sea for the first time.

**Soft Start:** Commencement of a dangerously noisy procedure (i.e. piling) with low energy release and building gradually and uniformly to operational levels.

**SOSS:** The Crown Estate Strategic Ornithological Support Services. A steering group, providing advice to the offshore wind farm industry with the aim of resolving the consenting challenges posed by the potential for offshore wind farms to impact bird populations.

**Sound attenuation:** Reduction of the level of sound pressure. Sound attenuation occurs naturally as a wave travels in a fluid or solid through dissipative processes (e.g. friction) that convert mechanical energy into thermal energy and chemical energy.

**Sound exposure level (SEL):** The constant sound level acting for one second, which has the same amount of acoustic energy, as indicated by the square of the sound pressure, as the original sound. It is the time-integrated, sound-pressure-squared level. SEL is typically used to compare transient sound events having different time durations, pressure levels and temporal characteristics.

**Sound exposure spectral density:** The relative energy in each narrow band of frequency that results from the Fast Fourier Transform (FFT - a mathematical operation that is used to express data recorded in the time domain as a function of frequency) of a transient waveform. It is a measure of the frequency distribution of a transient signal.

**Sound exposure:** The integral over all time of the square of the sound pressure of a transient waveform.

**Sound Power Level:** Sound power measured on a decibel scale, relative to a reference value of 10 to 12 W.

**Sound Power:** The sound energy radiated per unit time by a sound source. Measured in Watts (W).

**Sound pressure level (SPL):** The sound pressure level or SPL is an expression of the sound pressure using the decibel (dB) scale and the standard reference pressures of 1  $\mu\text{Pa}$  for water and biological tissues, and 20  $\mu\text{Pa}$  for air and other gases.

**Sound pressure:** Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.

**Special Area Conservation (SAC):** Special Areas of Conservation are strictly protected sites designated under the EC Habitats Directive. Article 3 of the Habitats Directive requires the establishment of a European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I (habitats) and II (species) of the Directive (as amended). The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). Of the Annex I habitat types, 78 are believed to occur in the UK. Of the Annex II species, 43 are native to, and normally resident in, the UK. This includes harbour porpoise, bottlenose dolphin, harbour seal and grey seal.

**Special Protected Area (SPA):** Special Protection Areas are strictly protected sites classified in accordance with Article 4 of the EC Birds Directive. Classified for rare or vulnerable birds.

**Spectrum:** A graphical display of the contribution of each frequency component contained in a sound.

**Statocyst:** A small organ of balance and orientation in some aquatic invertebrates, consisting of a sensory vesicle or cell containing statoliths.

**Sub-bottom Profiler:** (SBP) Low frequency echosounder that maps the seabed and underlying sediments.

**Subtidal:** Undersea areas below low water spring tide.

**Superficial deposits:** A geological term given to any unconsolidated material above the bedrock such as clay, silt, sand, gravel, cobbles and boulders.

**Superficial geology:** Quaternary geological deposits, these recent, unconsolidated sediments may include residual, alluvial, or glacial deposits lying on pre-quaternary bedrock.



**Surrogate:** An animal / person or thing acting as a substitute.

**Sustainable Drainage System (SuDS):** The management practice and control measures designed to drain run-off or surface water in a more sustainable manner than conventional techniques.

**Swales:** A narrow vegetated channel designed to direct and retain surface water.

**Swim bladder:** A gas-filled sac present in the body of many bony fishes, used to maintain and control buoyancy.

**Tanker:** A vessel designed to carry liquids in bulk.

**Telemetry:** A technology that allows measurements to be made at a distance, via radio wave or IP network transmission and reception of the information.

**Temporary threshold shift (TTS):** Temporary loss of hearing as a result of exposure to sound over time. Exposure to high levels of sound over relatively short time periods will cause the same amount of TTS as exposure to lower levels of sound over longer time periods. The mechanisms underlying TTS are not well understood, but there may be some temporary damage to the sensory cells. The duration of TTS varies depending on the nature of the stimulus, but there is generally recovery of full hearing over time.

**Threshold Shift:** Animals exposed to intense sound may exhibit an increase in their hearing threshold i.e. a change in the level at which they register sound. The magnitude of the shift normally reduces with time once the sound has ceased (temporary threshold shift, TTS). When a complete recovery is not achieved, this is considered a permanent threshold shift (PTS) and is described as a physical injury.

**Threshold:** The threshold generally represents the lowest signal level an animal will detect in some statistically predetermined percent of presentations of a signal. Most often, the threshold is the level at which an animal will indicate detection 50 % of the time. Auditory thresholds are the lowest sound levels detected by an animal at the 50 % level.

**Till:** A glacial deposit comprising unsorted deposits of clay, sand and gravel originating from basal glacial erosion during the last glacial period known as the Quaternary.

**Traffic Flows:** The movement of vehicles on roads.

**Traffic Volumes:** The number of vehicles on a road.

**Transect:** A fixed path along which a surveyor records occurrences of the study, e.g. birds.

**Trawling:** Trawling is a method of fishing that involves pulling a fishing net through the water behind one or more boats. The net that is used for trawling is called a trawl.

**Trip:** A single vehicle movement.

**Turbidity:** The cloudiness of water caused by suspended particles.

**UK Biodiversity Action Plan (UK BAP):** The UK Biodiversity Action Plan was published in 1994, and is the UK Government's response to the Convention on Biological Diversity (CBD), which the UK signed up to in 1992 in Rio de Janeiro. The CBD called for the development and enforcement of national strategies and associated action plans to identify, conserve and protect existing biological diversity, and to enhance it wherever possible.

**Under sail:** Any craft that's means of propulsion is a sail or sails.

**Unsaturated Zone:** The portion of ground above the water table.

**Unweighted sound levels:** Sound levels which are 'raw' or have not been adjusted in any way, for example, to account for the hearing ability of a species.

**Vehicle Movement:** A vehicle travelling in one direction from a starting point to a separate finish point.

**Vessel Traffic Services:** A VHF and Radar service, linked to ports or dense traffic areas, which provide marine traffic management of an advisory nature, and occasional emergency control, to reduce risk.

**Weathered:** A general term given to the processes that break down rocks and form the basis for associated soils.

**Weighted sound levels:** A sound level which has been adjusted with respect to a 'weighting envelope' in the frequency domain, typically to make an unweighted level relevant to a particular species. Examples of this are, the dB(A), where the overall sound level has been adjusted to account for the hearing ability of humans, or dBht(Species) for fish and marine mammals.

**White dunes:** This encompasses most of the vegetation of unstable dunes where there is active sand movement. Under these conditions sand-binding marram is always a prominent feature of the vegetation and is usually dominant.



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