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Seagreen Phase 1 Scoping Report

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Round 3: Firth of Forth

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EXECUTIVE SUMMARY

Seagreen Wind Energy Limited, hereafter referred to as Seagreen, has been awarded the rights to develop a number of offshore wind farms in the Firth of Forth Round 3 Zone by The Crown Estate, under the Third Round of the offshore wind licensing arrangements. Seagreen has a formal Zone Development Agreement (ZDA) with The Crown Estate which provides the contractual programme milestones for the development of the Zone and identifies a generation capacity of up to 3,465MW to be delivered across the Zone.

Offshore wind farm sites within Phase 1 of the Zone will be the first to be taken forward for development by Seagreen. The Phase covers an area of approximately 597km^2 and lies approximately 25km from the Angus coast. Seagreen plans to start construction of the wind farm sites within Phase 1 in 2015. Power generated by the wind farms will be transported to shore via an export cable that will run from the west of Phase 1 to a landfall location on the Angus coastline. It is expected that there will be two wind farms, Seagreen Alpha and Seagreen Bravo, with a total installed capacity of up to approximately 1,075 MW. The total target capacity for the entire Firth of Forth Zone is 3,465MW.

Seagreen intends to submit three Environmental Statements (ES) to accompany consent applications for: 1) Seagreen Alpha wind farm, 2) Seagreen Bravo wind farm and 3) the Export Cable Route (ECR). Seagreen will also submit a separate Scoping Report for the "onshore" elements (onshore substation and grid connection) of the development at a later date.

Seagreen has started consultation with stakeholders and consultees to inform this scoping report and has commenced discussion of the survey methodologies with relevant stakeholders and consultees to inform the EIA. Seagreen will maintain this communication and involvement with consultees throughout the development and construction process as the projects progress.

This report constitutes the information submitted as part of a formal request for a Scoping Opinion and aims to inform stakeholders about the proposed development. It provides an overview of the existing physical, human and biological environment and identifies known and accessible data sources. Building on this, the report provides an initial review of potential impacts associated with the construction, operation and decommissioning of Phase 1 and the export cable (both in isolation and in-combination with other plans and projects). For each parameter of study, Seagreen proposes methods for how these impacts will be assessed as part of future Environmental Impact Assessment (EIA) works.

This review suggests some key areas for further detailed investigation during the EIA both in the corridor and Phase 1 developments and identifies a number of areas which have been suggested to be "scoped out" of detailed consideration in EIA.

Seagreen invites consultees to respond to this report by providing a formal opinion to the suggested issues, data sources and gaps indentified and to the methodology proposed.

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LIST OF ACRONYMS & ABBREVIATIONS

ACRONYM / ABBREVIATION	FULL TEXT
AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AC	Alternating Current
AD	Air Defence
AQMA	Air Quality Management Area
ASCS	Air Surveillance and Control Systems
BACI	Before, After, Control, Impact
BAP	Biodiversity Action Plan
BWEA	British Wind Energy Association
CD	Chart Datum
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEH	Centre for Ecology and Hydrology
CO	Carbon monoxide
CO_2	Carbon dioxide
COWRIE	Collaborative Offshore Wind Research Into the Environment
CPA	Coast Protection Act
DBA	Desk Based Assessment
DC	Direct Current
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
EC	European Council
ECR	Export Cable Route
ECU	Energy Consents Unit
EIA	Environmental Impact Assessment
EMF	Electro-Magnetic Field
EMP	Environmental Management Plan
ES	Environmental Statement
EU	European Union
FEPA	Food and Environment Protection Act
FLO	Fisheries Liaison Officer
FTOWDG	Forth and Tay Offshore Wind Developers Group
GCR	Geological Conservation Review
GGOWF	Greater Gabbard Offshore Wind Farm
GIS	Geographic Information System
GW	Gigawatts
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
HS	Historic Scotland
HVDC	High Voltage Direct Current
IBA	Important Bird Area
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IFA	Institute for Field Archaeologists
IPC	Infrastructure Planning Commission
JNCC	Joint Nature Conservation Committee
LNR	Local Nature Reserves
LSE	Likely Significant Effect
MaRS	Marine Resource System database
MCA	Marine and Coastguard Agency
MESH	Mapping European Seabed Habitats
MHWS	Mean High Water Spring

ACRONYM / ABBREVIATION	FULL TEXT
MoD	Ministry of Defence
MPA	Marine Protected Area
MS	Marine Scotland
MSL	Mean Sea Level
NATS	National Air Traffic Services
NBN	National Biodiversity Network
NGET	National Grid Electricity Transmission
NNR	National Nature Reserves
NO_2	Nitrous oxide
NPF	National Planning Framework
NPPG	National Planning Policy Guidance
OFTO	Offshore Transmission Owner
OPSI	Office of Public Sector Information
OREI	Offshore Renewable Energy Installations
OSPAR	The convention for the protection of the marine environment of the north east Atlantic
PAN	Planning Advice Note
PDV	Phocine Distemper Virus
PEXA	Military Practice and Exercise Area
PM10	Particulate matter less than 10 micrometers diameter
PSR	Primary Surveillance Radar
R3	Round 3
RAF	Royal Air Force
RCAHMS	Royal Commission on the Ancient and Historic Monuments of Scotland
RES	Renewable Energy Strategy
REZ	Renewable Energy Zone
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SCANS	Small Cetaceans in the European Atlantic and North Sea
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SLVIA	Seascape and Landscape Visual Impact Assessment
SMRU	Sea Mammal Research Unit
SNCA	Statutory Nature Conservation Agencies
SNH	Scottish Natural Heritage
SO_2	Sulphur dioxide
SOSSG	Strategic Ornithological Support Services Group
SPA	Special Protection Area
SPP	Scottish Planning Policy
SSE	Scottish and Southern Energy
SSSI	Site of Special Scientific Interest
STW	Scottish Territorial Waters
SWEL	Seagreen Wind Energy Limited
SWT	Scottish Wildlife Trust
TIA	Traffic Impact Assessment
UKHO	United Kingdom Hydrographic Office
VMS	Vessel Monitoring Systems
WeBS	Wetlands Bird Survey
WEWS	Water Environment and Water Services Act
WFD	Water Framework Directive
WTG	Wind Turbine Generator
WWT	Wildfowl and Wetlands Trust

ACRONYM / ABBREVIATION	FULL TEXT
ZDA	Zone Development Agreement

1.0 INTRODUCTION

1.1 Background

Seagreen Wind Energy Limited, hereafter referred to as Seagreen, has been awarded the rights to develop a number of offshore wind farms in the Firth of Forth Round 3 (R3) Zone by The Crown Estate, under the third round of offshore wind licensing arrangements. Seagreen is a partnership between Scottish and Southern Energy (SSE) Renewables and Fluor Limited, the UK operating arm of Fluor Corporation. Seagreen and its partner companies have a successful history of identifying and developing some of the UK's leading offshore wind sites, including Arklow Bank, Greater Gabbard and the Beatrice Demonstrator. Over the years the Seagreen Partners have developed robust methodologies in the appraisal of offshore wind development opportunities, which will be utilised within the Firth of Forth Round 3 Zone (hereafter referred to the Zone).

Royal Haskoning has been commissioned by Seagreen to undertake an initial review of the key environmental issues and potential impacts associated with the construction, operation and eventual decommissioning of Phase 1 wind farms (Seagreen Alpha and Seagreen Bravo), an Export Cable Route and a proposed landfall location (transition pit), through a targeted scoping exercise. The Firth of Forth Round 3 Zone, Phase 1, ECR scoping corridor and proposed landfall locations are presented in Figure 1.1.

Seagreen believes that any future Environmental Impact Assessment (EIA) for sites within development Phase 1 of the Zone must be adaptive and take into account the lessons learnt from both Round 1 and 2 offshore wind farm projects that have gone through the consenting and construction.

1.2 Scoping Report

The Phase 1 wind farm sites (Seagreen Alpha and Seagreen Bravo) will be connected to the national electrical transmission grid via a single, shared Export Cable Route (ECR) running from the westerly boundary of the Firth of Forth Round 3 Zone to an onshore transition pit, where the offshore cables are converted to a single core onshore cable. The transition pit will be located within a 1km buffer landward of the Mean High Water Spring (MHWS) tide level (see Figure 1.1).

This Scoping Study therefore identifies the key issues associated with the proposed wind farms in Phase 1 (Seagreen Alpha and Seagreen Bravo), the ECR and proposed landfall location (transition pit) which together comprise the offshore elements of Phase 1 of the Firth of Forth Round 3 Zone development. Seagreen shall submit a separate Scoping Report for the "onshore" elements (onshore substation and grid connection) of the development.

The parameters considered within this study are:

- Physical processes;
- Nature conservation designations;
- Ornithology;
- Ecology – marine, intertidal and terrestrial
- Fish and Shellfish Resources;
- Marine Mammals;

- Commercial Fisheries;
- Shipping and Navigation;
- Seascape, Landscape and Visual Character;
- Archaeology and cultural heritage;
- Radar, Aviation and MOD;
- Water and sediment quality;
- Socio-economics;
- Tourism and recreation;
- Oil and gas activities;
- Pipelines and cables;
- Dredging and disposal;
- Traffic and Access;
- Noise and Vibration; and
- Air Quality.

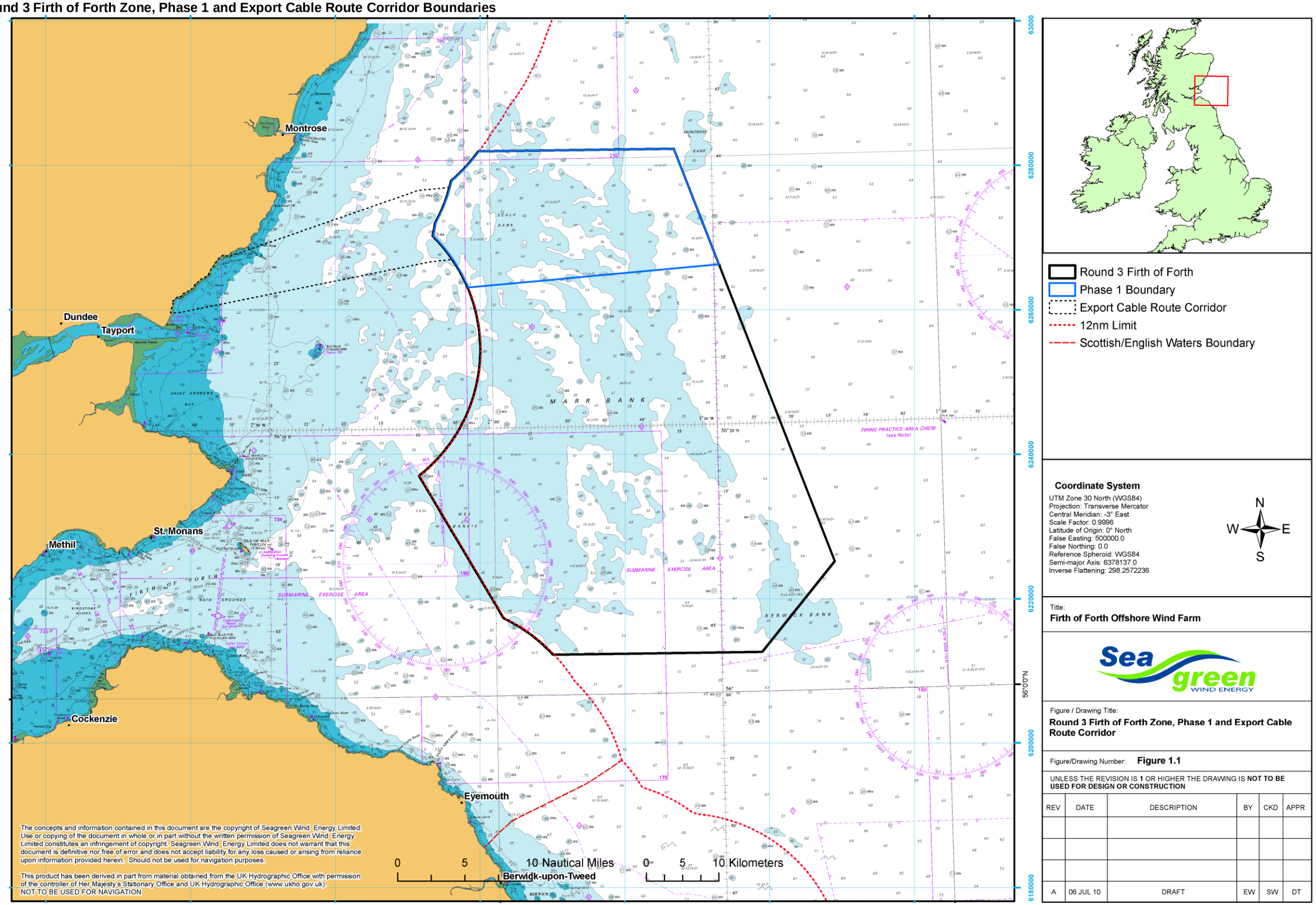
The identification of potential impacts is based upon an understanding of the environmental conditions likely to be encountered at the site and the lessons learnt during the development of other Round 1, Round 2 and Scottish Territorial Waters (STW) projects. Where significant impacts are not anticipated to arise during the construction, operation or decommissioning phases of the development, the parameters concerned should be 'scoped out'. All 'scoped out' parameters will still be included within the EIA, however, it is not expected that such parameters will require original research and data collection and will only be commented on in brief to ensure a holistic approach to the assessment of all environmental parameters.

This Scoping Report details the work requirements for the EIA and eventual production of an Environmental Statement (ES) to accompany consent applications for:

1. Seagreen Alpha wind farm
2. Seagreen Bravo wind farm
3. Export Cable Route

It is anticipated that Seagreen will submit applications for the necessary consents in 2012. This Scoping report forms the information submitted as part of a formal request for a Scoping opinion from Scottish Ministers.

Figure 1.1 Round 3 Firth of Forth Zone, Phase 1 and Export Cable Route Corridor Boundaries



1.3 How to Respond to Scoping

Seagreen is committed to informing and engaging with organisations and members of the public interested in the development of the Firth of Forth Round 3 Zone. Authorities, groups and organisations to be consulted during the progression of the EIA are presented in Appendix A. There are a number of ways in which you can be kept informed of developments:

1. Seagreen website and email

The scoping report, other documents and updates will be published on the website.

www.seagreenwindenergy.com

Email: **scoping@seagreenwindenergy.com**

2. Consultation events. Seagreen will be organising briefing sessions, public exhibitions and consultation evenings throughout the duration of the development process.

3. Telephone. You can call 0141 548 5241 to register your interest.

4. Write to us. You can write to us at:

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2.0 THE NEED FOR THE PROJECT

2.1 European and UK Renewable Energy Targets

In December 2008, the European Council (EC) agreed to a binding target for 20% of overall European Union (EU) energy consumption to be fed by renewable technologies by 2020. The UK has a major role to play in meeting these targets, as it has (amongst other resources) approximately 33% of the total EU wind resource (Risø National Laboratory, 1989). In accordance with this agreement, the UK Government, through the Renewable Energy Strategy (RES), has set a target of increasing its proportion of renewable energy by a factor of almost seven from 2.25% in 2008 to 15% by 2020. The Draft Overarching National Policy Statement for Energy (EN-1) states that offshore wind is expected to provide the largest single contribution towards the 2020 renewable energy generation capacity (DECC, 2009a).

The RES was pre-empted in 2007 by the announcement from the UK Government for the commencement of a Strategic Environmental Assessment (SEA) to open up the UK Renewable Energy Zone (REZ) to up to 25 Gigawatts (GW) of additional offshore wind energy. The Offshore Energy SEA was completed in March 2009 and a post-consultation report was published in June 2009 (see DECC, 2009).

2.1.1 Round 3

Round 3 of the offshore wind licensing arrangements aims to deliver up to 25GW of wind energy capacity, building on the 8GW planned for Round 1 and 2 projects and the additional capacity anticipated through extensions to existing projects under Round 2.5. Thereby achieving the 33GW of additional offshore wind energy as set out in the RES.

The Crown Estate, the UK Government and the offshore wind industry have made it clear that the scale of the proposed development for Round 3 will require extensive engagement with many stakeholders and a massive investment in onshore and offshore energy infrastructure and supply chains. The Crown Estate is to take a more prominent role in Round 3 than in previous rounds, through co-investment with developers, combining the technical experience of the offshore wind industry with efficiencies generated by The Crown Estate's access to resources and stakeholders.

2.2 Renewable Energy Policy in Scotland

Scotland's geography and climate offers enormous potential for the development of renewable energy resources and there is potential for Scotland to go beyond the fundamental renewables targets proposed for the UK as a whole. The Climate Change Programme for Scotland, Changing Our Ways, published in 2006, sets out Scotland's plan of action for tackling climate change (Scottish Executive, 2006a). It stated that 18% of the electricity generated in Scotland by 2010 should come from renewable sources, rising to 40% by 2020. A report published by the Scottish Renewables Forum, Delivering the New Generation of Electricity (2006), used independent research to indicate that renewables would be able to provide 33% of electricity in Scotland by 2010, and 54% by 2020, thus moving beyond Scottish Executive targets.

Following a change in Scottish Government in 2007, a new target to generate 50% of Scotland's electricity from renewables by 2020, with an interim target of 31% by 2011, has been set.

The Climate Change (Scotland) Act 2009 introduced binding targets on the Scottish Government to reduce net Scottish greenhouse gas emissions by 83% by 2050 from 1990 levels, with an interim target of 42% by 2020. The Scottish Renewables Action Plan 2009 reiterates the targets set in 2007. Support for renewables development, including offshore wind, is contained in National Planning Framework 2 and Scottish Planning Policy.

2.3 Offshore Wind in Scotland

The Scottish Executive commissioned the University of Edinburgh (Institute for Energy Systems) to investigate Scotland's renewable energy resource. The final report, Matching Renewable Electricity Generation and Demand (2006b) predicted that annual demand for electrical energy in Scotland could be around 41 terawatt-hours (TWh) with a peak power demand of around 7.3GW. Supplying 40% (16.4TWh) of the electricity required over the year from renewable resources suggests the need for around 6GW of renewable capacity.

Existing and planned hydro capacity in Scotland will contribute 1.5GW to the 2020 energy mix. Onshore wind projects built to date, and consented but not yet operational, should contribute at least a further 1.5GW. The balance of around 3GW could be met by a range of technologies. Although wave and tidal power, between them, have the potential to deliver over 1GW, these are promising technologies which still need to be developed commercially. Onshore and offshore wind has potential to contribute significantly more.

In the publication, Marine Renewable Energy and the Natural Heritage: an Overview and Policy Statement (2004), Scottish Natural Heritage (SNH) strongly encouraged exploration of marine renewable energy resources. SNH concluded that areas most likely to be suitable for the development of offshore wind energy were the near-shore and shallow sea areas such as the Moray coast, Solway Firth, and east of Dundee from the Tay and south to the Firth of Forth.

Furthermore, the Scottish Government has recently (May 2010) released its Draft Plan for Offshore Wind Energy in Scottish Waters. The Plan identifies a number of locations with potential for offshore wind farm development, including waters off the Firths of Forth and Tay. This Plan is currently subject to consultation.

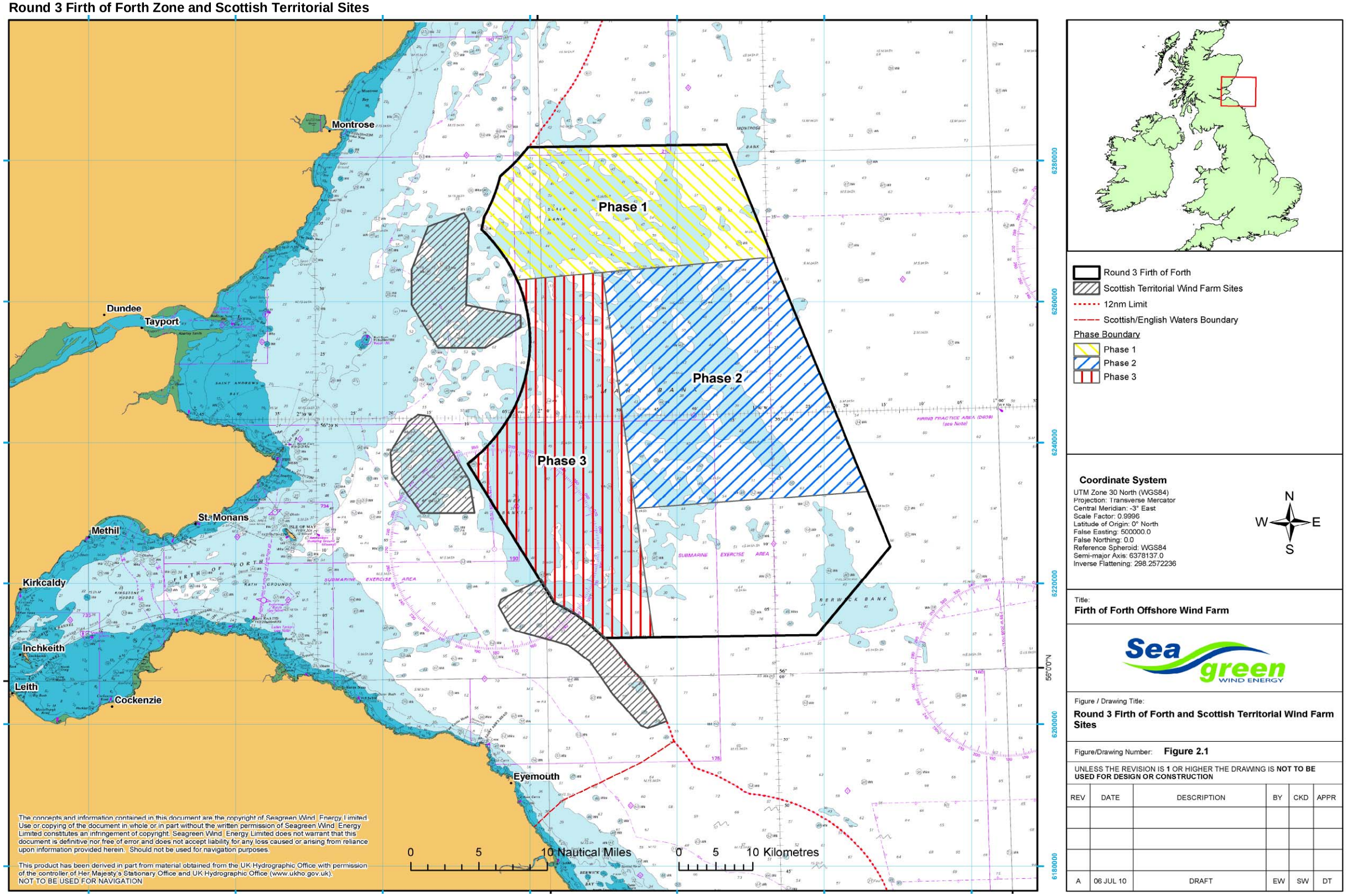
2.4 Offshore Wind Development in the Firth of Forth and Surrounding Area

During 2008, The Crown Estate requested initial expressions of interest from companies and consortia wishing to be considered for developing commercial scale wind farms within STW. In February 2009, a number of companies and consortia were awarded exclusive development rights by The Crown Estate for 10 sites with a total award capacity of 6,438 MW. Of these, four sites were located within STW offshore of the Firth of Forth and Firth of Tay, one of which, Bell Rock (consortium of SSE Renewables and Fluor) is not now being developed (see **Figure 2.1**). **Table 2.1** provides details of the three sites within close proximity to, or bordering, the Firth of Forth Round 3 Zone.

Table 2.1 Scottish Territorial Waters offshore wind generation sites

Site Name	Awarded Company/Consortium	Size (MW)	Area (Km^2)
Inch Cape	NPower Renewables Ltd SeaEnergy Renewables Ltd	905	149.9
Neart na Gaoithe	Mainstream Renewable Power Ltd	360	105.1
Forth Array	Fred Olsen Renewables Ltd	415	128.4

Figure 2.1 **Round 3 Firth of Forth Zone and Scottish Territorial Sites**



2.5 Firth of Forth Round 3 Zone

The Firth of Forth Round 3 Zone was defined by The Crown Estate in 2009 and all proposed wind farm development must fall within this boundary. The Crown Estate has confirmed that this boundary is fixed and no further variation will be possible. The Zone boundary lies approximately 25km offshore of the Firth of Forth, Scotland. The area of the Zone is approximately 2,850km^2, and is situated immediately east of STW 12nm limit (see **Figure 1.1**).

Seagreen was awarded the rights to develop the Firth of Forth Zone in January 2010 and has a formal Zone Development Agreement (ZDA) with The Crown Estate. The ZDA provides the contractual programme milestones for the development of the Zone and identifies a generation capacity of up to 3,465MW to be delivered across the Zone.

Seagreen are undertaking a structured Zone Appraisal and Planning (ZAP) exercise to define development sites within the zone, to appraise and manage consenting risks, and to identify the cumulative and in-combination impacts of development of the Zone. Seagreen commenced the Zone appraisal process prior to award in order to understand the physical, human and biological factors that are likely to influence development and to consider potential generation capacity. ZAP will continue and run in parallel to the EIA process; data acquired during EIA site investigations will aid more detailed characterisation of the Zone and be used to assess the constraints and opportunities for further phases of development. ZAP will therefore assist in the future delineation of, and amendments to, proposed site boundaries.

The identification of phases of development and potential wind farm sites within the Zone were identified following a detailed assessment of zone environmental and technical data (constraints mapping) undertaken during the Round 3 tender process. Data was initially compiled from a number of primary sources including Seazone, UKDEAL, Kingfisher and The Crown Estate on the parameters identified in **Table 2.2**.

Table 2.2 Parameters for site selection

Zone Data Compilation
• Water Depth and Distance to Shore; • Wind Speed and Metocean Conditions; • Environmental designations (existing and proposed, onshore and offshore) including Special Protection Areas (SPAs), Ramsar sites, Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs) and Important Bird Areas (IBAs;) • Ornithology; • Offshore habitats; • Marine ecology, including epifauna and infauna; • Marine mammals including cetaceans and seals; • Shipping and navigation; • Fishing effort;

Zone Data Compilation
• Seascape and landscape; • Archaeology and Cultural Heritage; • Aviation and telecommunications issues, including civil and military aspects; • Oil and gas infrastructure; • Emergency services; and • Cables and pipelines.

Constraint mapping facilitated the differentiation of the Zone into four discrete areas, three of which will be taken forward as development phases. Phase 1 is technically considered to be the least constrained, facilitating expedited development and timely connection to the grid. It is therefore Seagreen's intention to develop Phase 1 first.

The identification of sites within respective phase boundaries is designed to be flexible and responsive to environmental or technical issues. Phase 1 comprises two potential wind farm sites, Seagreen Alpha and Seagreen Bravo. A further five potential sites have been identified within the Zone comprising a further two phases of development. Development, however, is subject to Seagreen being successful in gaining the necessary consents for construction and operation of the wind farm. The adopted Seagreen nomenclature for proposed wind farms and their respective phases of development is presented in **Table 2.3.**

Table 2.3 Common nomenclatures for development phases and sites of the Zone

Phase	Site
1	Seagreen Alpha
1	Seagreen Bravo
2	Seagreen Charlie
2	Seagreen Delta
2	Seagreen Echo
3	Seagreen Foxtrot
3	Seagreen Golf

3.0 PROJECT DESCRIPTION

3.1 Site Location and Specification

Phase 1 of the Zone lies approximately 25km offshore, east of the Angus coastline. Phase 1 is in the north of the Zone (see **Figure 1.1**) and comprises an area of approximately 597km^2 located on the Scalp Bank. The ECR scoping corridor is orientated approximately east to west and comprises an area of approximately 283km^2. The physical and technical characteristics of Phase 1 of the Zone and the ECR corridor are provided in **Table 3.1**.

Table 3.1 Phase 1 and ECR physical and technical characteristics

Phase 1	
Parameter	**Details**
Estimated maximum installed capacity (MW)	Total: 1075
	Seagreen Alpha: 545 (nominal)
	Seagreen Bravo: 530 (nominal)
Area (km^2)	597
Approximate distance to shore (km)	25
Water depth below Chart Datum (m)	Minimum: 31 Maximum: 71 Mean: 46
Technical aspects	Sediments dominated by gravelly sand. Turbines to be micro-sited in shallower locations and to minimise environmental impact .
Export Cable Route	
Parameter	**Details**
Area (km^2)	283
Water depth below Chart Datum (m)	Minimum: 0 Maximum: 59 Mean: 29
Technical aspects	Sediments dominated by gravelly sand with increased proportions of mud nearshore. Export cable to be routed to minimise environmental impact.

The maximum site capacities above are constrained by the grid connection offers for the Phase 1 sites, which correspond to the potential capacities identified in the Round 3 bid. These were based on the assumption of installing wind turbines of 5MW capacity at a uniform spacing of 10 rotor diameters by 8 rotor diameters. Depending on technical and environmental issues there may be opportunities to develop a greater capacity at the site, however this would require a modified grid application. The detailed assessment and survey

programme planned will improve understanding of the extent of the potential area for development and ascertain the most suitable position for turbine locations. This will enable the project capacities and the ultimate project boundaries to be refined and confirmed.

3.2 Phase 1 Wind Farms (Seagreen Alpha and Seagreen Bravo)

3.2.1 Wind Turbine Generator Arrays

The total sea area covered by the wind farms, including a buffer of 500m around the outer edge is likely to be up to approximately 212 sq km[1], which would represent about 36% of the total area of Phase 1 and 7% of the area of the Zone. The precise location and internal arrangement of the wind farms and the route of the single export cable will be determined as the EIA data collection and analysis proceeds, which will enable suitable areas to be identified. At present it is expected that water depths of significantly greater than 50m will be generally avoided.

To date, turbines of 3MW, 3.6MW and 5MW have been utilised within offshore wind farm developments and are currently available to the market. It should be noted that the final decision on the preferred wind turbine will not be made until all the statutory consents are in place. Greater capacity wind turbines are in development for offshore installation and may be in production by this time. The design life of turbines is currently unknown though the lease term with The Crown Estate is expected to be in the region of 50 years.

The wind turbine layout for each site would nominally be arranged in rows with each turbine separated by eight rotor diameters in the non-predominant wind direction and by ten rotor diameters in the predominant wind direction (southwest). The wind turbines would be placed in a layout which best utilises the available wind resource while at the same time seeking to reduce the environmental impact of the proposed development. The height of the wind turbines will be around 200 metres from mean sea level to the blade tip in the vertical position, however new wind turbines available on the market at the time of development will be considered and their dimensions are not yet known. The nacelles and rotor will be mounted upon a cylindrical steel tower; which will in turn be supported by a foundation, the design and type of which is yet to be determined. The offshore construction period is likely to take approximately 24 months. Once in operation the Seagreen Alpha and Seagreen Bravo wind farms could produce enough to power approximately 860,000 average homes. (Royal Haskoning, 2005).

3.2.2 Foundations

Different foundation designs are being considered, though it should be noted that detailed design, based on the geotechnical study, shall be required prior to the finalisation of foundation type.

3.2.3 Offshore Platforms and Inter Array Cables

Associated with both Seagreen Alpha and Seagreen Bravo is the requirement for an offshore AC transformer platform (substation) for each site and associated 33kV inter-array cables. The purpose of the AC substation is to step up the voltage of the electricity

[1] This calculation is based upon 215 nominal 5MW wind turbines, with a spacing of 10 rotor diameters between turbines across wind and 8 rotor diameters down wind. Each row of wind turbines is offset from the previous row by one rotor diameter in the predominant wind direction.

generated at the wind turbine to a voltage that is suitable for conversion to DC and subsequent transmission ashore. A single offshore DC platform will be required to covert the power transmitted from the two offshore AC platforms to DC before it is transmitted onshore via HVDC cable. All the offshore platforms will be supported on foundations similar to a wind turbine foundation.

3.2.4 Meteorological Mast

A number of offshore meteorological masts will also be installed in the Zone to measure the wind speed and calculate energy output from the wind farm. These will include one or two preconstruction masts for which separate licence applications will be issued.

As the final design and layout of the wind farm is currently undefined, it is assumed that the meteorological masts will attain an elevation of approximately 100 m above Mean Sea Level (MSL). As with wind turbine foundations, the type of foundation for the offshore meteorological mast will depend upon a number of physical parameters such as water depth and geological conditions. The ultimate design will be informed by the geophysical survey and subsequent geotechnical investigations at the site.

Meteorological instrumentation will include a number of anemometers installed at several heights on the mast to facilitate measurement of the wind speed and wind shear profiles, wind vanes to measure wind direction, pressure and temperature and humidity sensors.

3.3 Export Cable Route

Subsea power cables are required to connect the wind farm to the electricity distribution or transmission network system. These cables will also comprise internal fibre optic communication links for wind farm control purposes. The AC and HVDC cables being considered comprise copper conductors with integral insulation, core screening, and steel armour (for stiffness, impact and resistance). The inter-turbine cables will be standard 33kV cables, similar to many such examples already installed in the marine environment.

The present working assumption is that both export and inter-turbine cables will be buried. However this is subject to the precise ground conditions which will be established following surveys. The need for cable burial is also linked to navigation risk assessment, density of fishing activity and ground and metocean conditions and the potential link between EMF and environmental receptors. All these factors will be considered in the decision making process.

Seagreen has commissioned an ECR feasibility study that assessed potential landfall and grid connection at five potential connection sites (Royal Haskoning 2010a). At the current time the exact route of the export cable has not been finalised, but it is assumed that it will be the shortest distance between the wind farm site and landfall in proximity to the onshore substation, taking into consideration the location of STW wind farm sites and any other obstacles identified during survey. Once the export cable route has been refined it is anticipated that Seagreen will seek consent for a cable corridor of approximately 1000m width (or 500m either side of the preferred export cable route). There are, however, a number of issues which will be taken into account in the route design including environmental, technical and economic constraints.

The preferred ECR exits from the western perimeter of Phase 1 and transitions to landfall on the coastline between Arbroath and Carnoustie. No decision has yet been made on whether an AC or HVDC connection will be required. Typically the export cable(s) will be laid within a trench of approximately 1.5m depth and 2m width which will subsequently be backfilled. Should more than one export cable be required a minimum separation distance of approximately 10m would be needed.

3.3.1 Transition Pit

A transition joint pit is required between the submarine and terrestrial cables. The transition pit would be located at the landfall, on the landward side of any environmentally sensitive coastal sites. A typical excavation for a transition pit is in the region of 10m x 4m x 2.5m (Length x Width x Depth) per circuit. Other, smaller excavations may be required in the vicinity of the transition joint pit for fibre optic link joints and earthing requirements. The excavations at the landfall will be temporary and will be filled and returned to their natural state upon completion of the export cable installation.

The ECR will be connected to the onshore grid network via an onshore grid cable and substation. The onshore infrastructure will be subject to a separate scoping exercise and EIA.

3.3.2 Electrical Transmission and Onshore Works

As part of this Scoping process Seagreen is consulting with regulatory authorities and key stakeholders in relation to the level of detail required within the EIA as set out herein to cover elements of the offshore electrical transmission and connection works.

This Scoping report includes a discussion of the EIA process for the ECR, in addition to the offshore Phase 1 wind farm sites.

4.0 ENVIRONMENTAL IMPACT ASSESSMENT

Under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (Statutory Instrument (SI) 2000/1927), offshore wind farm developments of the scale proposed in the Zone require EIA.

In addition to the above, the following consents may also be required:

- Section 36 of the Electricity Act, 1989;
- Section 5 Part II of the Food and Environment Protection Act (FEPA), 1985[2];
- Section 34 of Coast Protection Act, 1949[2];
- Section 32 or 57 of Town and Country Planning (Scotland) Act 1997;
- Section 20 of the Water Environment and Water Services Act (WEWS) 2003;
- Works Licences from the relevant port or harbour authorities. This may be required for works within Statutory harbour authority, and where authority has Works Licensing Powers (ability to regulate right of navigation and fishing within area);
- Lease of the seabed from the Crown Estate[3].
- Compliance under Scottish Planning Policies, National Planning Policy Guidance and relevant circulars; and
- Appropriate Assessment, under The Conservation of Habitats and Species Regulations 2010 (SI 2010 No 490) and The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007/1842 (as amended).

Seagreen is intending to avoid the need for any new overhead electricity transmission lines, and so consent under section 37 of the Electricity Act 1989 is not expected to be relevant.

4.1 Consenting Options

Seagreen will be seeking consent for all the necessary works, from the turbines through to the onshore substation works. The precise consenting approach for the two projects has not yet been resolved, and will be influenced by the fact that the export cable and onshore cables and substation will in due course be constructed and operated by the Offshore Transmission Owner (OFTO) appointed for the projects.

Each wind farm in phase 1 (wind turbines, offshore substations and met masts) will be the subject of its own Section 36 application, granted by Scottish Ministers. It is possible to apply at the same time for deemed planning permission for the onshore works (cable and substation) under section 57 of the Planning Act 1997. Alternatively those onshore works

[2] Seagreen will ensure it is fully cognisant of the emerging requirements under the Marine (Scotland) Act 2010 and UK Marine and Coastal Access Act 2009. From April 2011, Marine Licence under these regimes will replace the requirement for Coastal Protection Act consent and a FEPA licence.

[3] The Crown Estate issue leases for the development of wind farm sites within the 12 nm (nautical mile) territorial limit, whilst the Energy Act 2004 gives them rights to issue leases for development beyond the territorial limit within the Renewable Energy Zone (REZ) out to 200 nm.

can be the subject of a separate planning application under the Planning Act 1997 to the local planning authority.

The other principal consents will be marine licences to be issued by Marine Scotland under the Marine (Scotland) Act 2010 in relation to territorial waters and the Marine and Coastal Access Act 2009 in relation to waters beyond 12 miles from the shore. It is expected that these two new regimes will be in force by the time applications are submitted.

4.2 Planning Policy

Scottish Ministers are responsible for the National Planning Framework for Scotland (NPF) which sits at the top of the policy hierarchy and is the long term strategy for the development in Scotland over the next 25 years.

The current NPF, NPF2, was published in June 2009. The National Planning Framework is supported by the Scottish Planning Policy (SPP) and Planning Advice Notes (PAN), and a number of Circulars. The consolidated SPP replaces the former SPP and National Planning Policy Guidance (NPPG) series (including SPP 6 Renewable Energy). The new SPP includes policy on a series of topics, including renewable energy.

Development plans and statements of policy are a material consideration with regard to the authorisation of electricity generation schemes under Section 36 of the Electricity Act 1989. Offshore devices located below the low tide mark fall outside the control of the planning system. However, onshore grid connection infrastructure and works will have to be considered in terms of the onshore planning system.

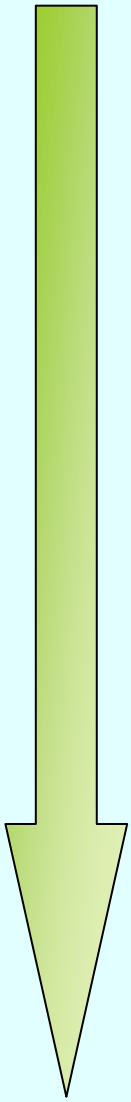
4.3 Approach to EIA

Seagreen will undertake EIAs for projects Seagreen Alpha and Bravo and the ECR. The EIAs will include the following standard stages, which are illustrated in **Table 4.1**:

- Screening determination of whether a development proposal needs an EIA[4];
- Scoping determination of the issues to be addressed by the EIA (this report);
- Consultation with Regulators, Stakeholder and Local Communities (ongoing);
- Original data collection and surveys where necessary to fill data gaps;
- Impact identification and evaluation during the construction, operation and decommissioning phases;
- Identification of mitigation and resultant residual impacts, and a commitment to mitigation measures;
- Identification of monitoring requirements;
- Submission of the ES to the relevant authorities as part of the consents process; and, if required
- Liaison and consultation to resolve matters or representations/objections.

[4] It is considered that all wind farm developments would require EIA, therefore this stage has not been undertaken.

Table 4.1 Stages of the EIA

Stage	Task	Aim/objective	Work/output (examples)	Public Participation and Consultation
Scoping	Scoping study	To identify the potentially significant direct and indirect impacts of the proposed development	Targets for specialist studies (e.g. hydrodynamic studies, sediment quality)	Consultation with statutory and non-statutory consultees
EIA 	Primary data collection	To characterise the existing environment	Background data including existing literature and specialist studies	Public participation is an important part of the planning process, in particular at the EIA and pre-application stages. Preliminary consultation with key consultees is considered important for setting the framework for consent. Consultation with statutory and non-statutory organisations and individuals with an interest in the area and the proposed development throughout the EIA process forms an integral part of the Seagreen approach to EIA.
	Specialist studies	To further investigate those environmental parameters which may be subject to potentially significant impacts	Specialist reports	
	Impact assessment	To evaluate the existing environment, in terms of sensitivity To evaluate and predict the impact (i.e. magnitude) on the existing environment To assess the significance of the predicted impacts	Potential adverse and beneficial impacts	
	Mitigation measures	To identify appropriate and practicable mitigation measures and enhancement measures	The provision of solutions to avoid or minimise adverse impacts as far as possible. Feedback into the design process, as applicable	
	Environmental Statement	Production of the Environmental Statement in accordance with EIA guidance Including a Non Technical Summary (NTS).	Environmental Statement Four main volumes: • NTS • Written statement • Appendices • Figures	
	Pre-Application Consultation	Advertising of application for licensing must occur in relation to marine licence and any major onshore planning application	Application for consent	
	Post submission	Liaison and consultation to resolve matters or representations/objections	Correspondence with relevant stakeholders	
EIA Consent Decision				

4.3.1 Identification and Evaluation of Impacts

An impact is determined from the existing baseline environment and the alteration of any physical, chemical, biological or perceived characteristics of that environment. For each parameter considered to be modified by the construction, operational and decommissioning phases of the development, a list of potential impacts shall be identified. An assessment of significance of each impact will be made. In order to determine significance, a number of criteria must be considered:

- Magnitude of the impact (local/strategic);
- Spatial extent of the impact (small scale/large scale);
- Duration of the impact (short term/long term);
- Reversibility of the impact (including species or habitat recoverability);
- Sensitivity and level of tolerance of the receptor or species;
- Conservation or protected status;
- Probability of occurrence of the impact;
- Confidence in the impact prediction; and
- The margins by which set values are exceeded (e.g. noise standards).

Where an impact can be quantified, thresholds are applied to determine the significance of an impact, unless otherwise stated.

Where an impact cannot be quantified because of the nature or complexity of the impact, a subjectivity scale is used to determine its significance e.g. local, regional, national importance.

The impact assessment will seek to classify the significance of impacts on a scale (from severe adverse/negative to maximum beneficial/positive). The magnitude of each proposed impact is compared with the sensitivity of the area, and the importance of individual assets (e.g. habitats or species). The magnitude of impact is characterised as high, medium or low for both negative and positive impacts. The sensitivity of the features to proposed impacts is characterised on a five-point scale from very high to low. **Table 4.2** presents impact significance characterisation.

Table 4.2 Significance criteria of magnitude versus receptor sensitivity / value of feature

Magnitude of Effects	Receptor Sensitivity/Value of Feature				
	Very High/ International/ National	**High/ Regional/ County**	**Medium/ District**	**Low/ Local**	**Very Low/ Site-Specific**
High	Major	Major	Major	Moderate	Minor
Medium	Major	Major or Moderate	Moderate	Minor	Minor
Low	Moderate	Moderate or Minor	Minor	Minor or None	None

The framework by which impact significance is expected to be defined for many of the parameters in the ESs is provided in **Table 4.3**.

Table 4.3 Terminology for classifying and defining environmental impacts

Impact	Description
Major beneficial	The activity/effect is expected to lead to a significant benefit, or a series of smaller long-term benefits that would lead to a potential large-scale benefit. In addition, significant cumulative and indirect benefits are likely within and outside the study area.
Moderate beneficial	The activity/effect is likely to lead to a significant localised improvement or benefit, or to a minor benefit on the larger regional or national scale.
Minor beneficial	The activity/effect is likely to lead to a moderate benefit, or a significant benefit of local scale. The benefits may be short-term large-scale or long-term and localised in scale. Where short-term benefits occur, they are less likely to be reversible.
No impact	The activity/effect is not likely to have any beneficial or adverse impacts either the short or long-term. A neutral impact arises when there is a fair degree of certainty that no beneficial or adverse impact is predicted.
Negligible	The activity/effect is likely to lead to a change, however, its scale or magnitude is such that it is difficult to determine in comparison to existing conditions occurring cumulatively or above background levels.
Minor adverse	The activity/effect is likely to lead to a moderate effect on an environmental parameter in the short-term, or a significant impact in a localised area. The impact may be short-term, large-scale, or long-term and localised in scale. The impact may have limited cumulative and indirect impacts within the study area. It is anticipated that mitigation measures can prevent or reduce these impacts.
Moderate adverse	The activity/effect is likely to lead to a significant loss or disturbance which is irreversible, or to a minor adverse effect on the larger regional or national scale.
Major adverse	The activity/effect could threaten specific assets already under threat, and the effects would be hard to reverse or difficult to mitigate, such that irreversible loss could occur or a significant magnitude or area/asset is affected. Indirect impacts may extend outside the study area. Where an activity/effect occurs on or extends to a regionally, nationally or internationally important asset a major adverse impact is expected unless otherwise shown.

4.3.2 Rochdale Envelope Principle

For the purposes of the EIA a range of potential wind turbine and foundation types will be considered and the worst case scenario will be assessed, in accordance with current best practice and the Rochdale Envelope Principle[5].

The Rochdale Envelope Principle requires a planning application to provide details of all potential design permutations in order to ensure that the project can be adequately assessed. In the case of offshore wind farm development, many elements of final engineering design are completely reliant upon the choice of wind turbine, foundation solution, transmission method (alternating current (AC) v direct current (DC)), for example. Such decisions cannot be finalised either prior to or at the time of consent application. As such, in order be compliant with the Rochdale Envelope Principle, it is normal practice to provide details of all potential permutations in design and to undertake the EIA based on the identified 'worst case scenario' for individual parameters.

[5] Case law (i.e. R v Rochdale MBC ex parte Tew (1999) and R v Rochdale MBC ex parte Milne (2000)). In respect of S36 consent, whichever scheme is ultimately built must have been covered by the scope of the EIA.

4.3.3 Mitigation

Where impact assessment identifies that the development is likely to give rise to a significant adverse environmental impact, Seagreen will propose mitigation measures to avoid or reduce the impact. Mitigation measures will also be incorporated into the design of the wind farms and associated infrastructure where possible.

The scoping of potential environmental impacts does not take account of the application of mitigation measures, thus the potential impacts described do not reflect the benefit of mitigation measures.

4.3.4 Environmental Statements

The Environmental Statements for Phase 1 offshore wind farm sites and the ECR will report on the EIA process and contain:

- Description of the development proposal, including any alternatives considered;
- Description of the existing environment at the site and its environs;
- Prediction of potential impacts on the existing human, physical and biological environment at the site;
- Description of mitigation measures;
- Description of monitoring requirements; and
- Non-Technical Summary (NTS).

4.3.5 Consultation

A co-ordinated approach to the consenting process, with the emphasis on early stakeholder involvement, is consistent with the provisions of the Planning etc (Scotland) Act 2006, the Marine (Scotland) Act 2010 and proposed improvements to the Section 36 consent processes. Seagreen has already met with a number of stakeholders and will continue to actively seek the views of regulators and stakeholders. Authorities, groups and organisations to be consulted during the progression of the EIA are presented in **Appendix A**.

4.4 Requirement for Appropriate Assessment

Under The Conservation of Habitats and Species Regulations 2010 and The Offshore Marine Conservation (Natural Habitats Etc) (Amendment) Regulations 2010, where a developer wishes to work in or near to a Natura 2000 site, or in an area recognised as an important for protected marine species such as, seals and cetaceans, the competent authority should determine, and inform the developer as early as possible, on the requirement to undertake an Appropriate Assessment (AA) prior to granting the relevant consents and licenses for development. The AA tests whether a plan or a project is likely to have a significant impact on a European site, species or habitat.

The Crown Estate being the competent authority for the Round 3 Plan has, therefore, undertaken an AA of the implications of the Round 3 Plan for European sites and sites designated under the International Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar sites).

The AA concludes that there will be no adverse impact on the integrity of a European/Ramsar site ("adverse impact")[6] arising from the Round 3 Plan. In reaching this conclusion the AA relies upon the following:

1. That general measures typically employed on offshore wind farms to avoid or mitigate adverse environmental impacts will be implemented where necessary at project-level. These measures are referred to here as "**general environmental measures**".

2. The fact that as a matter of law a project will be required to undergo project-level Appropriate Assessment (AA) wherever the possibility of a Likely Significant Impact (LSE) on a European or Ramsar site cannot be excluded. This approach is necessary given that the full details of how the Round 3 Plan will be implemented are not currently known.

The Plan-level AA also states that a project-level AA should address, amongst other things, circumstances where:

- any mitigation and avoidance measures incorporated into the plan are not delivered at project level; and/or
- new European/Ramsar sites have been notified or designated following conclusion of the Plan-level AA (it should be noted that the process of designating European and Ramsar sites is ongoing. The Statutory Nature Conservation Agencies should be regularly contacted to obtain up to date information about likely future designations that are relevant to project-level HRA); and/or
- new information exists regarding the nature and/or sensitivities of interest features within sites which have been assessed at Plan level and with that information it is not possible to exclude LSE on such features or sites; and/or
- additional information is available regarding specific in-combination impacts relating to defined project proposals and with this additional information it is not possible to exclude LSE on European/Ramsar sites.

The requirement for Appropriate Assessment will be identified as the EIAs progress and in consultation with regulators and key stakeholders.

4.5 Cumulative and In-Combination Impacts

Seagreen is currently working with the Forth and Tay Offshore Wind Developers Group (FTOWDG) to identify a combined strategy for the assessment of potential cumulative impacts resulting from the development of multiple wind farm sites within STW and the Zone. Detailed assessment methodologies will be presented in a Discussion Document currently due to be issued to key stakeholders in autumn 2010 (Royal Haskoning, in prep.). Outputs of shared studies will be used to inform project-specific EIAs.

[6] If a plan would adversely affect the coherence of the site's ecological structure and function across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified then there could be an adverse impact on the integrity of the site. In practice an adverse impact is likely to be one that prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation.

Seagreen considers it is essential that the full target capacity of the Zone is included in all cumulative assessments, even where the projects in later phases of development have not been scoped for project-specific EIA or been the subject of applications.

It is Seagreen's intention to bring forward the Zone on a phased basis, in accordance with its legal obligations under its Zone Development Agreement with The Crown Estate. However, it is important in terms of cumulative and in-combination assessments that the full extent of the Zone's intended capacity of 3,465 MW is taken fully into account when assessing these matters on all project applications going forward, rather than later phases in the Zone being given less weight.

The projects and plans listed in **Table 4.4** below will be considered for cumulative and in-combination impact assessment.

Table 4.4 Projects and plans considered for cumulative and in-combination impact assessment

Project	Description	Location	Status
Inch Cape	Installation of approx. 181 wind turbines, with approx. capacity 905MW	Approx. 15.5 km east of the Angus coastline	Application for consent expected 2011 earliest
Neart na Gaoithe	Approx. capacity 420MW	Approx. 15 km east of Fife Ness on the Fife coastline	Application for consent expected 2011 earliest
Forth Array	Approx. capacity 415MW	Approx. 17 km east of St Abbs on the Northumberland coastline	Application for consent expected 2011 earliest
Firth of Forth Round 3 Zone	Approx. capacity 2,500MW	Outside of the 12 nm territorial waters limit, east of the Firth of Forth	Application for consent expected 2013 earliest
Beatrice	Approx. capacity 920MW	Outer Moray Firth	Application for consent expected 2011 earliest
Moray Firth Round 3 Zone	To be confirmed	Outer Moray Firth	Application for consent expected 2013 earliest
Beatrice Demonstrator Project	2 turbines with max. capacity 10MW	Outer Moray Firth	Operational since 2006
Aberdeen Offshore Wind Farm	5 turbines, approx. capacity 115MW	1.5 – 5km east of the Aberdeen coastline	Site awarded
Blyth Offshore Wind Farm	2 turbines with max. capacity 3.8MW	1km off Blyth Harbour, north-east England	Operational since 2000
Edinburgh Waterfront Development	New housing, business, commercial and leisure facilities	Leith	Ongoing
Dundee Waterfront Development	New housing, business, commercial and leisure facilities	Dundee	Ongoing
Forth Replacement Crossing	Cable-stayed bridge	West of the existing Forth Road Bridge	Scheduled to be open 2016

4.6 Guidance and Best Practice

Current best practice guidelines for methodologies to establish both baseline conditions and assess potential impacts for offshore wind farm development have evolved from experience gained through both The Crown Estate Rounds 1 and 2. Guidance and best practice

documents are available from a range of sources, such as Collaborative Offshore Wind Research into the Environment (COWRIE), Renewable UK, formerly British Wind Energy Association (BWEA) and via the websites of a range of key regulators.

All published best practice and guidance documents will be used to develop assessment methodologies, to be agreed with key stakeholders.

5.0 PHYSICAL ENVIRONMENT

5.1 Physical Processes

5.1.1 Existing Environment

Bathymetry

Phase 1 of the Zone is located predominantly within an area known as the Scalp Bank. The bank is an area of elevated seabed which forms a bathymetric high in an offshore area otherwise dominated by deep water (51-71m below Chart Datum (CD)). Water depths across the Phase 1 area range from 30m to 71m below CD and are deepest around the northwest perimeter of the Phase 1 area.

Water depths across the ECR scoping corridor range from 59m below CD around the western perimeter of the Phase 1 area, to intertidal and fully exposed areas within the coastal margins (see **Figure 5.1**). The bathymetric expression of the seabed gradually shallows towards the nearshore with the -30m CD contour being orientated parallel to the shoreline.

Wind and waves

The offshore wave climate, both total sea (swell and wind generated) and significant (one third largest) wave height for return periods of 1-100 years, have been reported on by Ramsay & Brampton, (Ramsay & Brampton 2000a and b) for coastal cells to the north and south of Fife Ness respectively (Cairnbulg Point to St Abbs Head). The predicted wave climates were derived from the Met Office Wave Model (see Ramsay & Brampton, 200b) and are stated to be representative of the general offshore wave climate within a regional context for the Zone i.e. they do not represent one particular location (see **Table 5.1:** Total sea and significant wave height).

Table 5.1 Total sea and significant wave height

Return Period (years)	Total sea significant wave height (m)	Significant wave height (m)
1	6.23	3.56
10	7.62	4.49
100	8.95	5.36

Source: Ramsay & Brampton, 2000a

Offshore of the Firth of Forth, wave conditions are experienced from between 340°N through to 200°N with on average approximately 35% of conditions occurring from between 20°N and 60°N (Ramsay & Brampton, 2000a). Numerical modelling of the offshore wave climate (HR Wallingford, 1989) has shown that storm wave conditions can occur from any direction

where fetch length extends into the North Sea. Significant wave heights of over 4m can be experienced from any direction in the easterly sector (0°N - 180°N).

Little information exists on the nearshore wave climate. HR Wallingford (1989) states that the largest wave heights are incident from the ENE sector (45°N – 90°N) with inshore wave height varying due to complex nearshore bathymetry and platform.

Tides and tidal currents

The tidal regime within the Zone, and ECR corridor, is semi-diurnal in nature and characterised by a variable mean spring tidal range. Tidal range varies spatially along the coast in response to the interaction of incident tidal energy, bathymetry and the shape and orientation of the coast. Tidal range along the eastern Scottish shoreline, to the west of the Zone, is 4.6m at Dundee, 4.8m at Anstruther (Ramsay & Brampton 2000b) and 4.5m at Dunbar (Ramsay & Brampton 2000a).

North of the Firth of Tay the flood and ebb tides are rectilinear, flowing parallel with the coast. Offshore, the flood current flows in a southerly direction. The same tidal current processes are observed offshore of the Firth of Forth with tidal flow moving south along the coastline via Fife Ness (Ramsay & Brampton 2000a). Between St Abbs Head and Barns Ness tidal streams run east-southeast (flood) and west-northwest (ebb) parallel to the coastline with a peak tidal velocity of 0.5m/s off the coast.

Coastal (littoral) processes

Within the coastal and nearshore environment, physical processes are driven by a combination of wind, wave, tides and tidal currents. HR Wallingford (1989) noted in a detailed study of littoral processes that erosion dominated the northern part of Carnoustie Bay between 1969 and 1988 with the transport of material towards the south. On the intertidal beach, historical map analysis (Mitchell, 1997) at Barry Links illustrated the substantial seaward movement of the MHWS tide line over the period 1865 to 1959, with erosion and retreat since 1959. The recent erosion and coastal retreat was attributed to the formation of a large anti-clockwise eddy on the ebb tide to the east of Barry Links, which tended to re-circulate material towards the shoreline at Buddon Ness.

The net longshore drift of beach material within Carnoustie Bay is north to south, with the rate of coastal retreat slowing notably to the north of Carnoustie, due to the geological character of the coastline, with coastal erosion being limited to episodic (storm) events.

There is a high potential input of beach material into the active coastal system through reworking (erosion), though according to Ramsay & Brampton this is limited due to the coastal geomorphology being characterised by alternating unconsolidated sediment and exposed consolidated bedrock (Ramsay & Brampton, 2000a). Fluvial input from the River Tay is unlikely to be significant with much of the material being deposited on the intertidal sand banks found within the Tay estuary, or being deposited further offshore of the estuary within the outer Firth of Tay.

Geology and Geomorphology

The solid geology of the region (Cairnbulg Point to St Abbs Head) is characterised by bedrock of Silurian, Devonian, Carboniferous, Permian and Triassic age. Locally much of

the bedrock geology to the north of Fife Ness comprises mudstone, siltstone and sandstone, and in some areas marine limestone. To the south of Fife Ness, the geology is variable; comprising greywacke, shale, sandstone, limestone, basalt and dolerite. A number of vents of former volcanoes occur within the region (Ramsay & Brampton, 2000b), with the most notable located on the coastline to the southeast of St Andrews within the St Andrews to Craig Hartle SSSI.

Much of the solid geology is overlain by more recent glacial and post-glacial deposits, the thickness of which varies spatially along the coastline and within the offshore (e.g. a thin veneer in the nearshore to substantial deposits within the Zone such as the Marr Bank). Quaternary deposits found in the Zone include the Wee Bankie Formation, which is composed of glacial till and located approximately 30km to south of the Phase 1 area, and the Marr Bank Formation which is composed of inter-bedded mud and silt and is located approximately 20km due south of Phase 1. The thickness of the Quaternary deposits is generally less than 20m, though may be greater across the Wee Bankie.

There are several areas of potential Annex 1 reef habitat within the limits of Scottish Territorial Waters (SNH, 2010), which outcrop from the seabed in the scoping area for the ECR (see **Figure 6.1: Nature Conservation Designations**).

Coastal geomorphology

During the last glaciation ice flow was predominantly towards the east (offshore) from onshore. The major effect of the glaciation in terms of coastal geomorphology was the widespread accumulation of glacially derived sediments (till and glaciofluvial meltwater deposits) which are currently being reworked on-, off- and along the contemporary shoreline via winds, waves, tides and postglacial sea-level change. Much of this low-lying land was inundated during the postglacial marine transgression when relative sea-levels were higher than those of present, resulting in the formation of raised beach sequences (Ramsay & Brampton, 2000b). As relative sea-level began to drop, as a result of isostatic readjustment of the Scottish coastline, large areas of intertidal sands dried out and subsequently were reworked onshore. The coastline between Carnoustie and Arbroath consists largely of low lying land characteristic of coastal dune heathland overlain by a morphological variety of sand dunes which are in turn fronted by sand dominated beaches interspersed with areas of rocky foreshore.

The diversity of coastal landforms and their linkages with formative agents is of particular note, generally, along the eastern Scottish coastline of the study area. This variety is recognised locally, regionally, nationally and internationally in the array of geological features currently designated as SSSI, SAC, SPA and potential SAC (see **Section 6.1: Nature Conservation Designations**).

Seabed sediment

The geomorphology and sediment distribution on the modern seabed is strongly influenced by the nature of the geological units and their degree or otherwise of exposure. The bulk of modern seabed sediments within this region of the North Sea comprise substrates that are more than 10,000 years old and have been reworked from strata by wave and tidal processes. Predominant sediment transport in the area is in a northerly direction moving up the east coast of Scotland. The reworked sediments typically form large areas of seabed sand and gravel, and may also form large-scale sandbanks and ridges and smaller sand

waves (DECC, 2009b). These features are consistent with a net sediment transport regime driven by tidal and residual currents along the continental shelf (Halcrow, 2010 in DECC, 2009b). Seabed sediment data (1:250,000) obtained from the British Geological Survey (BGS) indicate that the seabed across much of site is composed of gravelly sand with areas of slightly gravelly sand and sand in the north and south of the Zone and a small isolated patch of sandy gravel located centrally (see **Figure 5.1**). Muddy sediments will tend to occur primarily nearshore within close proximity to the estuaries of the Forth and Tay where the proportion of muddy sand and mud shall increase markedly. It is acknowledged that the BGS data will have to be ground truthed and a more detailed understanding of seabed sediments developed as part of the EIA process.

The vast quantities of sediment on the seabed within much of the Zone and ECR corridor were deposited by the main river systems of the Forth and Tay during the last glacial and de-glacial cycle. Within the Phase 1 area, bed load sediment transport is driven by tidal currents and is predominantly in a north-north easterly direction. However, the residual current between the flood and the ebb is low, meaning bedload sediment transport is limited.

Sea-level rise

Global warming is predicted to increase pressure on the coastline due to increased storminess and rising sea levels from thermal expansion of seawater and melting of far-field glaciers. The Department of Environment, Food and Rural Affairs' (DEFRA, 2007) recommended allowances for sea level rise indicate that net sea level rise between now and 2025 is approximately 2.5mm/year rising to 13mm/year by 2085.

5.1.2 Potential effects[7]

The Zone – Phase 1

Construction

Hydrodynamic regime: The effects related to the presence of construction plant and activities upon prevailing hydrodynamic conditions are not anticipated to be significant. It is expected that any effects will be limited, both spatially and temporally.

Geological formations: Construction of the wind farm will not change the geology of the site other than in the case of localised effects associated with foundation installation. It is not anticipated that such changes would give rise to significant impacts on other parameters.

Geomorphology and sediment transport: Localised and short-term increases to suspended sediment levels are anticipated during the construction phase. The quantities of sediment brought into suspension will be linked to the installation method used, with primary sources being associated with foundation installation (e.g. through drilling or seabed preparation) and the laying and burial of inter-array and export cables.

Operation

[7] Note that it is not considered that 'impacts' will manifest on physical process parameters. It is possible that the construction, operation and decommissioning of the wind farm will have an effect on prevailing conditions which may then have an indirect 'impact' upon another parameter (e.g. marine ecology). Therefore, within this section, changes from prevailing conditions are referred to as 'effects'.

Hydrodynamic regime: The effects of offshore wind farm structures on wave energy and form has been studied at both Round 1 and Round 2 sites. These studies have concluded "that there would not be any significant impacts, either alone or in combination" (CEFAS, 2005). Therefore, any potential effects to wave climate during the operation of the wind farm are expected to be restricted to the wind farm site and are not considered to be significant. Potential effects resulting from the presence of turbine foundations (both singularly and collectively) on the local tidal regime are not thought likely to be significant in either the near or far field, based on findings reported in site specific studies carried out by CEFAS (2005) and reported in published Environmental Statements for other offshore wind developments (e.g. Royal Haskoning, 2009).

Geomorphology and sediment transport: Site specific monitoring studies undertaken by CEFAS (2005) and industry studies (ABPMer, 2005) have shown that offshore wind farms will have limited effect on sediment transport within the array area and beyond, as long as wind turbines are adequately spaced. Highly localised change in sediment transport is possible around individual foundation structures, but is not considered to represent a significant effect. Scouring may occur around foundations and other ancillary structures and this has the potential to affect localised morphological processes. However, given the localised nature of scouring effects and the mitigation measures available to reduce the extent of scour, any resultant changes in morphological conditions are unlikely to be significant.

Decommissioning

The effects associated with decommissioning of the project are expected to be very similar to those arising during the construction phase. It is not anticipated that any of the effects described previously would result in either significant changes from prevailing conditions or significant effects upon other parameters.

Cumulative and in-combination effects

Physical processes: Studies undertaken by CEFAS have shown that the cumulative effects of offshore wind farms on waves, currents and sediment transport are not considered to be significant, either in the near or far-field (CEFAS, 2004). While a number of wind farm developments are planned for the Zone and STW, it is not anticipated that there will be any physical interaction between them, given the inter-turbine and inter-project separation distances being proposed. This issue will, however, be given due consideration within the ES, in the context of the latest understanding of the differing potential effects of a range of feasible foundation and installation solutions.

In-combination effects on physical processes: There are no other known non-wind farm activities occurring within the vicinity of the Zone, Phase 1 or the ECR corridor that are anticipated to contribute to in-combination effects upon physical processes (e.g. aggregate dredging). As such, it is not anticipated that significant effects would arise.

Export Cable Route

Construction

Geomorphology and sediment transport: As per the Zone Phase 1

Landfall location: As the exact landfall location is still to be decided upon, a coastal process assessment will be required to ensure there are no significant effects upon sediment movement at the chosen location, which will be clarified upon further project design.

Operation

Landfall location: No changes to physical processes are anticipated at the landfall location. However, within the intertidal, localised and temporary changes to the hydrodynamic and sedimentary regimes may manifest. Scouring may occur around the export cable and this has the potential to affect localised morphological processes. However, given the localised nature of scouring effects and the mitigation measures available to reduce the extent of scour, any resultant changes in morphological conditions are unlikely to be significant.

Decommissioning

The effects associated with decommissioning of the ECR are expected to be very similar to those arising during the construction phase. It is not anticipated that any of the effects described previously would result in either significant changes from prevailing conditions or significant effects upon other parameters.

Cumulative and in-combination effects

Cumulative effects on physical processes: While a number of wind farm developments are planned for the Zone and STW, it is not anticipated that there will be any physical interaction between their associated ECR corridors, given the inter-project separation distances being proposed. No cumulative effects upon physical process are predicted.

In-combination effects on physical processes: Inch Cape wind farm is proposed within close proximity to the ECR corridor and its in-combination effects upon physical processes will be assessed as part of the EIA (see **Table 4.4**).

5.1.3 Methodology and Approach to EIA

The Zone – Phase 1

Various wind farm construction activities could result in sediment disturbance or potentially, without mitigation, destruction of small scale features. Seabed mapping undertaken in advance of these operations allows the identification and hence avoidance of valued seabed geological and sedimentary features (DECC, 2009b).

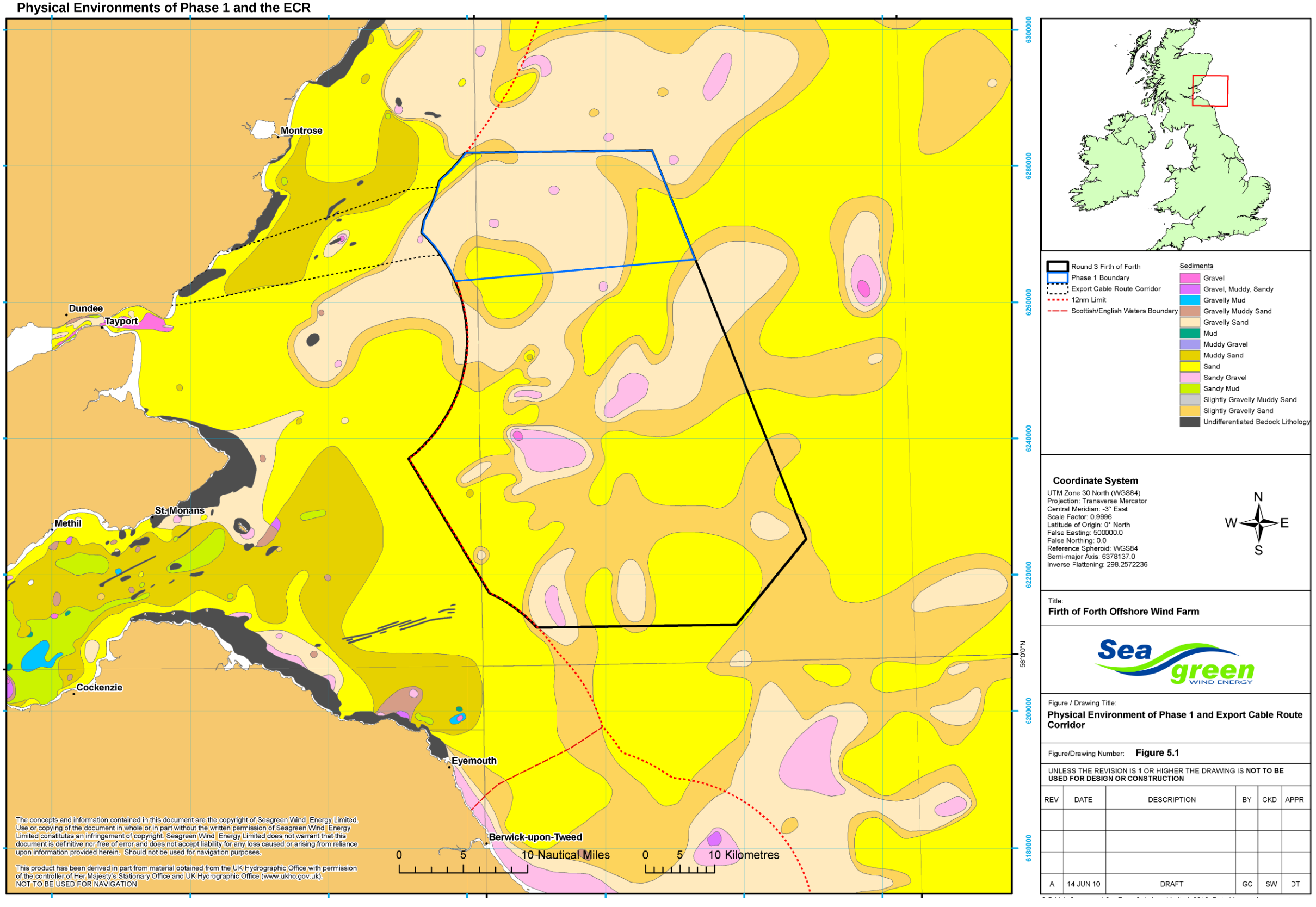
Key considerations for assessment that are highlighted in these documents include:

- Suspended sediment dispersion and deposition patterns resulting from foundation and cable installation or decommissioning;
- Changes in coastal morphology due to cable landfall installation and maintenance (informed via a coastal process effect assessment);
- Scour and scour protection;
- Wave generation;
- Wave energy dissipation or focusing;
- Wave and current processes and their effect on sandbank morphology;
- Changes to tidal regimes.

- Cumulative effects with other wind farms and in-combination effects with other activities; and
- The influence of climate change.

In order to address the above considerations, new site specific data will be acquired (through a dedicated geophysical survey) to investigate seabed sediment and geomorphological conditions and processes. Profiling will be used to provide an interpretation of the sub-seabed, including the thickness and geometry of sedimentary units, depth to top of bedrock, location and extent of sub-bottom anomalies (such as infill-channels) and information about the thickness of the mobile sediment layer.

Figure 5.1 **Physical Environments of Phase 1 and the ECR**



A sediment sampling campaign will be undertaken to gather data on the composition, geochemical properties, and particle size of the seabed sediments. Sample collection will be combined with the contaminant and benthic sampling programmes.

A metocean campaign is planned to collect data on wave and tidal conditions with the acquired data assisting the development of adequate and robust zonal characterisation while contributing toward the optimisation of the Zone and Phase layout and providing the necessary data requirements for future computational modelling to inform site specific EIA.

All data collection described above will be supplemented with knowledge gained from existing industry studies and data sets as well as site specific modelling studies (carried out using industry recognised techniques) to establish the baseline conditions and enable the effects to be predicted and assessed. A large body of seabed survey and other field work has been commissioned since 1999 by the Department of Energy and Climate Change, formerly the department of Business and Regulatory Reform programme. These surveys have made a valuable contribution to the overall understanding of the marine environment in UK waters and there is a volume of data that can be used within the EIA process for the Zone. Data and other outputs from this work are archived on the UK DEAL website.

Where there is a further requirement for additional numerical modelling work, the scope of this work will be established through consultation with the relevant regulatory authorities and statutory consultees.

Export Cable Route

As per the Zone – Phase 1.

5.1.4 Guidance and Best Practice

Title	Author	Date
Guidance note for Environmental Impact Assessment in respect of FEPA and Coast Protection Act (CPA) requirements	CEFAS	2004
Coastal processes modelling for offshore wind farm environmental impact assessment - best practice guide	ABPmer	2008
A further review of sediment monitoring data	COWRIE	2010

6.0 BIOLOGICAL ENVIRONMENT

6.1 Nature Conservation Designations

International Designations

Relevant international nature conservation designations include: Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar sites. There are a number of internationally and nationally designated sites within the regional study area. The following is a list of all internationally designated coastal nature conservation sites within approximately 50km of Phase 1:

- Firth of Tay and Eden Estuary SAC, SPA and Ramsar;
- Barry Links SAC and SSSI;
- Firth of Forth Islands SPA;
- Isle of May SAC;
- River Tay SAC;
- Montrose Basin Ramsar; and
- Firth of Forth Ramsar.

Other statutory international designations that are outside 50km of the regional study area include:

- St Abb's Head to Fast Castle SPA; and
- Berwickshire and North Northumberland Coast SAC and SPA.

The Phase 1 area is not located within or immediately adjacent to the boundaries of any European designated site or identified potential Annex 1[8] habitat, as shown in **Figure 6.1**. The proposed ECR corridor falls within the boundaries of the following internationally designated sites (see **Figure 6.1**):

- Firth of Tay and Eden Estuary SAC, SPA and Ramsar; and
- Barry Links SAC.

Within the ECR corridor there are two distinct areas of Annex I habitat[9]; firstly a continuous stretch of nearshore reef running approximately from Carnoustie to south of Arbroath, and a second area of patchy reef further offshore, within the centre of the proposed corridor.

National Designations

Large stretches of the coastline inshore of the Phase 1 area have been afforded protection under national designations such as: Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR). Many of the SSSI site boundaries are concurrent with non-statutory nature conservation areas such as Scottish Wildlife Trust (SWT) reserves,

[8] Annex 1 habitats are habitats that are considered to be under threat in the EU because they are in danger of disappearance or have a restricted range in Europe. Habitats are also included that present outstanding examples of one of the five biogeographical zones into which the EU is divided.

[9] Mapped areas of potential Annex 1 habitat are derived from British Geological Survey seabed sediment data, and further site-specific data would be required to confirm the presence and extent of Annex 1 habitat.

Geological Conservation Review (GCR) sites, and Local Nature Reserve (LNR) sites, which therefore are afforded statutory protection (see **Table 6.1**).

Table 6.1 National Designations inshore of the Phase 1 area (those in bold illustrate those that fall within the ECR corridor and Phase 1 areas)

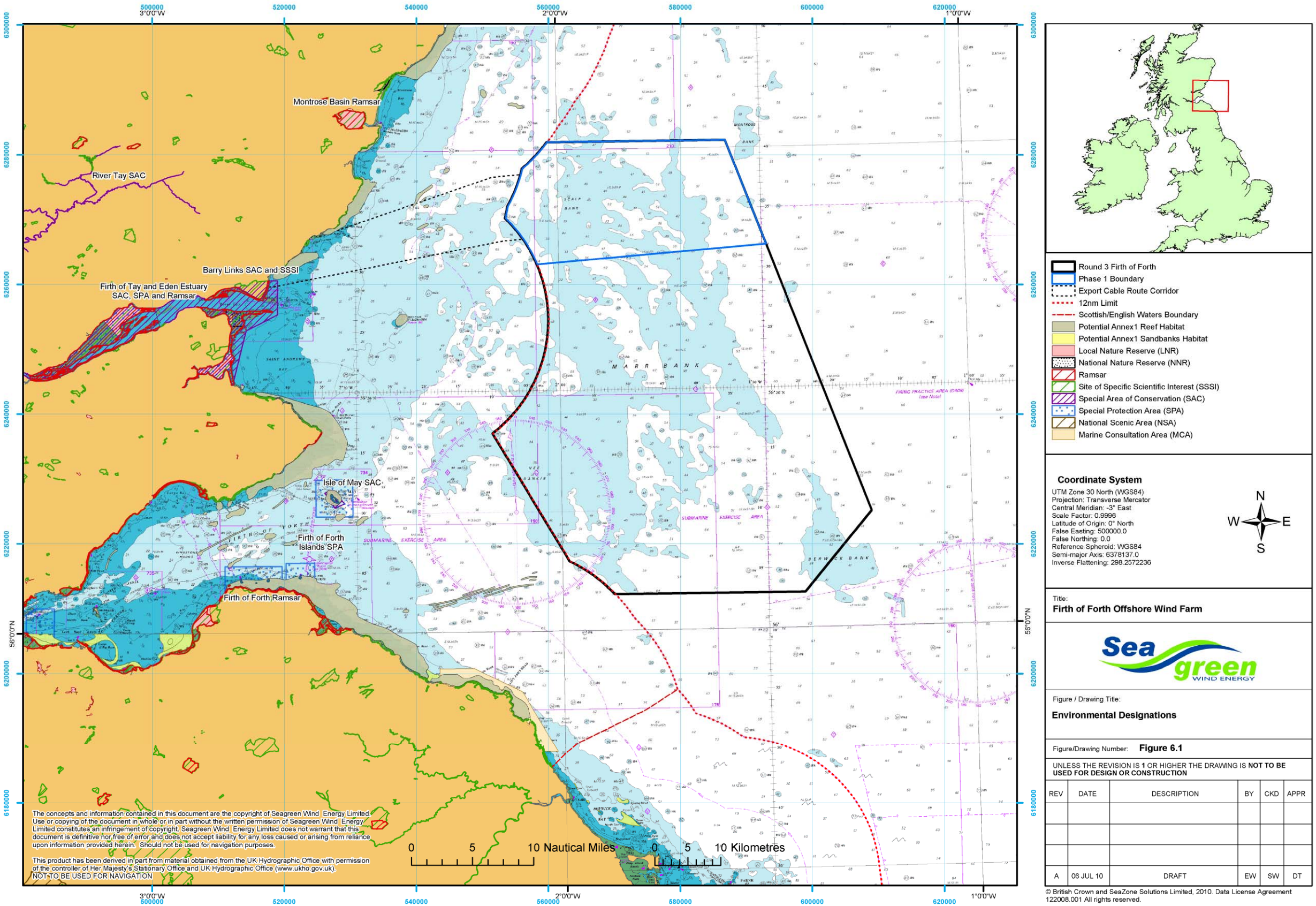
Type of Designations	Name of Designation	
SSSIs	Balmerino to Wormit Shore	**Firth of Tay and Eden Estuary**
	Barnsmuir Coast	Inner Tay Estuary
	Barry Links	Montifeith Bay
	Crawton Bay	Montrose Basin
	Earlshall Muir	Rickle Craig to Scurdie Ness
	Easthaven	St Andrews to Craig Hartle
	Eden Estuary	St Cyrus and Kinnaber Links
	Elliot Links	Tayport to Tentsmuir Coast
	Fife Ness coast	Tayport to Tentsmuir Coast
	Firth of Forth	Whiting Ness to Ethie Haven Coast
	Firth of Forth Islands	
NNRs	Isle Of May	Tayport to Tentsmuir Coast
SWT reserves	Fife Ness Coast	
GCR sites	Balmerino to Wormit Shore	Tayport to Tentsmuir Coast
	Barry Links	
LNR sites	Inner Tay Estuary	

Where there are non-statutory sites that are not concurrent with SSSI boundaries, they are not afforded statutory protection. These include the following GCR sites and Royal Society for the Protection of Birds (RSPB) and SWT reserves:

- Randerston Coast GCR;
- Scurdie Ness GCR;
- Scurdie Ness to Usan Harbour East Sands GCR;
- Seaton Cliffs Scottish Wildlife Trust Reserve;
- Fidra RSPB Reserve; and
- East Sands to Buddo Ness GCR.

Many of the sites designated for national importance, list in the “Relevant Conservation Interest” section of their citation, species which could interact with Phase 1 of the proposed development. These include bird species and also marine mammals. These species are discussed further in **Sections 6.2 Ornithology** and **6.5 Marine Mammals**.

Figure 6.1 Environmental Designations



Future Designations

To supplement the existing network of mostly terrestrial / intertidal SPAs around the UK and to better recognise the ecological requirements of birds using the marine environment, the Joint Nature Conservation Committee (JNCC) and country agencies are currently investigating the potential designation of a suite of new marine SPAs, as well as the seaward extension of a number of existing coastal SPAs. The relevance of this to development in Phase 1 is discussed in **Section 6.2 Ornithology**.

As with SPAs, new potential SACs are being identified in UK offshore waters for habitats listed on Annex I of the Habitats Directive, including:

- Reefs;
- Sandbanks which are slightly covered by seawater all of the time;
- Submarine structures made by leaking gases; and
- Submerged or partially submerged sea caves.

Several potential offshore SACs have already been identified, none of which fall within or near to the Phase 1 area or the proposed ECR corridor. However, areas of potential Annex 1 reef habitat (SNH, 2010) have been identified within 10km of the Phase 1 area and within the ECR corridor, as shown in **Figure 6.1**. There are no potential sandbank Annex 1 habitats within either the Phase 1 development area or ECR corridor; the nearest location is at Cockenzie within the Firth of Forth (as illustrated in **Figure 6.1**).

In addition, no UK Biodiversity Action Plan (BAP) Priority Habitats, or OSPAR Threatened and/or Declining Habitats have been identified within either the Phase 1 area or the proposed ECR corridor. However, the OSPAR habitat 'sea pens and burrowing megafauna' is found on shallower, more muddy sediments inshore of the Zone, within the Firth of Forth and south towards Dunbar.

Though not deemed to be a habitat of conservation importance in their own right, the sandbank features in the vicinity of the site, in particular Wee Bankie, do support important sandeel populations and, in turn, seabird and marine mammal populations (see **Sections 6.2: Ornithology, 6.4: Fish and Shellfish, 6.5: Marine Mammals** and **7.1: Commercial Fisheries** for more detail).

The UK Marine and Coastal Access Act 2009 and the Marine (Scotland) Act 2010 promote a suite of measures for the protection of the marine environment and the streamlining of development consents and makes provision for the establishment of Marine Protected Areas (MPA). In the context of the development of the Zone, the Marine and Coastal Access Act gives Scottish Ministers the power to designate MPAs in offshore waters adjacent to STW.

At the time of writing, Seagreen is not aware of any intention to designate an MPA within the Zone or its environs. However, throughout the development of the Zone, Seagreen will be in close liaison with the Marine Scotland, SNH and the JNCC and will take any new developments into account.

6.1.1 Potential Impacts

The identification of wind farm sites and the ECR, landfall and transition site will avoid, wherever possible, any direct impact to any statutory or non-statutory nature conservation designations, including all Ramsar, SPA, SAC, SSSI, NNR, LNR and SWT.

The Zone – Phase 1

The potential impacts on nature conservation designations arising during the construction, operation and decommission of Phase 1 developments, both alone and in-combination with other plans and projects are addressed within the relevant sections of this Scoping report (see **Sections 6.2**: **Ornithology**; **6.3**: **Marine, Intertidal and Terrestrial Ecology, 6.5 Marine Mammals**).

Export Cable Route

The potential impacts on nature conservation designations from the ECR are discussed within the relevant sections of this Scoping report (see **Sections 6.2**: **Ornithology**; **6.3**: **Marine, Intertidal and Terrestrial Ecology** and **6.5 Marine Mammals**).

6.1.2 Methodology and approach to EIA

The Zone – Phase 1

The investigations required to inform the EIA of designated features will be covered by the investigations detailed in *inter alia* the marine ecology, ornithology and marine mammals sections of this report.

Export Cable Route

As per The Zone – Phase 1.

6.1.3 Information for Appropriate Assessment

If a plan or project not connected to the management of a European site is likely to have a significant impact on that site, the Competent Authority is required to carry out an Appropriate Assessment (as described under Regulation 61(1) of the Habitats Regulations 2010) to determine whether the plan or project, either alone or in combination with other plans or projects, will have an adverse impact on the site's integrity.

A data collection programme shall be initiated to provide data of sufficient quality and quantity to adequately inform AA. The requirement to do so will be agreed with Marine Scotland and the methodology and approach to data acquisition agreed with the relevant statutory consultee(s).

6.1.4 Guidance and Best Practice

Title	Author	Date
Wind Farm Development and Nature Conservation	BWEA	2001

6.2 Ornithology

6.2.1 Existing Environment

Breeding species

The Phase 1 development area is within foraging range of a number of internationally important breeding seabird colonies designated as SPAs. (See **Section 6.1: Nature Conservation Designations**). Information on foraging range suggest that in summer, the area may be of particular importance to gannets *Morus bassanus,* black legged kittiwakes *Rissa tridactyla* and foraging auks, including guillemot *Uria aalge*, razorbill *Alca torda* and puffin *Fratercula arctica*; as well as (northern) fulmar *Fulmarus glacialis* and several gull species (Langston, 2010). Other species which may utilise the area in the summer/autumn months include terns, skuas and shearwaters.

Gannets have the largest foraging range of all the seabirds in the region extending across much of the central North Sea, with the waters off the Firth of Forth appearing to be particularly important (e.g. Skov *et al*., 2008; Hamer *et al*., 2001 and 2000). Birds are likely to come predominantly from the Bass Rock (Forth Islands SPA) which is the second largest gannetry in the UK supporting some 40,000 pairs (Mitchell *et al*. 2004). Fulmars also have the potential to cover the entire development area in the breeding period, with puffin, kittiwake, guillemot and razorbill ranging progressively smaller distances from colonies. Important colonies for breeding kittiwakes and auks within range of the development area include Fowlsheugh SPA, which supports 17.8% of the breeding guillemots in the UK (JNCC website); the Forth Islands SPA, particularly the Isle of May; and perhaps also the more distant St Abbs and Fastcastle SPA.

Preliminary analysis of aerial survey data collected between May and August 2009 (Seagreen, unpublished) broadly confirm the above showing the most abundant species within the Zone to be auks and kittiwakes. At times, these species have been recorded in high concentrations in the relatively shallow waters of the Wee Bankie and the Marr Bank to the south of the development area. Research suggests that these areas are used preferentially by species foraging birds targeting sandeels Ammodytes spp. in particular (e.g. Daunt *et al.*, 2008; Frederiksen *et al.*, 2008; Wanless *et al.,* 1998).

Although the aerial survey data suggest that the Phase 1 development area is not used as intensively in summer as parts of the surrounding area by a number species, owing to the importance of the local breeding populations, gannet, kittiwake, guillemot, razorbill and puffin are all likely to be identified as key species within the Zone.

Wintering species

Boat-based field data indicate that, in winter, auks including guillemot, razorbill (ECON Ecology, unpublished) and puffin (Harris *et al.*, 2010), remain the dominant species group within the development area. At this time of year little auk *Alle alle* may also be present in good numbers. Kittiwakes are also common together with lower numbers of wintering herring gull *Larus argentatus* and great black backed gulls *Larus marinus.* Fulmar and gannet numbers are reduced compared to the summer period (Kubetzki *et al.*. 2009). Nationally important numbers of divers, seaduck and grebes which winter in the Inner Firths of Forth and Tay (Dawson *et al.,* 2007, Sohle *et al.*, 2007, Barton & Pollock 2004) appear to be rare in the offshore waters of the Zone. However, the proposed Phase 1 development area has

had relatively low coverage in terms of winter seabird surveys (Pollock & Barton 2006) and the importance of the site for wintering seabird species has therefore yet to be fully established.

Passage species

The SPAs of the Firth of Forth and the Firth of Tay and Eden Estuary support large populations of wintering migrants including geese, seaduck, divers, grebes and waders (see **Section 6.1 Nature Conservation Designations**). These species, together with swans (Griffin *et al*. 2010) all have the potential to pass through the development area. Significant passage of skuas including Scottish breeding great skua *Stercorarius skua* and Arctic skua *Stercorarius parasiticus* which both breed in Northern Scotland, as well as little gull *Hydrocoelus minutus* is also possible. Large numbers of passerines also traverse the area on passage across the North Sea to winter in the UK. The distance from shore of the development area would suggest that migrating birds would generally pass over at heights well-above the wind turbine rotors. However, the altitude of migration may be species and weather dependant causing birds to pass through the development area at rotor height on some occasions. In general, the presence of passage species within the offshore region of the Zone has yet to be fully established.

At all times of year the seaward portion of the proposed ECR corridor is likely to include similar species to those within the Phase 1 development area. However, as a general rule the closer the greater the number of species that will be encountered with the inclusion of more shore birds and coastal species at the expense of more pelagic species (Camphuysen *et al*., 2005).

The nearshore section of the cable corridor falls within the extent of Tay Bay as defined by JNCC (Sohle *et al*., 2007). JNCC have undertaken a series of boat-based and aerial surveys in this area to determine its importance for inshore waterbirds outside the breeding season and to assess its potential to qualify as an offshore SPA (Sohle *et al*., 2007). Target species included red throated diver *Gavia stellata*, common eider *Somateria mollissima*, common scoter *Melanitta nigra*, velvet scoter *Melanitta fusca*, long tailed duck *Clangula hyemalis*, red breasted merganser *Mergus serrator* and little gull. Red throated divers were found to be present in numbers exceeding the 1% threshold of the UK wintering population (O'Brien *et al*., 2008) and further analyses are ongoing. These species could all potentially utilise the ECR corridor for feeding, loafing or roosting.

At landfall, the ECR corridor has the potential to cross a number of designated sites (see **Section 6.3 Marine, Intertidal and Terrestrial Ecology**) and the birds present will depend on the final location chosen. In general, the intertidal area comprises mixed sand and rocky foreshore and this may provide nesting and feeding areas for common shorebirds such as oystercatcher *Haematopus ostralegus* and ringed plover *Charadrius hiaticula* during the breeding period.

The southern corner of the proposed ECR corridor includes a part of the Firth of Tay and Eden Estuary SPA. This supports breeding marsh harriers *Circus aeruginosus* and little tern *Sternula albifrons*. During passage periods and in winter, the estuary supports an internationally important assemblage of geese, seaducks and waders (JNCC website).

6.2.2 Potential Impacts

The Zone – Phase 1

Potential impacts from offshore wind farms on bird populations are discussed in detail in a number of sources e.g. Drewitt and Langston (2006), and are summarised below.

Construction

- Disturbance and displacement (habitat loss); and
- Indirect impacts e.g. disruption to habitat function potentially leading to a reduction in prey; impacts on prey species, for example, due to piling.

Operation

- Collision with the rotating blades of the turbines;
- Disturbance and displacement (habitat loss);
- Barrier impacts causing disruption of flights lines, including migratory flight paths and day to day movements between feeding and breeding or roosting sites; and,
- Indirect impacts e.g. changes to habitat function and impacts on prey distribution and abundance.

Decommissioning

The potential impacts during the decommissioning of the project are expected to be similar in nature, extent and duration to those arising during construction.

Cumulative and in-combination impacts

The above impacts have the potential to act cumulatively with other offshore wind farm projects off the Firths of Forth and Tay, in the Moray Firth and off Aberdeen (Royal Haskoning, 2010b). In addition, for wide-ranging or migratory species, the impacts of wind farms further afield, including the Solway Firth, Round 1, 2 sites and the Round 3 zones, as well as onshore wind farms may need to be taken into account (AMEC, 2010).

As the impacts listed above are specific to wind farms, in-combination impacts with other industries are not predicted. However, there is a lack of information about indirect impacts of piling on species such as sandeels which may be affected and are a key prey species. The commercial sandeel (*Ammodytes* spp.) fishery in the region was closed in 2000 due to its potential impacts on seabird breeding success (e.g. Frederiksen *et al* 2008). Should it be reopened, there is potential for cumulative impacts between wind farm construction and commercial fishing (Parsons *et al.* 2008).

Different species vary in their sensitivity to the identified potential impacts and this has been evaluated for 26 seabird species in German waters (Garthe and Huppop, 2004) many of which occur in UK waters. It is understood that Scottish Natural Heritage (SNH) is intending to produce a similar scale of sensitivity for Scottish species based on emerging evidence (SNH correspondence with Seagreen, 21/05/10). Any new advice from SNH may be used to inform the process of impact assessment.

FTOWDG has commissioned a Cumulative Study Report on ornithology (AMEC, 2010). This identified a preliminary list of species which are potentially most sensitive to cumulative impacts owing to their distribution in the wider region. The report was presented to SNH and RSPB at meetings on 27th and 22nd October 2009 respectively. Advice included in their written responses of 11th December 2009 and 29th January 2010 respectively is being incorporated into a revised report. Methods by which cumulative impacts on birds will be assessed are included in the revised report Scottish Territorial Waters Offshore Wind Farms – East Coast Discussion Document – Cumulative Effects (Royal Haskoning, In press: See **Table 4.4**).

Export Cable Route

Construction

The potential impacts during the laying of the offshore export cable(s) are expected to be limited both in time and space to the period when the cable laying barge passes through the cable corridor. This may result in temporary disturbance or displacement which is not expected to be significant.

Impacts of cable laying in the nearshore, intertidal and onshore areas, including the installation of cable ducts if required, may result in relatively short term disturbance and displacement/ habitat loss but the impacts and the species affected will depend on the habitat through which the cable passes and the timing of installation works. It is expected that by employing suitable mitigation, to be agreed with the statutory agencies, that significant impacts can be avoided.

Operation

No impacts are anticipated during operation.

Decommissioning

The potential impacts during the decommissioning of the project are expected to be similar in nature, extent and duration to those arising during construction.

Cumulative and in-combination impacts

Currently, no cumulative impacts are expected as it is anticipated that only one export cable will be required.

6.2.3 Methodology and Approach to EIA

The Zone – Phase 1

Literature review

To supplement the specific field surveys (see below) and to inform the baseline of the impact assessment, a full review of existing literature, reports and data sets will be carried out and this will be supplemented by data from field surveys. Existing information sources include, but are not limited to:

- General ornithology texts describing the abundance and distribution of seabird species in UK waters (e.g., Mavor et al, 2008; Stone et al 2005; Mitchell *et al*. 2004; Wernham *et al*, 2002);
- Strategic level documents and databases covering large scale surveys of seabirds in offshore waters including the North Sea, such as Offshore Energy Strategic Environmental Assessment (e.g. DECC, 2009); European Seabirds At Sea database (ESAS-OBIS Seamap database);
- Regional surveys and databases e.g. Wetlands Bird Surveys (WeBS); JNCC surveys, recording the distribution of specific guilds or individual species within eastern Scotland (e.g. Dawson *et al*., 2009);
- Local ornithological reports (e.g. Scottish Ornithologists Club reports and Angus Birding); and
- A range of peer-reviewed, scientific papers relating specifically to the distribution and behaviour of key species in the wider Firth of Forth region (e.g. Scott *et al*., 2010; Kubetzki *et al* 2009; Skov et al, 2008; Daunt *et al*., 2003, 2002; Hammer et al. 2001, 2000).

Boat-based surveys

Boat-based bird (and marine mammal) surveys of the Phase 1 development area began in December 2009 and will be completed on a monthly basis over a two year period. Survey methods follow standard COWRIE guidance (Camphuysen *et al*., 2004) and incorporate modifications proposed in the recent review of current practice (Maclean *et al*., 2009). An amended methodology was issued by Seagreen on 4th June 2010 following discussions and correspondence with JNCC, SNH and RSPB (available upon request).

The survey vessel conforms to COWRIE guidance in terms of its size (32 m) and the height of the viewing platform above sea level (~ 8 m). Surveys follow parallel transects orientated perpendicular to the main predicted flight direction of breeding birds from the SPA colonies within the Firth of Forth and with a 3 km separation. Surveys are undertaken in sea states 5 or less. Both sides of the vessel are surveyed simultaneously to maximise survey effort. Records of marine mammals are only taken in sea states 3 or less. Surveys will be carried out as part of the monthly survey programme for the whole Zone in order to compare bird distribution within the Phase 1 development area with that across the wider zone.

Aerial surveys

A programme of aerial visual surveys was carried out between May 2009 and April 2010 covering the Zone, including the Phase 1 development area, and adjacent STW wind farm sites within the outer Firth of Forth. These surveys were commissioned from Wildfowl and Wetlands Trust (WWT) as part of The Crown Estate Enabling Actions and their methodology was agreed in advance with the statutory bodies. Further aerial surveys utilising digital survey methods may be considered in the future in order to provide additional bird distribution data across the region. Any work would be undertaken in conjunction with the FTOWDG and methodologies agreed with Statutory Nature Conservation Agencies (SNCAs).

Other surveys and studies

Owing to the number of breeding seabird SPAs within the wider Firth of Forth and North Sea region an attempt has been made to identify the connectivity of the birds within the

development area with neighbouring SPAs. In order to do this Seagreen has worked with the FTOWDG to identify priority species.

Species have been selected based on their abundance in the development area, the likelihood of cumulative impacts with other wind farms which may be built within the region, the percentage of the UK breeding population represented within the regional SPAs and their potential sensitivity to wind farm impacts. Priority species have been identified as fulmar, northern gannet, black-legged kittiwake, guillemot, razorbill, and puffin.

FTOWDG has commissioned a literature review of historical data on tagging and tracking studies on the above species with a particular emphasis on work carried out in the Firth of Forth and Tay region. It has currently (summer 2010) commissioned Centre for Ecology and Hydrology (CEH) to collect new tracking data from breeding birds on the Isle of May (Forth Islands SPA) focussing on kittiwakes, guillemots and razorbills in the first instance. Liaison with groups such as RSPB which are undertaking other tracking studies in the region are ongoing. These studies will establish the foraging ranges of birds from specific SPAs during the breeding season and will be helpful in determining connectivity.

Methods of collating information on passage species within the offshore region including the Phase 1 development area are currently under discussion with The Crown Estate and the Strategic Ornithological Support Services Group (SOSSG) as this is considered to be a complex issue which affects the wider wind industry.

Data analysis and impact assessment

Data collected during boat-based surveys will be used to calculate density distributions and derive population estimates for each species within the proposed development area using distance software (e.g Buckland *et al*., 2004). The ES will identify the nature of that use i.e. for foraging, overwintering, migration or other activities and include an assessment of the importance of the sites within the development area relative to the wider area including planned STW sites, for seabirds throughout the year.

The sensitivity of each species will be determined based on the size of its population i.e. whether it is of local, regional, national or international significance, its conservations status and its known sensitivity to offshore wind farms. Species identified as sensitive receptors will be subject to full impact assessment against the impacts listed in **Section 6.2.2**.

The impact assessment methodology will follow standard matrix methods e.g. SNH 2005, but will also incorporate recommendations set out in the IEEM Guidance (In Press) to qualify the decision on whether an impact is assessed as significant or not significant in the context of the proposed development.

Particular attention will be paid to species which are features of European sites and for which a Habitats Regulation Assessment may be required. This will include consideration of qualifying species and species named in the assemblage of existing SPAs as well as sites that are currently Areas of Search for offshore SPAs. If requested, separate reports on relevant species could be compiled to inform the process of Appropriate Assessment.

Regular meetings and consultation will be held between Seagreen, JNCC, SNH and RSPB throughout the process of data collection and impact assessment. Local interest groups, including groups within the scientific community, will also be invited to attend these meetings

where appropriate. The objective will be to engender positive relationships amongst all stakeholders and for statutory nature conservation agencies and other consultees to both input into the assessment process and to monitor its progress.

Export Cable Route

Owing to the temporary nature of construction operations within the offshore region of the ECR corridor only a limited number of boat-based surveys are likely to be required. These may be undertaken as a extension to the current boat-based survey programme using the same vessel and observers. Particular attention will also be paid to the review of existing literature on bird distribution in the area.

Once the cable route has been finalised, a range of onshore surveys are proposed, these may include: breeding bird surveys; low and high tide counts and land-based vantage point surveys. All methods will be agreed with the appropriate statutory bodies.

Impact assessment methods will follow those outlined above. However, it is expected that with appropriate mitigation, significant impacts can be avoided.

6.2.4 Guidance and Best Practice

Title	Author	Date
Quantifying the relative use of coastal waters by breeding terns through visual tracking, colony transects and simulation modelling: towards impactive tools for planning and assessing the impact of offshore windfarms	COWRIE	In Progress
Development of standards for high definition digital photographic recording of seabirds and marine mammals	BTO	2009
Development of revised best practice guidance and technical specifications for the use of remote techniques for observing bird behaviour in relation to offshore windfarms	RPS	2009
Development of Guidance on Ornithological Cumulative Impact Assessment for Offshore Windfarm Developers	AMEC	2009
Further use of aerial surveys to detect bird displacement by offshore windfarms	COWRIE	2007
Potential use of population viability analysis to assess the impact of offshore windfarms on bird populations	COWRIE	2007

Collision risk modelling will be based on SNH guidance (the Band model) (e.g. SNH 2000). However, this method was designed for onshore wind farms where collision calculations are based on flight lengths derived from observations of the whole wind farm area. As boat-based surveys cannot provide similar data, a modified method will be used which calculates flight lengths based on bird density and the average flight distance across the wind farm. All modifications will be clearly described in the ES and any additional guidance from SNH on the implementation of collision risk modelling in the offshore region would also be incorporated.

Cumulative assessment methods will follow those outlined in COWRIE guidance (King *et al*., 2009). Seagreen is currently working with FTOWDG to ensure that standard data recording and assessment methodologies are used to facilitate cumulative assessment.

6.3 Marine, Intertidal and Terrestrial Ecology

This section presents the ecological interest including marine, intertidal and terrestrial. For the purposes of clarification, marine ecology refers to subtidal species / habitats below Mean Low Water Spring (MLWS). Intertidal ecology refers to the area between MLWS and the Highest Astronomical Tide (HAT) colloquially known as the 'intertidal' zone, whilst terrestrial ecology refers to everything landward of HAT. . The proposed Phase 1 development area has the potential to impact upon marine ecology, whilst the proposed ECR corridor has the potential to impact upon marine (cable only), intertidal (landfall area) and terrestrial (cable and transition pit) ecology. **Figure 6.2** illustrates the boundaries for the marine, intertidal and terrestrial zones and how these relate to the ECR corridor, landfall and transition pit.

6.3.1 Existing Environment

Marine ecology

Information describing offshore benthic habitats within or in the vicinity of the Phase 1 area and proposed ECR corridor is limited both in quantity and quality. Habitat maps, published in Mapping European Seabed Habitats (MESH) WebGIS, exist for parts of the Tay and Forth estuaries and the coastline to the southwest of the Zone. Further habitat sample points provide an indicative broad-scale model of habitats across much of the Zone, and indicate that the Zone is likely to be dominated by sand and gravel habitats.

Survey data available from the National Biodiversity Network (NBN) database (JNCC, 2008) in the area surrounding Phase 1 include:

- Annual SOAFD St. Abbs/Bell Rock sludge-dumping site surveys, ca.16km from the Phase 1 area;
- 2001-2003 FRS North Sea benthic trawl survey, ca. 13-14km from the Phase 1 area; and
- 1990-1996 UK National Marine Monitoring Programme, ca. 8-22km from the Phase 1 area.

No known survey data are available within the Phase 1 area, apart from the aforementioned scattered MESH habitat sample points.

There have been a number of strategic studies to inform the environments found within UK territorial waters, which provide an overview of marine ecology likely to be encountered within broadly similar sedimentary and physical process driven environments. However, no study has given a particular focus to the seabed beyond the 12nm limit.

The seabed within Phase 1 is characterised by water depths of between 30m and 71m below CD and is dominated by sand, sandy gravel and gravelly sand substrates. Such sedimentary habitats, due to their dynamic nature, are generally species poor and tend to be characterised by a mobile fauna of polychaete worms, bivalve molluscs, crustaceans and starfish. It is not anticipated that the Zone, or Phase 1 area in particular, would vary greatly from this typical assemblage.

This assumption needs to be confirmed by Phase and Zone wide characterisation surveys, but for the purposes of Scoping, this assumption is supported by the findings of Jennings *et al.* (cited in Eleftheriou *et al.* 2004) who reported that the epifauna of the North Sea (south of

57°30'N) was characterised by a mixed fauna including starfish, crustaceans, bivalves and polychaete worms. However, many of the species described in the report are representative of harder substrates, so may only be present where cobbles and boulders occur on the seafloor and would not be expected on gravelly sand substrates. In 1982, Dyer *et al*. (cited in Eleftheriou *et al.* 2004) recorded, in the central North Sea between latitudes of 57° and 55°, a community dominated by the king scallop (*Pecten maximus*) and white sea urchin (*Echinus acutus*). The presence and significance of the king scallop is discussed in the **Section 7.1 Commercial Fisheries**.

Within the ECR corridor, the marine habitat is characteristic of shallow subtidal areas adjacent to the intertidal zone, potentially including areas of subtidal rocky reef (a potential Annex I reef habitat). The seabed surrounding areas of rocky substrate is characterised by areas of sandy mud.

Intertidal/coastal ecology

The intertidal area within the landward ECR corridor comprises sand dominated beaches interspersed with areas of rocky foreshore and backed by sand dunes and coastal dune heathland. The edges of the ECR corridor are located within a number of international and national designations. The northern corner of the ECR corridor is located within the Elliot Links SSSI, which protects an area (27.1ha) of sand dunes and fen vegetation. The southern corner of the ECR corridor is located within the outer edges of the Firth of Tay and Eden Estuary SAC, SPA, Ramsar and SSSI sites, which protect the intertidal sandflats and subtidal sandbanks that support internationally important numbers of breeding and over-wintering birds (see **Section 6.2: Ornithology** for further details).

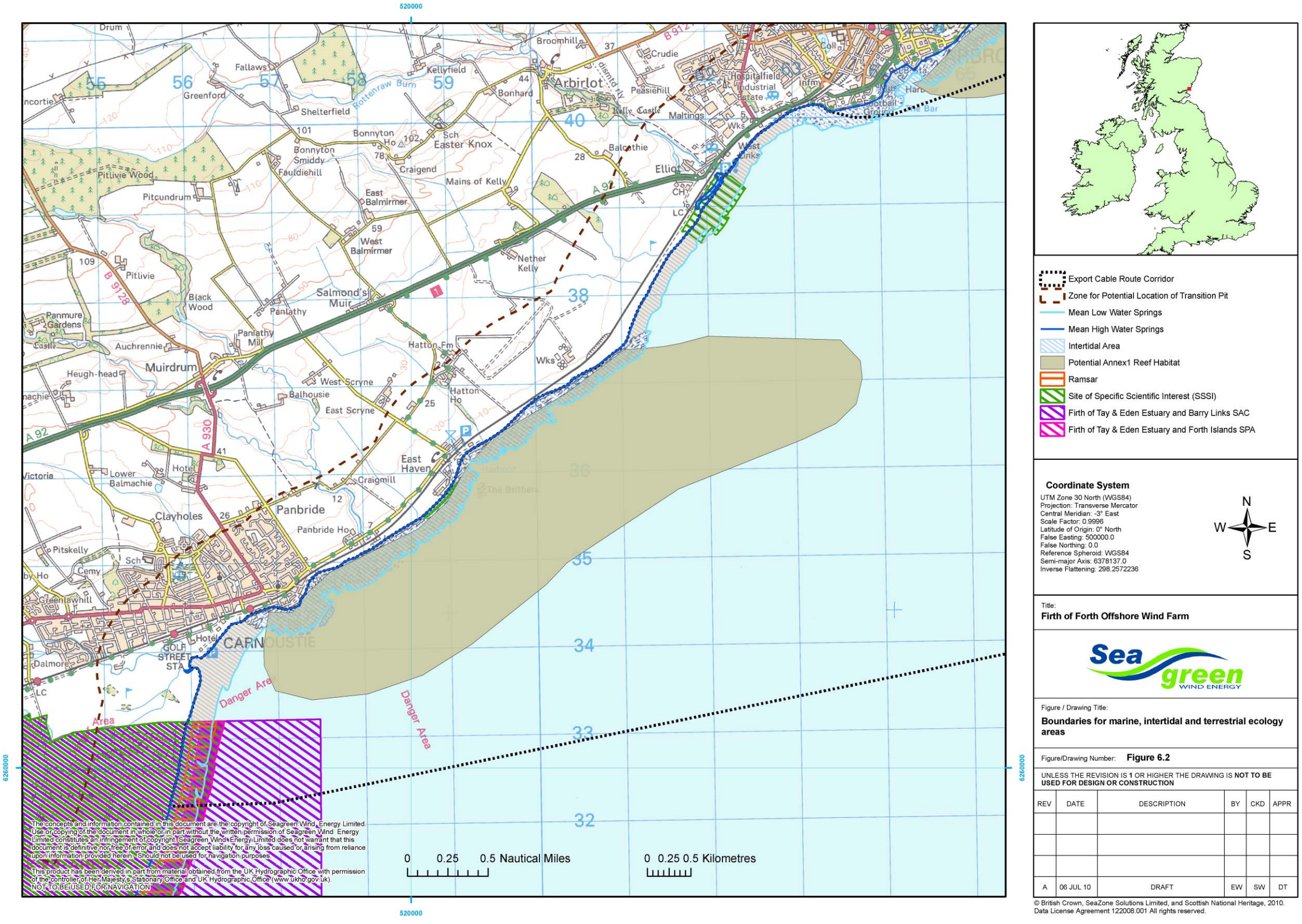
The southern corner of the ECR corridor also overlaps with the extensive sand-covered foreland of Barry Links, which is protected by the Barry Links SAC and SSSI. The foreland is one of the largest dune systems in eastern Scotland and is considered one of the best examples of a natural coastal dune system in the UK. There are five Annex I habitats associated with the dune system, these are:

- Embryonic shifting dunes
- Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
- Fixed dunes with herbaceous vegetation ('grey dunes') *priority habitat
- Atlantic decalcified fixed dunes (Calluno-Ulicetea) *priority habitat
- Humid dune slacks

The dunes illustrate relatively undisturbed natural coastal dune succession with a full range of characteristic plant communities, including national and regional rarities (e.g. sand couch *Elytrigia juncea*). The site supports an unusually large number of rare mosses and liverworts and several species of sand dune invertebrates which are very local in their distribution. The breeding bird community includes one national rarity and the site is of regional importance for the variety of its wintering species (see **Section 6.2: Ornithology**).

Outside of designated areas, mobile sand dunes are rather more rudimentary in their geomorphological form and ecological linkages due to the quantity of wind blown sand that the coastal dune system receives having diminished over time (Loizou, 2001). The fixed dune habitats are however, rather more well developed.

Figure 6.2 Marine, intertidal and terrestrial ecology boundaries



Only one designated site occurs entirely within the proposed ECR corridor; Easthaven SSSI, which is a small section (1.2ha) of coast that lies 2 miles north of Carnoustie. This area is protected as it provides habitat to the only recorded location in Scotland of the greater yellow-rattle *Rhinanthus angustifolius*, a plant species which is recorded in only eight other dune sites in Great Britain. Easthaven SSSI is also thought to have a healthy insect population, and the surrounding area often has many wildfowl and waders.

Terrestrial ecology

The south-western extent and north-eastern extents of the proposed ECR corridor comprises the outskirts of the built up areas of Arbroath, the small settlement of Wormiehills, Arbroath Gold Club, the small village of Easthaven, and Carnoustie. Surrounding these settlements the majority of the coastline is relatively flat and is backed by arable land and pasture. The coastal dunes are relatively low-lying from Carnoustie to north-east of Easthaven (known as 'the flat links area') being characteristically covered in marram grass, beyond which they become deeper and higher without constraint from the Arbroath to Carnoustie railway line.

Three small rivers discharge on the coast. Monikie Burn flows past Craigmill and Panbride House (between Easthaven and Carnoustie), Barry Burn flows through Carnoustie and discharges on the north-eastern end of Barry Sands beach, and finally Elliot Water (also known as Rottenraw Burn) discharges into the sea at Elliot (for further information on their water quality refer to **Section 7.6: Water and Sediment Quality**). Elliot has a stable sand dune system with abandoned river meanders that supports open dune and fen plant communities, which are uncommon in Angus. The area is designated as a SSSI, and supports several rare plant communities, including the nationally scarce sea pea *Lathyrus japonicus* and small scabious *Scabiosa columbaria*. Many invertebrates are found in the rich sand dune habitat, particularly butterflies such as ringlet, small blues, small heath and common blue. Little tern have bred here in the past.

6.3.2 Potential Impacts

The Zone – Phase 1

Construction

Physical disturbance: Construction activities, such as the installation of foundations, cables and ancillary structures and the placement of jack-up vessel legs may result in direct physical disturbance to the seabed. These impacts, although highly abrasive in nature, will be temporary and localised, and the significance of this impact will be dependant upon the habitats and communities present within the impact footprint of the Phase 1 developments. Considering the inferences made with regards to seabed sediments / substrate and anticipated habitat / species considered to be present at the site, it is anticipated that species richness and diversity will be low and that direct impacts will not be significant. This assumption, however, needs to be confirmed by Phase and Zone wide data collection, analysis and subsequent habitat characterisation.

Habitat alteration: Areas impacted by installation activity will subsequently undergo varying degrees of habitat alteration during the construction phase of the proposed works proportional to the area of the temporary working footprint. It should be noted that, although

the impact around the foundations will be localised, the area impacted will ultimately be determined by the construction methodology employed.

Habitat loss: Installation of foundations and other structures represents a direct permanent loss of seabed (i.e. marine ecology) within the installation footprint. However, the area of permanent loss within the marine environment will be very small in relation to the overall area of similar habitat likely to be encountered within the Zone and surrounding environment of the North Sea.

Smothering: Settling-out of sediments brought into suspension by construction and decommissioning operations can result in the smothering of sessile organisms. The significance of this smothering will be dependant upon the sensitivity and tolerance of the receptors present at the time and the quantities of sediment involved. It is anticipated that the benthic community present within the area of potential smothering impacts will be adapted to life in a dynamic sedimentary environment and that these species will be relatively tolerant of periodic disturbance and smothering events. While this needs to be confirmed following the phase and zone wide survey and characterisation, it is not anticipated that increased suspended sediment levels as a result of the wind farm would be significant when compared with natural background variation.

Contaminated sediments: One wellhead, listed as being plugged and abandoned in 1985, is located within the Zone. Other than this single well, the Phase 1 area has not been subject to oil and gas exploration and is not within an offshore disposal area, the closest disposal site being some 16km away (see **Section 7.6 Water and Sediment Quality**). Given the prevailing hydrodynamic conditions across the site (see **Section 5.1: Physical Process**), and the distance offshore, it is not anticipated that elevated levels of contamination will be encountered within the seabed sediments present.

Operation

Habitat loss: Indirect loss of habitat may occur as a result of scour around foundations and other ancillary structures. Such impact will not be extensive and it is anticipated that a new dynamic equilibrium would be achieved in a relatively short period following the initial scour event.

Colonisation of foundations: Small and localised increases in biodiversity would be expected, as species that are not regularly found in sandy/gravelly environments will be able to establish themselves on the foundation structures of the wind farm.

Decrease in fishing effort: As discussed in **Section 7.1 Commercial Fisheries** scallop dredging occurs within the Phase 1 development area. If cessation or reduction of this activity is required, the scallop population may increase in this area. Due to the relatively destructive nature of scallop dredging it could be expected that the benthic community may also develop / recover to pre-impacted levels.

Decommissioning

The potential impacts during the decommissioning of the project are expected to be similar in nature, extent and duration to those arising during construction. Following removal of the wind farm structures, it is anticipated that the benthic assemblage would rapidly recover, given the dynamic sedimentary nature of the seabed and the opportunistic, mobile species

likely to colonise. It is anticipated that such impacts would be assessed as part of a separate environmental assessment undertaken to inform the final Decommissioning Plan.

Cumulative and in-combination impacts

Cumulative impacts on habitats and species: Given that the impacts described for the construction, operation and decommissioning of Phase 1 are considered, on the whole, to be short-term and localised, it is considered highly unlikely that cumulative impacts would arise between wind farms within the Zone and beyond.

There will be an aggregated permanent loss of habitat within the Zone and STW sites. However, given that the seabed habitats within the Phase 1 area are considered to be widespread throughout much of this region of the North Sea (sand and gravel dominated), the cumulative impact is not anticipated to be significant in the context of the wider study area. Where data are available, the direct loss of habitat will be assessed in relation to similar habitat loss associated with other projects (see **Table 4.4**).

In-combination impacts on habitats and species: Other activities capable of affecting the benthic environment are limited within the Zone and the surrounding study area. Given the widespread availability of similar habitats and environmental conditions within the study area, the overall significance of in-combination impacts with other developments such as STW wind farm sites is expected to be low. However, the potential cumulative impacts shall be assessed within the EIA.

Export Cable Route

Construction

Direct physical disturbance to marine ecology: During construction the laying of the Export Cable(s) could cause direct physical disturbance of subtidal regions of the seabed. These impacts, although abrasive in nature, will be temporary and localised, and the significance of this impact will be dependant upon the habitat(s) and community(ies) present within the impact footprint of the ECR corridor. It is anticipated that any direct impacts will not be significant given that the majority of the seabed is inferred to comprise of soft sediment and to be of low species richness and diversity. Additionally the coastline in this area is hydrodynamically exposed and ecological assemblages would be expected to have experienced frequent natural perturbations,. This may not be the case across areas of potential Annex 1 reef, however, and assumptions need to be confirmed by phase and zone wide data collection, also including ECR, and ecological characterisation. For example, it will be necessary to understand how the shallow coastal (both subtidal and intertidal) areas are used for feeding and/or roosting by birds (see **Section 6.2: Ornithology**) and for fish spawning, nursery and/or feeding grounds (see **Section 6.4: Fish and Shellfish Resources**)

Habitat alteration/loss: Areas impacted by the installation of the export cable will undergo some degree of habitat alteration during the cable laying activities and again during removal. There will however, be no permanent loss of seabed/intertidal area.

Smothering: In addition to direct disturbance, sediment mobilisation from the laying of the export cable within the subtidal area has the potential to resultant in smothering of sessile intertidal and subtidal organisms. The significance of this smothering will be dependant upon

the sensitivity and tolerance of the receptors present at the time and the quantities of sediment involved. It is anticipated that the intertidal and subtidal benthic communities present within the ECR corridor will be adapted to life in a dynamic sedimentary environment and that these species will be relatively tolerant of periodic disturbance and smothering events. The rocky reefs within the ECR corridor are also likely to be characterised by an ecological assemblage that is accustomed to being in a dynamic environment and it is therefore anticipated that smothering will not be a significant issue. While this needs to be confirmed via survey and characterisation, it is not anticipated that increased suspended sediment levels as a result of the cable installation would be significant when compared with natural background variation in sediment concentrations.

Contaminated sediments: As per The Zone – Phase 1

Disturbance of dune vegetation: The proposed ECR corridor may potentially pass in close proximity to the dune system that backs the intertidal sand and rocky foreshore on the Carnoustie to Arbroath coastline. The majority of the dunes within the ECR scoping area are not designated, with the exception of those areas at the outer corners of the scoped corridor. However, route planning shall seek to minimise any potential disturbance of the dunes and dune slacks (and associated invertebrates) as much as possible.

Disturbance to other vegetation types: Construction could cause disturbance to the vegetation and associated species (e.g. grassland, woodland, scrub) that are currently found landward of the coastal dune system.

Disturbance of protected terrestrial species: The proposed ECR corridor would require careful consideration to avoid the Easthaven SSSI where greater yellow-rattle (*Rhinanthus angustifolius*) is found. Consideration will be required for areas that afford habitat to protected species such as badgers, bats and reptiles. Once a potential route has been identified site-specific habitats and species surveys will be conducted (see **Section 6.3.3** below for more details). Further information will ensure that any protected species will not be impacted by the ECR.

Permanent land take: There will be permanent loss of land in the location of the transition pit. The current site location is unknown at this stage, though the chosen location will be selected to minimise any potential impact upon coastal ecology and nature conservation.

Operation

It is not anticipated that there will be any impact during the operation of the wind farm other than if there were to be a problem with the export cable that required parts of the cable to be replaced. If this were the case the impacts would be similar to those stated for construction.

Decommissioning

The potential impacts during the decommissioning of the project are expected to be similar in nature, extent and duration to those arising during construction. Following removal of the ECR, it is anticipated that the intertidal and subtidal benthic assemblage would rapidly recover, given the dynamic sedimentary nature of the seabed and the opportunistic, mobile species likely to colonise

Cumulative and in-combination impacts

Cumulative impacts on habitats and species: Seagreen understands that the scale of development planned for the Zone and the STW sites will necessitate a relatively large number of export cables from multiple offshore wind farm projects. However, given that the impacts described for the construction (i.e. cable-laying) and decommissioning of Phase 1 are considered, on the whole, to be short-term and localised, it is considered highly unlikely that cumulative impacts would arise between wind farms within the Zone and beyond. No cumulative impacts associated with multiple ECRs on intertidal or terrestrial ecology are envisaged.

In-combination impacts on habitats and species: Given the widespread availability of similar habitats and environmental conditions within the study area, the overall significance of in-combination impacts is expected to be low. No in-combination impacts on intertidal or terrestrial ecology are envisaged.

6.3.3 Methodology and Approach to EIA

The Zone – Phase 1

Marine ecology

Benthic surveys will be undertaken within the Phase 1 area based upon Cefas guidance (Cefas, 2004) and following consultation and agreement with the relevant statutory advisors, in particular, Marine Scotland. Initially acoustic surveys will be undertaken, with interpretation of the resulting data aiding identification of seabed texture and potential habitat extents. Identified provisional seabed habitats will be ground-truthed through a combination of grab sampling, epibenthic trawls and, where practicable, drop down camera/video. The method of ground-truthing selected will be substrate and potentially habitat dependent. Any features of conservation significance, such as potential *Sabellaria spinulosa* reefs or *Modiolus* beds, will be clearly delineated.

It is not the intention of Seagreen, at this stage in the development of the project, to undertake a fully replicated and quantitative assessment of the benthos. The survey will ensure that the benthic habitats and associated communities within the agreed study area can be characterised and assessed in terms of its sensitivity to the impacts associated with the construction, operation and decommissioning of the wind farm. This will inform the EIA process and highlight the need for and approach to any Before, After, Control, Impact (BACI) or other styles of monitoring that may be required post-consent and pre-construction. Seagreen feel that this approach to characterisation reduces the survey and cost burden on the project during the pre-application phase and provides fit for purpose data to inform the EIA. Data already collected from other marine environmental assessments will be used to assist in impact prediction and interpretation such as that collected within previous SEA campaigns (see SEA 5 report (Eleftheriou *et al.*, 2004)).

Export Cable Route

Marine ecology

The methodology and approach to EIA of the ECR will be similar to that outlined for Phase 1 (detailed above). However, due to the proximity of the ECR to potential Annex 1 biogenic

reef habitats, as well as its transition through the intertidal zone, the survey methodology may differ from that for the Phase 1 area. In order to assess any impacts resultant from the installation of the export cable on both the intertidal and subtidal habitats, geophysical surveys shall be required to ensure that subtidal biogenic reef habitats are avoided, where such habitats are present.

Intertidal ecology

An initial broad scale Phase 1 intertidal biotope survey will be required to identify the exact locations of any sensitive habitats and/or species that are likely to occur within the export cable corridor, for example, areas of intertidal rocky foreshore and fixed dunes. The survey would be carried out to a method based on the standard intertidal biotope mapping, for example, as described by Wyn et al. (2000). Identifying and mapping the biotopes would be concluded in accordance with the MNCR biotopes manual 97.06 (Connor et al., 1997). The biotope mapping would then assist in the identification of the most appropriate route for the ECR, following which a more detailed intertidal survey is likely to be required in the footprint.

Terrestrial ecology

Once the final ECR corridor has been defined and its feasibility assessed, the route will be subject to an extended Phase 1 Habitat Survey. The Phase 1 Habitat Survey will follow the methodology outlined within the JNCC 'Handbook for Phase 1 Habitat Survey' (2003), with all habitat and plant communities within the study area being recorded and mapped using broad habitat and boundary features. Detailed target notes will record the dominant species present within any areas of natural or semi-natural vegetation, including woodlands, trees, grasslands and verges and water features. Target notes would also be used to map any rare or scarce plants. The study area would be surveyed for any sign of protected or BAP species such as badgers *Meles meles*, bats, water voles *Arvicola terrestris*, otter *Lutra lutra* great-crested newts *Triturus cristatus* and vegetation suitable for supporting breeding birds, including water-bodies within a radius of 500m of the proposed cable and transition pit. This survey will deem whether there is a requirement for further species-specific surveys. Again, the scope of any such surveys would be discussed and agreed with SNH.

Furthermore, an initial Phase 1 habitat survey of the dune system would be needed to identify the types of dunes and any protected species along the ECR corridor. The results from this survey would determine whether further specialist botanical or entomological surveys would be required, including an NVC survey of the preferred ECR. A National Vegetation Classification (NVC) survey would be carried out of the dune systems that lie within the ECR, as well as within 500m of the route. The scope of any such surveys would be discussed and agreed with SNH.

6.3.4 Guidance and Best Practice

Title	Author	Date
Data Standards Guidance for Marine Benthic Data	MBA	2008
Wind Farm Development and Nature Conservation	BWEA	2001

6.4 Fish and Shellfish Resources

6.4.1 Existing Environment

The seabed within the Phase 1 area is anticipated to be similar to sedimentary environments present within much of the wider North Sea area (see **Section 6.3: Marine, Intertidal and Terrestrial Ecology**). As such, it is expected that a broad assemblage of fish and shellfish species will be represented in the study area, and that this assemblage will be similar to that found throughout much of the North Sea area, in similar environmental conditions.

A number of fish species have spawning grounds covering the Phase 1 and ECR scoping area, as presented in **Figures 6.3** and **6.4**. Further species are known to spawn within the wider study region (central and northern North Sea). Species of note include the UK BAP species cod *Gadus morhua*, herring *Clupea harengus*, plaice *Pleuronectes platessa* and whiting *Merlangius merlangus* shown in **Figure 6.3**, as well as non UK BAP species nephrops *Nephrops norvegicus*, sprat *Sprattus sprattus*, lemon sole *Microstomus kitt* and sandeel *Ammodytidae* shown in **Figure 6.4**.

The presence and extent of nursery grounds for individual species within the Firth of Forth region and across the Phase 1 development area and the proposed ECR corridor are presented in **Figure 6.5**. Nursery grounds include sandeel, whiting, sprat, nephrops, cod and saithe. In the outer Forth and Tay area there are nursery grounds for plaice, herring, haddock *Melanogrammus aeglefinus*, norway pout *Trisopterus esmarki* and lemon sole.

Spawning and nursery ground data suggests that the Phase 1 area and the Zone in general, are not markedly different in species presence from other UK offshore wind farm developments.

The Zone is recognised for its rich sandeel grounds with the Wee Bankie (located approximately 30km to the south of Phase 1) being a particularly suitable habitat for this species. The regional sandeel population is a significant source of food for many other species. They are relatively slow growing and late maturing when compared to other sandeel populations, such as those in the Shetlands and other areas in the North Sea (Fisheries Research Services, undated). This has meant that the regional population, which includes the Wee Bankie, is particularly vulnerable and slow to recover from population crashes. This vulnerability led to a large area off the Scottish east coast being closed to sandeel fishing in 2000 (FishSource 2009).

The Scalp Bank, located within the Phase 1 area (see **Figure 1.1 and 2.1),** is known to be an important area for scallops. Landings of scallop from International Council for the Exploration of the Sea (ICES) rectangle 42E8, an area which includes most of Phase 1, are relatively high. Also landings from ICES rectangle 42E7 which covers the ECR corridor and the western edge of Phase 1 are also dominated by scallop with crab species and nephrops also landed from this area (Danbrit Ship Management Ltd, 2009). For further detail on scallops see **Section 7.1 Commercial Fisheries**.

The River Tay, inshore of the Phase 1 development area (and adjacent to the ECR corridor), and River Forth, inshore to the south west of the Phase 1 area (and approximately 20km South of the ECR), are known to support a number of diadramous (migratory between fresh and salt waters) species, specifically sea trout *Salmo trutta*, Atlantic salmon *Salmo salar*, and eels *Anguilla anguilla*. Atlantic salmon is an Annex II species under the Habitats

Directive and is a primary reason for the designation of the River Tay as an SAC. Atlantic salmon associated with the Tay and Forth pass through the estuaries on migration to and from offshore feeding grounds. Little is known about the salmon's migration or behaviour once the open sea is reached. However, evidence suggests that fish movements are likely to occur nearer to the coast.

6.4.2 Potential Impacts

The Zone – Phase 1

Construction

Physical disturbance: Demersal fish and benthic species (such as scallops, crabs and lobsters) could be prone to direct physical disturbance during the construction phase, especially where disturbance coincides with key spawning periods. Zone and phase characterisation will reveal the potential for this and, where necessary, mitigation measures will be investigated in order to reduce or avoid significant impacts.

Noise and vibration: The potential impact of underwater noise associated with the construction of offshore wind farms has been subject to detailed investigation during the current decade. These studies have suggested that demersal spawning activity by sensitive species could be disrupted over considerable distances.

Phase 1 lies within the vicinity of spawning grounds of a number of species which may be affected by underwater noise, to varying degrees dependent upon their sensitivity. It is anticipated that key species in the context of the development of the Zone will be sandeel, sprat and herring, being species that are most sensitive to noise impacts.

The level of noise produced and its extent of impact appear to be closely linked to foundation type and water depth. It is expected that the most significant impact, in terms of underwater noise, would be in the case of driven monopiles, and that the extent of the impact would be primarily dictated by monopile diameter. Whether monopiles are used as a foundation type has currently not been established (see **Section 3: Project Description**)

Suspended sediments: Suspended sediments generated through the construction activities have the potential to impair respiratory or reproductive functions, or disrupt migration/spawning activity in sensitive species of both fish and shellfish. Juvenile/larval stages are most likely to be susceptible to such impacts as they are less mobile and may not be able to avoid areas of high turbidity (ABP Research, 1997). It is not, however, anticipated that significant quantities of sediment would be brought into suspension (against natural background levels) as a result of the construction in the Phase 1 area. Also the sediment across much of the site is of a large grain size and would rapidly settle out of suspension when disturbed (see **Section 5.1: Physical Processes** for further detail).

Figure 6.3 **Natural Fisheries – Spawning Species Listed in the UK BAP**

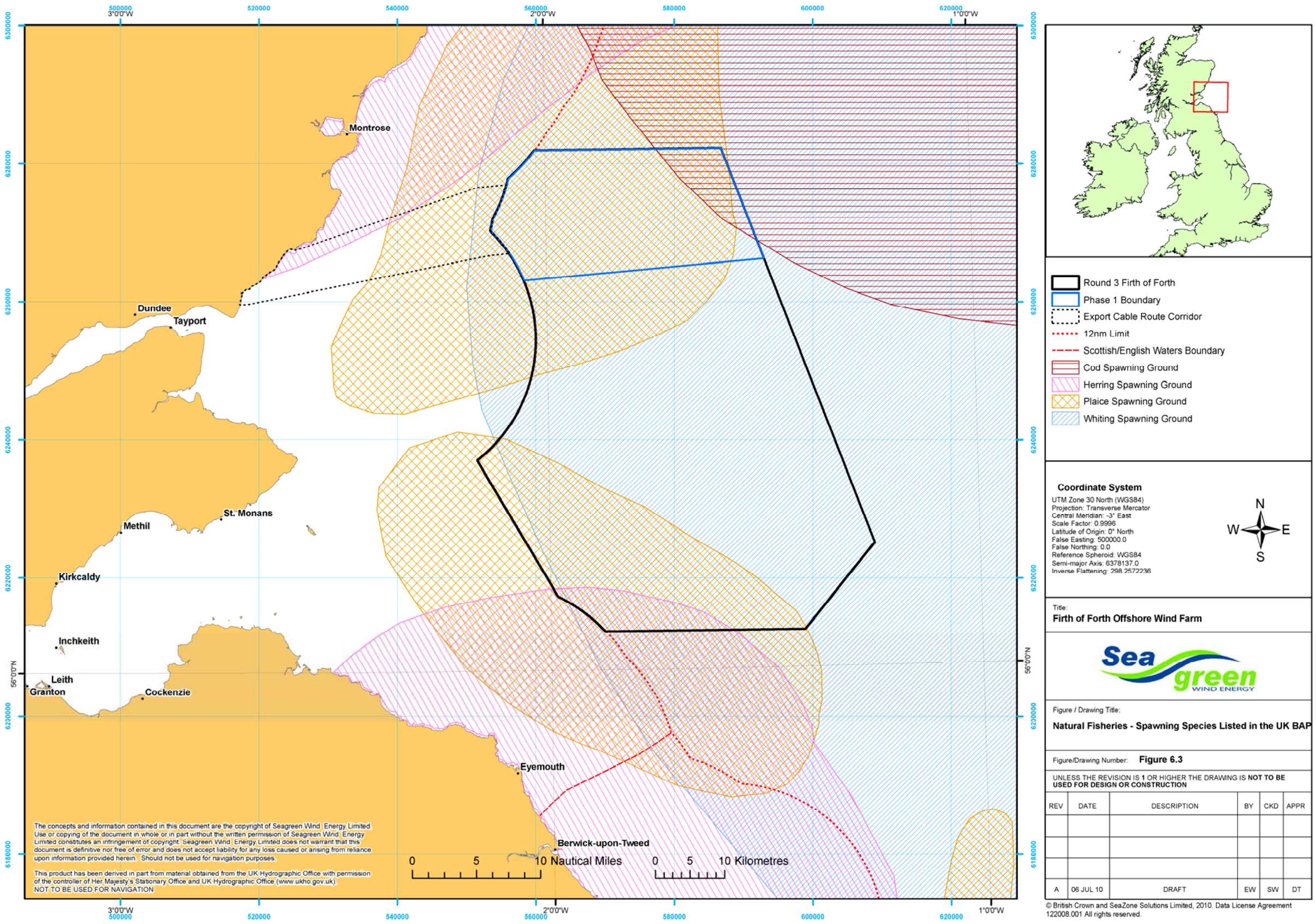


Figure 6.4 **Natural Fisheries – Spawning Non UK BAP Species**

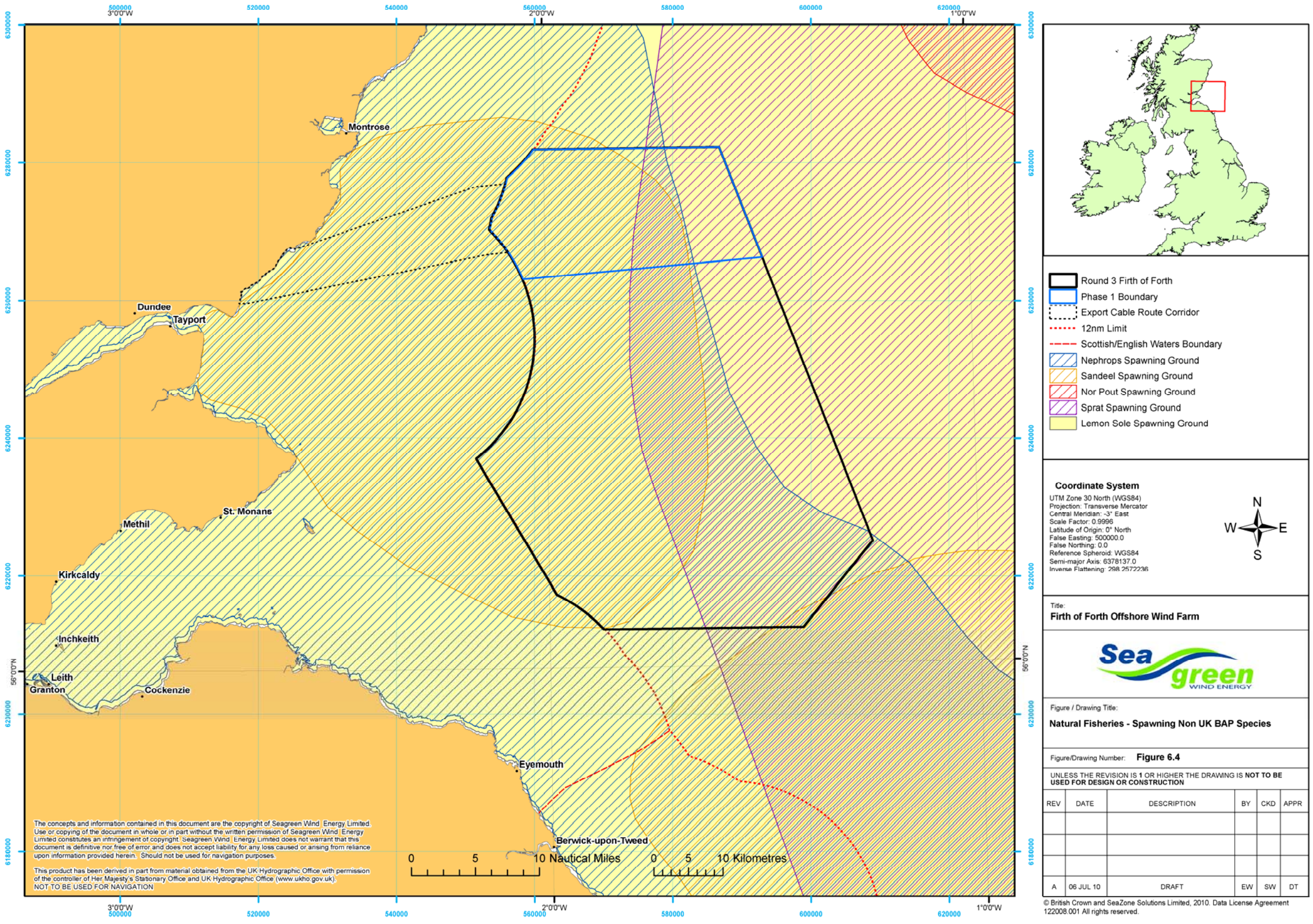
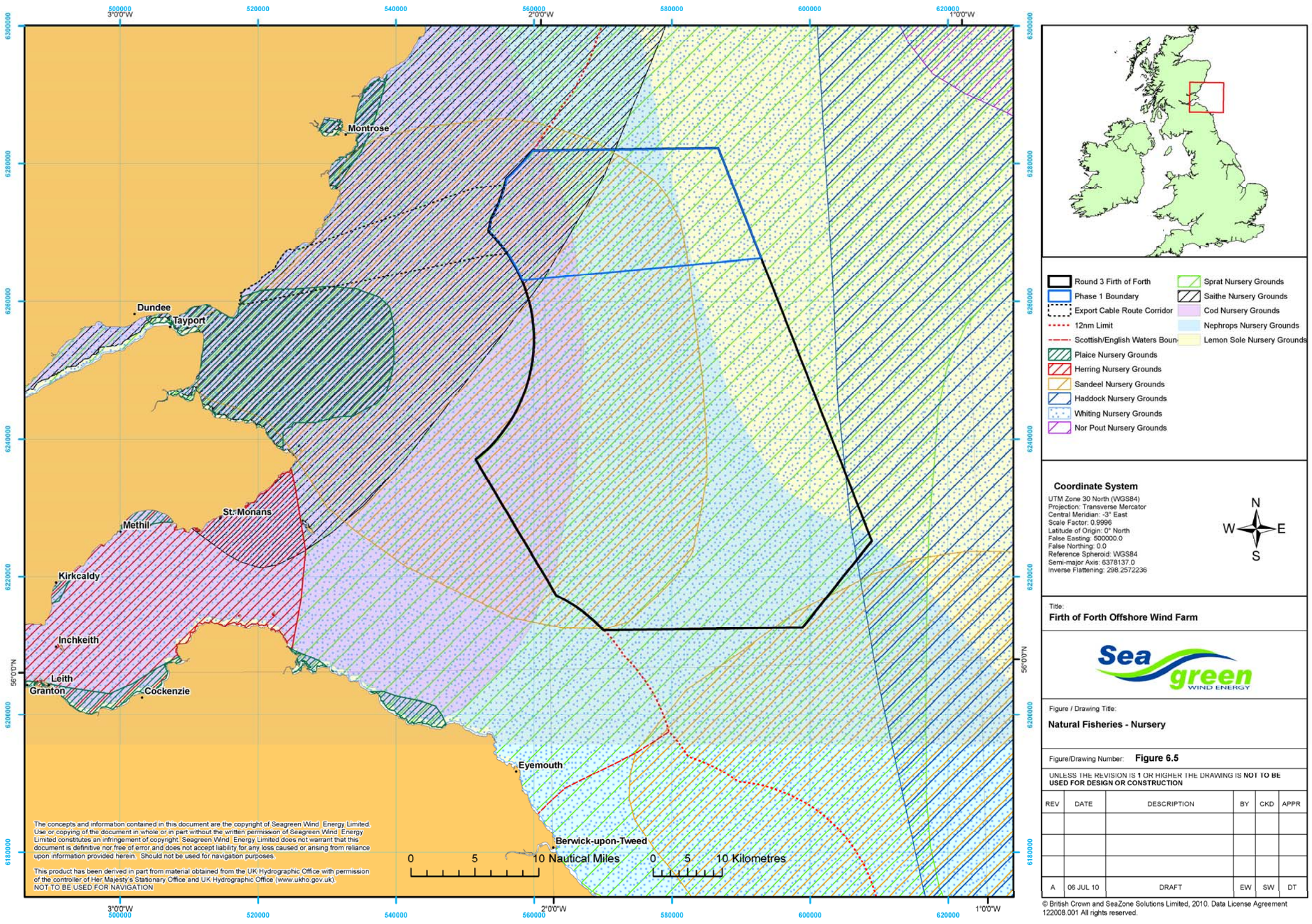


Figure 6.5 Natural Fisheries - Nursery



Operation

Loss of habitat: The physical presence of foundations represents a permanent loss of habitat within a small footprint. The significance of this impact would be dependant upon the habitats present and the distribution of such habitat within the wider study area. There is no indication that the Phase 1 area supports habitat and environmental conditions that are unique to the wider region or the fish and shellfish assemblages. However, fish and shellfish studies conducted as part of the EIA process will confirm this.

Impacts of electromagnetic fields (EMF): Seagreen is cognisant of the concerns raised by the fishing industry and other quarters into the potential impacts of EMF on fish species associated with the electrical transmission system of offshore wind farms. Studies are ongoing at an industry level in order to determine the types of impacts that could manifest and their likely significance. Seagreen recognises that EMF issues need to be addressed in EIA.

Increase in diversity/number of individuals: Stable structures introduced into dynamic sedimentary marine environments will be colonised by a range of fauna and flora, which will, in turn, facilitate the presence of mobile predatory species. Such new assemblages of prey resource, coupled with introduced heterogeneity and niche habitat is known to promote an increase in the presence and abundance of fish and shellfish species. However, while offshore wind farms have the potential to act as fish aggregating devices in this way, it does not necessarily follow that fish productivity will increase.

Decommissioning

The potential impacts from the decommissioning phase are envisaged to be similar to those described for the construction phase. It is conceivable, however that the fouling and epibenthic communities around scour protection measures and submerged hard structures, such as gravity bases, would have matured and it may be counter productive to natural fish and shell fish resources to remove them. It is anticipated that such impacts would be assessed as part of a separate EIA undertaken to inform the final Decommissioning Plan.

Cumulative and in-combination impacts

Underwater noise: A potential significant cumulative impact of the development of Phase 1 area in conjunction with construction at other sites within the Zone and/or STW sites on fish and shellfish is that of underwater noise, most significantly associated with the installation of foundation structures. For example, cumulative impacts could arise if two or more projects undertake construction works in the same spawning period. Dependant upon the proximity of sites to known spawning grounds and the species of fish involved, the combined impact of simultaneous piling could manifest over a greater extent than a single project in isolation.

Similarly, cumulative impacts could arise if construction of one or more projects occurs over consecutive spawning periods. Dependant upon the size and the significance of the spawning grounds affected, such an impact could reduce reproductive success.

Seagreen believes that a strategic approach should be developed to the mitigation and management of underwater noise impacts and that this should be controlled through the conditions attached to consent licences. Any spatial and/or temporal restrictions on construction operations should be based on best available evidence and not applied as a

blanket precautionary approach. Where appropriate Seagreen will work with the offshore wind industry, particularly in the Forth and Tay area in order to address this issue in the best interests of both development and nature conservation (see **Table 4.4**)

Increased turbidity: Increased suspended sediments can impair respiratory or reproductive functions, or disrupt migration/spawning activity in sensitive species of both fish and shellfish. The magnitude of this possible cumulative impact would entirely depend on the distance between construction sites and composition of the seabed sediment at construction sites. These factors are to be determined during the EIA process.

Export Cable Route

Construction

Suspended sediments: Suspended sediments generated through the installation of the export cable have the potential to impair respiratory or reproductive functions, or disrupt migration/spawning activity in sensitive species of both fish and shellfish. Juvenile/larval stages are most likely to be susceptible to such impacts as they are less mobile and may not be able to avoid areas of high turbidity (ABP Research, 1997). It is not, however, anticipated that significant quantities of sediment would be brought into suspension (against natural background levels) as a result of cable installation activities providing appropriate engineering solutions are implemented. In addition, the increase in suspended sediment will be short term and local to cable installation activities.

Operation

Impacts of electromagnetic fields (EMF): As per the Zone Phase 1.

Decommissioning

The magnitude of impacts associated with decommissioning of the export cable will entirely depend upon the method of decommissioning. If it is decided that the cable shall remain buried in the seabed, there will be virtually no impact caused by decommissioning. If however, the cable is removed from the seabed it is likely that the impacts of decommissioning will be similar in nature and magnitude to those seen during construction (see above). It is anticipated that such impacts would be assessed as part of a separate EIA undertaken to inform the final Decommissioning Plan.

Cumulative and in-combination impacts

EMF: Seagreen understands that the scale of development planned for the Zone and the STW sites will mean a relatively large number of export cables will run to the shore from multiple offshore wind farm projects. There remains a high level of uncertainty over the likelihood and significance of EMF impacts and whether or not such impacts should be addressed as part of the EIA process. Seagreen will seek to use the latest industry guidance on the assessment and management of EMF issues during the development of Phase 1 and the ECR.

6.4.3 Methodology and approach to EIA

The Zone – Phase 1

The requirements for studies in relation to offshore wind farm developments in order to meet FEPA and CPA requirements (to be superseded by Marine Licenses) are thoroughly detailed in the guidance produced by Cefas (2004) and site specific data collection will be carried out in accordance with these. This is likely to mean a targeted survey using trawled gear as well as grab/drop down video (if practicable) to confirm presence of spawning grounds for key species. The scope of such studies will be agreed in discussions with Marine Scotland and will follow a methodology appropriate for the key species in the study area.

To further support the EIA a detailed desk based assessment combining existing data and that acquired through consultation with local fisheries committees and organisations will be compiled to describe the baseline environment.

Information on the likely impacts of EMF will draw on the existing studies (such as those commissioned by COWRIE, 2007), in addition to any other more up to date monitoring programmes undertaken in the interim.

The sediment dispersion assessment (as discussed in **5.1 Physical Processes**) combined with the predictions from scouring potential will be used to inform the EIA of the potential for impacts due to sediment deposition in fish spawning or nursery areas. Mitigation measures (such as construction techniques and timing) will be identified based on the latest advice coming out of the industry and the Regulatory Authorities during EIA.

Export Cable Route

The methodology and approach to EIA of the ECR will be similar to that outlined for Phase 1 (detailed above) adhering to the requirements of FEPA and CPA applications and will be discussed and agreed with SNH. However, due to the proximity of the ECR to the Scottish coastline and important salmon rivers, survey methodology may differ from that of Phase 1 in order to assess any impacts that may be caused by installation of the export cable on coastal waters and rivers.

6.4.4 Guidance and Best Practice

Title	Author	Date
Research on options & opportunities for marine fisheries and environmental mitigation associated with wind farm developments	Marine Consulting	2010
Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise	Nedwell et. al.	2003
Assessment of subsea acoustic noise emission and vibration from offshore wind turbines and its impact on marine wildlife	Subacoustech Ltd	2003
Best Practice Guidelines - Consultation for Offshore Wind Energy Developments Fisheries Liaison	BWEA	2004
Framework for dialogue between the fishing and wind farm industries on how to assess the value of fishing activities and any disruption or displacement caused to them by wind farm	BERR	2006

Title	Author	Date
developments		
Assessment and costing of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore wind farms	BioConsult SH	2008
Fishing Liaison with Offshore Wind and Wet renewables group (FLOWW) recommendations for fisheries liaison	BERR	2008
Development of spatial information layers for commercial fishing and shellfishing in UK waters to support strategic siting of offshore wind farms	ABPmer	2009
Options and opportunities for marine fisheries mitigation associated with windfarms	COWRIE	2010
Impact of pile driving noise on the behaviour of marine fish	CEFAS	In Prep
Quantifying the performance of acoustic mitigation devices (AMDs)	Subacoustech Ltd.	In Progress)

6.5 Marine Mammals

6.5.1 Existing Environment

Cetaceans

Six cetacean species occur frequently within the outer Firth of Forth region; harbour porpoise *Phocoena phocoena*, white-beaked dolphin *Lagenorhynchus albirostris*, Atlantic white-sided dolphin *Lagenorhynchus acutus*, orca *Orcinus orca*, bottlenose dolphin *Tursiops truncatus* and minke whale *Balaenoptera acutorostrata* (Hammond *et al.* 2004). These species can all be expected within the Phase 1 area and proposed ECR corridor.

Only two of the cetacean species listed within UK waters are qualifying features of SACs (harbour porpoise and bottlenose dolphin). No sites have been designated for these species within approximately 200km of the Phase 1 area. Estimated summer 2005 abundances of species surveyed in the Regional Sea 1 area were: 169,294 harbour porpoise; 10,562 white-beaked dolphin; 19,492 *Lagenorhynchus* spp. (white-beaked dolphin and Atlantic white-sided dolphin); 653 bottlenose dolphin; 88 common and/or striped dolphin; and 10,541 minke whale (DECC, 2009b). The Regional Sea 1 area includes the central and northern North Sea and, therefore, encompasses the Phase 1 area (see **Figure 6.6**).

Pinnepeds

Common seal *Phoca vitulina* and grey seal *Halichoerus grypus* are found in coastal regions, particularly to the south of the landfall for the export cable. It is possible that seals will move through the Phase 1 area and ECR corridor during foraging trips. There are no known seal haul out sites within the landfall area (Carnoustie to Arbroath) of the ECR.

Declines in population sizes have been observed at major common seal colonies throughout Britain, with the possible exception of the Inner Hebrides (Lonergan *et al*. 2007). Surveys of the Scottish east coast populations reflect this general trend, with a decline in numbers between 2001 and 2005, in comparison to a previously stable population. Outbreaks of Phocine Distemper Virus (PDV) in 2002 have contributed to the decline as well as

documented shooting in the Moray Firth. Since a conservation order to prevent *ad libitum* shooting of common seals was put in place the population has shown signs of initial recovery (JNCC, 2007).

The Firth of Tay and Eden Estuary SAC supports a breeding colony of common seal. A survey in 1997 by the Sea Mammal Research Unit (SMRU) reported 2,400 sightings of common seal off the east coast of Scotland. In the Firth of Tay area, common seal have been reported to feed on sandeels, gadoids and flatfish, but diet will vary seasonally and with location (Hammond *et al.* 2004).

The Isle of May supports a breeding colony of grey seal which contributes to approximately 4.5% of the UK grey seal population (JNCC, undated). Pupping occurs from October to January and moulting occurs in February/March. Most of the population will remain on, or close to land during these periods. Grey seal have been recorded to eat sandeels, gadoids and flatfish but diet will vary seasonally and with location (Hammond et al. 2004).

Large numbers of both common and grey seal can be seen throughout the year at the Tentsmuir Point National Nature Reserve, at the mouth of the Firth of Tay, approximately 10km to the south of the Carnoustie. Up to 2000 grey seals have been observed hauled out on the Abertay Sands within the reserve and several hundred common seal use all of the sand banks in the reserve as well as the southern foreshore. (SNH, 2002).

6.5.2 Potential Impacts

The Zone – Phase 1

Construction

Disturbance through noise and vibration: The most significant potential for disturbance to marine mammals from offshore wind farms arises from underwater noise associated with the installation of driven monopile foundations. Noise created during pile driving operations involves sound pressure levels that may cause behavioural responses in marine mammals from considerable distances (Thomsen *et al* 2006) as well as impair hearing and cause physical injury at close range (Madsen. *et al* 2006; Shepherd *et al.* 2006). The Scottish Marine Renewables SEA (Faber Maunsell and Metoc, 2007) suggests that seals and cetaceans could both be expected to hear piling noise up to a distance of 80km with behavioural responses expected up to 20km away. However, monitoring carried out during the construction phase of a number of Round 2 sites suggests that these distances may be overly conservative and that the area over which impacts manifest may be significantly lower.

Collision risk: To date, Seagreen is not aware of any reported incidences of vessels involved in the construction of offshore wind farm projects having collided with a marine mammal. However, even if the potential for collision is very low, the protected nature of all marine mammal species implies that any such collision would be considered as being potentially significant.

Changes to abundance of prey: Construction activities that have the potential to displace prey resources (i.e. fish) over considerable distance may have a knock on impact on marine mammals, as they follow the prey to different areas. This impact is unlikely to be significant in the context of the Phase 1 area, but could be exacerbated if more than one offshore wind

farm project is installing driven monopiles or other piled structures, either concurrently or consecutively. The assessment of impacts on fish resources will, therefore, be used to inform any subsequent assessment of the impacts on marine mammals as part of the Seagreen EIA works.

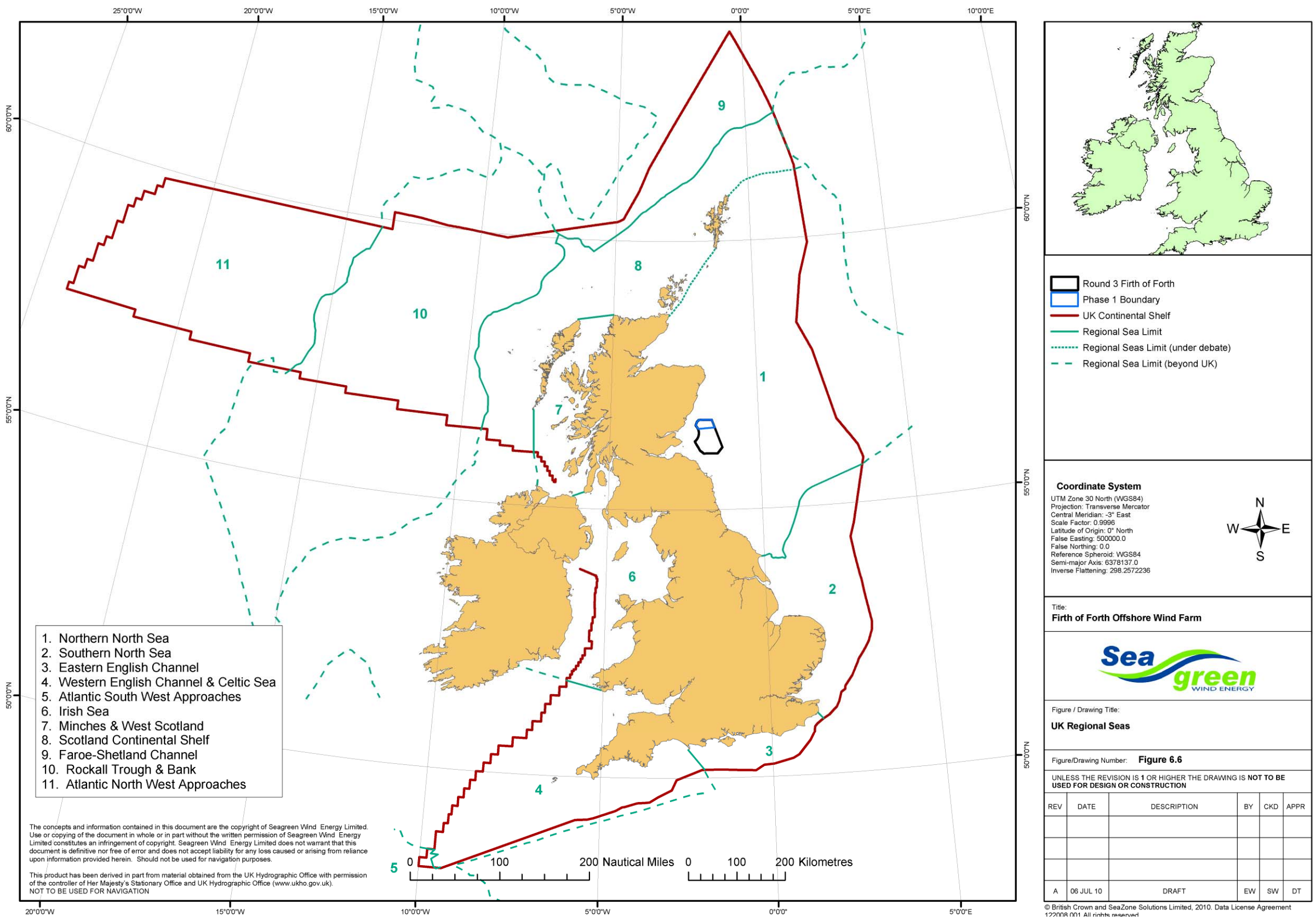
Accidental release of contaminants: Spillage of any contaminants, such as hydraulic oil following an accident during construction could cause physical harm to any marine mammals which come in to contact with the contamination. However, the risk of such an accident occurring will be assessed as part of the pre-construction works. Appropriate contingency planning and remediation measures for the control of pollution will be developed and agreed in conjunction with the Marine and Coastguard Agency (MAC) and Marine Scotland and with SEPA for accidental spillages and the release of contaminants within 3nm.

Increased suspended sediments: Reduced visibility as a result of suspended sediments during construction may impact the feeding regimes of marine mammals in the vicinity of the array. Grey and common seals are believed to be highly sensitive to reductions in visibility, while cetaceans have a moderate sensitivity (Scottish Executive, 2007). As discussed in relation to physical process changes, the levels of sediment brought into suspension during the construction works will be studied as part of the EIA process and assessed in the context of potential impacts on marine mammals.

Operation

Barrier impacts: It is not predicted that the Phase 1 wind farm sites will provide a barrier for any recurring routes used by marine mammals. Given the ca. 30km distance between the Phase 1 area and the shore, and the separation distance between wind turbines, marine mammals are expected to navigate through and around the site with minimal disruption or additional energy expenditure.

Figure 6.6 UK Regional Seas



Disturbance through noise and vibration: Operational wind turbines are known to emit broadband, low frequency airborne and underwater noise which, at close range, can be above ambient conditions (Fldegaard and Danneskiold-Samsöe, 2000 cited in Dolman et. al., Undated).

In terms of underwater noise, the sound propagated is at the low end of the threshold frequency spectra of the cetaceans of relevance to Phase 1. It is considered highly unlikely that this noise would result in significant adverse impacts on marine mammals, either individually or as a population.

Accidental release of contaminants: As with construction impacts there is a potential for accidents to occur with the maintenance vessels. As with the construction process, the risk of pollution incidents during the operational life of the wind farm will be strictly controlled and monitored. Seagreen will apply best practice at the time of construction to avoid or reduce the probability of any accidental release.

Changes to abundance of prey: It is predicted that the turbine structures could act to aggregate mobile species, such as pelagic fish which could in turn attract marine mammals to the site. This impact, if it does occur is not considered to represent a potentially significant impact.

Decommissioning

The potential impacts during the decommissioning phase are expected to be of the same nature and magnitude as those described for the construction phase.

Cumulative and in-combination impacts

Interactions between other wind farms: The most significant cumulative impact on marine mammals is likely to be associated with construction noise, either from concurrent or consecutive developments; the former potentially affecting a greater area, and the latter potentially having a longer duration but shorter range of impact. The impacts of noise can be direct (e.g. disturbance impacts) or indirect (e.g. through displacement of prey species).

Where appropriate Seagreen will work with the developers of the STW projects, stakeholders and the wider offshore wind industry in order to ensure that cumulative effects are properly and consistently assessed (see **Table 4.4**). Seagreen considers it is essential that the full target capacity of the Zone is included in all cumulative assessments, even where the projects in later phases have not been scoped for project-specific EIA or been the subject of applications

Interactions between other activities: Other activities with the potential to affect marine mammals within the Phase 1 area are considered to be limited to shipping and fishing activity. No aggregate dredging or oil and gas exploration, with the exception of one well head, plugged in 1985, occurs within the Zone or its surroundings. It is considered highly unlikely that in-combination impacts would manifest; however, this will be considered in the EIA.

Export Cable Route

Construction

Potential impacts are as per Phase 1, with the addition of:

Habitat exclusion: As a result of the lack of seal haul out sites within the landfall area of the ECR, between Carnoustie and Arbroath it is not expected that habitat exclusion will be significant. Seagreen intend to assess marine mammal activity in the area during EIA and if any significant haul out sites are discovered, the impact of this will be considered further. Habitat exclusion within the offshore area of the ECR is not expected to be significant as a result of the ECR representing a small part of a large habitat.

Operation

Barrier impacts: It is not predicted that the export cable once *in situ* or any maintenance works to the cable will provide a barrier for any recurring routes used by marine mammals.

Disturbance through noise and vibration: Once *in situ* the export cable is not expected to generate significant noise or vibrations. Maintenance vessels may generate some noise however it is not expected that this will be significant in relation to baseline conditions.

Accidental release of contaminants: As per Phase 1.

Decommissioning

The potential impacts during the decommissioning phase are expected to be of the same nature and magnitude as those described for the construction phase.

Cumulative and in-combination impacts

Interactions between other wind farms: The most significant cumulative impact on marine mammals would occur if export cables for additional wind farms are installed either concurrently or consecutively with the installation of the export cable. In the event of this the increased activity could create a barrier impact. As discussed previously the levels of noise generated during installation of the export cable will depend on the methodology used. Cumulative impacts of noise could result in avoidance behaviour.

Interactions between other activities: Other activities with the potential to affect marine mammals within the ECR are considered to be limited to shipping and fishing activity. No aggregate dredging or oil and gas exploration activity occurs in the Phase 1 area, with the exception of one well head, plugged in 1985. The potential for in-combination impacts will be considered in EIA.

6.5.3 Methodology and approach to EIA

The Zone – Phase 1

In order to further the general understanding of marine mammal abundance and distribution within the Phase 1 area, incidental sightings of marine mammals during other planned surveys on site (i.e. the ornithological surveys being undertaken to inform both the ZAP and

Seagreen EIAs) will be recorded. It is anticipated that additional information will also become available from the data being collected as part of the STW projects and other offshore environmental assessments within the North Sea.

Seagreen has followed the development of the Joint Nature Conservation Agency (JNCC) guidance on marine mammal mitigation (JNCC, 2009) and understands that a similar document, or approval of the original document, may be forthcoming from SNH. Seagreen is aware of the need to address marine mammal issues at a site specific and strategic (i.e. cumulative) level and will use the EIA to commit to working with the statutory nature conservation advisors in the development of an acceptable marine mammal mitigation protocol. In addition, data from the most recent Strategic Environmental Assessment for offshore energy (DECC, 2009b) has a number of supporting data sets to provide an overview of marine mammals within specific regions of the North Sea.

Data such as that collected on SCANS (Small Cetaceans in the European Atlantic and North Sea) survey of the 'U' area (central North Sea) will overlap with data collected to inform Seagreen EIAs.

Export Cable Route

As per Phase 1.

6.5.4 Guidance and Best Practice

Title	Author	Date
Assessment of subsea acoustic noise emission and vibration from offshore wind turbines and its impact on marine wildlife	Subacoustech	2003

7.0 HUMAN ENVIRONMENT

7.1 Commercial Fisheries

There is currently no single data set or model which can accurately quantify the precise levels or values of commercial or recreational fishing within a small discrete sea area such as an offshore windfarm and associated export cable route. As a result, data and information used to compile the commercial fisheries baseline will be acquired from a range of sources:

- International Council for the Exploration of the Sea (ICES)
- EU Fisheries Committee Publications & Data sets (Europa & Eurolex)
- Marine Management Organisation (MMO)/Marine Scotland (MS)– Fisheries Statistics Unit & Data and Communications Team
- Marine Scotland Science
- Seafish
- UK Oil & Gas (UKKOA)
- Scottish Fishermen's Federation (SFF)
- National Federation of Fishermen's Organisation (NFFO)
- Regional fishermen's associations and producer organisations
- Local non affiliated fishermen's associations, groups and individual skippers
- Local port merchants and agents
- Marine Scotland District Fisheries Inspectors
- Local Harbour Masters
- Foreign National Fisheries Agencies (as identified through the course of the EIA)

The following section provides an overview of the current commercial fishing activity within the Phase 1 area and export cable corridor, based on preliminary assessment of fisheries data (MMO landings and values statistical data, 2000-2008, MMO VMS data, 2005-2009).

ICES statistical rectangles are currently the smallest area statistical units used for collating fisheries data. Rectangle boundaries align to 1° longitude and 30' latitude and for the most part have sea areas equating to approximately 900 nautical miles. The majority of the R3 zone Phase 1 Area is located within ICES rectangle 42E8, with a smaller section and the export cable corridor falling within rectangle 42E7 **(see Figure 7.1).**

In Rectangle 42E8 the majority of landings by value (average 2000-2008) is from scallop dredging (76.8%). Haddock, principally caught by scottish seines, is the second most vaulable species (15.5%) **(See Table 7.1 below).**

Scallop dredging represents a high percentage of the landings by value (42.8%) in Rectangle 42E7, although potting for crustacea, such as lobster, edible crab and velvet crab, also has a high combined value (41.8%). Nephrops, targeted by both trawlers and creelers, has the third highest landings values (10.5%) of an individual species **(Table 7.2**).

Table 7.1 **Average (2000-08) Annual Landings Values by Species ICES Rectangle 42E8 (Source: MMO, 2009)**

Species	Rectangle 42E8	
	Average Landings Values (2000-2008)	% of Total value from 42E8
Scallops	£738,305	76.8%
Haddock	£148,995	15.5%
Squid	£19,222	2.0%
Lemon Sole	£11,729	1.2%
Whiting	£8,177	0.9%
Plaice	£6,617	0.7%
Cod	£3,868	0.4%
Nephrops	£3,100	0.3%
Red Gurnards	£3,091	0.3%
Monks or Anglers	£3,086	0.3%
Other	£14,784	1.5%

Table 7.2 **Average (2000-08) Annual Landings Values by Species ICES Rectangle 42E7 (Source: MMO, 2009)**

Species	Rectangle 42E7	
	Average Landings Values (2000-2008)	% of Total value from 42E7
Scallops	£729,352	42.8%
Lobsters	£427,985	25.1%
Nephrops	£178,411	10.5%
Edible Crab	£169,224	9.9%
Velvet Crab	£115,882	6.8%
Squid	£54,739	3.2%
Haddock	£8,679	0.5%
Other Molluscs	£3,817	0.2%
Plaice	£3,664	0.2%
Cod	£2,433	0.1%
Other	£10,439	0.6%

An indication of the pricipal ports generating landgings values in the general area of the Phase 1 site is given in **Table 7.3** and **Table 7.4**. These show the top 10 ports by landings values and the percentage of the total value of the port that fishing ICES rectangles 42E8 and 42E7 represents respectively.

Table 7.3 Top 10 Ports by Landings Values from Rectangle 42E8 (Source: MMO, 2009)

Port	Rectangle 42E8			
	Annual Landings Values from 42E8 (average 2000-08)	% of Total Value of rectangle 42E8	Total Annual Port Values (average 2000-08)	% of Total Annual Port Value that fishing rectangle 42E8 represents (average 2000-08)
Aberdeen	£534,350	55.6%	£13,397,222	4.0%
Arbroath	£113,854	11.8%	£819,632	13.9%
Peterhead	£112,403	11.7%	£82,280,944	0.1%
Eyemouth	£70,276	7.3%	£3,681,730	1.9%
Montrose	£43,635	4.5%	£238,503	18.3%
Buckie	£33,420	3.5%	£3,241,696	1.0%
Fraserburgh	£19,016	2.0%	£39,617,782	0.0%
Gourdon	£10,394	1.1%	£265,574	3.9%
Stonehaven	£7,323	0.8%	£89,417	8.2%
Macduff	£5,401	0.6%	£1,487,809	0.4%

Table 7.4 Top 10 Ports by Landings Values from Rectangle 42E7 (Source: MM0, 2009)

Port	Rectangle 42E7			
	Annual Landings Values from 42E7 (average 2000-08)	% of Total Value of rectangle 42E7	Total Annual Port Values (average 2000-08)	% of Total Annual Port Value that fishing rectangle 42E7 represents (average 2000-08)
Arbroath	£556,263	32.6%	£819,632	67.9%
Aberdeen	£496,092	29.1%	£13,397,222	3.7%
Gourdon	£248,867	14.6%	£265,574	93.7%
Montrose	£133,695	7.8%	£238,503	56.1%
Stonehaven	£75,677	4.4%	£89,417	84.6%
Johnshaven	£68,144	4.0%	£68,727	99.2%
Peterhead	£52,722	3.1%	£82,280,944	0.1%
Fraserburgh	£20,811	1.2%	£39,617,782	0.1%
Buckie	£15,552	0.9%	£3,241,696	0.5%
Pittenweem	£5,401	0.6%	£1,487,809	0.4%

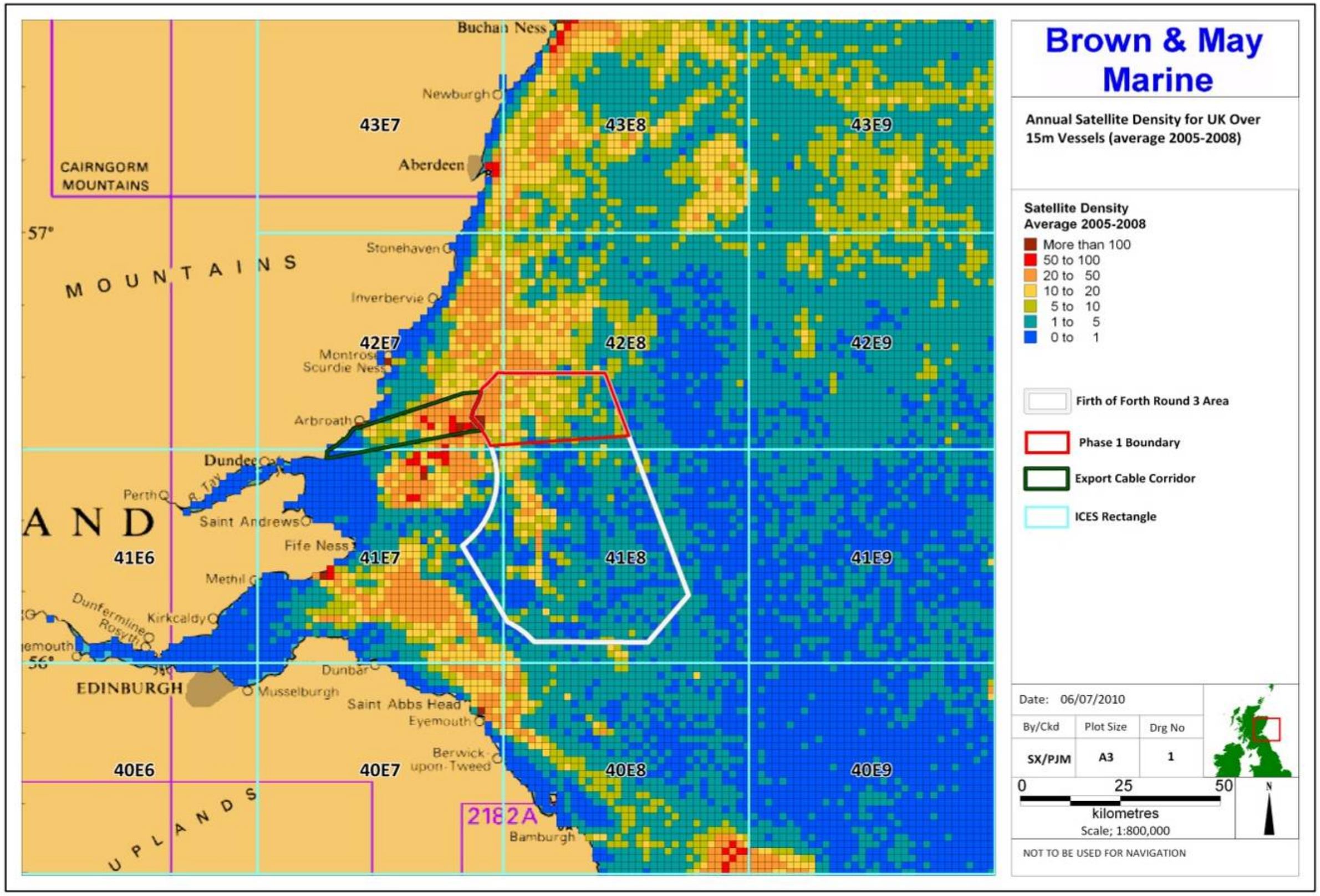
The spatial distribution of fishing activity within the Phase 1 Area and export cable corridor is illustrated in Figure 4.1 (annual satellite density, 2005-2008). The figure has been derived by plotting the Vessel Monitoring System (VMS) data provided by the MMO. The limitations of this data source should however be recognised: only vessels that are 15m and above are satellite tracked.

It is considered that the majority of vessels operating in Rectangle 42E8 are greater than 15m in length (96.7%) and hence fitted with VMS. The satellite densities illustrated in Figure 7.1 therefore give a good indication of the fishing intensity in this rectangle.

In Rectangle 42E7 however, where potting and nephrops trawling account for a significant proportion of the landings values, and the vessels engaging in these activities are often less than 15m in length (59.4% under 15m), it is expected that the satellite densities given below underestimate the actual levels of fishing. Identification of the levels and locations of fishing activities within this Rectangle will be will be undertaken during the EIA process.

Figure 7.1 demonstrates that the highest densities of over-15m vessels within the Phase 1 Area are recorded in coastal waters, with the west section of the Phase 1 Area and the east section of the export cable corridor recording relatively higher densities.

Figure 7.1 **Commercial Fisheries**



7.1.1 Potential Impacts

The Zone – Phase 1

The following aspects (potential impacts) will be addressed in respect of commercial fishing during the construction, operation and decommissioning phases of the development, including the export cable corridor:

- presence of seabed obstacles
- adverse impacts on commercially exploited species
- increased steaming times to fishing grounds
- safety issues for fishing vessels
- complete loss or restricted access to traditional fishing grounds
- interference with fisheries activities
- any other concerns raised by local fishermen and fishermen's organisations

Export Cable Route

As per the Zone – Phase 1

7.1.2 Methodology and approach to EIA

The Zone – Phase 1

An impact assessment of the proposed Wind Farm upon Firth of Forth commercial fishing operations will be undertaken as part of the ES. To assist this assessment, discussions and consultation will be undertaken with the relevant national and local marine fisheries bodies, and fishermen's associations and representatives.

In each instance, potential mitigation measures will be identified, and the significance of effects will take these measures into consideration. The residual effects will then be identified, as will the monitoring requirements.

In addition to a site specific impact assessment, the criteria described above will be used to assess the cumulative and in-combination impacts of the proposed development.

Export Cable Route

The methodology and approach to EIA detailed above for Phase 1 of the Zone development will also be applied to the EIA of the export cable.

Whether the generic approach to fisheries surveys detailed for the Zone differs from the techniques required for inshore characterisation will be determined during the initial EIA consultation period.

7.1.3 Guidance and Best Practice

Scottish specific guidance addressing approaches to impact assessments upon commercial fishing activities is not currently available. In light of this, and based upon experience of other UK wind farm developments, the assessment methodology as outlined in the Defra Guidelines (2004) has been assumed.

Title	Author	Date
Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise	Nedwell *et. al*.	2003
Assessment of subsea acoustic noise emission and vibration from offshore wind turbines and its impact on marine wildlife	Subacoustech Ltd	2003
Best Practice Guidelines - Consultation for Offshore Wind Energy Developments Fisheries Liaison	BWEA	2004
Framework for dialogue between the fishing and wind farm industries on how to assess the value of fishing activities and any disruption or displacement caused to them by wind farm developments	BERR	2006
Assessment and costing of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore wind farms	BioConsult SH	2008
Fishing Liaison with Offshore Wind and Wet renewables group (FLOWW) recommendations for fisheries liaison	BERR	2008
Development of spatial information layers for commercial fishing and shellfishing in UK waters to support strategic siting of offshore wind farms	ABPmer	2009
Options and opportunities for marine fisheries mitigation associated with windfarms	COWRIE	2010
Impact of pile driving noise on the behaviour of marine fish	CEFAS	In Prep
Quantifying the performance of acoustic mitigation devices (AMDs)	Subacoustech Ltd.	(In Progress)

7.2 Shipping and Navigation

7.2.1 Existing Environment

Anatec UK Ltd. was commissioned by Seagreen to undertake a review of commercial shipping activity and navigation issues in the Zone (Anatec UK Ltd., 2008). Their report identified that the average density of shipping activity within the Phase 1 area was approximately 1 vessel per day with large expanses of the Zone being devoid of shipping activity (see **Figure 7.2**). Shipping activity in the Zone is therefore low in the context of wider UK levels where significantly higher vessel densities occur. However, to the west of the Zone boundary, approximately 10km offshore and parallel to the coastline, a 2-4 vessel per day shipping route dissects the currently proposed ECR (see **Figure 7.2**). A further 2-4 vessel per day shipping route crosses to the south of the Zone in an east-west direction, representing the boundary between Phase 2 to the north and the remainder of the Zone to the south. The highest density of vessel activity is located approximately 10-15km to the south and southwest of the Zone (see **Figure 7.2.)** The Anatec (2008) study also and concluded that recreational activity within the Zone was limited.

The majority of shipping activity in the vicinity of the Phase 1 area and the proposed ECR corridor is associated with parts of the Firth of Tay and the Firth of Forth located approximately 45km west and 50km south west of the Phase 1 area respectively. The Firth of Tay, of which Dundee is the main port, handles crude oil and general cargo, with some oil & gas related traffic.

The ports of the Firth handle over 30 million tonnes of cargo annually. This is mostly oil, petro-chemicals and liquefied gases, which pass through the port of Grangemouth and the two marine terminals at Hound Point and Braefoot Bay. There is also considerable container and general cargo traffic at Grangemouth and other ports in the Forth such as Burntisland, Granton and Leith (Anatec UK Ltd 2008).

Nine shipping routes have been identified within the vicinity of the Zone. These have been defined on the basis of including 90% of recorded shipping traffic. Six of the routes pass through or are within close proximity to Phase 1 and/or the proposed ECR corridor:

- Route 1 (1 vessel/day) is generally used by medium sized cargo vessels and offshore support vessels heading between east coast ports in the UK (e.g. Aberdeen, Immingham and Tees / Tyne);
- Route 3 (1 vessel/day) is used by cargo vessels and offshore support vessels headed north to Aberdeen or south to various ports such as Immingham and Antwerp.
- Route 4 (1 vessel/day) is used mainly by small/medium sized cargo vessels headed to/from Montrose.
- Route 5 (1 vessel/day) is used by east-west traffic between the Tay (mainly Dundee) and either North Sea offshore platforms or northern European / Baltic Sea ports; and
- Route 6 (1 vessel/day) is used by coastal traffic between the Forth and ports to the north, in particular, Aberdeen. (Route 9 is a slightly busier, alternative route, closer to shore).
- Route 9 (2-4 vessels/day) is used mainly by coastal traffic heading between the Forth and ports to the north, such as Inverness and Aberdeen.

The location of these routes and others identified by Anatec UK Ltd., 2008 are illustrated in **Figure 7.2.**

Seagreen, as part of FTOWDG, has commissioned the collection of shipping data via shore-based Automatic Identification System (AIS) survey. Survey has commenced and is ongoing and data will be used to determine baseline navigational conditions.

Other navigational activities

A submarine exercise area is located approximately 40km to the south of Phase 1 and the boundary of firing practice area (known as D609) is located just south east of the eastern boundary of the Phase 1 area (see **Figure 7.5: Radar, Aviation and MOD**).

7.2.2 Potential Impacts

The Zone – Phase 1

Construction

- Ship to ship collision risk;
- Ship to structure collision risk;
- Interference with established navigation routes; and
- Restriction of shipping lanes and general use of sea.

It is anticipated that development within Phase 1 would not result in significant disruption to shipping and navigation. As previously highlighted, Seagreen will make an application to establish Safety Zones around construction vessels during installation of wind turbines and ECR which has the potential to affecting shipping and navigation during the Phase 1 site development.

Operation

- Ship to ship collision risk;
- Ship to structure collision risk;
- Interference with established navigation routes;
- Squeeze of sea area;
- Interference with shipboard radar and VHF systems;
- Impacts on visual navigation;
- Impacts due to the impacts of buried cables; and
- Impacts on search and rescue operations.

The potential impacts during the operational phase of the proposed development will be assessed during the EIA process through close consultation with the shipping industry and its representatives.

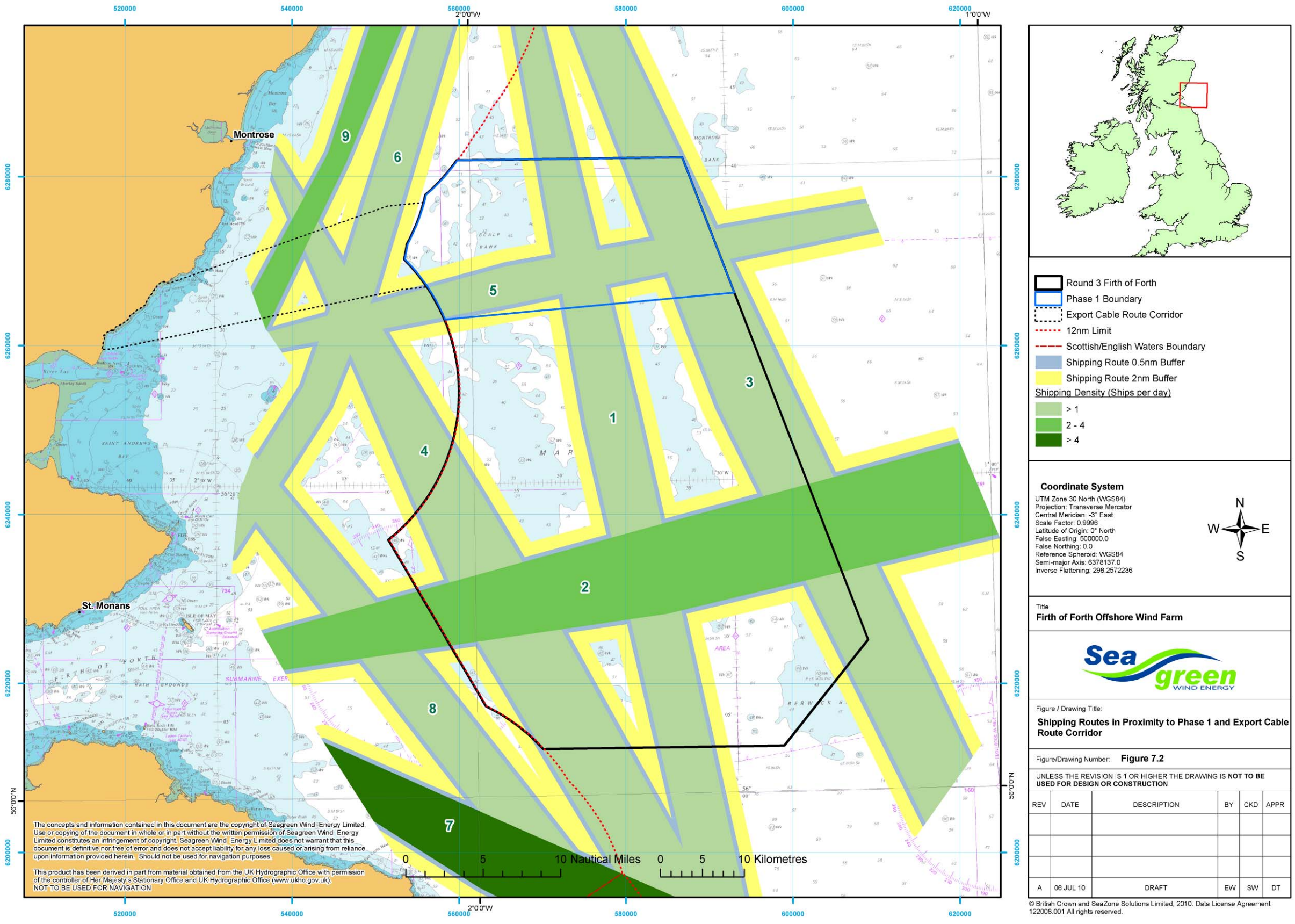
Decommissioning

Impacts associated with the decommissioning of the wind farms are anticipated to be similar in nature and extent to those identified during the construction phase.

Cumulative and in-combination impacts

The development of the Zone in combination with STW projects represents a significant quantity of offshore wind farm development in the Forth and Tay area. Where appropriate Seagreen will continue to liaise at an industry level, together with other offshore wind farm developers in order to identify potentially significant cumulative impacts associated with the current planned level of development within the wider study area.

Figure 7.2 Shipping Routes in Proximity of Phase 1 and the ECR



Export Cable Route

Construction

- Ship to ship collision risk;
- Interference with established navigation routes; and
- Restriction of shipping lanes and general use of sea

The currently proposed ECR corridor crosses shipping Route 9 (Anatec, 2009) and is currently identified as being one of the busier routes (2-4 vessels a day) in the Firth of Forth area (see **Figure 7.2**). The potential therefore arises to impact upon a greater number of vessels during the ECR construction phase than that envisaged for the wind farms. However, it should be noted that the anticipated construction phase for the ECR is significantly of shorter duration than that proposed for the wind farms (24 months).

Operation

No major impacts to shipping and navigation are anticipated during operation of the export cable, as the preconstruction environment shall be fully reinstated.

Decommissioning

The magnitude of impacts associated with decommissioning of the export cable will entirely depend upon the method used for decommissioning. If it is decided that the cable shall remain buried in the seabed, it is anticipated that the impact resulting from the decommissioning of the ECR shall be minimal in terms of disruption to shipping and navigation. It is anticipated that such impacts would be assessed as part of the EIA undertaken to inform the final Decommissioning Plan.

Cumulative and in-combination impacts

With many offshore wind farms likely to be under construction simultaneously there is potential for cumulative impacts to shipping and navigation. Careful planning between all developers could reduce the potential impacts significantly. Where appropriate, Seagreen shall work with the FTOWDG to reduce the impacts of multiple wind farms within the Firth of Forth area (see **Table 4.4**).

7.2.3 Methodology and Approach to EIA

The Zone – Phase 1

Seagreen does not wish to prejudge the outcome of consultation with shipping and navigation stakeholders through the identification of potential impacts in this scoping report. It is clear that the Zone is located within a wider study area of significance to navigational interest and to international trade.

Seagreen will continue consultation throughout the pre-application phase of the development to ensure that any identified risks to navigation are minimised to the satisfaction of the MCA and other key navigation stakeholders.

A Navigation Assessment and a Navigational Risk Assessment will be undertaken in accordance with MCA guidance to assess impacts on both navigational safety and emergency response (i.e. rescue and counter pollution).

Seagreen anticipates that the following studies will be undertaken, either on a site specific basis, or covering the whole of the Zone:

- Data collection from existing databases of shipping activity;
- A 28 day AIS survey, operating 24/7 over two 14 day periods to capture potential peak seasonal variation in small vessel movements;
- A Hazard Assessment based on the results of the 28 day survey that will be used to inform further consultation with the MCA over the location and boundaries of Seagreen Bravo;
- Risk collision modelling as part of the Navigational Risk Assessment, including base risk (i.e. ship to ship collision and grounding risk) and the additional risk of the presence of the wind turbines; and
- A review of the potential impact of the development of Phase 1 on search and rescue operations. As part of this process Seagreen will commit to the development of an Active Safety Management Plan for the project.

The results of the Navigational Risk Assessment will feed directly into the EIA process and will inform the assessments of potentially significant impacts associated with the construction, operation and decommissioning of the wind farm.

Export Cable Route

Data collected for the Phase 1 area to inform subsequent wind farm EIAs (detailed above) will also be used to inform the EIA of the export cable. The general approach to EIA of the Export cable will be similar to that of the Phase 1 EIAs (detailed above).

7.2.4 Guidance and Best Practice

In addition to the Marine Guidance Notes, the following will be considered at EIA:

Title	Author	Date
Guidance on the Assessment of the Impact of Offshore Wind Farms - Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms	DTI/MCA/DfT	2005
Investigation of Technical and Operational Impacts on Marine Radar close to Kentish Flats Offshore Wind Farm	BWEA	2007
Offshore Renewable Energy Installations (OREIs): Guidance to mariners operating in the vicinity of UK OREIs.	MCA	2008a
Offshore Renewable Energy Installations (OREIs): Guidance on UK navigational pratice, safety and emergency response issues.	MCA	2008b
Offshore Renewable Energy Installations, Emergency Response Cooperation Plans (ERCoP) and Requirements for Emergency Response and SAR Helicopter Operations	MCA	2010
Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms	DTI	2004

7.3 Seascape, Landscape and Visual Character

7.3.1 Existing Environment

SNH commissioned a study to contribute to strategic guidance on areas where the impact of offshore wind energy development on Scottish seascapes is likely to be of least significance (Scott *et al*, 2005). In general, the east coast of Scotland was found to have a higher relative capacity for wind farm development than the west coast, as a result of its lower visibility ratings, open coastlines, and fewer designated landscapes. The findings of the seascape assessment relevant to Phase 1 are presented in **Figure 7.3** and **Table 7.3.**

The western boundary of Phase 1 lies approximately 25km from the nearest shoreline at Arbroath. The seascape is relatively busy, traversed by commercial and recreational vessels, many of which are associated with ports and harbours in the Firths of Tay and Forth (see **Section 7.2: Shipping and Navigation**).

Table 7.5 Seascape sensitivity

Seascape Unit	Brief Description	Sensitivity	Capacity Rating
Berwick upon Tweed	Rocky coastline with open sea views and some remote high cliffs at St Abbs.	Low - Medium	Higher
Firth of Forth	Semi-open character in outer Firth within a broad bay but with views funnelled towards open sea. Inner Firth forms a narrow plane of water, strongly contained by hills.	Medium	Med – Higher

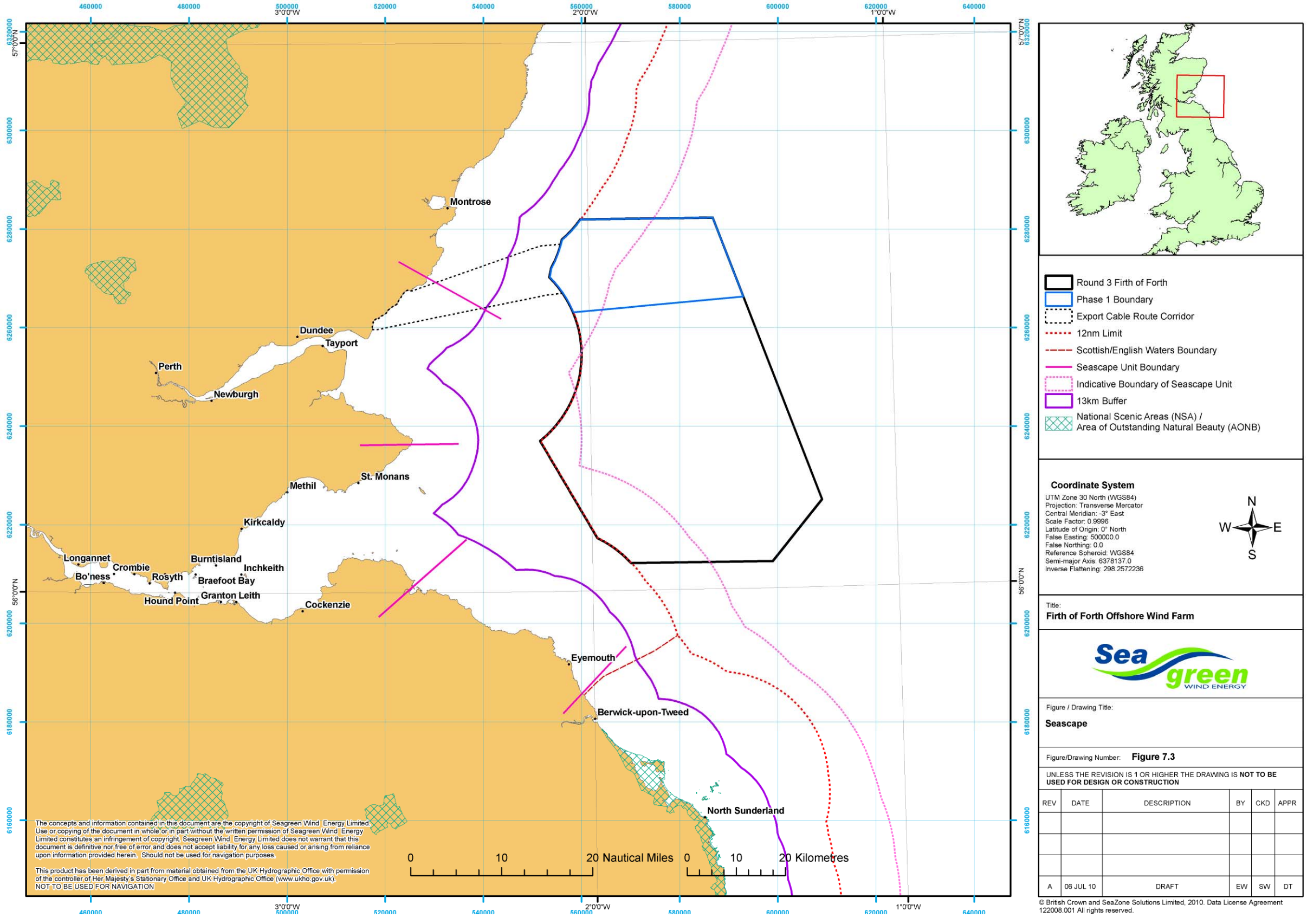
Seascape Unit	Brief Description	Sensitivity	Capacity Rating
East Fife / Firth of Tay	Medium to large scale overall. Containment of hills reduces scale in Inner Firth, flatter coastal landform and greater expanse of open sea increases scale in Outer Firth.	Medium	Med – Higher
North East Coast	Long, east-facing generally 'straight' coastline with many small indentations and few significant headlands and with open views out to North Sea.	Low – Medium	Higher

Source: Scott *et al.* (2005)

The ECR corridor will make landfall on the Angus coastline, at a location between Arbroath and Carnoustie. The Tayside Landscape Character Assessment (Land Use Consultants, 1999) indicates that the landscape here is made up of a narrow coastal belt of variously sandy and cliffed shoreline, urban centres at Arbroath and Dundee, and an immediate hinterland of dipslope farmland (arable and pasture farmland generally sloping from the north-west to the south-east, with a dispersed settlement pattern). This coastal landscape is not considered to be especially sensitive to development (i.e. not designated for landscape value, not sparsely developed with extensive views).

The nearest areas designated for their landscape value (primarily National Scenic Areas) lie some distance inland, the nearest designated landscape being at Deeside and Lochnagar.

Figure 7.3 **Seascape**



7.3.2 Potential impacts

The Zone – Phase 1

Construction

Temporary impacts on seascape / landscape character during wind farm construction are expected to be minimal. Movements of vessels associated with wind farm construction would not be visually obtrusive in a setting already busy with shipping activity in certain areas.

Operation

The relevant seascape units are judged to be of low to medium sensitivity and based upon the guidance presented in **Table 7.6** the development of wind farm sites within the Phase 1 area in isolation would not be expected to impact significantly on seascape. However, it should be noted that the guidance presented in **Table 7.6** is subject to ongoing debate.

Table 7.6 Impacts of proposed development for different seascape unit sensitivities (amended from BMT Cordah, 2003)

Seascape unit sensitivity	Significance of impact		
	Possible minor or no impact	Threshold to possible medium impact	Threshold of possible major impacts
Low / no sensitivity	8km+ offshore	N/A	<8km offshore
Medium sensitivity	13km+ offshore	8-13km offshore	<8km offshore
High sensitivity	24km+ offshore	13-24km offshore	<13km offshore

The visual impact of offshore developments relating to wind farm infrastructure is principally a function of their visibility from the coast which is dependent on their distance from any given viewpoint, the elevation of that viewpoint, and the atmospheric conditions (e.g. contrast and haze) prevailing at the time of viewing (Hill *et al*., 2001, Bishop & Miller 2007).

Assessing the visual impact of offshore wind farms with atmospheric conditions of environmental haze, DECC (2009b) suggests the potential viewing distance in south Scotland to be 26km, increasing to 39km in northern Scotland, and that if the results from Seascape and Landscape Visual Impact Assessments (SLVIAs) for Round 1 and 2 sites are considered, the average maximum distance at which low magnitude impacts were assessed to occur was 32km. As the most landward boundary of the Phase 1 area is located approximately 25km from the closest landfall, Seagreen believes that the wind farm will be visible from shore, under suitable weather conditions, but does not anticipate that the impact of this will be considered significant, in isolation.

Decommissioning

As per the construction phase, impacts on seascape / landscape are expected to be minimal and will be assessed as part of the EIA process.

Cumulative and in-combination impacts

Significant offshore wind farm development is planned for the Zone and STW projects. As a result of the scale of proposed development in this region, offshore wind farms are likely to become characteristic of the seascape of the outer Forth and Tay and southern North Sea (i.e. there will be a change in seascape character). It is likely that any visual impacts of offshore wind farm development would be increased with greater areas of the horizon being covered by wind turbines (White Consultants, 2009).

The coordination of cumulative assessment methodologies with other STW developers is currently on-going. This will ensure a more standardised approach to seascape, landscape and visual character data collection, facilitating future cumulative impact assessment (see **Table 4.4**).

Export Cable Route

Construction

It is anticipated that cable laying and landfall/ transition pit works will have a limited zone of visual influence. This is due to the relatively small scale of the associated works and the fact that these infrastructure features are buried, hence, are expected to result in localised and temporary impacts on visual amenity as a result of construction activities.

Operation

It is unlikely that there will be cumulative impacts due to the infrastructure being buried.

Decommissioning

As per the construction phase, impacts on seascape / landscape are expected to be minimal and the approach to their assessment shall be agreed with the regulatory authorities and key consultees.

Cumulative and in-combination impacts

As per the Zone Phase 1

7.3.3 Methodology and approach to EIA

The Zone – Phase 1

Seagreen will undertake consultation with relevant stakeholders in order to define the scope and coverage of any Seascape and Landscape Visual Impact Assessment (SLVIA) considered necessary as part of the EIA process for sites within Phase 1 and their associated infrastructure.

Cumulative assessment scope and methodology will be agreed with stakeholders during the EIA.

Export Cable Route

Not required.

7.3.4 Guidance and Best Practice

Title	Author	Date
Guidelines for Landscape and Visual Impact Assessment: Second Edition	IEMA	2002
Cumulative Impacts of Wind Farms: Version 2	Scottish Natural Heritage	2005
Guidance on the Assessment of Impact of Offshore Wind Farms: Seascape and Visual Impact Report (DTI, 2005)	DTI	2005
Visual Representation of Wind Farms: Good Practice Guidance, produced for Scottish Natural Heritage	Horner and MacLennan and Envision	2006

7.4 Archaeology and Cultural Heritage

7.4.1 Existing Environment

A desk-based review has examined the prehistoric archaeological resource within the northern North Sea (Flemming, 2004), and concluded that remains 'could occur with low probability anywhere in the SEA 5 area', which incorporates the footprint of Phase 1 and the ECR corridor. This is a direct consequence of parts of the Marr Bank being exposed during periods of lower than present sea-level during the early Holocene (~10,000 yrs B.P.).

In terms of more recent history, four charted wrecks are located within Phase 1, with a further two wrecks on the southern Phase 1 boundary (see **Figure 7.4**). The highest concentration of charted wrecks occurs along the proposed ECR corridor, with a total of 23 charted wrecks. The positions of known wrecks are marked on Admiralty Chart 1407, none of which are afforded designated protection. The majority of the wreck sites lie within the central eastern and southern areas of the Zone (see **Figure 7.4)**. It is possible that undiscovered wrecks are present within Phase 1.

Due to the distance from the coast and the lack of records for such areas, the marine cultural heritage in the study area is limited to known or discovered wrecks, which falls short of the full potential within such an environment. Other information may also be held by geological borehole data for the study area, which may provide some indication on the geological and geomorphological development of the area, as well as its potential prehistoric land surfaces.

Bell Rock Lighthouse, constructed on Inchcape Rock, 18km off the Angus coast, is listed as a National Monument of Scotland, given its status as the oldest surviving rock-built lighthouse in Britain, first lit in February 1811. The lighthouse, located at OS Grid Reference NO 76165 26808 (see **Figure 7.4**), has a range of 55km and is located 27km from Phase 1 (http://canmore.rcahms.gov.uk).

Along the coastline where landfall will be made and where a transition pit will be located there is significantly more information available regarding the cultural heritage resource; the Angus coast has a rich archaeological and historic legacy. There are a number of Listed Buildings, Scheduled Ancient Monuments and National Monuments. These features tend to

be concentrated around settlements, such as Arbroath, Carnoustie, Monifieth and Dundee. Historic and recorded sites are shown in **Figure 7.4**.

7.4.2 Potential Impacts

The Zone – Phase 1

Construction

Direct impacts may result from the construction of the wind farm and ancillary infrastructure (e.g. cable trenching, foundation installation for wind turbines, placement of scour protection) and include direct damage to structures, features, deposits and artefacts, but also the disturbance or destruction of relationships between structures, features, deposits and artefacts and their wider surroundings. Similar impacts may occur on surficial and shallow archaeology as a result of anchoring and jack-up activities associated with the construction works.

Indirect impacts can result from changes to water quality or sediment transport patterns.

Operation

Maintenance works on Phase 1 wind farm sites are unlikely to result in direct impacts on archaeological features. Indirect impacts can result from changes to water quality or sediment transport patterns. For example, scour around wind turbine foundations has the potential to affect archaeological features over time. The proposed wind farm development associated with Phase 1 of the Zone has the potential to cumulatively impact on the historic 'setting' of Bell Rock Lighthouse.

Decommissioning

The impacts during decommissioning of the wind farms would be similar to those associated with construction activities, though since decommissioning activities would take place in the same locations as construction works, the seabed will have already been disturbed.

Cumulative and in-combination impacts

Numerous offshore wind farm developments are proposed in the waters adjacent to the Phase 1 area and the proposed ECR corridor. It is considered unlikely that cumulative direct impacts will be of significance, though there is the potential for cumulative indirect impacts on archaeological features as a result of changes to hydrodynamic conditions associated with multiple wind farm development.

The proposed wind farm development associated with Phase 1 of the Zone have the potential to cumulatively impact on the historic 'setting' of Bell Rock Lighthouse.

However, it should be noted that a positive cumulative impacts relates to the rapid increase in knowledge derived through commissioned studies relating to wind farm developments via the interpretation of geophysical and geotechnical data and the concluding of an Archaeological Desk Based Assessment (ADBA).

Export Cable Route

Construction

As per the Zone Phase 1

Operation

As per the Zone Phase 1

Decommissioning

As per the Zone Phase 1

Cumulative impacts

As per the Zone Phase 1

Decommissioning

The impacts during decommissioning of the ECR would be similar to those associated with construction activities, though since decommissioning activities would take place in the same locations as construction works, the seabed and coastline will have already been disturbed.

Cumulative and in-combination impacts

Numerous offshore wind farm developments are proposed in the waters adjacent to the proposed ECR corridor. It is considered unlikely that cumulative direct impacts will be of significance.

In terms of onshore (landfall and transition pit) infrastructure development, it is considered unlikely that cumulative impacts will result.

7.4.3 Methodology and Approach to EIA

Archaeological surveys and assessments to support EIA for Phase 1 and the proposed ECR corridor will be undertaken in a staged manner in close consultation with Historic Scotland (HS) and SNH, and in line with the latest guidance on the historic environment.

The Zone – Phase 1

The first stage of the study will include an Archaeological Desk Based Assessment (ADBA) to identify and obtain information about known archaeological resource. This will be carried out in line with best practice as cited in **Section 7.4.4**. The ADBA will cover the Phase 1and ECR areas. Information will be sought from a wide range of local and national bodies, including HS, the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) and the United Kingdom Hydrographic Office (UKHO). The ADBA aims to identify the archaeological resource within the study area.

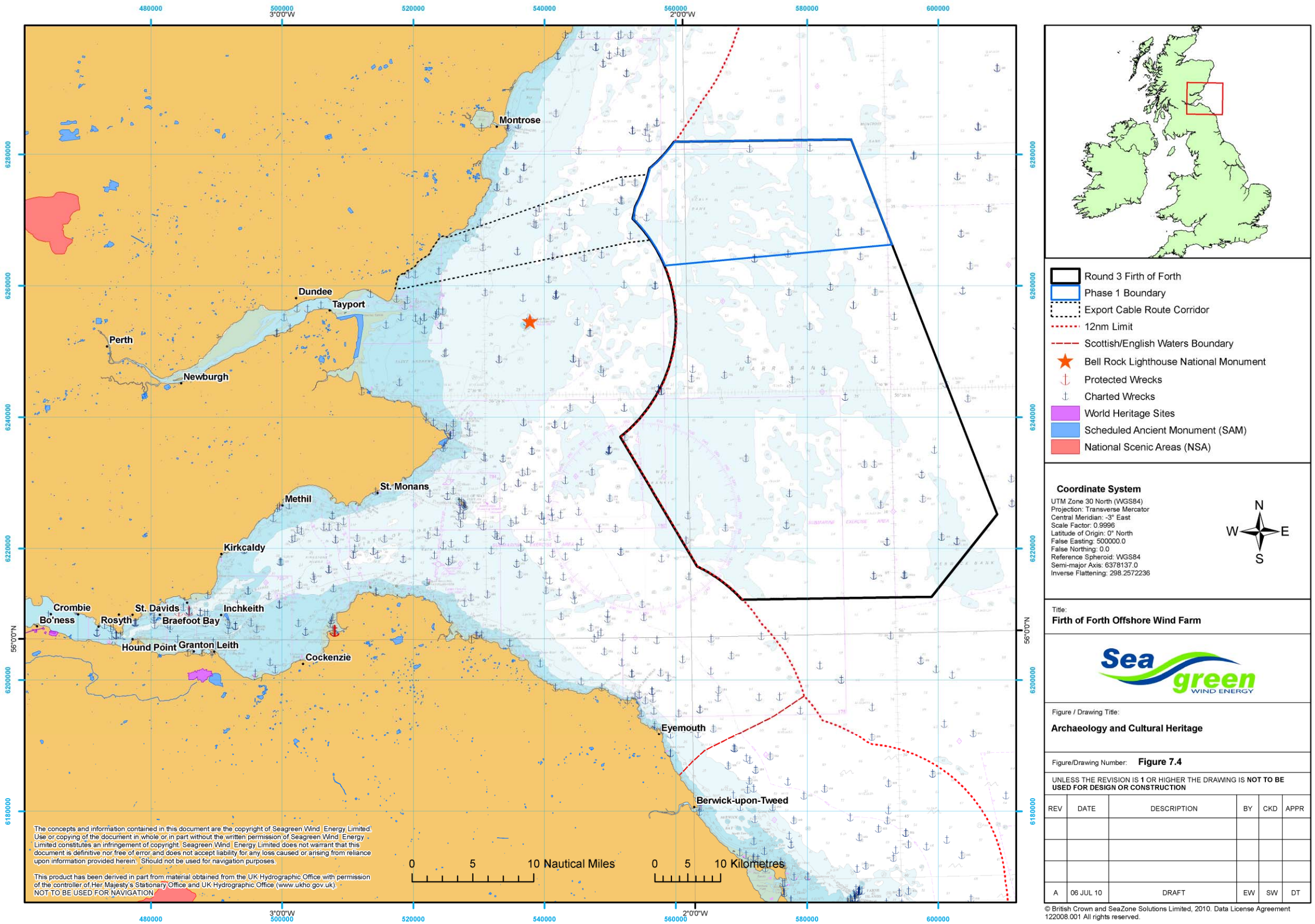
The second stage of the study will consist of primary data collection to confirm the findings of the ADBA and identify any unrecorded archaeological resource. High specification geophysical surveys of the seabed within Phase 1 and the ECR corridor will be carried out and the resulting data will be assessed for indication of the presence or absence of features (e.g. wreckage, magnetic anomalies etc.), and to determine the extent of these features. The data collected will ascertain whether any further survey would be required.

Should any seabed anomalies be identified from such surveys where the wind farms have the potential to cause a significant impact then further detailed site examination of the identified features may be undertaken where deemed necessary. If necessary, a protocol will be developed setting out procedures for dealing with any feature that appears to be a marine historic asset.

It is currently assumed that data on submerged features of potential archaeological value, sufficient to enable an initial assessment of impacts during the EIA, will be available as a result of the completed geophysical survey of the study area.

The ADBA and EIA will also consider potential impacts of development on the setting of historic sites and structures (e.g. Bell Rock Lighthouse).

Figure 7.4 Archaeology and Cultural Heritage



Export Cable Route

The ADBA, as described above, will cover not only Phase 1, but also the ECR up to the point at which it reaches the onshore transition pit.

In terms of the onshore study area (from landfall to transition pit), primary data collection is expected to comprise a walk-over survey of the study area to ground truth the findings of the ADBA and identify any previously unrecorded heritage features.

The ADBA and EIA will also consider potential impacts of development on the setting of historic sites and structures.

7.4.4 Guidance and Best Practice

Title	Author	Date
Historic environment guidance for the offshore renewable energy sector	Wessex Archaeology Ltd	2007
Standard and Guidance for Archaeological Desk-based Assessment	Institute for Field Archaeologists	2008
Guidance for Assessment of Cumulative Impacts on the Historic Environment	COWRIE	2008b
Development of guidance for the assessment of cumulative impact on the historic environment from offshore renewable energy industry	Oxford Archaeology Ltd,	2008
Offshore renewables protocol for archaeological discoveries	TCE	2010
Round 3 offshore renewables projects model clauses for Archaeological Written Schemes of Investigation	TCE	2010
Offshore Geotechnical Investigations and Historic Environment Analysis: guidance for the renewable energy sector	EMU	In Progress

7.5 Radar, Aviation and Ministry of Defence (MOD)

7.5.1 Existing Environment

Seagreen has commissioned studies by Pager Power (2008) and XY Associates (2009) to review potential issues posed by development within the Zone in the context of civil and military airspace and radar operations. These studies have identified the range of potentially sensitive receptors to offshore wind farms within a study area that encompasses all known military and civil aviation facilities (e.g. airfields, airports and radar installations) and activities (e.g. flight paths, practice and exercise areas (PEXA), helicopter routes etc).

Phase 1 of the Zone and the ECR are not located within a PEXA. Military practice and exercise area (PEXA) D609 'St Andrews' is located east of the Phase 1 area (see **Figure 7.5**). D609 is used by RAF aircraft deploying missiles and sonobuoys and to the east, D613 is used for air combat training. A range of air, sea and underwater exercises do occur within the Zone. Furthermore, within the stretch of coastline where landfall will be made, PEXA D604 is located at Barry Buddon (see **Figure 7.5**), which is utilised for parachute dropping and firing.

The majority of the Phase 1 area is located within an area where NATS has identified a likelihood of interference between wind farm development and operational air traffic control infrastructure (see **Figure 7.5**). Development in the south west of the Phase 1 area may have potential to interfere with this infrastructure. The NATS data identifies where turbines amy be in radar line-of-sight and consultation with NATS would be required to identify the level of constraint.

The Zone is located in an area considered to be of moderate civil and military aviation interest. There are no identified offshore heliports or obstructions within six nautical miles of the boundary of Phase 1. In addition, no main helicopter routes pass over the Phase 1 area and no civilian airports are located within the 50km statutory notification range.

7.5.2 Potential Impacts

The Zone – Phase 1

Construction

Disturbance to PEXA activity: It is not expected that construction activities within the Phase 1 area will result in any significant direct impacts on military PEXA. However, there is a possibility that military vessels transiting the area to/from PEXA could be temporarily displaced.

Interference with radar: Issues are primarily related to the offshore wind farms in their operational phase, and the impacts associated with the presence of wind turbines. No significant impacts on aviation are expected during construction.

Operation

Seagreen does not wish to pre-judge the outcome of consultation on the issue of military and civil aviation, but considers the following to be key considerations associated with the operation of Phase 1 wind farm sites that are likely to be addressed at the EIA stage:

- Impact on NATS operational infrastructure;
- Impact on en route and air traffic control operations in relation to airports and airfields;
- Impact on Royal Air Force (RAF) Primary Surveillance Radar (PSR);
- Impact on RAF Air Surveillance and Control Systems (ASCS);
- Impact on RAF Air Defence (AD) radar;
- Impact on helicopter routes; and,
- Disturbance to PEXA.

Decommissioning

Issues are primarily related to the offshore wind farms in their operational phase, and the impacts associated with the presence of wind turbines. No significant impacts on aviation are expected during decommissioning.

Cumulative and in-combination impacts

Development of all of the proposed wind farm sites within the Zone and STW may result in cumulative impacts on military and civilian aviation interests. Impact assessment studies will need to consider the combined impacts of all known wind farm sites, plus cumulative assessment with onshore wind farms where required.

Export Cable Route

Construction

Depending upon the final landfall and transition pit works, there is potential for temporary disturbance of PEXA activity at Barry Buddon.

Operation

None anticipated.

Decommissioning

Depending upon the final landfall and transition pit works, there is potential for temporary disturbance of PEXA activity at Barry Buddon.

Cumulative and in-combination impacts

Multiple wind farm developments are proposed for the region, with associated export cables. This may have implications for disturbance of military activity and access to/from PEXA across a wider area which shall be assessed as part of the EIA.

7.5.3 Methodology and approach to EIA

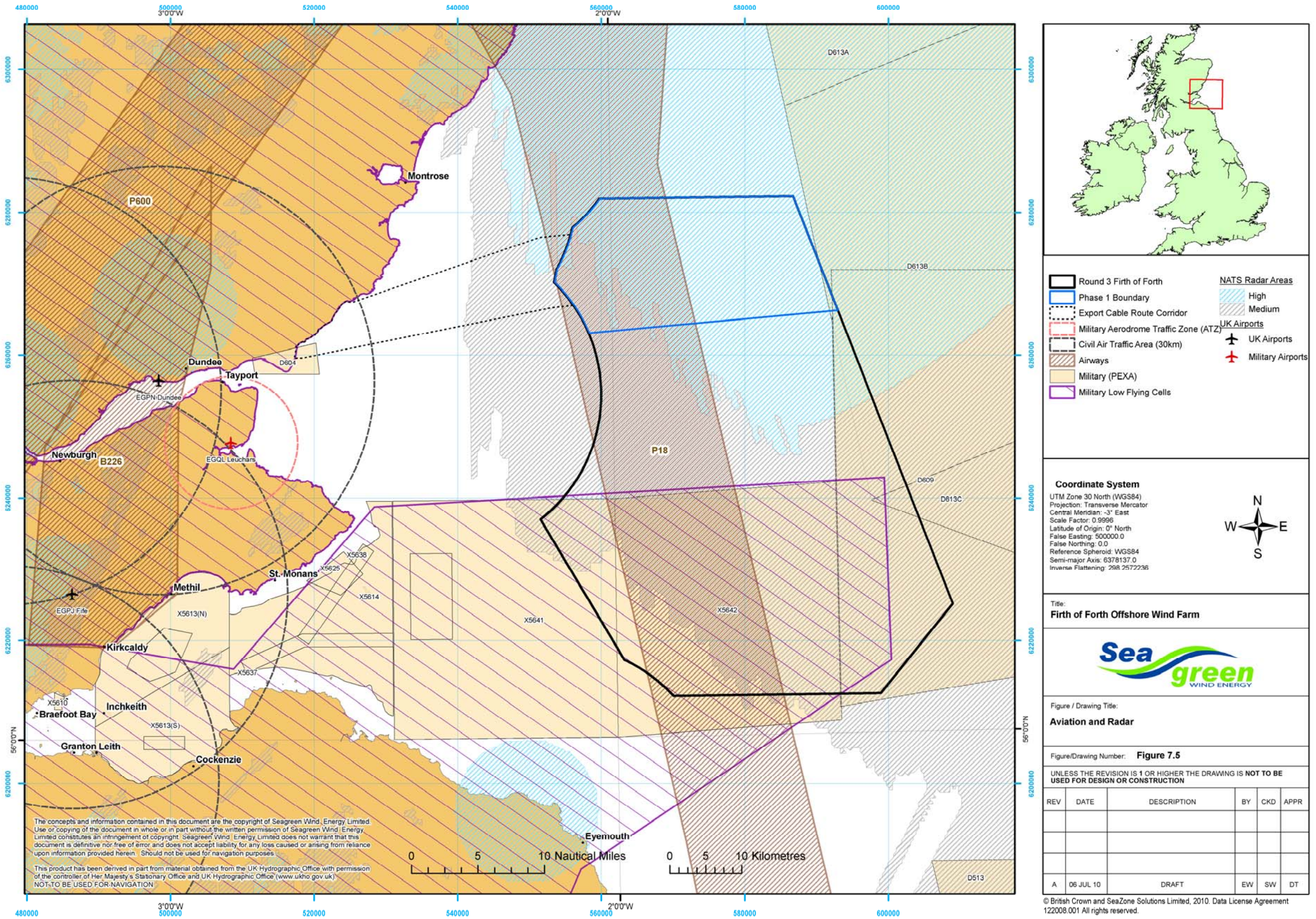
The EIA process is likely to be supported by further desk-based studies that will identify and examine in greater detail, sensitive aviation and MOD receptors. Studies will be undertaken in parallel with consultation and meetings with specific stakeholders in order to provide a detailed understanding of potential impacts. It is expected that consultation will be an iterative process, allowing for any concerns that are raised to be considered in the wind turbine layout and optimisation process of wind farm design.

Seagreen have submitted a standard offshore wind farm pro-forma to the Civil Aviation Authority (CAA) who have commented and passed to National Air Traffic Services (NATS). The pro forma is currently being considered by the MOD. Furthermore, the coordination of data collection activities with other STW developers is currently on-going. This will ensure a standardised approach to military and civil aviation assessment, facilitating future cumulative impact assessment, the approach to which shall be agreed with regulators and statutory consultees as part of the EIA process.

7.5.4 Guidance and Best Practice

Title	Author	Date
Wind Energy and Aviation Interests – Interim Guidelines	DTI/MoD/CAA/BWEA	2002
Mitigating the impacts of wind turbines on NATS En-Route Ltd (NERL) operations	NERL	2008
CAP 764: CAA Policy and Guidelines on Wind Turbines	CAA	2010
Investigation into the interference impacts of wind turbines on the PAR system	ADATS Technical Branch	2009

Figure 7.5 Radar, Aviation and MOD



7.6 Water and Sediment Quality

7.6.1 Existing Environment

Water quality

Scottish coastal, transitional (estuaries), freshwater and groundwater bodies are monitored by SEPA to ensure the performance and compliance with water quality status targets. These targets are set in accordance with the Water Framework Directive (WFD) 2000/60/EC and delivered through River Basin Management Plans (RBMPs). The information provided herein, particularly identification (IDs) has been derived from the Tay River Basin Management Plan (Natural Scotland, 2009).

Within the scoping area for the Phase 1 development there are no classified water bodies, however within the ECR corridor there is one coastal water body, three river bodies, none of which are classified as being 'Heavily Modified', and one groundwater body (see **Figure 7.6**). There are no transitional or freshwater bodies (i.e. lochs). The coastal water body (which extends out to 3nm) is 'Deil's Head to Carnoustie (ID 200072)', which is classified as in Good Ecological Status (Natural Scotland, 2009). There are three rivers within the scoping area that discharge into the sea, all of which are in 'Bad Ecological Status'. Monikie Burn (ID 5952) flows past Craigmill and Panbride House (between Easthaven and Carnoustie), Barry Burn (ID 5953) flows through Carnoustie and discharges on the north-eastern end of Barry Sands beach, and finally Elliot Water (ID 5950; also known as Rottenraw Burn), which discharges into the sea at Elliot. The groundwater body is 'Carnoustie bedrock and localised sand and gravel aquifers (ID 150257)' and is classified as 'Poor Quality' (Natural Scotland, 2009).

Protected areas

Water bodies (or parts of water bodies) can be designated as protected areas to ensure they are managed and achieve the objectives required by the Water Framework Directive (WFD) and the Water Environment (Register of Protected Areas) (Scotland) Regulations 2004. The areas designated as requiring special protection and/or conservation include:

- **Areas designated to protect economically significant species**: these protected areas were established under earlier European directives aimed at protecting shellfish (79/923/EEC) and freshwater fish (78/659/EEC).
- **Bathing waters**: previously designated under the Bathing Water Directive (76/160/EEC), these waters are now covered by the revised Bathing Water Directive (2006/7/EC) which was enacted in the UK by regulations in 2008.
- **Nutrient sensitive areas**: these comprise nitrate vulnerable zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Waste Water Treatment Directive (91/271/EEC).

The protected areas that are applicable to the scoping of the Phase 1 development area and the ECR corridor are illustrated in **Figure 7.6**. There are two protected 'Bathing Waters' within the ECR corridor, to the north and south respectively. Classified bathing water is located between Arbroath and Elliot, with the other at Carnoustie (see **Figure 7.6**). The 'Carnoustie bedrock and localised sand and gravel aquifer' is a drinking water protection zone, which is designated under the Drinking Water Directive 93/83/EU.

Finally, Tay Waste Water Treatment Works (TWWTW), located at Hatton midway between Arbroath and Carnoustie, has recently been completed and commissioned. Sewage from all the major settlements between Arbroath and Dundee is pumped to Hatton where it is treated and discharged via a sea outfall 1.6km from the shore. Discharge monitoring is undertaken by SEPA.

Sediment quality

The seabed across much of the Phase 1 area is composed predominantly of gravelly sand. In the absence of any anthropogenic activity such as dredging and disposal, it is unlikely that seabed sediments are contaminated above the natural background threshold for such contaminants. However, there is a disposal ground located to the south west of the Phase 1 area which has been utilised historically for the disposal of sewage sludge (see **Figure 7.6)** between 1978 and 1998. Sediment sampling was regularly undertaken at the disposal site up to cessation of dumping activity, with sample analysis considering metal and organic determinants.

Sampling results from monitoring of the disposal site (see **Figure 7.6** for spatial extent of sampling strategy) indicated that seabed sediments display no signs of serious organic or heavy metal contamination (CEFAS, 1997). Due to the majority of the seabed being composed of gravelly sand there is limited scope for particulate material to be adsorbed onto the surface of coarse-grained substrates or associated organic material and it is further expected that potential pollutants would be widely dispersed from the site of disposal. Additionally, benthic fauna have also been monitored. Sampling results suggest a mild impact of sludge disposal but show that seabed sediments display no signs of serious organic or heavy metal contamination.

7.6.2 Potential Impacts

The Zone – Phase 1

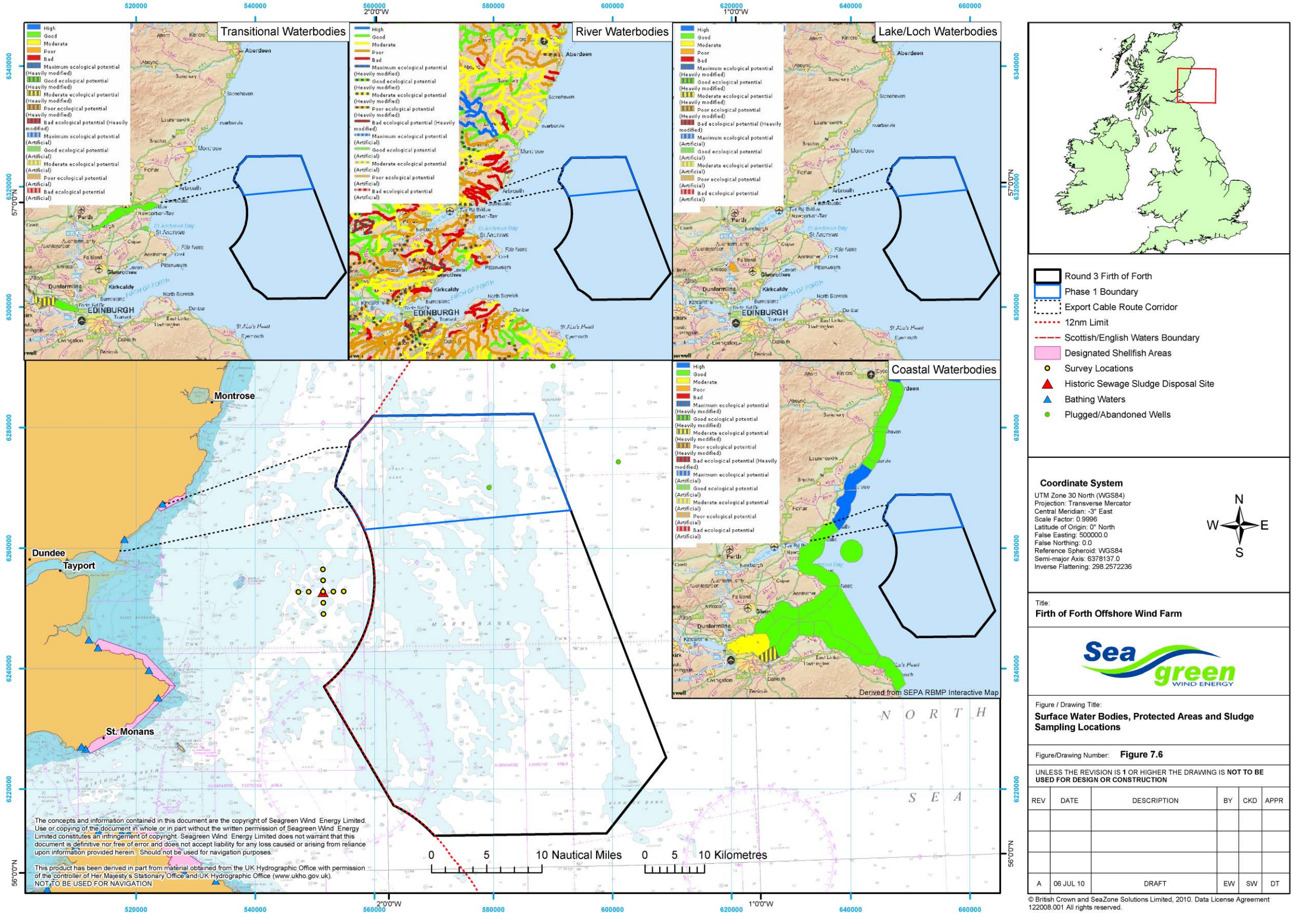
Construction

Impacts on water quality: Disturbance and potential re-suspension of seabed sediments during wind farm construction may result in increased suspended sediment concentrations in the water column. This impact will be short-lived and is not expected to result in any impacts on water quality due to the anticipated large class size of substrate present and relatively low near bed tidal current velocity.

Leakage of pollutants from vessels and equipment used during wind farm installation could impact upon water quality. However, Seagreen intends to follow best practice at the time of construction for pollution prevention.

Disturbance of contaminants: Given the lack of past activities within the vicinity of the Phase 1 area that would suggest contaminated sediments could be present, the risk of this impact arising is considered to be low.

Figure 7.6 Surface Water Bodies, Protected Areas and Sludge Sampling Locations



Operation

During operation, leakage of hydraulic fluids, erosion of sacrificial anodes, and use of antifoulants have potential to impact adversely upon water quality. With the use of appropriate site management and control of chemicals it is considered that the risk of a pollution incident will be minimal.

Decommissioning

As per the construction phase, impacts on water and sediment quality are expected to be associated with disturbance of seabed sediments, and will be of temporary duration.

Cumulative and in-combination impacts

The Zone could support a number of wind farm developments, in addition to several proposed wind farm sites further inshore in STW. As a result of the scale of proposed development in this region, there is potential, if large scale construction is undertaken simultaneously, that there maybe areas where sediment and water quality is temporarily reduced. However, due to the nature of the sediments around the Zone it is likely that sediment would settle out quickly and the impacts would be very localised and minimal.

Export Cable Route

Construction

As per the Zone Phase 1, though there is potential for impacts to manifest upon river as well as marine water quality.

As per the Zone Phase 1, though there is potential for impacts to manifest upon river as well as marine sediment quality.

Operation

No significant disturbance of sediments is anticipated during the operation phase. The main potential for impact on water quality is from accidental spillages of materials during any cable or landfall maintenance.

Decommissioning

Impacts during decommissioning will be largely associated with any removal of structures and associated re-suspension of sediments. Impacts are likely to be as per those described for the construction phase above.

Cumulative and in-combination impacts

No other activities, such as marine aggregate extraction or disposal, take place within the vicinity of the landfall coastline and therefore no significant cumulative impacts on water quality are expected.

7.6.3 Methodology and Approach to EIA

The Zone – Phase 1

Seagreen will consult with Marine Scotland, SEPA and other relevant stakeholders in order to define the need for and scope of any sedimentary/water sampling considered necessary to inform the EIA process. However, Seagreen does not consider that this will require significant survey effort and shall be adequately assessed via currently available data sources supplemented with data acquired as part of benthic data collection and coastal process modelling (see **Section 5.1: Physical Processes**).

Export Cable Route

It is likely that an assessment will be required under the Water Framework Directive (WFD:2000/60/EC) as part of the EIA. Discussions will be initiated with the view to seeking agreement with SEPA as to whether an individual WFD assessment will be required as part of the EIA process. Where necessary, a summary assessment, signposting information within the ES shall be provided for the purposes of assessment should SEPA deem that a formal WFD assessment is not required.

7.6.4 Guidance and Best Practice

Title	Author	Date
Offshore Wind Farms – Guidance note for Environmental Impact Assessment in respect of FEPA and CPA Requirements	CEFAS	2004
Groundwater Protection Policy for Scotland	SEPA	2009
Control of priority and dangerous substances and specific pollutants in the water environment	SEPA	2009
PPG5 Works in ,near or liable to affect watercourses	SEPA	1999

7.7 Socio-economics

7.7.1 Existing Environment

Much of the open coastline between Aberdeen and Eyemouth is relatively sparsely populated although the Firths of Forth and Tay support major population centres (Edinburgh and Dundee conurbations respectively). Coastal settlements within the vicinity of a potential landfall location include Arbroath, Carnoustie, Monifieth and Broughty Ferry on the outskirts of Dundee. The Local Authority at the proposed landfall location is Angus Council (2008 population of 110,300). Other Local Authorities (LAs) within close proximity to the Zone are Dundee City (142,500), Fife (361,900) and East Lothian (96,100).

Industries such as agriculture, fishing and ship building have traditionally been important in the Fife and Angus regions. In common with most other advanced industrialised economies, Scotland has seen a decline in the importance of the manufacturing industries and primary-based extractive industries. Locally, Dundee has particularly suffered (for example, with the demise of the jute industry). This has, however, been combined with a rise in the service

sector of the economy (Nomis statistics, 2010[10]), with growth in engineering and new technology serving the offshore industry and tourism replacing declining traditional industries.

In 2009, the proportion of economically active people in employment in Angus stands at approximately 78%. Over the past decade there have been minor fluctuations in employment rates with a low of 74% in 2004 and a high of 81% in 2001/02. The unemployment rate is lower than the Scottish and UK averages.

7.7.2 Potential Impacts

The Zone – Phase 1

Construction

Capital expenditure and supply chain: The Zone development is a major undertaking, incurring substantial capital costs. It is envisaged that a proportion of this capital expenditure may add to local, regional and UK company income over the duration of the development phase. Expenditure on key elements of the wind farms, such as wind turbines, will result in further expenditure further down the supply chain for component parts (e.g. lubricants, paints) and other services (e.g. hotel facilities, catering, security). As such, direct expenditure re-circulates, supporting indirect expenditure to other companies, known as the multiplier effect.

Direct employment: The wind farm would require staff (man hours) that would be employed directly by the operator, contractors and manufacturers, at various stages of construction. Seagreen shares the offshore wind industry's hope and belief that the requisite engineering skills and experience for the offshore construction works can be sourced from UK workers, with a particular emphasis on regional acquisition.

Indirect and induced employment: Indirect employment is generated through additional demand created by the primary wind farm construction businesses. For example, local companies may provide maintenance services to vessels used during wind farm construction. Over the lifetime of the Zone development, this may be significant.

Impacts on other commercial sectors: Development of Phase 1 may impact existing commercial fishing and tourism activity; impacts on these sectors are considered in the relevant sections of this scoping report (see **Sections 6.1: Commercial Fisheries** and **6.12: Tourism and Recreation**, respectively).

Operation

Impact on employment: Phase 1 wind farm developments will be operational for 25 years; the lease term however is 50 years with the potential for re-powering if possible at the time. Maintenance will be required throughout the operational life of the wind farms and a number of full-time jobs are likely to be created to provide the operations and maintenance team for Seagreen Alpha and Seagreen Bravo.

[10] https://www.nomisweb.co.uk/reports/lmp/la/2038432123/report.aspx?town=angus

Impacts on other commercial sectors: During their operational lifetime the wind farm projects may impact existing commercial fishing and tourism activity; impacts on these sectors are considered in the relevant sections of this scoping report (see **Sections 6.1: Commercial Fisheries** and **6.12: Tourism and Recreation**, respectively).

All the above potential impacts, envisaged to be mostly beneficial to the regional and local economy, shall be assessed as part of the EIA process.

Decommissioning

Decommissioning of the project would be undertaken in line with a decommissioning plan as set out within the ES. This operation will entail considerable expenditure and require employment at similar levels of numbers and experience to that involved in the construction phase.

Cumulative and in-combination impacts

There are multiple offshore wind farms currently being planned for the Firth of Forth region. Development (and maintenance of constructed sites) on this scale has the potential to generate significant expenditure and employment over a sustained period

The coordination of data collection activities with other STW developers is currently on-going. This will ensure a more standardised approach to socio-economic data collection, facilitating future cumulative impact assessment (see **Table 4.4**).

Export Cable Route

Construction

As per the Zone. Impacts however may be of lesser magnitude given the relatively smaller scale of the works.

Operation

As per the Zone. Impacts however may be of lesser magnitude given the relatively smaller scale of the works.

Decommissioning

As per the Zone. Impacts however may be of lesser magnitude given the relatively smaller scale of the works.

Cumulative and in-combination impacts

As per the Zone. Impacts however may be of lesser magnitude given the relatively smaller scale of the works.

7.7.3 Methodology and approach to EIA

The Zone – Phase 1

It is proposed that the socio-economic assessment for the EIA will be undertaken through:

- Data collation and literature review in order to provide background information on the existing environment within the study area from sources such the Office for National Statistics (Nomis), the General Register Office for Scotland, Scottish Enterprise and local authorities in Fife, Angus, Dundee and East Lothian.
- The economic impact assessment will be based on the recently published studies analysing the supply chain and the economic impacts of wind farms developments, together with the internal project information and other literature (see **Section 7.7.4**)
- Consultation with key organisations and industry representatives to obtain specific information and data (e.g. local knowledge) and to discuss the potential impacts in relation to their organisations' interests. It is anticipated that the following organisations will be liaised with:

    - Local Authorities;
    - Fishermen's organisations;
    - Port operators;
    - Community councils; and
    - Scottish Renewable Forum.

Export Cable Route

The socio-economic assessment described above would not be exclusive to the offshore wind farm sites and would take account of ECR works and maintenance.

7.7.4 Guidance and Best Practice

Title	Author	Date
UK Offshore Wind: Moving up a gear	BVG Associates	2007
Towards Round 3: Building the Offshore Wind Supply Chain. A review for The Crown Estate on how to improve delivery of UK offshore wind	BVG Associates	2009
Study of the Socio-Economic Impacts of Round 2 Offshore Windfarms on Fishing Activities	DEFRA	Undated
Socio-economic Indicators of Marine-related Activities in the UK economy	Pugh	2008
Scroby Sands – Supply Chain Analysis, a report to Renewables East	Douglas-Westwood and ODE	2005
POWER – Offshore Wind Supply Chain Study for the East of England, a report to Suffolk County Council	Douglas-Westwood	2005
Renewable Supply Chain Study, for the DTI	DTI	2004
Offshore Wind Onshore Jobs – A new Industry for Britain	Greenpeace	2004

Towards Round 3: Building the Offshore Wind Supply Chain. A review for The Crown Estate on how to improve delivery of UK offshore wind	BVG Associates	2009
Socio-economic Indicators of Marine-related Activities in the UK Economy	Crown Estate	2008

7.8 Tourism and Recreation

7.8.1 Existing Environment

Phase 1 supports minimal recreational activity. The most western phase boundary is approximately 25km from the nearest coastline, and approximately 40km from the recognised Royal Yachting Association (RYA) sailing area around the inner Firth of Forth and the Firth of Tay. Two medium-use RYA vessel cruising routes (i.e. popular routes on which some recreational craft will be seen at most times during summer daylight hours) pass approximately north-south through the Phase 1 area. Nearshore cruising routes also intersect the ECR corridor and coastal waters are regularly used for dinghy sailing. There are a number of local sailing clubs and associations, including the Royal Tay Yacht Club (Broughty Ferry) and the Forth Yacht Clubs Association.

Several charted wrecks lie within Phase 1 and the ECR, but their depth exceeds that attained by most recreational divers and the otherwise featureless seabed is not likely to prove attractive.

It may be expected that some recreational sea angling will take place across the Phase 1 area and particularly within the proposed ECR corridor as survey data indicates that waters off the Firths of Forth and Tay are heavily utilised by anglers (Land Use Consultants, 2007).

The coastline where the proposed ECR corridor makes landfall and where the transition pit will be located is used for formal and informal recreational pursuits, both land and water based. Survey data gathered as part of a review of marine and coastal recreation in Scotland, commissioned by SNH (Land Use Consultants, 2007), confirms that popular activities include walking, wildlife and bird watching (e.g. pleasure boat trips run from Arbroath), golf (e.g. Carnoustie golf club), passive beach activities, wild-fowling, horse-riding and camping, sailing, recreational angling, bathing, water and jet skiing (e.g. Tayjet Personal Watercraft Club based out of Dundee), surfing and wind surfing (e.g. Lunan Bay in Angus is recognised as one of the top wind surfing beaches in Scotland), canoeing and motor boating in nearshore waters. A large number of water-based coastal activities are run out of Broughty Ferry, Dundee.

7.8.2 Potential Impacts

The Zone – Phase 1

Construction

During the construction phase of the proposed works there will be increased shipping activities to and from the Phase 1 and proposed ECR corridor area. Due to safety requirements, the development locations will not be accessible to other (non-construction)

vessels during the construction phase. In the case of the temporary working footprints established during Phase 1 of the proposed development works, this may disrupt recreational yachting activity.

Operation

Any impacts are expected to be related to access and navigation for sailing and yachting; once wind farms are operational there may be restrictions in navigation (e.g. Safety Zones around each structure). This may impact the RYA routes passing through Phase 1, though the minimum clearance of the wind turbine blades above highest sea level will be 22m possibly enabling transit of the sites by recreational vessels.

Decommissioning

Impacts on tourism and recreation are expected to be very similar to those outlined during the construction phase. Any restrictions on navigation would be removed following decommissioning.

Cumulative and in-combination impacts

While the development of Phase 1 in isolation is unlikely to result in significant disturbance to other marine users, the wider development of offshore wind farm sites in the Zone and in STW has the potential to have an impact over a wider area and duration. However, given the limited recreational activity in waters further offshore, it is expected that impacts will be restricted to potential disruption of recreational sailing.

Export Cable Route

Construction

Impacts of nearshore ECR works, and landfall and transition pit works will be localised and temporary (duration of the construction phase). The extent of disturbance to tourism and recreation will depend on the final location of the ECR and associated onshore works and timings. It is considered unlikely that construction works will deter visitors.

Operation

No impacts are expected during the operational phase given that the infrastructure will be buried.

Decommissioning

Impacts on tourism and recreation are expected to be very similar to those outlined during the construction phase. Any restrictions on navigation would be removed.

Cumulative and in-combination impacts

It is not expected that any significant cumulative impacts will be associated with the export cable or landfall/transition pit.

7.8.3 Methodology and approach to EIA

The Zone – Phase 1

Potential impacts within Phase 1 of the Zone will be assessed as part of the EIA process and will be informed by a desk-based study that will collate available data relating to tourism and recreation (e.g. visitor numbers and associated spend data available via Visit Scotland, SNH Scottish Recreation Survey), and the outputs from consultation with key organisations and stakeholders (e.g. Visit Scotland, Royal Yachting Association (RYA)). Although a single desk-based study will be produced to cover both the offshore wind farm sites and the ECR, it will reflect the differences in utilisation of offshore waters, coastal waters and the coastline.

Export Cable Route

Potential impacts within the proposed ECR corridor will be assessed as per Phase 1.

Note that Seascape, Landscape and Visual Impact Assessment will take account of impacts on key tourism and recreation receptors.

7.8.4 Guidance and Best Practice

Consultation with stakeholders will be key to the EIA process, and will adhere to the following guidance:

Title	Author	Date
The impact of wind farms on the tourist industry in the UK	BWEA	2006
Tourist attitudes towards wind farms	MORI Scotland	2002
Best Practice Guidelines: Consultation for Offshore Wind Energy Developments	BWEA	2002

7.9 Oil and Gas Activities

A single historical exploratory well (found to be dry, plugged and abandoned in 1985) is present in the north east portion of Zone, within the Phase 1 area (see **Figure 7.6**. No other oil or gas infrastructure is present across the Zone or ECR corridor, and future exploration or production activity is considered unlikely. Geophysical survey planned by Seagreen will confirm ground conditions at the well site. Any issues associated with ground conditions would be addressed at the EIA stage (see **Section 5.1 Physical Environment).**

7.10 Pipelines and Cables

There are no cables or pipelines located within the entirety of Phase 1 or the ECR.

7.11 Dredging and Disposal (including munitions)

7.11.1 Existing Environment

No licensed extraction, dredging or sea disposal activities currently take place within Phase 1 or the ECR. The nearest aggregate extraction sites lie over 20km inshore of the Phase 1 area and approximately 10km from the landfall location, with licences granted in the Tay Estuary and at Middle Bank in the Firth of Forth. No extraction is currently taking place.

Maintenance and capital dredging activity is concentrated in estuarine and coastal waters, at harbours and ports within the Firths. There are several currently licensed sea disposal sites in coastal waters inshore of Phase 1 receiving the material arising from port and harbour dredging activity. Licensed sea disposal sites are located at Montrose, Arbroath, Middle Bank (Tay), Methill, Leith, Granton & Rosyth and Bo'ness.

An historic offshore sewage sludge disposal site is located approximately 10km inshore of the Zone (see **Figure 7.6**). The site was used for disposal between 1978 and 1998. Sediment sampling was regularly undertaken at the disposal site up to cessation of dumping activity, with sample analysis considering metal and organic determinants. Additionally, benthic fauna have also been monitored. Sampling results suggest a mild impact of sludge disposal but show that seabed sediments display no signs of serious organic or heavy metal contamination.

7.11.2 Potential Impacts

The Zone – Phase 1

Construction

Phase 1 is outside any existing marine aggregate extraction or disposal sites and no impacts on these activities are expected during construction.

The potential impacts of the development upon sediment and water quality and the biological environment are addressed in the relevant sections of this Scoping report (**Sections 7.6: Water and Sediment Quality** and **6.3: Marine, Intertidal and Terrestrial Ecology**).

Operation

No impacts during operation are anticipated.

Decommissioning

As per construction impacts.

Cumulative and in-combination impacts

No cumulative impacts on dredging and disposal activity associated with Phase 1 development are anticipated.

Export Cable Route

Construction

Depending upon the final routing of the export cable in nearshore waters, it may run close to a sea disposal site (e.g. Arbroath). However, this would be considered at the design stage of the project. If this is the case it is likely that any disposal activity will be prohibited during construction for safety reasons. Installation activity may also interrupt the movement of dredge disposal vessels. However, this would be considered at the design stage and avoided where possible.

Operation

As per construction impact.

Decommissioning

As per construction impacts.

Cumulative and in-combination impacts

Cumulative impacts on dredging and disposal activity are not anticipated.

7.11.3 Methodology and approach to EIA

The Zone – Phase 1

In is not considered likely that EIA works associated with the development of Phase 1 will need to consider dredging and disposal activity.

Export Cable Route

Seagreen will consult with active and potential operators (Forth Ports) and regulatory bodies (Marine Scotland) to determine the current status of extraction and disposal sites and the potential for any impacts on these activities to arise as a result of development.

7.11.4 Guidance and Best Practice

None identified.

7.12 Traffic and Access

7.12.1 Existing Environment

Access along the coastline from Arbroath to Carnoustie is attained via the A92 from Arbroath to the north and via the A930 from Carnoustie to the south. The A92 runs parallel to the coastline south of Arbroath prior to turning inland at Wormiehills approximately 4km south of Arbroath. Access via the A930 from Carnoustie is attained along an unclassified coastal road which turns landward at East Haven prior to joining the A90 between Salmond's Muir and Muirdrum.

The Carnoustie to Arbroath railway line parallels the coastal slope, maintaining proximity of ±300m for the duration of its length. Access is prohibited to the west of the railway line in the area of the Arbroath Artisan Golf Club, while the coastal fringe is dissected by a range of footpaths which cross the dunes and dune heathland between East Haven and Wormiehills.

7.12.2 Potential Impacts

The Zone – Phase 1

Construction

Given the scale of the proposed development within the Phase 1 area there are likely to be some transport impacts during construction of the wind farm, although these are anticipated to be predominantly associated with marine traffic and hence assessed therein (see **Section 7.2: Shipping and Navigation**). Traffic will increase as a result of the transportation of equipment and materials to the chosen port facility, during the construction of the offshore elements. There will be HGV movements associated with the construction phase of works particularly the peak movements related to any continuous input of construction materials. However, it is envisaged that large construction plant and machinery shall access the offshore temporary working footprint via the sea.

Operation

Traffic and access impacts during the operation phase are expected to be limited to terrestrial access. Offshore access will be assessed under Shipping and Navigation (see **Section 7.2**) and Tourism and Recreation (see **Section 7.8**) respectively. Any impacts are expected to be related to access for walkers once the transition pit is operational as there may be restrictions (e.g. Safety Zones around each structure).

Decommissioning

Impacts on traffic and access are expected to be very similar to those outlined during the construction phase.

Cumulative and in-combination impacts

It is not expected that any significant cumulative impacts will be associated with the ECR or landfall/transition pit due to the relatively remote location and the single landfall location for the Zone and STW developers within this location.

There are a number of other wind farm projects and proposals that could result in increased traffic flows in the wider Phase 1 area of the proposed development. These include the construction of Neart na Gaothie and Inch Cape wind farms. The timelines of all these projects will need to be carefully considered to determine cumulative traffic impacts.

Export Cable Route

Construction

The construction of the landfall infrastructure (transition pit) shall require access to the coastal frontage between Arbroath and Carnoustie which may result in short-term increases in land based traffic and associated increased noise, vibration and dust from machinery entering and leaving the construction site. A preferred access route will be identified and assessed, and traffic management measures proposed to minimise traffic impacts on the main public roads during construction. Traffic will increase as a result of the transportation of equipment and materials to the development site, during the construction of the onshore elements. There will be HGV movements associated with the construction phase of works particularly the peak movements related to any continuous concrete pours.

Increased traffic flows during the construction phase are likely to require further consideration of the following areas (in accordance with the IEMA guidelines):

- Noise and air quality;
- Highway safety;
- Driver delay; and
- Pedestrian amenity/delay and severance.

Operation

The cable route will not require a permanent staff presence. Operational staff will be limited to periodic maintenance activity. As such, there are not expected to be any significant operational traffic impacts. During the operational phase, access restrictions would be applied to the electrical infrastructure for safety reasons.

Decommissioning

The impacts associated with decommissioning of the ECR and landfall transition pit infrastructure are expected to be very similar to those arising during the construction phase. It is not anticipated that any of the impacts described previously would result in either significant changes from prevailing conditions or significant impacts upon other parameters.

Cumulative and in-combination impacts

As per the Zone – Phase 1

7.12.3 Methodology and approach to EIA

A Traffic Impact Assessment (TIA) will be undertaken as part of the EIA. The assessment will be made of the impact of the works on traffic and access to quantify the amount of traffic that will be generated by the scheme. It is envisaged that the main impact will take place during the construction phase as outlined above. The most important information to obtain for the purposes of establishing the baseline environment will include:

- The numbers and sizes of vehicles that will be required;
- The times of day and year that they will be travelling;

- The route that they will take into and out of the site;
- The road surface texture, speed and gradient, in order to identify noise and emissions; and
- The existing usage of the relevant road system and its capacity.

This assessment will identify whether the construction traffic would affect traffic flow significantly, this will be undertaken by ascertaining the capacity of the road network and calculating the likely affect on flow of the additional traffic. If a potentially significant impact was identified appropriate mitigation would be discussed with Angus Council.

Consultation will be carried out with Angus Council and Traffic Scotland throughout the EIA process in order to discuss the proposed route and site planning issues which need to be taken into account.

7.12.4 Guidance and Best Practice

Title	Author	Date
Guidelines for the Environmental Assessment of Road Traffic	IEMA	1992
The Design Manual for Roads and Bridges. Volume 11 – Environmental Assessment	Department for Transport	1992
The Institute of Highways and Transportation (IHT) Guidelines for Traffic Impact Assessment	Department for Transport	2007
Guide to traffic assessment in Scotland	Scottish Executive	2005

7.13 Airborne Noise and Vibration

7.13.1 Existing Environment

The setting of the proposed development is predominantly offshore. The proposed landfall and transition pit works scoping area are situated within a relatively undeveloped coastal corridor. The main noise sensitive receptors are therefore anticipated to be residential properties close to the proposed development area. It is anticipated that ambient noise levels in the area are relatively low. Existing ground-borne vibration may be present alongside the main A90 road to the town centre of Arbroath, associated with movements of heavy vehicles.

Noise sensitive receptors potentially affected by the proposed development are listed below:

- Residential properties close to or overlooking the proposed development area;
- Residential properties close to or overlooking the proposed ECR and landfall development area;
- Residential and other noise / vibration sensitive properties close to public roads affected by increased construction-related HGV movements; and
- Residential and other noise / vibration sensitive properties affected by increases of 25% or decreases of 20%, in total traffic flows, arising from the operation of the development.

7.13.2 Potential Impacts

This section deals solely with the impacts of airborne noise. Underwater noise impacts are addressed with the respective sections of the Scoping Report upon which underwater noise impacts manifest (e.g. Marine Mammals and Fisheries).

The Zone – Phase 1

Construction

Due to the distance of the Zone to the nearest environmental noise receptors (>25km) the impacts of airborne noise are anticipated to be minor.

Operation

As with construction issues, as a consequence of the distance of the Zone to the nearest environmental airborne noise receptors (>25km) the impacts of noise during the operational phase of the proposed works are anticipated to be negligible.

Decommissioning

The impacts associated with decommissioning of the Phase 1 wind farms are expected to be very similar to those arising during the construction phase. It is not anticipated that any of the impacts described previously would result in either significant changes from prevailing conditions or significant impacts upon other parameters.

Cumulative and in-combination impacts

There are a number of other wind farm projects and proposals that could result in increased traffic flows in the wider area of the proposed Phase 1 area. These include the construction of Neart na Gaothie and Inch Cape wind farms. The timelines of all these projects will need to be carefully considered to determine cumulative traffic impacts of noise and vibration upon sensitive receptors.

Export Cable Route

Construction

The main sources of noise during construction will be associated with construction traffic and specific construction activities.

Operation

No impacts during operation are anticipated.

Decommissioning

The impacts associated with decommissioning of the ECR are expected to be very similar to those arising during the construction phase. It is not anticipated that any of the impacts described previously would result in either significant changes from prevailing conditions or significant impacts upon other parameters.

Cumulative and in-combination impacts

It is not expected that any significant cumulative impacts will be associated with the ECR or landfall/transition pit due to the relatively remote location and the single landfall location.

7.13.3 Methodology and Approach to EIA

Potential temporary noise issues associated with landfall construction works will be discussed with Angus Council's Environmental Health Department, though it is not anticipated that any noise survey or assessment will be required as part of EIA. Due to the distance of the proposed wind farms offshore, it is not proposed to complete an operational noise assessment.

7.13.4 Guidance and Best Practice

Title	Author	Date
BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites	British Standard	2009
Environmental Impact Assessment (Scotland) Amended Regulations 2006 (No 614) – Part III Roads	OPSI	2006
PAN 56: Planning and Noise	Scottish Government	1999

7.14 Air Quality

7.14.1 Existing Environment

The Environment Act 1995 and subsequent regulations require local authorities to conduct a Review and Assessment of air quality in their area to assess compliance with the standards and objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2000. For local authorities within Scotland further regulations are set out in the Air Quality (Scotland) Regulations 2000 (OPSI, 2000) and Air Quality (Scotland) Amendment Regulations 2002 (OPSI, 2002).

Angus Council currently monitors CO, SO_2, NO_2 and PM_{10} throughout the Council area. The monitoring network includes automatic analysers and passive diffusion tubes (Angus Council, 2009). The current monitoring sites are located as follows:

- four NO_2 diffusion tube sites in Arbroath;
- three NO_2 diffusion tube sites in Brechin;
- NO_2 diffusion tube site in Montrose;
- NO_2 diffusion tube site in Monifieth;
- NO_2 diffusion tube site in Forfar;
- NO_2 diffusion tube site in Carnoustie;
- NO_2 diffusion tube site in Kirriemuir;
- gravimetric PM_{10} partisol analyser site in Carnoustie;
- gravimetric PM_{10} partisol analyser site in Ferryden, By Montrose; and
- mobile automatic unit (groundhog) including CO, SO_2, NO_2 and PM_{10} analysers.

Ongoing monitoring and assessment indicates that Air Quality Standard (AQS) objectives in Angus are not being exceeded. Angus Council has not declared any Air Quality Management Areas (AQMAs).

While increases in traffic may result in increases in both NO_2 and PM_{10}, an air quality data analysis exercise has been undertaken to inform this report. The analysis concludes that there was no significant relationship between NO_2 and PM_{10} concentrations at sites assessed by Angus Council (2009) and therefore road traffic emissions were not the dominant contributor to PM_{10} concentrations at Carnoustie, within the ECR scoping area.

7.14.2 Potential Impacts

The Zone – Phase 1

Construction

The main sources of emissions (dust and particulates) during construction will be associated with construction traffic and specific construction activities. It is anticipated that these shall be of temporary duration and of limited spatial extent.

Operation

There are no operational impacts associated with the scheme as it will not lead to a significant change in vehicle flows to and from the site, or introduce any new emission sources, apart from those associated with maintenance activities. Such activities are not anticipated to raise traffic and hence emission levels above the natural background variation.

On a wider national and global scale, the proposed Phase 1 wind farms would contribute positively to improved air quality over its operational life and, through reductions in carbon dioxide and other emissions, to global climate change. Renewable energy, in association with energy efficiency and energy reduction, are the primary means by which the Government seeks to meet its national air quality and climate change objectives. Electric generation from offshore wind generates no emissions to air; therefore local and regional air quality will not be adversely affected during operation.

Decommissioning

The impacts on traffic during decommissioning are anticipated to be similar to those discussed during construction of the wind farm.

Cumulative and in-combination impacts

There are a number of other wind farm projects and proposals that could result in increased traffic flows in the wider area of the proposed Phase 1 area. These potentially include the construction of Neart na Gaothie, Inch Cape and Forth Array wind farms. The timelines of all these projects will need to be carefully considered to determine cumulative traffic impacts.

Export Cable Route

Construction

Construction dust emissions have the potential to cause nuisance at nearby receptors, such as residential properties, by causing soiling of surfaces.

Construction is expected to take place for a period of up to 1 year, however, as the location of dust generating activities will move as the onshore cable is laid down, the duration of such activities at any one location along the route is anticipated to be relatively short. Therefore, given the existing good air quality in the area and the expected transient nature of the construction phase along the cable route, it is considered that the application of best practice mitigation measures for the control of dust released from the construction site will be appropriate.

Seagreen will implement best practice dust mitigation measures at the time of construction.

Operation

As per the Zone Phase 1.

Decommissioning

The impacts associated with decommissioning of the Export Cable Route are expected to be very similar to those arising during the construction phase. It is not anticipated that any of the impacts described previously would result in either significant changes from prevailing conditions or significant impacts upon other parameters.

Cumulative and in-combination impacts

It is not expected that any significant cumulative impacts will be associated with the ECR or landfall/transition pit due to the relatively remote location and the single landfall location for R3 and STW developers within this location.

7.14.3 Methodology and approach to EIA

The methodology and approach to assessment of dust and air quality, if required, will be established and agreed with the relevant regulator and statutory consultees. The 2010 updated guidance, 'Development Control: Planning for Air Quality' (Environmental Protection UK, 2010) states that professional judgment is required when deciding whether an air quality assessment is necessary, but also provides some criteria to help establish when one is likely to be considered necessary, including:

- "Proposals giving rise to a significant change in traffic volumes…a change in annual average daily traffic (AADT) of greater than +/- 10% outside of an AQMA) on roads with more than 10,000 AADT (5,000 if 'narrow and congested');
- Proposals that would significantly alter the traffic composition on local roads, for instance, increase the number of heavy duty vehicles (HDVs) by 200 movements or more per day; and
- Large, long-term construction sites that would generate large HDV flows (>200 movements per day) over a period of a year or more."

Any potential increase in traffic due to the construction of the landfall transition pit will be of temporary duration with traffic accessing the site via the main A90.

Given the existing air quality in the area at and surrounding the offshore wind farm development area (Phase 1) and the relatively low, short-term predicted impacts, it is proposed that air quality is not specifically assessed in the Environmental Statements.

7.14.4 Guidance and Best Practice

Title	Author	Date
Development Control: Planning for Air Quality	Environmental Protection UK	2010

8.0 CONCLUSION

The information in this study has been provided to support Seagreen's formal request for a Scoping opinion in relation to the potential impacts of the proposed wind farm development in Phase 1 and the associated ECR.

Seagreen believes that knowledge of the impacts associated with the construction, operation and decommissioning of offshore wind farms and associated infrastructure has progressed throughout both Round 1 and Round 2. It is noted that the Seagreen Phase 1 developments will be among the first offshore (greater than 12nm) wind farm projects to go through EIA in Scotland.

A summary of the potential impacts described in this report are showing in the tables below. **Table 8.1** relates to Phase 1, and **Table 8.2** relates to the ECR. There are a number of areas which it is considered can be "scoped out" of detailed consideration, including air quality, airborne noise and vibration, oil and gas, pipelines and cables and dredging and disposal.

Scottish Ministers and relevant consultees are specifically asked to confirm that the areas shaded green in these tables can be "scoped out" of the EIA, for the reasons specified the relevant topic sections.

Table 8.1 High-level assessment of the impacts (before mitigation) associated with the key environmental parameters (Phase 1)

Parameter	During Construction	Operation	De-commissioning	Cumulative
Physical processes				
Ornithology				
Marine ecology				
Fish and shellfish resources				
Marine mammals				
Commercial fisheries				
Shipping/Navigation				
Seascape, landscape and visual character				
Archaeology and cultural heritage				
Military and civil aviation				
Military exercise areas				
Water and sediment quality				
Socio-economics				
Oil and gas				
Pipelines and cables				
Dredging and disposal				
Tourism and recreation				
Traffic and access				
Airborne noise and vibration				
Air quality				

Potentially significant impacts (before mitigation). Parameter must be included in the EIA.

No significant impacts. Further work required through the EIA in order to confirm.

No significant impacts. Impact not believed to require detailed individual investigation as part of the EIA subject to formal Scoping response.

Table 8.2 High-level assessment of the impacts (before mitigation) associated with the key environmental parameters (ECR)

Parameter	During Construction	Operation	De-commissioning	Cumulative
Physical processes				
Ornithology				
Marine, intertidal and terrestrial ecology				
Fish and shellfish resources				
Marine mammals				
Commercial fisheries				
Shipping/Navigation				
Seascape, landscape and visual character				
Archaeology and cultural heritage				
Military and civil aviation				
Military exercise areas				
Water and sediment quality				
Socio-economics				
Oil and gas				
Pipelines and cables				
Dredging and disposal				
Tourism and recreation				
Traffic and access				
Airborne noise and vibration				
Air quality				

Potentially significant impacts (before mitigation). Parameter must be included in the EIA.

No significant impacts. Further work required through the EIA in order to confirm.

No significant impacts. Impact not believed to require detailed individual investigation as part of the EIA subject to formal Scoping response.

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Appendix A

Table A.1 Authorities, groups and organisations to be consulted at initial Scoping stage.

Scoping Consultee List
Anglo Scottish Fishermen's Association
Angus Council
Arbroath & District Static Gear Association
Arbroath Harbour Master
Associated British Ports
Association of District Salmon Fisheries Boards
Atlantic Salmon Trust
BAA Airports Limited
British Marine Aggregate Producer's Association
British Sub Aqua Club
British Trust for Ornithology
BT Network Radio Protection
Centre for Environment, Fisheries and Aquaculture Science
Chamber of Shipping
Civil Aviation Authority
Cockenzie & Port Seton Fishermen's Association
Defence Estates
Department for Energy and Climate Change
Dundee City Council
East Lothian Council
Fife Coast and Countryside Trust
Fife Council
Fife Creel Fishermen's Association
Fife Fishermen's Association
Fisheries Committee
Forth Estuary Forum
Forth Estuary Transport Authority
Forth Ports
Greenpeace
Health & Safety Executive
Highlands and Islands Airports
Highland & Islands Enterprise
Historic Scotland
International Cable Protection Committee
Joint Nature Conservation Committee
Joint Nautical Archaeology Policy Committee
Joint Radio Company
Malliag & North West Fishermen's Association
Marine Conservation Society
Marine Management Organisation
Marine Safety Forum
Marine Scotland

Scoping Consultee List
Marine Scotland Compliance
Marine Scotland Science
Maritime and Coastguard Agency
Montrose Harbour Master
National Air Traffic Services
National Coast Watch Institution
National Federation of Fishermen's Organisations
National Grid
Natural England
Nautical Archaeological Society
Network Rail
Northern Lighthouse Board
OFCOM
OFGEM
Royal Commission of Ancient & Historic Monuments of Scotland
Royal National Lifeboat Institution
Royal Society for the Protection of Birds
Royal Yachting Association
Salmon & Trout Association
Salmon Net Fishing Association
Scallop Association
Scottish Anglers National Association Limited
Scottish Canoe Association
Scottish Coastal Forum
Scottish Enterprise
Scottish Environment Link
Scottish Environment Protection Agency
Scottish Fishermen's Federation
Scottish Fishermen's Organisation
Scottish Government Energy Consents Unit
Scottish Natural Heritage (SNH)
Scottish Static Gear Association
Scottish Surfing Federation
Scottish Tourist Board (Visit Scotland)
Scottish Trust for Underwater Archaeology
Scottish Water
Scottish White Fish Producers Association
Scottish Wildlife Trust
Sea Trout Group
Sea Mammal Research Unit
South East Scotland Inshore Fisheries Group
Tay Estuary Forum
Tayside Biodiversity Partnership
The Crown Estate
The Cruising Association

Scoping Consultee List
The National Trust for Scotland
Transport Scotland
UK Oil & Gas
United Kingdom Maritime Pilot's Association
Whale & Dolphin Conservation Society