Galloper Wind Farm Project

Scoping Study

SSE Renewables Developments UK Ltd & RWE Npower Renewables Ltd

June 2010

Final Report

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ROYAL HASKONING

SSE Renewables

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Drafted by	Peter Gaches, Jon Allen *et al*	
Checked by	Rob Staniland	
Date/initials check	RS…….	07.04.2010……
Approved by	Dr. Martin Budd (Royal Haskoning)	
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Approved by	Kate Tibble (Galloper Wind Farm - Project Manager)	
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Approved by	Jamie May (Galloper Wind Farm - Development Manager)	
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1 INTRODUCTION

1.1 Background

1.1.1 In July 2009, The Crown Estate announced that it would be running a tender round for developers to apply for extensions to existing Round 1 and 2 offshore wind farm sites. This 'Extensions Round', known as 'Round 2.5', was devised to plug a perceived supply chain gap between the completion of Round 2 wind farms and the start of construction of Round 3 projects.

1.1.2 SSE Renewables Developments UK Ltd (SSER) and RWE Npower Renewables Ltd (NRL) have been awarded the rights to develop an offshore wind farm in the Outer Thames Strategy Area (SEA) by The Crown Estate under Round 2.5 of the Offshore Wind Licensing Arrangements. This is subject to SSER and NRL being successful in gaining the necessary consents for the construction and operation of the wind farm.

1.1.3 The location of the proposed site, known as **Galloper Wind Farm (GWF)**, is shown in **Figures 1.1, 1.2** and **1.3**.

1.1.4 This document comprises the EIA Scoping Study submitted by SSER and NRL to the Infrastructure Planning Commission (IPC) for the proposed GWF project. The Scoping Report, undertaken by Royal Haskoning, serves as a request for a formal 'Scoping Opinion' under Section 8(1) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 detailing the proposed approach to the studies that will form the work requirements for the EIA and eventual production of a formal Environmental Statement (ES) for the GWF project.

1.1.5 SSER and NRL propose to submit applications for the necessary consent for the proposed GWF project in late 2010.

1.1.6 The Round 2 development around which the proposed GWF project is based is known as the Greater Gabbard Offshore Wind Farm (GGOWF). This 500MW_e project comprises an offshore wind farm, export cabling to a landfall on the Suffolk coast at Sizewell and onshore infrastructure (including a substation) to connect the project to the national grid network.

1.1.7 The GGOWF was awarded consent for development in 2007, following the submission of an Environmental Statement (ES) in 2006. GGOWF construction commenced in June 2009 and is due to be completed in 2012. Once complete, GGOWF will comprise of 140 Siemens 3.6MW_e wind turbine generators (WTG).

1.1.8 The GGOWF is owned by Greater Gabbard Offshore Winds Limited (GGOWL), a 50/50 Joint Venture between SSER and NRL.

1.2 The development consortia

1.2.1 This joint venture between two of Europe's leading offshore wind developers builds on the existing successful partnership between SSER and NRL on the adjacent Round 2 GGOWF project.

1.2.2 **SSER** (formerly known as Airtricity) is responsible for the development and construction of SSE's (formerly Scottish and Southern Energy) renewable energy projects across the UK, Ireland and Continental Europe. SSE is the UK's leading generator of renewable energy with over 2,200 Megawatt (MW_e) of renewable electricity generation capacity and is the second largest generator in the UK with a total electricity generation capacity of 11,500MW_e.

1.2.3 **NRL** is the UK subsidiary of RWE Innogy and already operates the North Hoyle (60 MW_e) and Rhyl Flats (90 MW_e) offshore wind farms in North Wales. The company is also planning construction of the consented Gwynt y Môr wind farm (576 MW_e), which is likewise situated off the north coast of Wales. A number of additional major projects, including Triton Knoll (1,200 MW_e) and Atlantic Array (1,500 MW_e), are currently in development. RWE Innogy is also progressing a number of offshore wind farms on the continent and is currently planning construction of the Nordsee Ost wind farm (295 MW_e), with further development planned for the Innogy Nordsee 1 project (approx. 1,000 MW_e). Overall, RWE Innogy operates renewable power plants with a total rated capacity of 2,200 MW_e and invests approximately 1.4 billion Euros a year in the expansion of renewable energy within Europe.

Figure 1.1: GWF project overview – Offshore components

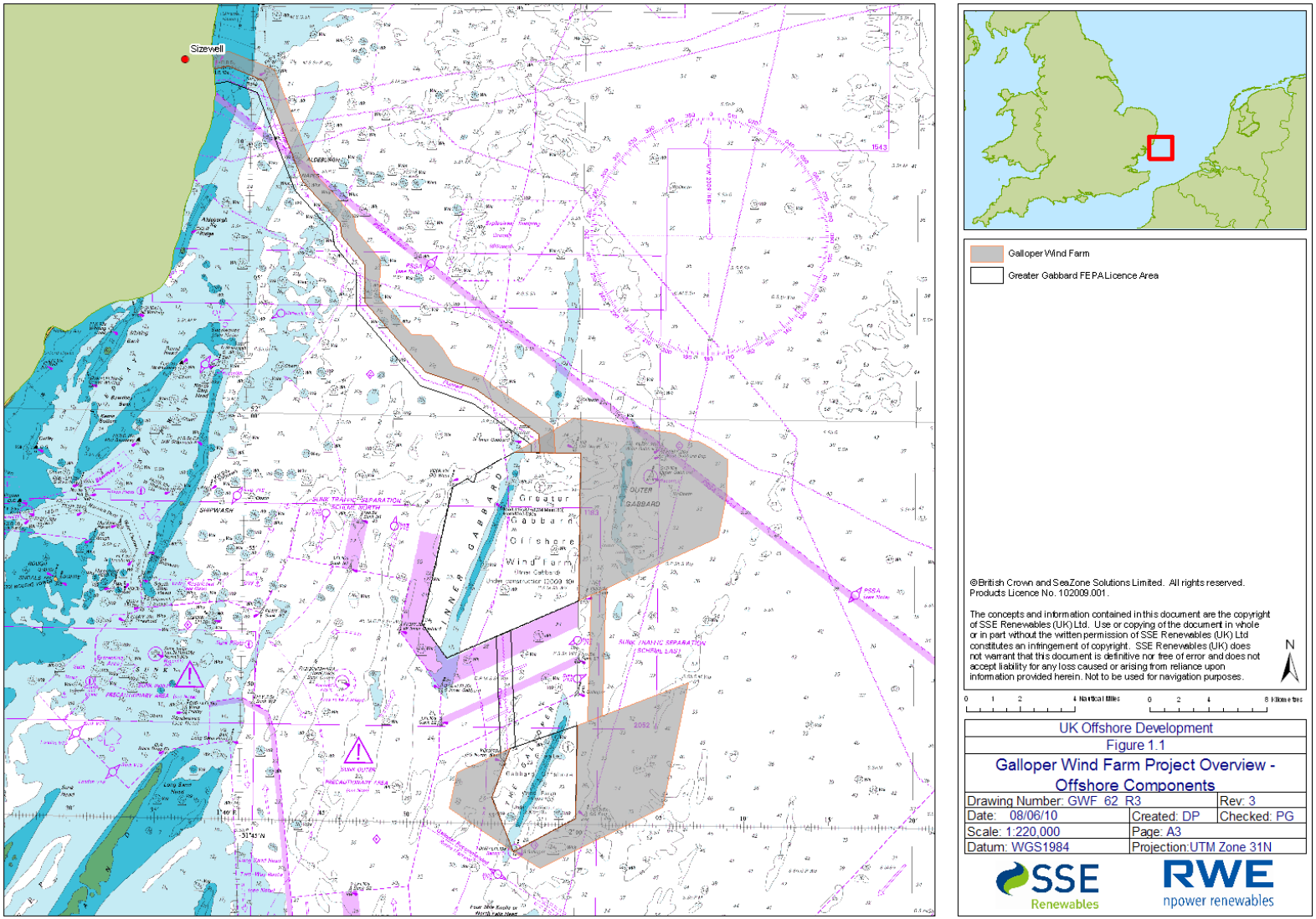


Figure 1.2: Onshore substation – areas of potential development interest

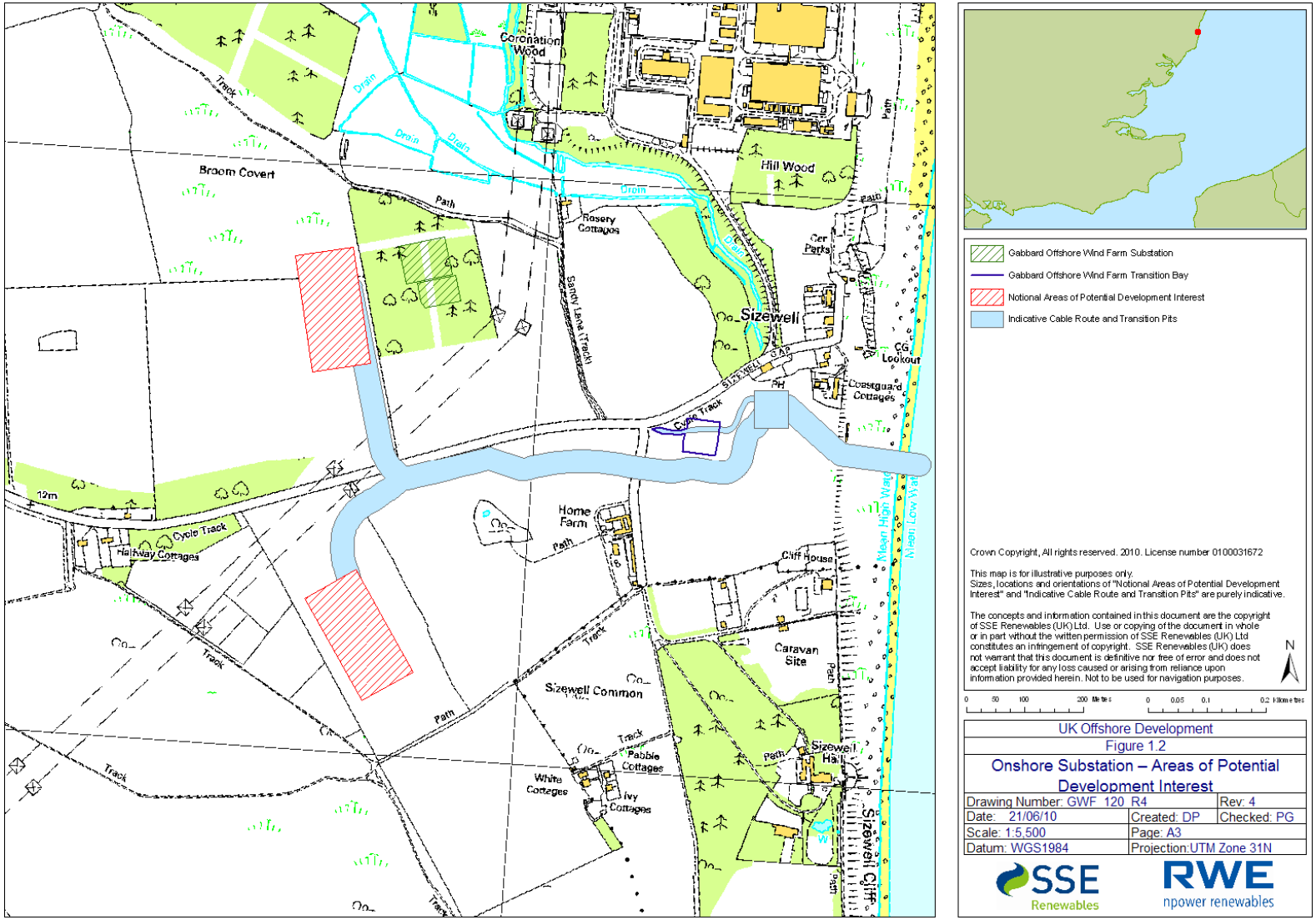
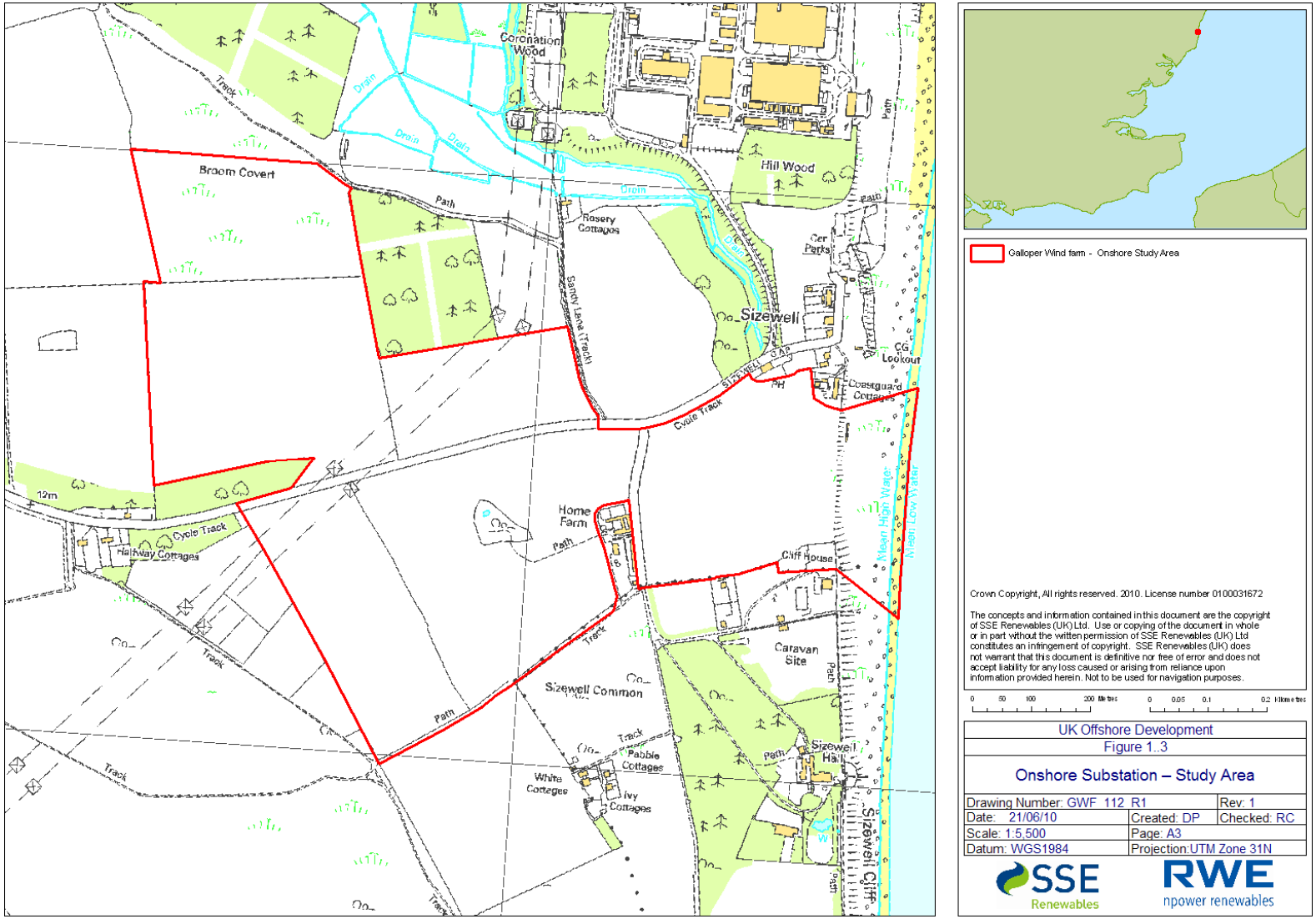


Figure 1.3: Onshore substation – onshore study area



1.3 The Scoping Study

Study aims

1.3.1 The following Scoping Study presents the information supporting SSER and NRL's request for a formal 'Scoping Opinion' from the Infrastructure Planning Commission (IPC).

1.3.2 The scoping of likely environmental impacts is one of the first stages in the Environmental Impact Assessment (EIA) process, and is fundamental to ensuring that the investigative and assessment work that is subsequently undertaken is focussed and detailed enough to ensure that likely impacts are avoided, removed or minimised where at all possible.

1.3.3 This study describes the key issues that SSER and NRL have identified as being relevant to the construction and operation of the GWF project. It also sets out the anticipated work and consultation requirements for the Environmental Impact Assessment (EIA) and eventual production of both the Preliminary Environmental Information (PEI) and the Environmental Statement (ES) documents that will support the formal consent application for the project. It is anticipated that SSER and NRL will submit their consent application for the GWF project in late 2010. The aim of the Scoping Study is to provide sufficient information to enable the IPC (through consultation with relevant stakeholders) to provide an informed 'Scoping Opinion' on the proposed approach to the GWF EIA.

Study approach

1.3.4 This Scoping Study provides an overview of the GWF project and a summary of the baseline environment of the proposed GWF, its offshore connection cable and proposed onshore requirements (and surrounding environs, where appropriate). It also sets out SSER and NRL's current understanding of the key environmental impacts that may arise as a result of the construction, operation and eventual decommissioning of the project. Finally, and importantly, it then identifies the proposed approach by SSER and NRL to the undertaking of specific studies to enable a robust EIA to be carried out for the proposed GWF project.

1.3.5 The environmental parameters considered within this study are:

- Bathymetry and Hydrodynamics;
- Geology and Geomorphology;
- Geology, Water Resource and Land Quality;
- Nature Conservation Designations;
- Ornithology;
- Marine Ecology;
- Fish and Shellfish Resources;
- Marine Mammals;
- Terrestrial Ecology;
- Commercial Fisheries;
- Landscape, Seascape and Visual Resource;
- Shipping and Navigation;
- Archaeology;
- Military and Aviation Radar;
- Other Human Activities;
- Socio-economics;
- Coastal Tourism and Recreation;
- Traffic and Access;
- Air Quality;
- Noise;
- Flood Risk and Climate Change; and
- Information for Appropriate Assessment.

1.3.6 The identification of potentially significant impacts is based upon an understanding of the environmental conditions likely to be encountered at the site and the lessons learned during the development of other Round 1 and Round 2 sites, as well as other European projects, where relevant. Key to informing the GWF EIA will be the experience and lessons learnt from the GGOWF project, which shares many developmental and environmental similarities. Where significant impacts are not anticipated to arise during the construction, operation or decommissioning phase of the development (based on detailed knowledge of the issue through GGOWF and more recent consultation), SSER and NRL feels that the parameters concerned should be 'scoped out'. All 'scoped out' parameters will still be included and addressed within the ES, however, it is not expected that such parameters will require original research and data collection, and will only be commented on in brief. Knowledge gained from the development of the GGOWF project has greatly informed this Scoping Study.

1.3.7 SSER and NRL have undertaken consultation on the proposed GWF project with the Regulatory Authorities and key stakeholders. These consultations have helped to inform this Scoping Study and the outcome is captured within the relevant parameter sections. Further detail on this is provided in **Section 3**.

1.4 Need for the project

1.4.1 The draft Overarching National Policy Statement (NPS) for Energy (EN-1) outlines the Government's assessment on the need for new energy production and concluded that there is a significant need for major energy generation infrastructure. It was further identified that this will have to be met by projects coming through quickly given that developments such as nuclear power stations have very long lead in times (DECC 2009a).

1.4.2 The key drivers for additional energy infrastructure have been indentified: the need to replace existing capacity that will close; the need to move to a low carbon generation mix; the need to ensure security of supply, and ability to meet changes in demand (DECC, 2009a).

1.4.3 Renewable energy is central to the government's objectives to secure diverse energy supply and to reduce carbon dioxide emissions by 60% by 2050. In March 2007, the European Council agreed a binding target for 20% of overall EU energy consumption to be fed by renewable energies by 2020. With the UK Government's target being to achieve 15% of the UK's electricity being supplied from renewable sources by 2020. While many of the 27 current EU member states do not have sufficient resources to significantly contribute, the UK has a major role to play in meeting these targets as it has (amongst other sources) approximately 33% of the total EU wind resource (Risø National Laboratory 1989).

1.4.4 The need for offshore wind farm development is underpinned within the draft NPS for Renewable Energy Infrastructure (EN-3) and the draft Overarching NPS for Energy (EN-1). The commitment by the Government to extensions of existing offshore wind farms in assisting to achieve the UKs carbon reduction targets is set out in Section 2.6.16 of NPS (EN-3) where it is stated that:

"…the Government has decided that, in line with Recommendation 6 of the Post Consultation Report (PCR), there is potential for capacity extensions to existing wind farm leases within UK waters.." (DECC, 2006b).

1.4.5 Round 2.5 of the Offshore Wind Licencing Arrangements has a key role to play in meeting the binding 2020 target. SSER and NRL have undertaken extensive work (in terms of data collection) on the GWF site and are confident that this project will be able to directly contribute to these early targets.

1.5 Consenting regime and EIA approach

1.5.1 The Planning Act 2008 (The Act), which received Royal Assent on 26 November 2008 seeks to provide for a streamlined and front-loaded development consent system for major energy infrastructure projects, amongst others. The Act makes provision for the creation of a new independent body, the IPC, which will examine applications for development consent for a nationally significant infrastructure projects (NSIPs). The IPC are currently able to provide promoters with EIA screening and scoping opinions.

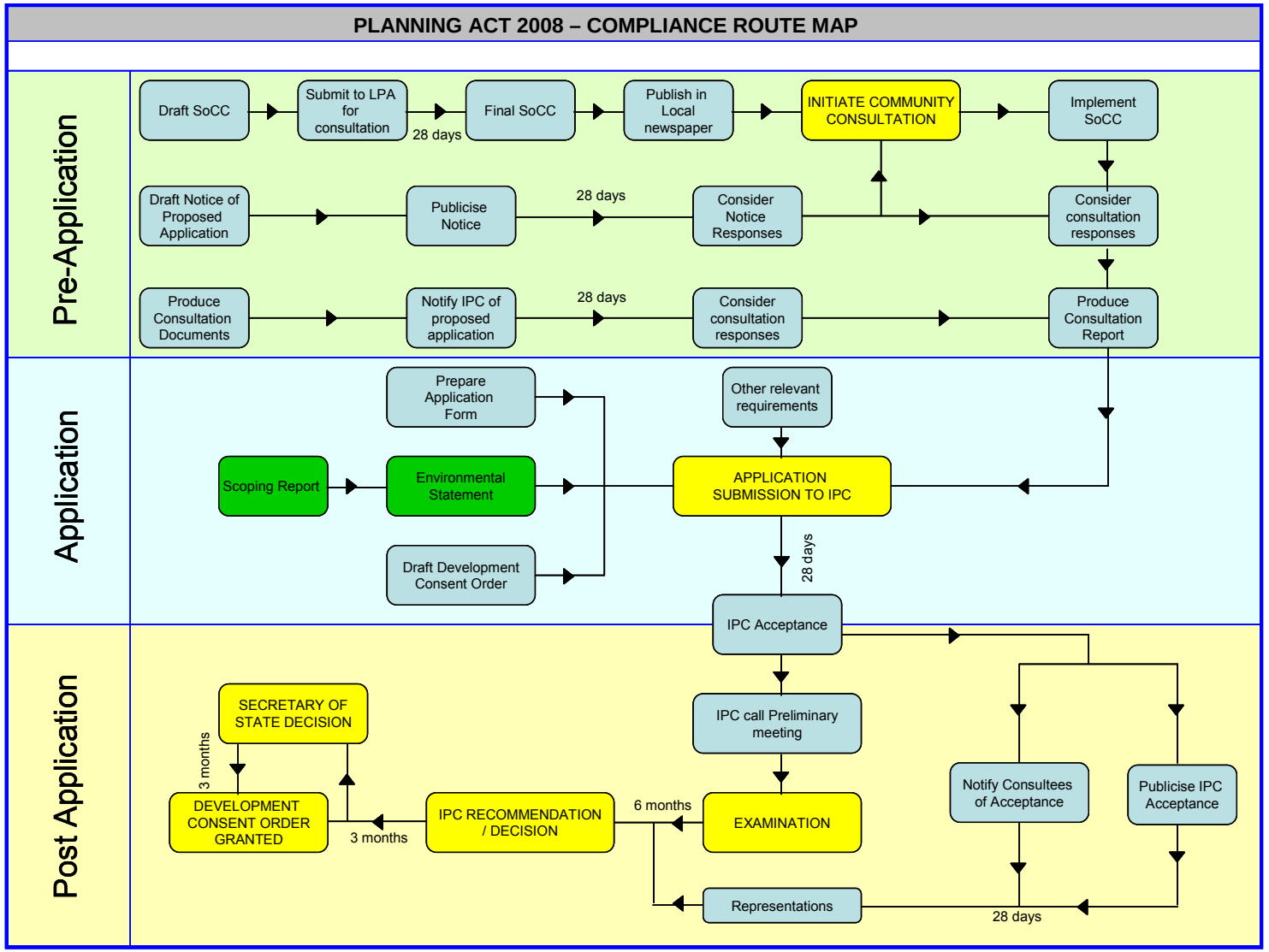
1.5.2 Under the Act, all new offshore renewable energy generation stations over 100 MW_e are classed as an NSIP and, as such, will be consented through the IPC. A single consent (known as the Development Consent Order) is sought from the IPC, which replaces the previous requirement for consent to be sought under Section 36 of the Electricity Act (1989), Section 90 of the Town and Country Planning Act (1990), Section 5 of the Food and Environment Protection Act (FEPA) (1980) and Section 34 of the Coast Protection Act (CPA), (1949) (the latter two of which have recently been consolidated into a Marine Licence under the Marine and Coastal Access Act 2009)

1.5.3 The GWF project was introduced and logged with the IPC on the 11th May 2010, following site award and it is anticipated that formal consent documents will be submitted in late 2010.

1.5.4 This Scoping Study focuses on the work that will be undertaken to inform the EIA for the proposed GWF project. Alongside these studies SSER and NRL are undertaking a number of additional work programmes associated with the new planning regime. They are largely associated with the requirement for consultation under Sections 42 and 47 of The Act. This consultation will form an iterative process with the EIA to ensure that any concerns raised are considered within the ES and is detailed further in **Section 3**.

1.5.5 **Figure 1.4** sets out SSER and NRL's understanding of the consenting requirements under The Planning Act 2008.

Figure 1.4 Consenting steps under The Planning Act 2008



1.5.6 An Environmental Statement (ES), the report documenting the EIA process, will be prepared in accordance with The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (2009/2263). Furthermore, the EIA will take into account the relevant guidance, namely:

- The Planning Act 2008 guidance documentation on consenting a project under the new planning regime;
- Centre of Environment, Fisheries and Aquaculture Science (Cefas) guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements (2005); and
- Nature conservation guidance on offshore wind farm development (Defra, 2005).

1.5.7 It will also be undertaken with due regard to The Conservation of Habitats and Species Regulations 2010 and The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010.

1.5.8 The nature of offshore wind farm development is such that at the EIA stage it is not always possible to provided definitive information on certain engineering aspects. This may be as a result of a lack of detailed site knowledge, or uncertainty in the market place with regard to wind farm components. Therefore for a certain aspect (be it a specific component or construction methodology) there may be a number of options under consideration. Within the EIA this is dealt with through employing the 'Rochdale envelope' principal (Case law (i.e. R.V. Rochdale MBC Ex. Part C Tew 1999 - "the Rochdale case")). This principal relates to assessing the realistic 'worst case scenario' where multiple options exist for an aspect. This approach is a well established practice within the offshore wind farm consenting industry and allows for the developer to maintain the necessary level of flexibility at that stage, whilst ensuring that the assessment made within the EIA is reflective of the worst level of impact under any development scenario. **Table 1.1** provides some examples of how the Rochdale envelope would be implemented within the EIA.

Table 1.1 Rochdale envelope examples

EIA parameter	Aspect	Development scenarios	Worst case scenario assessed
Benthic communities	Foundation type	1. Gravity base 2. Monopile 3. Jacket	Gravity base; as the footprint (direct impact on benthos) will be greatest from this option.
Marine mammals	Foundation type	1. Gravity base 2. Monopile 3. Jacket	Monopile; as the installation technique will result in the greatest level of disturbance.

1.5.9 The ES will form part of the wider submissions required under the IPC in order to secure granting of the Development Consent Order for the project (as detailed in **Figure 1.4**).

Cumulative Impact Assessment

1.5.10 Cumulative impact assessment (CIA) forms part of the EIA process. It considers the effects of the construction, operation and decommissioning of GWF in isolation, cumulatively with other offshore wind farm projects as well as with other non-wind farm related activities. Consultation has taken place with the Joint Nature Conservation Committee (JNCC), Natural England, Centre for Environment, Fisheries and Aquaculture Science (Cefas), the Marine and Fisheries Agency (MFA, prior to it becoming the Marine Management Organisation (MMO)) and Local Planning Authorities (LPA), with regard to cumulative considerations.

1.5.11 During this consultation it was made clear by the Government advisory bodies, that there is a potential conflict between the use of the phrases 'in-combination' effects and 'cumulative' effects. To date, within wider cumulative assessment work, the phrase 'in-combination effects' has been used to discuss those effects arising from interaction between the project (e.g. the wind farm) and other non-related human activities (such as aggregate extraction or fishing).

1.5.12 However, under The Conservation of Habitats and Species Regulations 2010 and The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010, the term 'in-combination' effects is used to describe impacts on the designated site arising from the interaction of any plans or projects that are not directly connected to its management (i.e. for conservation purposes).

1.5.13 Therefore, to provide a consistent approach throughout this EIA and to align with legislative terminology (as set out within the Habitats Regulations), the following approach will be adopted:

The term **Cumulative effects** will be broadened to encompass all impacts of the GWF project that have the potential to overlap with any existing and reasonably foreseeable plan or project (be it other wind farms or non-related human activities). Within the EIA the cumulative impacts will be classified as follows:

- *Effects within the project* (to describe cumulative effects that occur between different aspects of the considered project); and
- *Effects between other plans or projects* (to describe cumulative effects between the considered project and external sources).

The term **In-combination effects** will be restricted to describing the effects of the GWF project with any other plans or projects on European designated sites.

1.5.14 The cumulative considerations for each EIA parameter are discussed within the relevant section of this study. Consultation has taken place with the JNCC, Cefas, MMO and Natural England regarding the inclusion of Round 3 (in particular the Norfolk Zone) within the CIA. It was agreed that Round 3 projects would not be included within the CIA, given that detailed plans are not currently available in the public domain as yet and are unlikely to be so at the time of the assessment work (due to be completed by August 2010). However, should the GWF EIA phase extend over a time period during which detailed plans for the Round 3 Zone are made public then further consultation will be undertaken with the statutory bodies to establish an appropriate way forward.

1.5.15 The Crown Estate's Round 2.5 announcement (made in April 2010) also included extensions to Kentish Flats and Thanet, both of which lie within the Thames Strategic Area. These projects, like the Norfolk Zone project are very much in their infancy. Given the limited available knowledge on project detail and or programme the same approach with regard to cumulative assessment for these extension projects is proposed to be adopted.

Appropriate Assessment

1.5.16 Under The Conservation of Habitats and Species Regulations 2010, and The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010 any development that is considered to have the potential to have a significant effect on a European site requires an Appropriate Assessment. It is the developer's responsibility, where this is likely, to provide the regulatory authority with sufficient information to enable them to carry out an Appropriate Assessment. This study identifies the likely requirement for this and sets out the information that will be provided within the subsequent ES to address this issue. In accordance with guidance from the JNCC the information provided for addressing issues relating to effects on European sites will be in a separate section to the main impact assessment section and can serve as a stand alone report.

1.5.17 Early consultation with the statutory nature conservation advisors (the JNCC and Natural England) has identified that an Appropriate Assessment is considered likely for the GWF project, on the grounds of concerns relating to potential cumulative impacts on key bird species (namely red-throated diver and lesser black-backed gull) for which the Thames Estuary pSPA and the Alde-Ore SPA are designated.

1.5.18 The EIA for the GWF will, therefore, ensure that there is adequate information provided within a dedicated section that will enable the Competent Authority to carry out the Appropriate Assessment. It is envisaged that this will focus on the findings of the ornithological impact assessment (as detailed in **Section 3.2.3**) and set these in context of the relevant SPA features.

1.5.19 Should any further concerns be raised (following the ongoing data gathering and consultation process) relating to potential impacts on additional features of surrounding European designated sites (to those discussed above) then the relevant information will be included within this section of the EIA.

Strategic Environmental Assessment context

1.5.20 Strategic Environmental Assessment (SEA) is required under the EC SEA Directive (2001/42/EC) and enacted in England under The Environmental Assessment of Plans and Programmes Regulations 2004. The SEA's purpose is to provide consideration of the environmental implications of a draft plan or programme (encompassing public and stakeholder consultation), in order to inform Government's decision making process on the plan / programme.

1.5.21 There are two existing SEA's that hold relevance for informing the GWF project. Those being the Round 2 SEA and the Offshore Energy SEA (OSEA) (which was undertaken with a view to enable further rounds of offshore wind farm leasing in the UK Renewable Energy Zone and the territorial waters of England and Wales with the objective of achieving some 25GW of additional generation capacity by 2020 (DECC, 2009)).

1.5.22 Furthermore, the UK Government has commissioned an SEA; UK Offshore Energy SEA2 (termed OSEA2) that will follow directly on from the OSEA released in 2009, with a view (with regard to offshore wind) to enabling further rounds of offshore wind farm leasing in the UK Renewable Energy Zone and the territorial waters of England and Wales. OSEA2's major objective is to achieve some 33 GW of generation capacity (DECC, 2010). The Scoping Report for OSEA2 was released in 2010 and the full SEA is expected to be released for public consultation in late 2010.

1.5.23 Within NPS EN-3 it is noted that the extension programme should be subject to careful site-specific evaluation through the planning process and in line with the Government's OSEA (DECC, 2009b) and OSEA2.

1.5.24 The EIA for the GWF will duly give consideration to the context of the project in light of the latest Offshore Energy SEA as well as taking into account any pertinent findings from the Round 2 SEA that may help to inform the project.

1.6 Site location

1.6.1 The proposed GWF development area lies approximately 27.5km from the Suffolk coastline at its closest point. The development area lies predominantly to the east of GGOWF with a small area to the west of the southern site as shown in **Figure 1.1**.

1.6.2 The proposed area for the GWF site was identified through extensive targeted investigation of environmental and human constraints and opportunities. In addition, the proposed wind farm location was established through a number of pre-requisites from The Crown Estate:

- The proposed extension must share a substantial part of one or more boundaries with the original site;
- No maximum size of extension is set, however, the scale of the extension should be appropriate for the scale of the original site;
- The extension proposal should demonstrate synergies with the original site,(e.g. of construction, operation, improvement of economics and / or grid connectivity);
- No extension will be permitted to encroach within a radius less than five kilometres of any nearby round one or two sites, except with the express agreement of the tenant of the existing nearby site.; and

- The proposed extension must not adversely affect delivery or operation of the original site or any neighbouring site.

1.6.3 The proposed location for the GWF is considered to provide least overall environmental risk, whilst maintaining compliance with The Crown Estate stipulations.

1.6.4 In December 2009, SSER and NRL secured a Grid Connection Agreement for a 132kV onshore substation for the GWF at Leiston from the National Grid. Landfall considerations for this study have, therefore, reflected this and have been focused around the Sizewell vicinity.

1.6.5 Several locations were considered for the cable landfall and 132kV onshore substation within the Sizewell area. An option appraisal exercise reduced the list to two clear options. The options under consideration are indicatively shown on **Figure 1.2**.

Option 1 is located to the north of Sizewell Gap, just to the west of the existing GGOWF substation site. It is adjacent to a block of woodland (Sizewell Wents) in an area that includes grassland (used predominantly for grazing) as well as arable land.

Option 2 is located to the south of Sizewell Gap, in a block of arable land.

2 PROJECT DESCRIPTION

Project components

2.1.1 The proposed 504 MW_e GWF project currently comprises the following components:

- Offshore wind farm array (WTG's and foundations);
- Inter-array cabling;
- Offshore substations, collection and accommodation platforms;
- Offshore meteorological mast(s);
- Export cabling to shore;
- Onshore transition pits;
- Onshore cabling; and
- Onshore 132kV Substation and National Grid compliant SVC compound (this project does not include consideration of National Grid's proposed 400kV substation).

2.1.2 **Table 2.1** provides further detail on these components.

Table 2.1: Project summary details

Item	Detail	Notes
Project capacity	504 MW_e	
WTGs	3.6 MW_e - 7 MW_e	Maximum tip height of 195m (above LAT) Two 3.6 MW WTGs are under consideration; one with a 107m diameter rotor and the other with a 120m diameter rotor.
Foundations	Monopile, jacket or gravity base system.	A number of foundation options remain in consideration at this stage, given the water depths and early stage of project design.
Offshore substations	2 on jacket foundations	Likely to be one in each extension area installed on jacket foundations
Collection Platform	1	Installed on jacket or monopile foundation
Accommodation Platform	1	Installed on jacket foundation
Meteorological masts	Up to 6	Installed on monopiles
Export cable	Up to 4 cables	North of the existing GGOWF route
Landfall	Sizewell	Two options being considered
Transition pit	Sizewell	Two options being considered
Onshore cables	Underground	Up to five cables required
132kV Substation	Sizewell	Two options under consideration

2.1.3 The proposed site boundaries (in WGS 84) are detailed in **Tables 2.2** and **2.3**)

Table 2.2: Northern area location

Corner	Easting	Northing	Longitude	Latitude
A	426790	5759183	1° 56' 02.67"	51° 58' 42.60"
B	430795	5761506	1° 59' 30.90"	51° 59' 59.61"
C01	437729	5760502	2° 05' 35.13"	51° 59' 30.07"
C02	437783	5760458	2° 05' 37.95"	51° 59' 28.67"
C03	437916	5760363	2° 05' 44.98"	51° 59' 25.64"
C04	438055	5760276	2° 05' 52.32"	51° 59' 22.90"
C05	438199	5760199	2° 06' 59.94"	51° 59' 20.46"
C06	438348	5760132	2° 06' 07.79"	51° 59' 18.34"
C07	438501	5760074	2° 06' 15.85"	51° 59' 16.53"
C08	438657	5760027	2° 06' 24.09"	51° 59' 15.06"
C09	438817	5759989	2° 06' 32.47"	51° 59' 13.92"
C10	438978	5759963	2° 06' 40.94"	51° 59' 13.12"
C11	439133	5759947	2° 06' 49.05"	51° 59' 12.68"
C12	439325	5759934	2° 06' 59.14"	51° 59' 12.33"
D	440306	5759427	2° 07' 50.89"	51° 58' 56.29"
E	441324	5758719	2° 08' 44.67"	51° 58' 33.77"
F	441289	5756246	2° 08' 44.38"	51° 57' 13.72"
G	440684	5753290	2° 08' 14.51"	51° 55' 37.84"
H	433042	5749837	2° 01' 36.87"	51° 53' 42.96"
I	432029	5749380	2° 00' 44.24"	51° 53' 27.72"
J	431181	5748998	2° 00' 00.14"	51° 53' 15.00"
K	431320	5759119	2° 00' 00.14"	51° 58' 42.60"

Table 2.3: Southern area location

Corner	Easting	Northing	Longitude	Latitude
L	431061	5740482	2° 00' 00.00"	51° 48' 39.35"
M	431766	5740761	2° 00' 36.60"	51°48' 48.66"
N	432782	5741151	2° 01' 29.38"	51° 49' 01.73"
O	438660	5743407	2° 06' 34.87"	51° 50' 17.18"
P	436911	5734868	2° 05' 09.10"	51° 45' 40.12"
Q	428513	5730729	1° 57' 54.17"	51° 43' 22.53"
R	422305	5734815	1° 52' 27.41"	51° 45' 31.80"
S	422886	5737271	1° 52' 55.73"	51° 46' 51.58"
T	426487	5738887	1° 56' 02.40"	51° 47' 45.60"
U	425224	5735568	1° 54' 59.04"	51° 45' 57.60"
V	426696	5731876	1° 56' 18.60"	51° 43' 58.80"
W	430975	5734151	2° 00' 00.00"	51° 45' 14.40"
X	431006	5736446	2° 00' 00.00"	51° 46' 28.67"

2.1.4 The project currently comprises extensions to both the northern and southern areas of the GGOWF project of approximately 336MW_e and 168MW_e respectively (enough to power over 500,000 average homes).

2.1.5 The offshore wind farm array will cover an area of up to 174km^2 and consist of up to 140 WTGs depending on the size used (with 3.6 MW_e to 7 MW_e being considered). The precise location and internal arrangement may be amended following consultation or due to technical reasons (see **Figures 2.1, 2.2 and 2.3** for indicative layouts based on 7 MW_e and 3.6 MW_e WTG arrays).

2.1.6 This means that the wind farm array may range from 72 * 7 MW WTGs to 140 * 3.6 MW WTGs (as depicted in **Figures 2.1**, **2.2** and **2.3**) , or a variety of variations in between, involving other WTG sizes. It will not necessarily be the case that all the WTGs used will be of the same capacity or dimensions. Furthermore, the separation distances will vary depending on WTG size. The Development Consent Order to be applied for will seek the flexibility to follow this approach, as with the Section 36 consents for Round 2 projects. As discussed, the EIA will follow the Rochdale envelope principles in the assessment of these variations, to ensure that the resulting consenting envelope has been informed by a realistic worst case assessment of impacts. The limiting factor on the project will be the total capacity (of 504MW_e) rather than the number of WTGs.

2.1.7 The maximum height of the WTGs will be up to 195m above mean sea level (MSL) to the blade tip in the vertical position. 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.

2.1.8 Monopile, jacket and gravity-based system (GBS) foundations are being considered for this project. It is possible that a variety of foundation types may be used depending on the water depth and ground conditions (i.e. monopiles used in the water depths less than 35m and jackets or gravity-based systems (GBS) used in deeper water).

2.1.9 An onshore 132kV substation and National Grid compliant SVC compound will be constructed as part of the GWF. Throughout this report this will be referred to as 'the substation'. Two areas of potential development interest are proposed, within this report, but only one of these options will ultimately be consented and constructed. Both options, and the potential cable route to both areas, are shown on **Figure 1.2**. A wider onshore study area is shown in **Figure 1.3**.

2.1.10 Each potential development area (132kV substation) measures 200m x 100m. This represents an indicative size, location and orientation at this stage and may be subject to amendment following additional consultation or dependent upon technical constraints.

2.1.11 Further to the GWF onshore infrastructure (132kV substation), National Grid intend to consent and construct an additional 400kV substation in the area. Details of this additional piece of National Grid infrastructure are not yet available and as such are not considered in detail within this scoping report.

2.1.12 The GWF 132kV substation will be fully considered within the EIA, and throughout this report is simply referred to as 'the substation'. The additional National Grid infrastructure will be considered as part of the cumulative impact assessment within the EIA.

Project timescale

2.1.13 At present construction is planned to commence in 2014 with completion by the end of 2016, covering three summer periods. Once built the offshore wind farm will be operational for 25 years. At the end of its lifespan the project may be repowered or decommissioned.

Consideration of alternatives

2.1.14 Specific consideration of alternatives, (relating to alternative technology types, design detail, as well as site layout options) will be identified and addressed within the EIA as more detailed ongoing engineering investigations progress. The ES will contain a dedicated chapter detailing the main alternatives considered and include justification for these options not being taken forward.

Figure 2.1: GWF project indicative WTG layout – 7MW$_e$ option

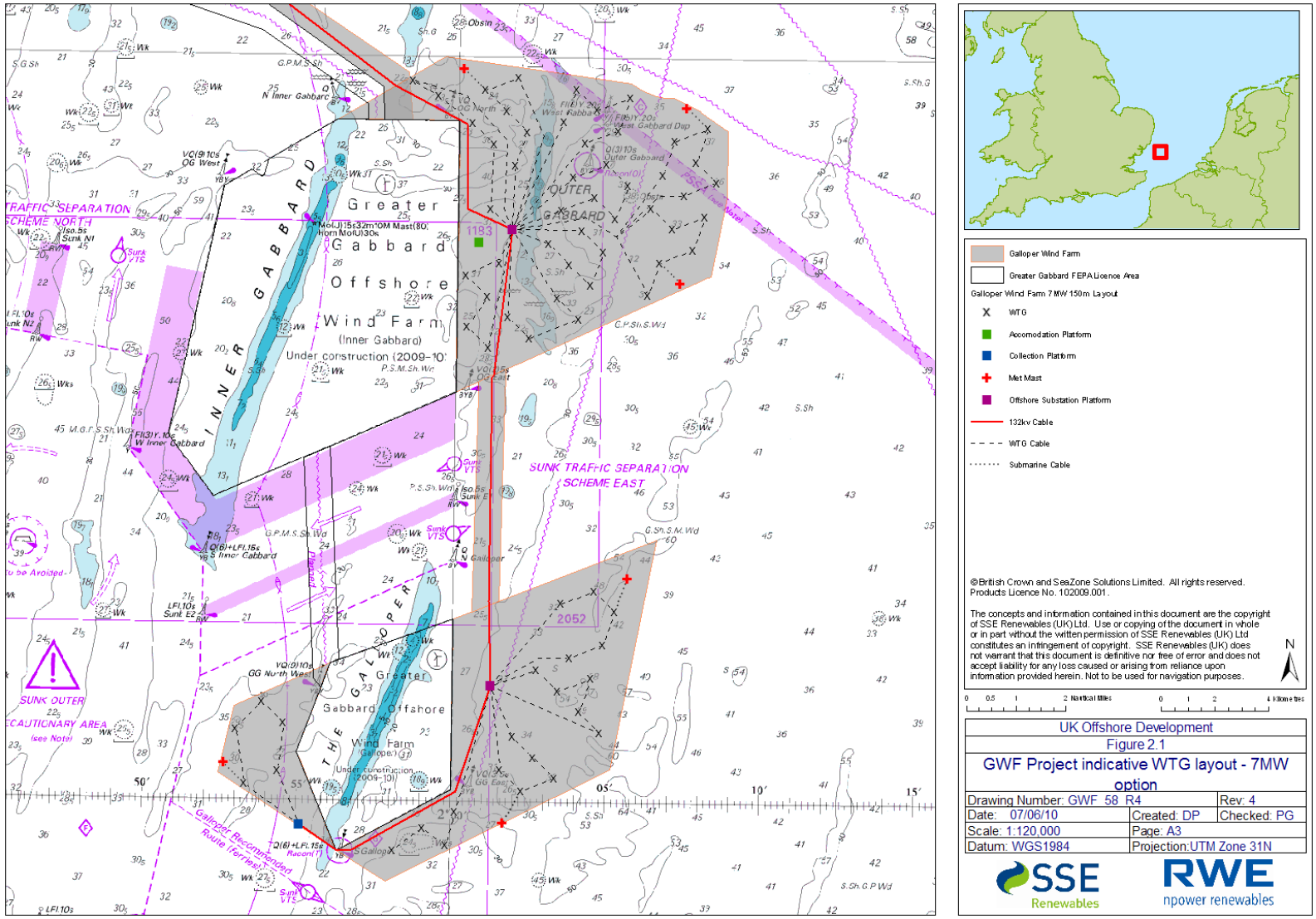


Figure 2.2: GWF project indicative WTG layout – 3.6MW$_e$ (107m) option

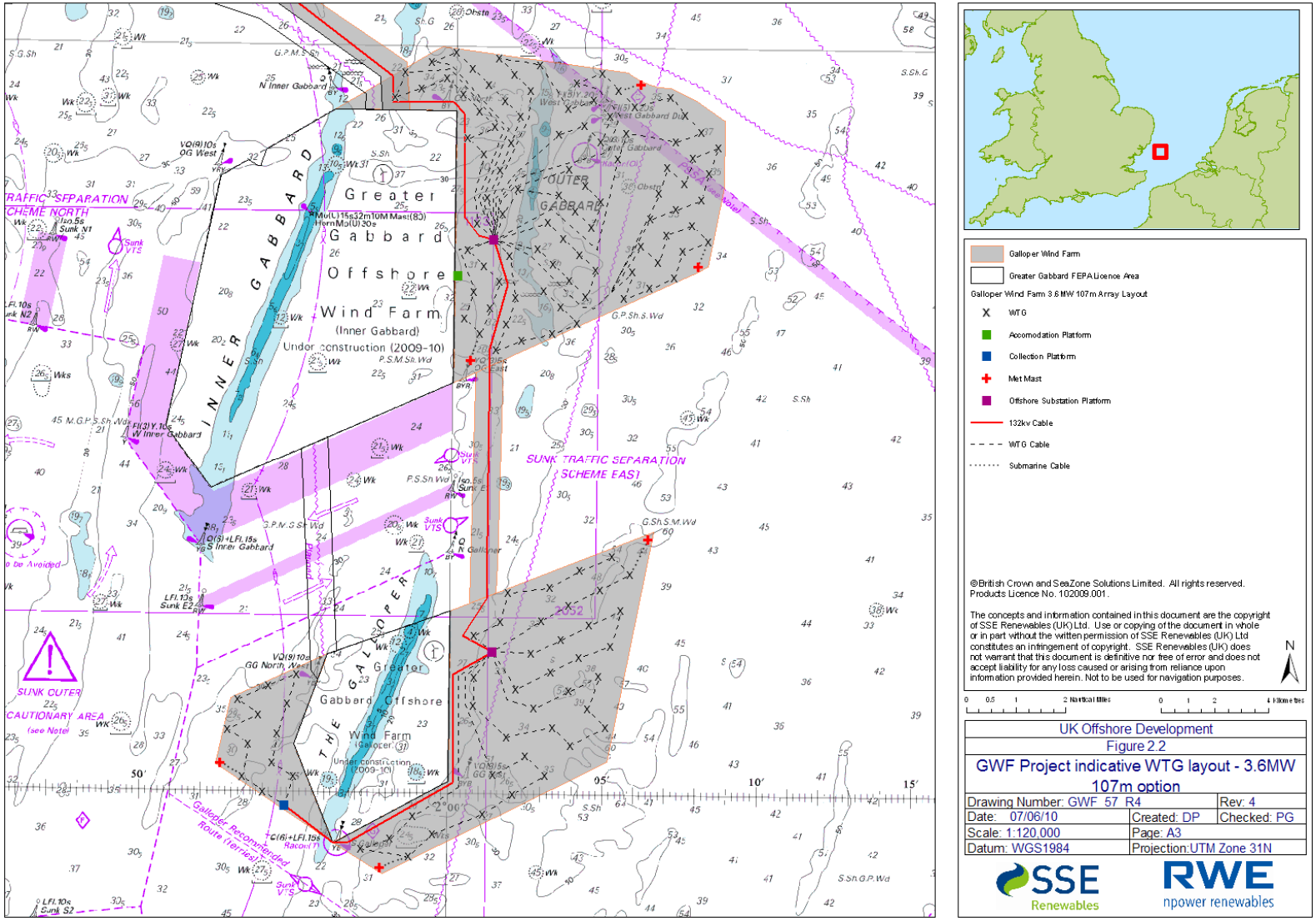
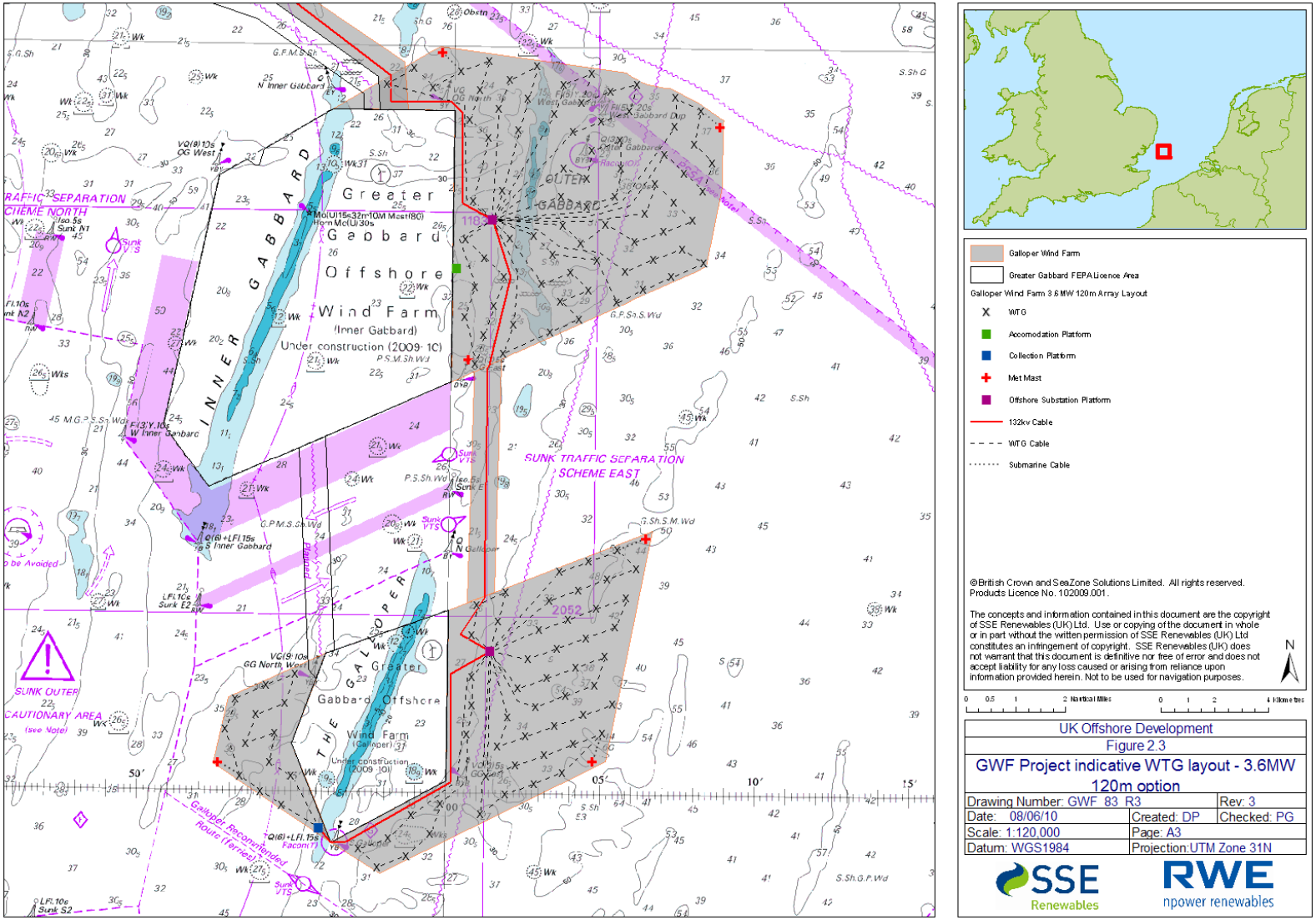


Figure 2.3: GWF project indicative WTG layout – 3.6MW$_e$ (120m) option



3 CONSULTATION

3.1 Introduction

3.1.1 SSER and NRL are fully cognisant of the consultation requirements that are effected by the Planning Act 2008. Under the Act there is a statutory obligation throughout the pre-application phase for early involvement of local authorities, statutory consultees and local communities to:

- Allow regulators, stakeholders and members of the public to influence the way the project is developed;
- To help local people understand better what a particular project means for them, so that concerns resulting from misunderstandings are resolved early on in the project life cycle;
- To obtain important information relating to the EIA parameters, thus helping promoters identify project options;
- To enable mitigation measures to be considered and, in some cases, built into the project before an application is submitted; and
- Identify ways in which the project could, without significant costs to the promoter, support wider strategic or local objectives (DCLG, 2009).

3.1.2 Specific consultation requirements are set out in Sections 42 and 47 of the Act.

3.1.3 Section 42 places a duty on the promoter to consult about a proposed application with:

- Parties specified in secondary legislation (as set out in the Infrastructure Planning (Applications: Prescribed Forms & Procedure) Regulations 2009;
- Relevant local authorities (defined in section 43[1]); and
- 'Interested persons' as defined in section 44[2].

3.1.4 Section 47 relates to the requirement of the promoter to consult the local community. The promoter must draw up a Statement of Community Consultation (SoCC) explaining how it intends to carry out consultation with the people who live in the vicinity of the land it wants to develop and those who may not be in the vicinity but who have an interest in the project. Before drawing up the statement, the promoter is required to consult the relevant local authorities, including the Marine Management Organisation (MMO) for offshore projects, regarding the content of the SoCC (DCLG, 2009).

[1] Section 43 – defines what a local authority is for the purposes of section 42 i.e. any local authority in whose area proposed development would be sited and neighbouring authorities sharing a boundary. The definition includes National Park authorities and the Broads Authority (DCLG, 2009).

[2] Section 44 – provides a list of categories of people who should be consulted under s.42(d), including owners, tenants, lessees or occupiers of the land, people with an interest in the land or with the power to sell, convey or release the land, or people who could have a claim for compensation as a result of the development going ahead (DCLG, 2009).

3.1.5 Under Section 47, the promoter must:

- Have regard to any responses from the local authorities about the statement when preparing it
- Having prepared the statement, then publish the statement in a newspaper circulating within the area of the land he wants to develop, and in such other manner as may be prescribed; and
- Carry out the consultation as laid out in its statement (DCLG, 2009)

3.2 Consultation with regulators and stakeholders (Section 42 consultation)

3.2.1 SSER and NRL recognise that clear and concise consultation from the outset will be fundamental in addressing a number of potential concerns that may be raised by the development of GWF. As an extension to an existing development, one of the key concerns may include cumulative effects. The consultation being undertaken for the GWF project builds upon the previous consultation undertaken as part of the EIA process for the GGOWF project. Consultation at an early stage of the EIA process allows potentially significant impacts to be identified and appropriately addressed in the EIA. SSER and NRL have undertaken consultation with key stakeholders from the outset of the GWF project. The focus of these consultations has been to:

- to introduce the proposals;
- to explain the nature of the proposals and answer any queries;
- to obtain existing information and data for the study area;
- to obtain initial comments or concerns that stakeholders may have about the proposals; and
- to discuss and agree the proposed scope of the EIA investigations and requirements for the ES.

3.2.2 A wide variety of stakeholders will be involved in the consultation process which will enable the project to receive a full range of opinions. The consultees can be broadly categorised into the following groups:

- Regulatory authorities;
- Statutory consultees / publicly funded organisations;
- Non-governmental organisations;
- Clubs and societies; and
- Local community.

3.2.3 The views of stakeholders, where already consulted, have been incorporated into the environmental Scoping Study. Reference is made to these views throughout this document. **Table 3.1** presents the environmental aspects upon which consultation has commenced and provides an overview of the consultation to date. This consultation has been undertaken to procure the studies that will support the ES for the proposed GWF project.

Table 3.1: GWF project consultation to date

Environmental Aspect	Purpose of consultation
Ornithological survey	The scope of the surveys was agreed via consultation with the JNCC.
Ornithological Technical Report	The scope of the works is currently under consultation with the JNCC, Natural England, MFA (now MMO) and RSPB.
Fish & Shellfish resource survey	The scope of the surveys was agreed in advance with Cefas.
Geophysical survey	The scope of works was agreed through consultation with the JNCC, Natural England, MFA and Cefas.
Benthic survey	The scope of works was agreed through consultation with the JNCC, Natural England, MFA and Cefas.
Underwater Noise Assessment	The scope of work was agreed through consultation with Cefas.
Coastal Processes Study	The scope of work and modelling requirements were agreed through consultation with Cefas.
Shipping & Navigation Assessment	The scope of work was agreed through consultation with the MCA.
Seascape, Landscape & Visual Impact Assessment (SLVIA)	The scope of works is currently being discussed with Natural England and other local consultees.
Military and Civil Aviation	The pro-formas have been sent to the MoD and NATs for consultation.
Terrestrial Ecology	The existing data (2005/6/7 data) were confirmed, with Natural England, as a suitable dataset to progress the EIA. Further survey data is planned to supplement this and further consultation will be undertaken.
Traffic Survey and impact assessment approach	The scope of works has been agreed via consultation with local council officers.

3.2.4 As required by Section 42 of The Act there will be formal consultation with the statutory consultees specified in paragraph 3.1.1 above, in relation to consultation documents supplied to those consultees describing the project. This will involve a consultation period of at least 28 days with a formal response deadline. Non-statutory consultees will also be asked to comment on the same documents by the same deadline. This formal process is part of an overall continuing process of dialogue with statutory and non-statutory consultees throughout the pre-application phase to seek to narrow or resolve issues before the application is finalised and submitted.

3.3 Community involvement and public access to information (Section 47 consultation)

3.3.1 In accordance with relevant IPC consultation guidance, SSER and NRL will work with the local authorities to develop the community consultation process. The SoCC will describe how SSER and NRL propose to carry out the consultation required by Section 47. It will be prepared in consultation with Suffolk Coastal District Council (SCDC) and Suffolk County Council (SCC) as the district and county councils within which the proposed substation lies. The MMO will also be consulted as the local authority representing the offshore community.

3.3.2 The GWF project community consultation objectives are to:

- Provide an opportunity for local people to put forward their ideas and have a role in developing proposals where they can have an influence;

- Provide information on an inclusive basis to all sections of the relevant community;
- Create a process through which local people can comment on the formal proposals; and
- Inform community stakeholders about the following aspects of the GWF project in a clear and concise way:
    - the offshore wind farm and interconnecting array cables;
    - offshore substations;
    - offshore cable route and onshore transition joint bays (where the offshore cables connect to the onshore cables);
    - onshore cable route;
    - onshore substation; and
    - offshore meteorological monitoring masts.

3.3.3 There are many ways in which communities can be effectively involved in decisions on the project development. At the most simple level, community involvement process will ensure that the local community have:

- Access to information;
- A forum to put forward their own ideas and feel confident that there is a process for considering ideas;
- An active role in developing proposals and options to ensure local knowledge and perspectives are taken into account;
- Ability through properly defined channels for comment on and influence formal proposals; and
- Receive feedback and be informed about progress and outcomes.

3.3.4 The consultation responses received by SSER and NRL will be collated and used to help define certain aspects of the project. Areas of the project that are open to influence will be defined in the SoCC. SSER and NRL are required to demonstrate how all significant responses to formal consultations have been considered, and how they have influenced the development of the project in a Consultation Report, which will be submitted as part of the application for development consent to the IPC.

4 PHYSICAL ENVIRONMENT

4.1 Offshore physical environment

Existing environment

Bathymetry

4.1.1 The bathymetry across the majority of the GWF site is generally between 20m and 40m below Chart Datum (CD). Topographic highs are associated with the Inner Gabbard, Outer Gabbard and Galloper sandbank features immediately adjacent to the existing GGOWF site. At the offshore limit of the GWF site and to the east of the Galloper sandbank, water depths reach 60m below CD. A similar situation occurs off the eastern side of the Outer Gabbard, where depths reach 55m below CD. Inshore, along the cable route there are minor banks off Sizewell and Minsmere, as well as the Aldeburgh Napes (see **Figure 4.1**).

Tides and currents

4.1.2 The tidal range across the proposed GWF area is classified as meso-tidal having a range of between 2-4m, with slightly higher ranges experienced towards the coast (GGOWL, 2005). Tidal currents flow parallel with the shoreline along the line of the major sand banks. Average bed speeds recorded within the project vicinity are approximately 0.4m/s (GGOWL, 2005). Tidal currents across the array site and cable route control bedload sediment transport in the form of sandbanks and sand waves.

Wave climate

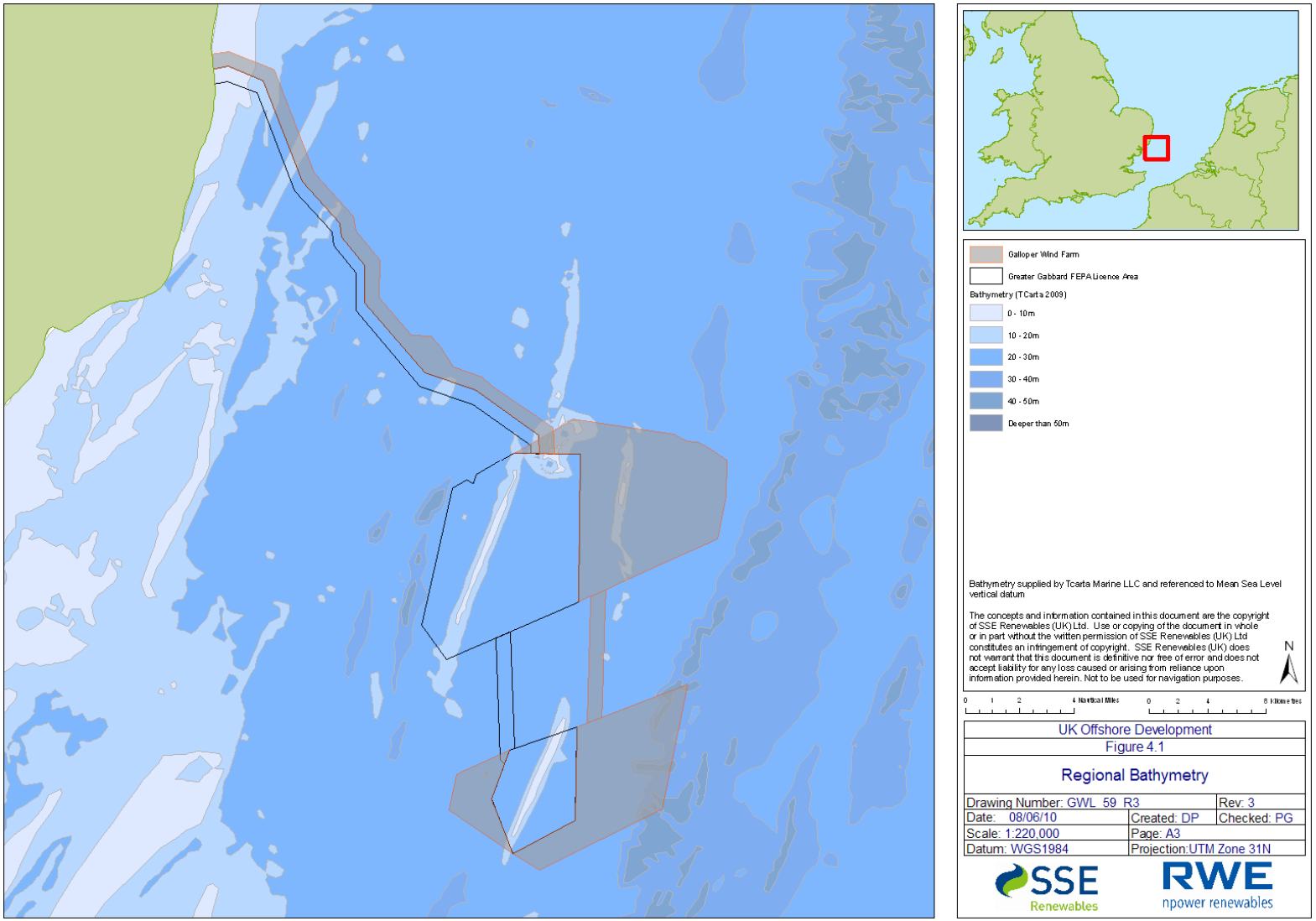
4.1.3 Wave data collected to inform the GGOWF ES revealed that the primary wave direction is from 0 to 60º with a smaller percentage from between 180 to 240º, with a most common height of between 0.5 to 1.5m (GGOWL, 2005).

4.1.4 The largest waves experienced in the area propagate from the north (0 to 30º) although these are rarely greater than 4m in height.

4.1.5 The wave periods recorded during the GGOWF investigations between 2004 and 2005 were small, never exceeded a period of greater than 7s and the majority of waves have a period that is between 4 to 5.5s (GGOWL, 2005).

4.1.6 The typical wave regime experienced within this area is characterised by relatively small, short period wind swells, which is reflective of the sites relative shelter from the larger, long period groundswells that propagate south down the North Sea. It can be concluded therefore, that the local wind conditions appear to play an important role in determining the height and period of the waves for this region (GGOWL, 2005).

Figure 4.1: Regional Bathymetry



Geology

4.1.7 An analysis of borehole data, carried out as part of the GGOWF studies, revealed that in general, the study area can be considered to be based upon London Clay, overlain by sands and gravels (GGOWL, 2005).

4.1.8 The Thames area is part of the North Sea basin. The sub-surface bedrock geology comprises London Clay and Upper Cretaceous Chalk. The dominant Tertiary component is London Clay consisting of clayey silts, silty clays and silts, and thickens from approximately 50m near the landfall site to approximately 300m to the east of the proposed GWF site. Underlying this thick Tertiary deposit is the Upper Cretaceous Chalk, which reaches a thickness of up to 200m beneath the GWF site and cable route corridor (Cameron et al., 1992).

4.1.9 Younger Tertiary deposits of Pliocene Coralline Crag and Plio-Pleistocene Red Crag outcrop close to shore along the cable route, where they overlie the London Clay (British Geological Survey (BGS), 1996, 2001). The Coralline Crag is about 25m thick and composed of carbonate sands and silty sands (Cameron et al., 1992). The Red Crag (Plio-Pleistocene) is 70-80m thick close to Sizewell, thinning offshore and disappearing south east of Aldeburgh Napes sand bank. It is composed of shelly sands and gravels resting on London Clay. Many of these older deposits are overlain by more recent Holocene deposits dominated by marine transgression following the Last Glacial Maximum when sea levels rose >100m (Emu Ltd, 2009).

4.1.10 One relevant feature of geological interest is a narrow palaeo-valley that extends a total distance of 55km from the entrance to Harwich harbour in the west to the east beneath the northern end of the Inner Gabbard Bank and Outer Gabbard sandbanks (Emu Ltd, 2009).

Geomorphological environment

4.1.11 Within the wider region, comprehensive analysis of the morphology of the greater Thames seabed indicates that the gross organisation of banks, ridges and channels has changed very little over the last 180 years (Burningham and French, 2009) and that the presence and distribution of features has remained remarkably similar over the last 200 to 300 years (Burningham and French, 2008). Given the lack of significant erosional or depositional changes it is concluded that this region exhibits inherent and significant long-term stability (Burningham and French, 2009).

4.1.12 There are three distinct geomorphological sandbank features within or adjacent to the GWF site; the Outer Gabbard, the Inner Gabbard and The Galloper (**Figure 4.1**). These banks trend north-northeast to south-southwest, are up to 10km long, 1 to 2km wide, with crests at depths of -5 to -10m CD. The banks are asymmetrical, with steeper slopes facing west and sub-parallel to the dominant tidal flow direction (Kenyon *et al*., 1981 as cited in Emu Ltd, 2009). Inshore, along the cable route, there are minor banks off Sizewell and Minsmere, as well as the Aldeburgh Napes.

4.1.13 Specific analysis of two offshore banks within the study area (The Inner Gabbard and The Galloper) was carried out for the GGOWF ES (by Kenyon and also D'Olier, 2005). Movement of the sand banks was determined through an analysis of historical charts and the seismic profiles collected as part of the geophysical survey, with both studies returning similar conclusions (GGOWL, 2005).

4.1.14 The two banks have been relatively stable features over the past 70 years, with only slight movement recorded. This movement is most accentuated around the head and tail of the banks, which is indicative of the natural changes in the physical processes i.e. surges (GGOWL, 2005).

4.1.15 Bedload transport around the offshore sand banks is clockwise and oblique to the elongation of the banks. This circulation drives sand waves towards the south and the crest on the east sides of the banks and towards the north and the crest on the west sides of the banks.

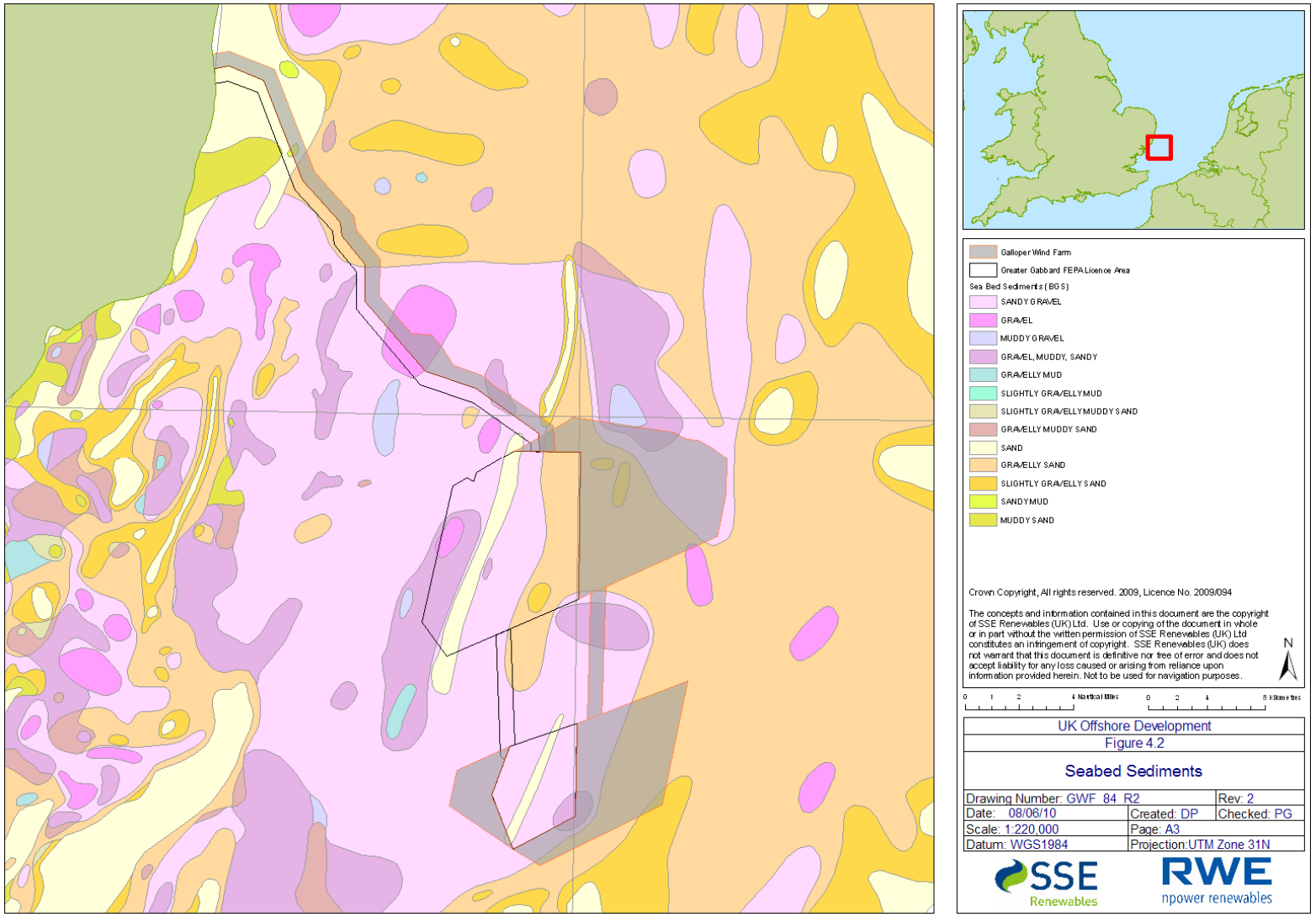
Seabed sediments

4.1.16 Sediment characteristics and descriptions have been obtained from the GGOWF grab sampling programme and align with the British Geological Society (BGS) definition of bed surface sediments, as shown in **Figure 4.2**. Nearshore sediments along the adjacent GGOWF export cable route were found to consist primarily of medium to coarse sand with silt and clay elements, turning to more mixed circalittoral sediment towards the south, with elements of sand and gravel (including pebbles) with underlying clay and areas of cobbles. Observation of samples from the Inner Gabbard revealed mixed sediments with areas of patchy cobbles to the west of the sandbank and medium to coarse and coarse sand with areas of gravel (including pebbles) to the east. The Galloper followed a similar pattern of more mixed sediments to the west of the sandbank and medium to coarse sediments with areas of gravel to the east (Gardline Environmental Limited 2009a).

Water and Sediment Quality

4.1.17 Studies undertaken as part of the GGOWF site investigations revealed a low level of contamination of the water and sediments, as is typical of the wider area where human activity, such as oil and gas development and disposal activity has been limited. Levels of Arsenic were elevated in some samples across the site however; this was attributed to geological inputs and seabed rock weathering (GGOWL, 2005) rather than any anthropogenic source of contamination.

Figure 4.2: Seabed Sediments



Identification of key issues

4.1.18 Investigations carried out as part of, and subsequent to, the GGOWF ES concluded that there was very little potential for a significant alteration of the existing hydrodynamic, wave, sedimentological and underlying geology both in the area local to the development site and over a more regional scale. The changes predicted were comparable to those resulting from natural changes and also those observed within the natural variability of the system. It was also shown that scour effects can be expected as a function of the tidal, rather than the wave regime. Given the proximity of the two projects and the similarity in conditions it is likely that there will be synergy with regard to significance of potential effects with perhaps the exception of cumulative considerations. Nevertheless, the potential effects are outlined and discussed below in accordance with the requirements listed in relevance guidance.

Potential effects during construction

4.1.19 Impact on geological formations: The GWF construction will not change the geology of the site other than the localised areas directly affected by the foundations. It is recommended that this item is 'Scoped out' of the EIA.

4.1.20 Effects on wave and tidal climate: Whilst potential effects on wave and tidal climate are recognised it is noted that studies undertaken to inform the ES for the adjacent GGOWF project predicted only small localised short term changes in prevailing hydrodynamic conditions as a result of the construction activities being undertaken at the site. These were not considered to have any significant effect on the current wave and tide climate at the site (GGOWL, 2005).

4.1.21 Change in morphological conditions: Short term increases in suspended sediment levels may occur as a result of ground preparation, cable laying and foundation installation, although the quantities of sediment brought into suspension would be largely dependant on the construction methods used. GGOWF studies identified that increased levels of suspended sediments are anticipated to remain localised and would not spread at a significant level beyond the wind farm footprint and will not significantly impact on morphological features (GGOWL, 2005).

4.1.22 Effects on water quality: Effects on water quality may occur from the re-suspension of contaminated sediments and or the release of chemicals used in the construction process into the water column.

Potential impacts during operation

4.1.23 Effect on wave climate: Studies carried out by Cefas (2005) and site specific modelling carried out by ABPmer (2005) for the GGOWF have shown that wave diffraction associated with monopile foundations would result in an insignificant effect on wave regime. As a result, wave driven effects on sediment transport are also considered insignificant, with only a small and highly localised reduction in sediment transport being likely (Cefas, 2005). As a result of these studies, developers are no longer required to monitor waves for diffraction/interference effects under a FEPA licence.

4.1.24 Effect on the hydrodynamic regime: Numerical modelling studies carried out for the GGOWF site by ABPmer Ltd (2005) indicate there is little potential for significant effects upon the existing hydrodynamic regime, both locally and over more regional scales (referred to as the 'near field' and 'far field'. Results indicated minor changes in flow direction and speed which only occurred in close proximity to the turbines themselves.

4.1.25 Effect on shallow geological formations: Peak tidal currents combined with significant wave induced currents are likely to create scour impacts around foundation structures, although studies indicate the impacts of scour pits are generally localised (Cefas, 2006). The effects of localised scour on the underlying geology are highly unlikely to occur due to the consolidated nature of the London Clay.

4.1.26 Change in sediment transport regime: Changes to sediment transport (through accretion or erosion) have been studied at both an industry (ABPmer, 2005) and site specific level (e.g. Cefas, 2006). These studies have concluded that near and far field impacts on sediment transport can be expected to be minimal provided that foundations are adequately spaced so that scour pits do not interact with each other. Appropriate consideration should be given to scour protection if it is to be used, as poorly designed scour protection can lead to secondary scour effects.

4.1.27 Indirect effect - change in morphological conditions: The hydrodynamic and sedimentological regimes are intrinsically linked to produce a morphological response. The key morphological features within the area are the sandbanks. No in-direct effects on the morphological regime were predicted from the GGOWF (GGOWL, 2005).

Potential impacts during decommissioning

4.1.28 The impacts from the decommissioning will be akin to those experienced during the construction phase.

Potential cumulative impacts

4.1.29 Cumulative effects on the hydrodynamic regime: Physical process studies and assessments in The Wash (Cefas, 2004) have shown that the cumulative effects of offshore wind farms on waves, currents and sediment transport, both in the near field and far field are not considered to be significant. Although the GWF site is not in close proximity to the majority of the other wind farms in the Thames Estuary SEA area, it is an extension site and, therefore, immediately adjacent to the GGOWF area. As such, the potential for cumulative effects exists and the extent of these will be investigated in the coastal process studies and modelling that will be undertaken.

4.1.30 The only other marine activities known to occur in the vicinity of the site comprise aggregate extraction. However, given the anticipated local scale of effects the potential for cumulative effects between these two aspects with regard to the hydrodynamic regime is not considered likely, and it is considered that this area does not warrant further detailed investigation in the EIA.

4.1.31 Cumulative effects on geomorphological conditions: The cumulative impact assessment undertaken as part of the GGOWF ES identified, through consultation with Cefas and the Department for Environment, Food and Rural Affairs (Defra), that the only parameter that required assessment with regard to geomorphological regime were those associated with suspended sediments between the wind farm construction process and nearby aggregate extraction.

4.1.32 Following modelling work, no significant effects were predicted (GGOWL, 2005). Given, the proximity of dredging application area 452 to the GWF export cable route, due consideration will be given with the ES, should dredging operations overlap with the construction work associated with the GWF cable installation. However, at this stage it is not clear whether this dredging application area will be taken forward and, therefore, whether this represents a potential source of impact.

Methodology and approach to EIA

4.1.33 The approach to investigations carried out to inform the EIA will be to follow the guidance on the generic requirements of a physical process study as provided in 'Offshore wind farms: guidance note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements: Version 2' (Defra, 2004). This is also in line with guidance provided for the dredging industry 'Guidance on Environmental Impact Assessment in Relation to Dredging Applications' (ODPM, 2001) and 'Nature Conservation Guidance on Offshore Wind Farm Development' (Defra, 2005). Best practice guidance on the application and numerical models to predict the potential impact from offshore wind farms on coastal processes has also recently been updated in line with the much larger Round 3 sites (Lambkin *et al*., 2009).

4.1.34 Significant levels of data relating to the physical environment have been collected and detailed modeling work carried out as part of the GGOWF project. ABPmer were therefore, commissioned to undertake a review of these existing data and studies and identify what further aspects would be required to inform the GWF EIA.

4.1.35 In order to characterise the baseline phsycial environment it was agreed (in consultation with Cefas in August 2009) that no new metocean data (wave and tidal information) were required, as the GGWOF data remained valid in addition to the data available from a number of other valid sources: TotalTide tidal level and tidal diamond data;

- Met. Office mooring data and wave model output;
- Tide gauge data from nearby coastal stations; and
- Wave data from the West Gabbard Wavenet buoy

4.1.36 However, despite there being sufficient existing metocean data, it was determined that site specific bathymetry, seabed texture, morphology, magnetrometry and shallow geology data was required.

4.1.37 Consequently SSER and NRL commissioned a dedicated geophysical survey of the proposed GWF study area. This survey was carried out between August 2009 and April 2010. The scope of the survey was agreed in advance through consultation with Cefas, the JNCC, Natural England and the MFA (now MMO). The survey extent is provided in **Appendix A**.

4.1.38 In order to ascertain the significance of the potential impacts from the development SSER and NRL have commissioned ABPmer to undertake a study into the offshore physical environment. The scope or work, including the numerical modelling requirements, was agreed through consultation with Cefas in August 2009, and has taken into account the guidance set out above. The study is designed to assess the magnitude and significance of change to the three following coastal process regimes:

- Tidal regime (e.g. Water levels and current flows);
- Wave regime (e.g. Wave height and direction); and
- Sediment regime (e.g. Bed and suspended sediments, transport pathways).

4.1.39 Furthermore, the following consultation the study will also undertake a Sea Bed Stability Analysis through the analysis of available historic bathymetric data across the site, in order to provide quantification of sea bed change across the site (where data coverage permits) through time.

4.1.40 To address the cumulative concerns, it has been agreed through consultation with the JNCC, Cefas and the MFA (in August, 2009) that the following assessment will be undertaken within the physical process studies for GWF:

- **Cumulative Assessment:** Potential effects from GGOWF and GWF combined to be considered within the operational phase assessment. This is to be achieved through a series of sensitivity tests predicting the effects of both schemes.

Study summary

EIA study	Purpose
Geophysical site survey, comprising single beam echosounder, swathe bathymetry, sidescan sonar, magnetometer and sub bottom profiler (undertaken by OSIRIS Ltd)	To help characterise the bathymetry, seabed texture, morphology, magnetic anomalies and shallow geology of the site.
Physical Processes desk-based study, including modelling of wave, tidal and sediment regimes, bed stability analysis and cumulative assessment (undertaken by ABPmer Ltd)	To help inform the EIA of potential impacts and their likely significance.

4.2 Onshore geology, water resource and land quality

Existing environment

Geology

4.2.1 The solid geology (BGS solid & drift geology, Sheet 191 Saxmundham) in the area around the landfall and potential substation locations comprises the Crag Group of sands and laminated clays up to approximately 55m thick, over the Harwich Formation of sandy siltstones (approximately 17m thick) and mudstones over the Lambeth group of mudstones, followed by the Ormesby Clay and the Upper Chalk.

Groundwater

4.2.2 The Environment Agency Groundwater Vulnerability Map for the area (Sheet 22: East Suffolk) indicates that the site is underlain by a minor aquifer, of variable permeability and soils of high permeability (deep, permeable, coarse texture soils, which transmit a wide range of pollutants due to rapid drainage and low potential for attenuation).

4.2.3 This classification is relevant to the Groundwater Regulations (1998). These have been recently superseded by the Groundwater Regulations (2009). As a result of the Water Framework Directive[3] and Groundwater Daughter Directive[4], aquifers are now defined on their basis to support ecosystems (whereas previously it was based on an abstraction basis). The new Groundwater Body Types map shows the site lying in an area that is underlain by a Principal Aquifer. Principal aquifers provide significant quantities of water for people and may also sustain rivers, lakes and wetlands.

4.2.4 The area is also classified as a Nitrate Vulnerable Zone (NVZ) by the Environment Agency under the auspices of the Nitrates Directive5. The Nitrates Directive requires all known areas of land which drain into polluted waters to be designated as NVZs. Polluted waters are defined as follows[6].

(a) Surface freshwaters which contain or could contain, if preventative action is not taken, nitrate concentrations greater than 50 milligrammes per litre (mg/l).

(b) Groundwaters which contain or could contain, if preventative action is not taken, nitrate concentrations greater than 50mg/l.

(c) Natural freshwater lakes, or other freshwater bodies, estuaries, coastal waters and marine waters which are eutrophic or may become so in the near future if preventative action is not taken.

Hydrology

4.2.5 The nearest surface water features include:

- A small pond located 120m south of Sizewell Gap road, in 'Kell Field' belonging to Home Farm (NGR TM 469 624); and

[3] Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy.
[4] Directive 2006/118/EC on the protection of groundwater against pollution and deterioration.
[5] Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.
[6] Taken from http://web.adas.co.uk/defra/regional.htm

- Drains associated with Sizewell Belts the nearest of which passes approximately 100m north of Sizewell Wents woodland.

4.2.6 The drains of Sizewell Belts discharge into Leiston Brook, a tributary of the River Minsmere (approximately 450m and 3.35km north of the study area, respectively).

Land quality

4.2.7 An Envirocheck report has confirmed that there is no history of any significant contamination sources within the study area.

Identification of key issues

4.2.8 A contaminated land desk study, and ground investigation were undertaken in 2007 and 2008 respectively, to characterise the footprint of the original GGOWF export cable route and substation. The intrusive investigation (Royal Haskoning, 2008) included 5 boreholes and 20 trial pits across the export cable route and substation area, providing groundwater samples and soil samples throughout. The conclusions from those studies were:

- No potential risks to site users were identified;
- Risks to construction workers were considered low;
- The soils encountered within Sizewell Wents were considered to be suitable for reuse on-site based on the negligible risk to human health; and
- No potential risks to controlled waters were identified.

4.2.9 The new transition pit location and associated cable route between the landfall and either potential substation will, however, fall just outside of the previously investigated area.

Methodology and approach to EIA

Conceptual site model

4.2.10 In accordance with the Environmental Protection Act 1990, for “contaminated land” to exist there should be a source of contamination, a receptor where “significant harm” or “significant possibility of significant harm” may be caused, or pollution of controlled waters is being or likely to be caused, and a pathway which connects the two. Should any element of this contaminant linkage (source-pathway-receptor) be absent or severed, then the land may not be regarded as “contaminated land” as defined in Part 2A of the Act. A site may be affected by contamination without meeting the legal definition of “contaminated land”, if the risk is not deemed to be “significant” or if it is considered “suitable for use" under Planning Policy.

4.2.11 In accordance with the above approach, a Conceptual Site Model (CSM) will be developed that describes the likely sources and pathways associated with the landfall works, and the receptors which may be adversely impacted by a pollutant linkage. Subsequently, in order to assess the risk posed by the various source, pathway and receptor linkages that may exist at the site, a ‘linkage model’ will be produced.

4.2.12 Risks are rated in accordance with the Department of Environment (now the Department for Environment Food and Rural Affairs (Defra)), Contaminated Land Research Report series (CLR Report No. 6) 'Prioritisation and categorisation procedure for sites which may be contaminated'.

4.2.13 The following data are available to inform the GWF EIA:

- Greater Gabbard Offshore Wind Farm Environmental Statement (2005);
- Royal Haskoning (September 2007), Contaminated Land Phase I Desk Based Assessment; and
- Royal Haskoning (March 2008) Phase II Environmental Baseline Survey, Greater Gabbard Offshore Wind Farm Substation Site.

4.2.14 These assessments were undertaken for the GGOWF project and the extent of the survey footprints are shown on **Figure 4.3**. The 2007 and 2008 survey footprints were specific in considering an area adjacent to Option 1.

4.2.15 The substation location for Option 2 was previously considered for the GGOWF application in 2005. This information is presented in GGOWL, 2005.

Option 1

4.2.16 It is considered that the data for the Geology, Hydrogeology and Land Quality elements of the GWF are still valid, both spatially and temporally. The previous ground investigation works do not fully incorporate the newly proposed transition pit and export cable route, however, the proximity of the two footprints is sufficiently close to make this dataset valid for the GWF project.

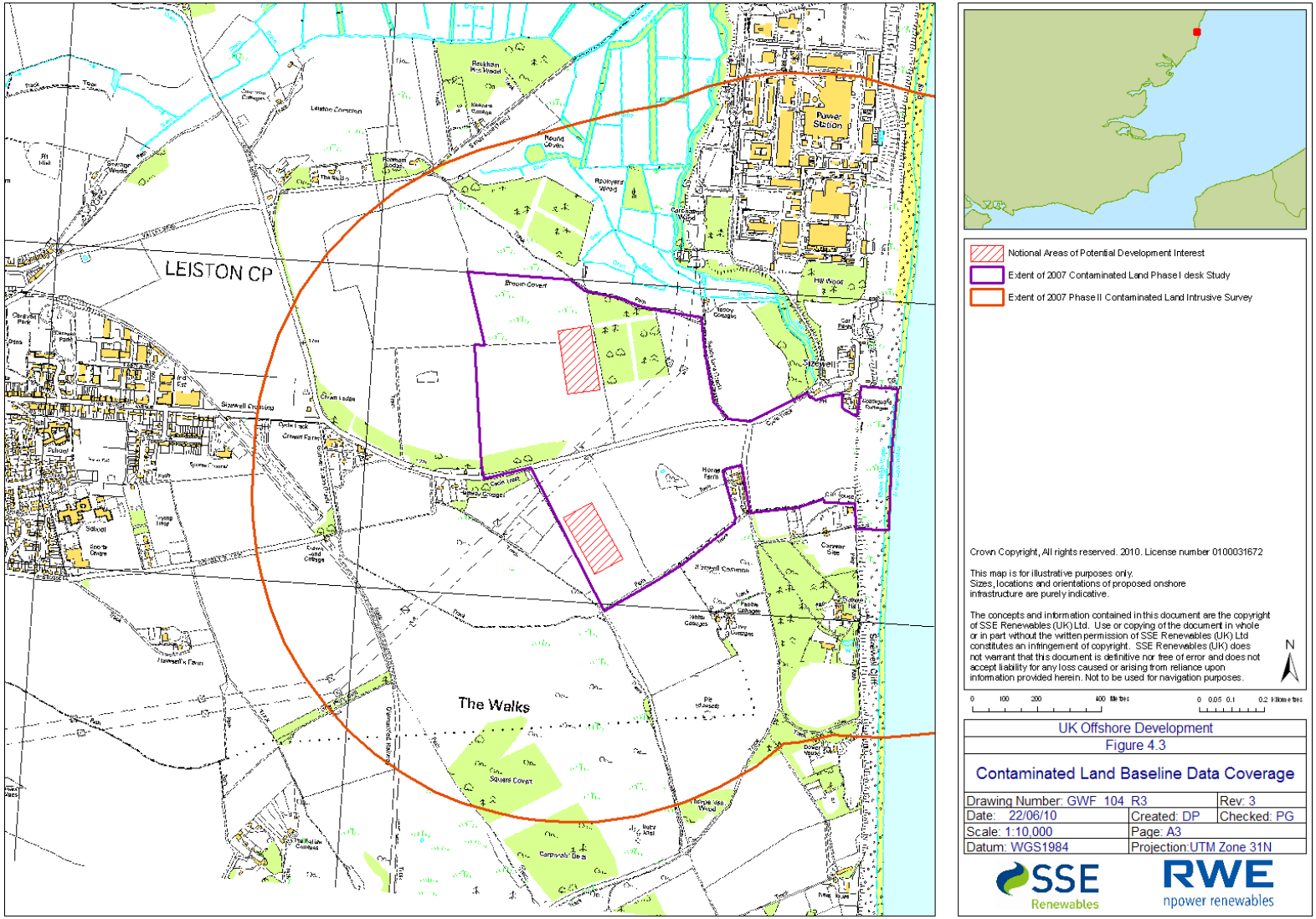
Option 2

4.2.17 This site has not been the subject of any previous intrusive ground investigation works. However, the site was specifically considered within the 2005 application and, at that time, any risk of land contamination was considered relatively low due to a low pollution potential and lack of major sensitive receptors in the immediate vicinity of the works. In addition, the 2007 Phase 1 desk study includes this site. The data presented in the 2005 ES and the 2007 desk study will be re-examined to inform this EIA, should Option 2 be taken forward.

Study summary

EIA study	Purpose
Conceptual Site Model based on existing data associated with the GGOWF project.	The model will identify the likely contamination sources and pathways associated with the landfall works, and the receptors which may be adversely impacted by a pollutant linkage.

Figure 4.3: Contaminated land baseline data coverage



5 BIOLOGICAL PARAMETERS

5.1 Nature conservation designations

Existing environment

5.1.1 There are a number of local, national and international designated sites for nature conservation importance within this region. The majority of these are some distance from the GWF site itself, but some are in close proximity to, or overlapping with the export cable corridor and onshore site.

Statutory international designations

5.1.2 Statutory international designated sites in the United Kingdom (UK) include Ramsar wetland and Natura 2000 sites, known as Special Protection Areas (SPA) and Special Areas of Conservation (SAC).

5.1.3 Ramsar sites of relevance to the GWF include:

- Minsmere – Walberswick (35.5km from the GWF site; 2km from onshore substation); and
- Alde-Ore Estuary (28km from the GWF site; 5km from onshore substation).

Special Protection Areas

5.1.4 SPAs are statutory designated sites that are classified under European Union (EU) law in accordance with Article 4 of the European Council (EC) Directive on the conservation of wild birds (79/409/EEC) (known as the Birds Directive). They are classified for rare and vulnerable birds, listed in Annex I to the Birds Directive, and for regularly occurring migratory species. These designations do not extend below Mean Low Water. SPAs of relevance to GWF include:

- The Sandlings (32.5km from the GWF site; <100m from onshore substation);
- Minsmere – Walberswick (35.5km from the GWF site; 2km from onshore substation); and
- Alde-Ore Estuary (28km from the GWF site; 5km from onshore substation).

Special Areas of Conservation

5.1.5 SACs are sites designated under EU Directive 92/43/EEC on the conservation of habitats and of wild flora and fauna (known as the Habitats Directive), because they make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive. SACs of relevance to GWF include:

- Minsmere to Walberswick Heaths and Marshes (35.5km from the GWF site; 2km from onshore substation);
- Alde, Ore and Butley Estuaries (29km from the GWF site; 5km from onshore substation);
- Orfordness –Shingle Street (28km from the GWF site; 7km from onshore substation); and
- Essex Estuaries (52.5km from the GWF site).

5.1.6 SACs and SPAs form the Natura 2000 network, which is designed to protect Europe's most important areas for wildlife. Listed Ramsar sites are also afforded the same protection at a policy level, in respect of new development, as is afforded to sites which are designated under the Birds and Habitats Directives as part of the EU Natura 2000 network.

Statutory national designations

5.1.7 At a national level, and within the study area, there are two types of designated site for nature conservation; Sites of Special Scientific Interest (SSSI); and National Nature Reserves (NNR). The following national sites are found within a 2km radius around the landfall site:

- Leiston-Aldeburgh SSSI;
- Minsmere-Walberswick Heaths and Marshes SSSI;
- Sizewell Marshes SSSI;
- Benacre NNR;
- Orfordness-Havergate NNR;
- Suffolk Coast NNR (Walberswick); and
- Hamford water NNR.

Non statutory designations

5.1.8 The principal types of non-statutory sites of conservation importance are as follows:

- Local Nature Reserves (LNR);
- Areas of Outstanding Natural Beauty (AONB);
- Heritage Coasts;
- County Wildlife Sites (CWS);
- County Geological Sites (CGS);
- Sites of Importance for Nature Conservation (SINC);
- Ancient Woodland (AW); and
- Sensitive Marine Areas (SMA).

5.1.9 The following non statutory sites are located within 2km of the landfall works:

- Orfordness SMA;
- Leiston Common CWS;
- Sizewell Levels and Associated Areas CWS;
- Southern Minsmere Levels CWS;
- Sizewell Rigs CWS;
- Suffolk Shingle Beaches CWS;
- The Suffolk Coast and Heaths AONB; and
- Suffolk Coast Heritage Coast.

Figure 5.1a: Nature Conservation Designations in the GWF vicinity

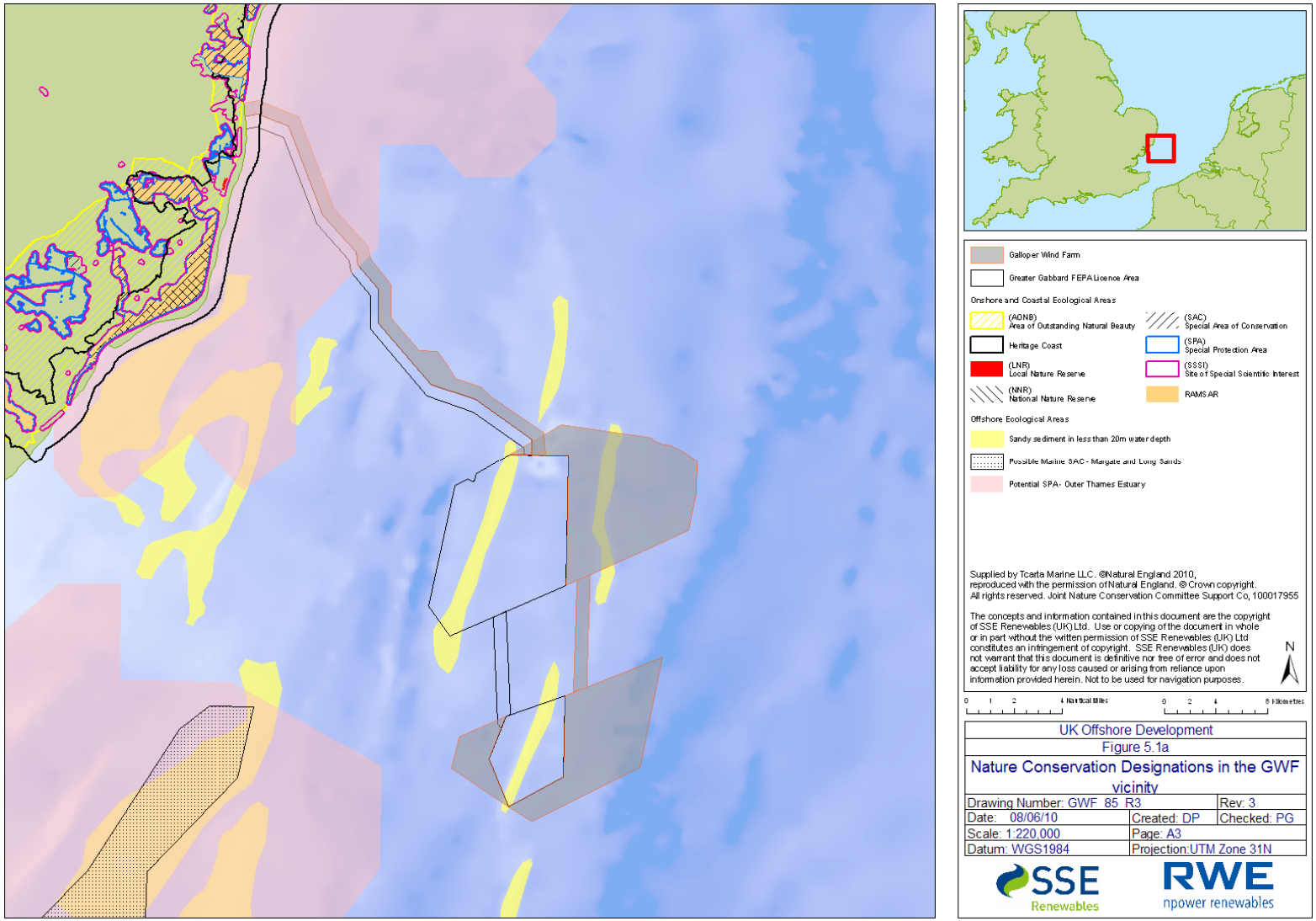
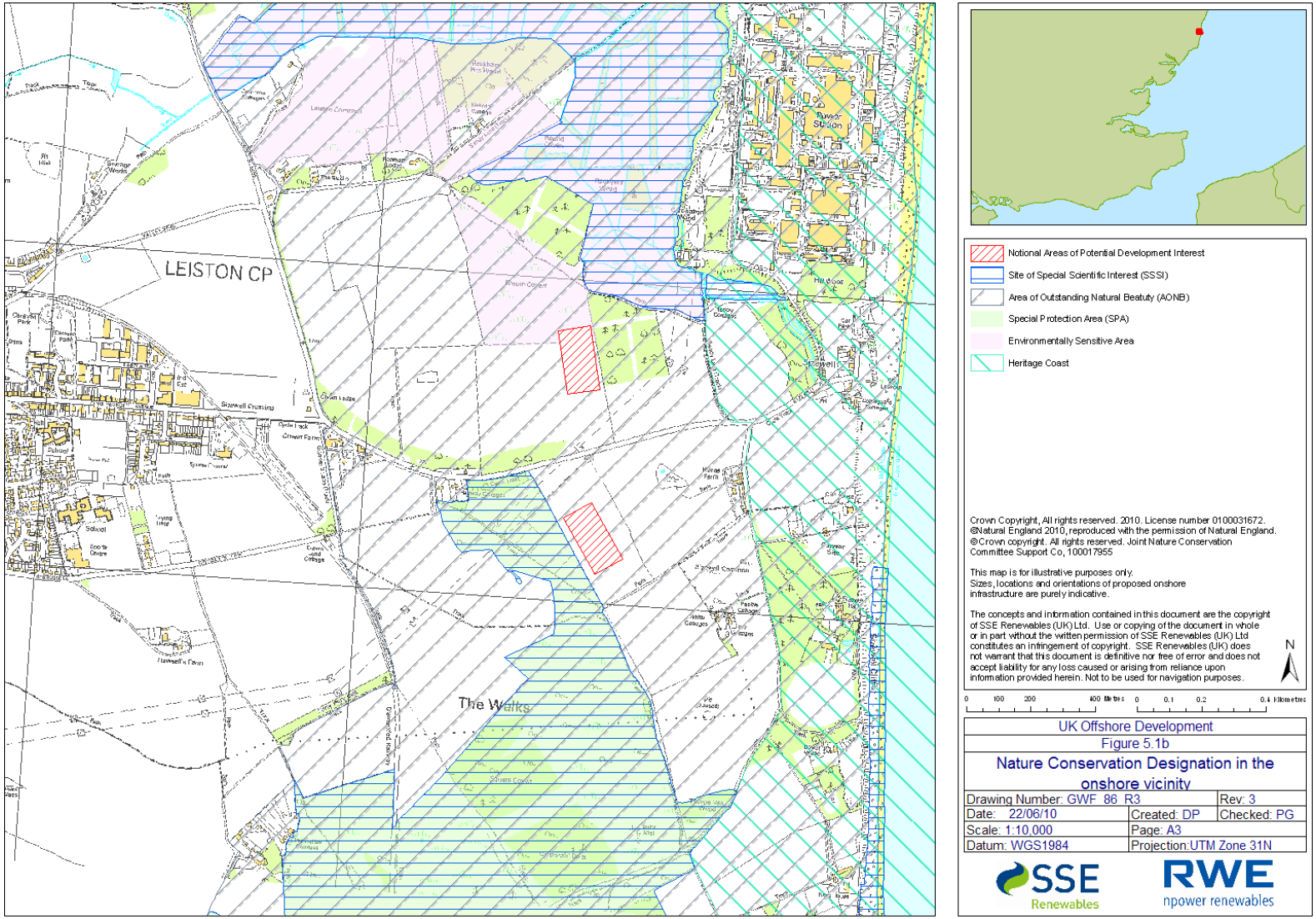


Figure 5.1b: Nature Conservation Designations in the onshore works vicinity



Future designations

5.1.10 Natural England and the JNCC are proceeding with the selection and designation of a second series of Natura 2000 sites (both SPAs and SACs) in the UK inshore area (0 – 12nm zone) and offshore marine area (waters beyond 12nm but within British Fishery Limits and seabed within the UK Continental Shelf Designated Area) (JNCC, 2009).

SACs

5.1.11 These sites will contain qualifying marine habitats or species listed on Annex I of the Habitats Directive, including the additional Annex I marine habitat types of reefs, sandbanks, submarine structures made by leaking gases and submerged or partially submerged sea caves (JNCC, 2009).

5.1.12 Two sandbank complexes in the vicinity of GWF have been selected by Natural England and the JNCC as draft SACs (dSACs) and will be designated, subject to ongoing consultation and approval by Government:

- Haisborough, Hammond and Winterton dSAC; and
- Margate and Long Sands dSAC.

5.1.13 Haisborough, Hammond and Winterton dSAC is located 71km north of the GWF site, and Margate and Longsands dSAC is located 16km southwest of the GWF site. The location of these potential future designations is provided in **Figure 5.1a** (JNCC, 2008).

5.1.14 Outer Gabbard, Inner Gabbard, The Galloper, North and South Falls Inshore Areas of Search were considered against the site selection criteria for SACs, but were rejected as it was deemed that the sandbank features were better represented by other North Sea sites (JNCC, 2008).

SPAs

5.1.15 The Outer Thames Estuary has been identified by Natural England as potentially qualifying as a SPA, based on data collected from aerial surveys during the period from January 1989 to winters of 2005/06 and 2006/07 and analysed by the JNCC Seabirds and Cetaceans Team (Natural England, 2009a). These data demonstrate that the dSPA regularly supports wintering red-throated diver *Gavia stellata* in numbers of European importance (Natural England, 2009a). Whilst the GWF lies outwith this dSPA, the export cable corridor is likely to pass through the area of interest.

Identification of key issues

5.1.16 The impacts relating to the designated sites are not considered within this section as they are covered within the parameter relevant to the feature of designation e.g. physical processes, ornithology and marine ecology.

Methodology and approach to EIA

5.1.17 All designated sites at European (Natura 2000 sites), National and local level will be identified in relation to the project footprint within the EIA. This will encompass both existing and draft designated sites.

5.1.18 The investigations required to inform the potential for impacts on designated features will be covered by the investigations detailed in *inter alia* the physical environment, marine ecology and ornithology sections of this report.

Information for Appropriate Assessment

5.1.19 If a plan or project not connected to the management of a European site is likely to have a significant effect on that site, the Competent Authority is required to carry out an Appropriate Assessment (as described under Regulation 48(1) of the Habitats Regulations) to determine whether the plan or project, either alone or in combination with other plans or projects, will have an adverse effect on the site's integrity.

5.1.20 The EIA will therefore, provide a review of the potential impacts of the proposed development, in terms of likely significant effects on the interest features of the Natura 2000 sites that may be affected by the proposals, especially those that comprise the draft Outer Thames SPA (dSPA), the Alde-Ore SPA and the draft Margate and Long Sands SAC (dSAC) to sufficient detail to inform the Appropriate Assessment. This review will include consideration of the potential cumulative effects on the designated sites, in particular the potential for cumulative impacts with other Outer Thames Estuary offshore wind farms on ornithological features.

5.2 Ornithology

Existing environment

5.2.1 GWF is not located within any sites designated for their bird interest, however due to the wide-ranging behaviour of most seabird and coastal bird species there is the potential for a number of nearby designated sites and their bird populations to be affected by the project. The greatest potential for such issues to arise are anticipated to be with the Alde-Ore Estuary SPA and the Thames Estuary pSPA.

5.2.2 The Alde-Ore Estuary SPA supports internationally important numbers of a range of bird species throughout the year. These include lesser black-backed gull *Larus fuscus* (which are present in nationally important numbers around the proposed GWF site), herring gull, *Larus argentatus,* black-headed gull *Larus ridibundus*, little tern *Sterna albifrons* and sandwich tern *Sterna sandvicensis*. The Thames Estuary pSPA supports internationally important numbers of wintering red-throated diver *Gavia stellata*.

5.2.3 Data collected during boat-based surveys of the GWF site and surrounding area between June 2008 and May 2009, identified a number of key bird species. Species that were present within the study area for the majority of the year or in reasonable numbers (over 50) included; Arctic skua *Stercorarius parasiticus*, gannet *Morus bassanus*, great black-backed gull *Larus marinus*, great skua *Stercorarius skua*, guillemot *Uria aalge*, herring gull, kittiwake *Rissa tridactyla*, lesser black-backed gull, northern fulmar *Fulmarus glacialis*, razorbill *Alca torda* and red-throated diver (Airtricity, 2009a). No species were recorded within the GWF site alone in nationally important numbers during the surveys.

5.2.4 When the survey study area as a whole is considered (of which the GWF site forms approximately 30%), nationally important numbers (>1% of the recognised national estimate for the species) of four species were recorded during the surveys. These were:

- Arctic skua (during August);
- Great skua (during September);
- Great black-backed gull (during December); and
- Lesser black-backed gull (during June and August).

5.2.5 Two key species to the study area; red-throated diver and lesser black-backed gull are considered qualifying features of the SPA and pSPA discussed above. **Figure 5.2** and **Figure 5.3** illustrate the summarised quarterly densities of the key SPA species, red-throated diver and lesser black-backed gull from surveys undertaken during winter and summer Quarters in 2009.

5.2.6 No species were recorded within the proposed GWF site boundary in nationally important numbers during the baseline surveys between June 2008 and May 2009.

Figure 5.2: Red-throated diver densities - winter (January to February) and summer (June to August)

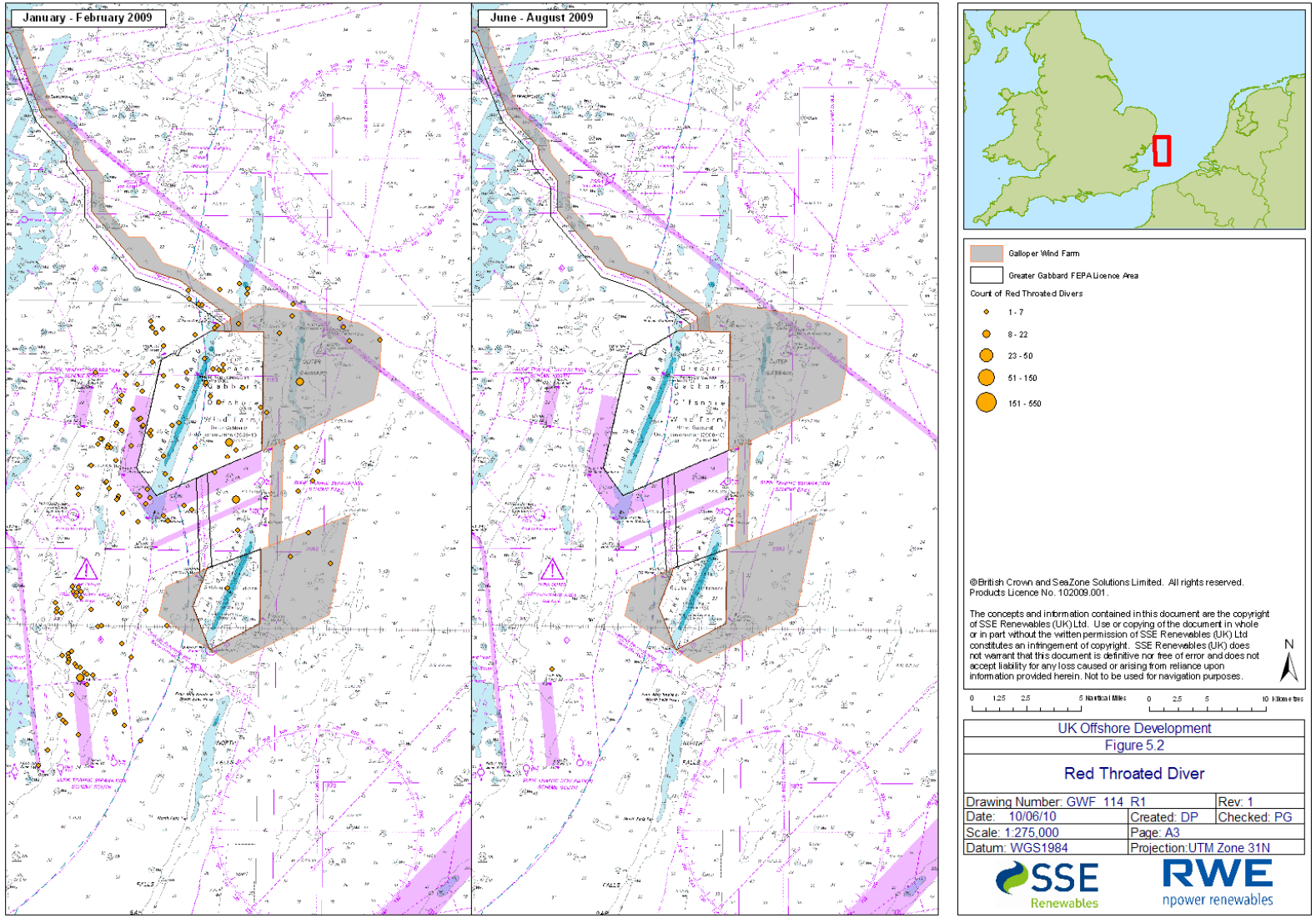
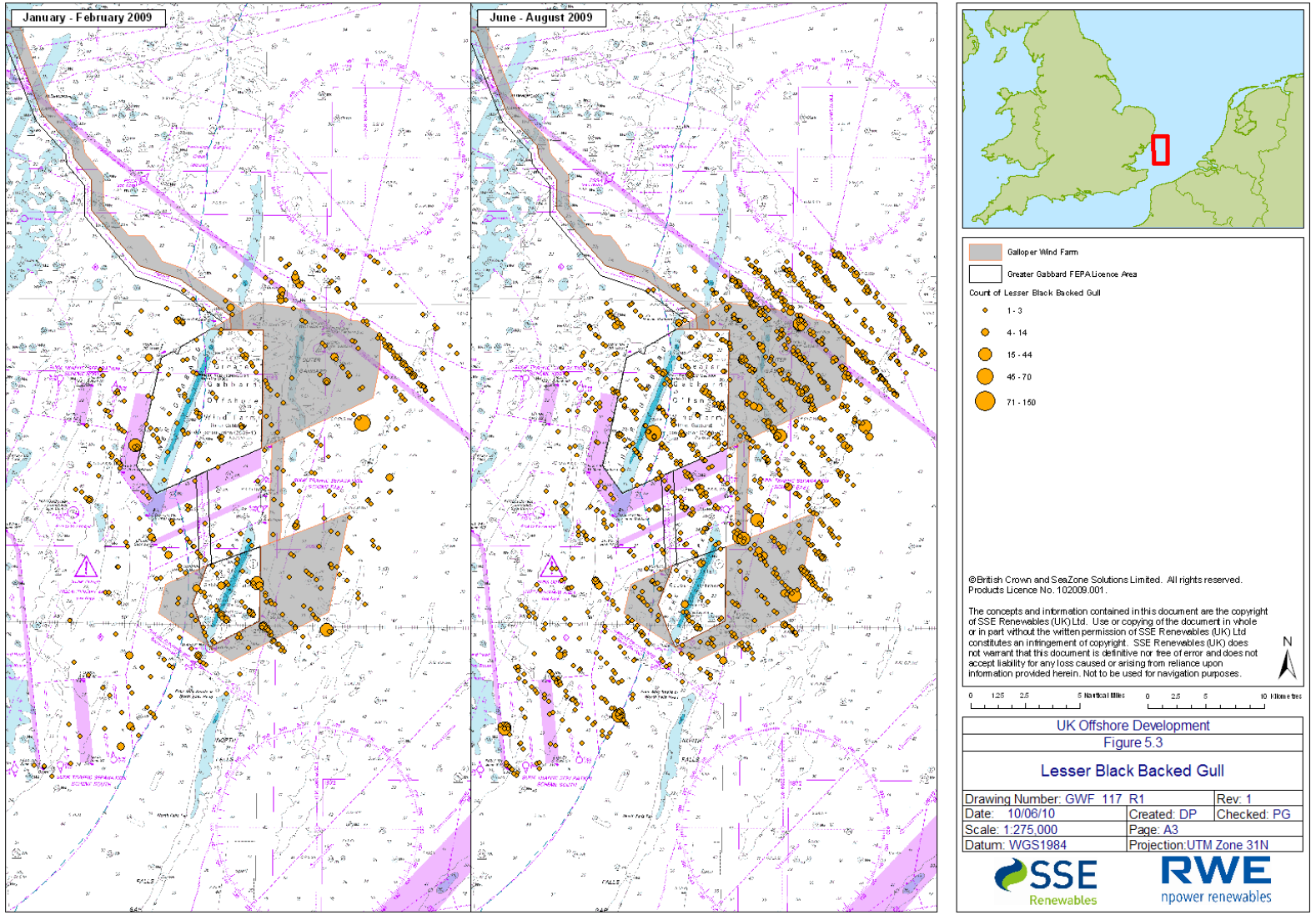


Figure 5.3: Lesser black-backed gull densities - winter (January to February) and summer (June to August)



5.2.7 Clear seasonal variation was recorded amongst most species, including lesser black-backed gull, gannet, great black-backed gull, kittiwake and herring gull. Spatial variation across the GWF survey area was also apparent for a number of species, with coastal species such as red-throated diver recorded in greater numbers within the western, more coastal extents. Conversely, higher numbers of species with more maritime lifestyles, such as gannet and guillemot were recorded within the eastern extents of the survey area. Fishing vessel associations were observed during the majority of the monitoring surveys, with a number of species (mainly gulls), recorded following fishing vessels and resulting in temporarily and sometimes substantially increased densities in the survey area.

Identification of key issues

Potential impacts during construction

5.2.8 Disturbance and displacement: Presence of construction vessel spread, noise and vibration generated during construction activities may disturb and displace birds using the GWF site and buffers (1km and 4km) for feeding, resting and passage, for the duration of installation activities (NERI, 2004). Sensitivities of individual species to disturbance vary, with species such as divers being most sensitive to the effects and, therefore, more easily displaced (Garthe and Hüppop, 2004, NERI, 2004). Gulls, skua and fulmar have, however, been classed as significantly less sensitive to disturbance (Garthe and Hüppop, 2004).

5.2.9 Ongoing boat-based surveys within the project area have identified the presence of a number of key species, which are present within the GWF site and surrounding area during and outside of, the breeding season, both in nationally and regionally important numbers (Airtricity, 2009a). These comprise mainly species of gull, which are not considered sensitive to the effects of disturbance, however red-throated diver are also present in significant numbers, during certain periods of the year. As such, the possibility for seasonal disturbance to more sensitive species, such as red-throated diver, is recognised (in the more inshore regions of the GWF site).

5.2.10 Displacement from feeding habitat and changes to prey supply: Noise and vibration associated with construction may also cause temporary, localised displacement of prey species, such as fish.

5.2.11 Displacement will affect different species in different ways, and will largely be dependant upon the availability of suitable feeding habitat in the wider area to which bird species are displaced. Species with specific habitat requirements, such as divers, are likely to be more vulnerable to the effects of displacement than habitat generalists such as gannet, gulls and fulmar (Garthe and Hüppop, 2004, Maclean *et al*, 2009). As such, the possibility for seasonal effects on more vulnerable species, such as red-throated diver, is recognised. The majority of species that have been recorded feeding within the proposed GWF site and buffers during recent boat-based surveys are however considered habitat generalists (gulls, auks, skuas, and fulmar), which are not considered sensitive to habitat exclusion.

Potential impacts during operation

5.2.12 Barrier effect: During operation, birds may change their flight path to avoid crossing through a wind farm, with the wind farm effectively acting as a barrier to free movement. This can result in increased energetic costs of daily movements and migration (DECC, 2009). The impact as a result of any barrier effect will be both species and movement specific. Large bulky species with high wing loadings, which have to repeatedly avoid the wind farm, will be the most affected.

5.2.13 Disturbance and displacement: Similar to during construction, certain species are likely to be more sensitive to the disturbance effects of operational wind farms, and may be displaced from an area of former use. Gulls (which form the majority of the species observed at the GWF), skua and fulmar have, however, been classed as significantly less sensitive to such disturbance (Garthe and Hüppop, 2004).

5.2.14 Recent monitoring studies at the Horns Rev offshore wind farm have recorded avoidance of the wind farm site and buffers (2km and 4km) by divers, common scoter, guillemot and razorbill during its operation (NERI, 2005). Red-throated diver, guillemot and razorbill have been recorded within the GWF site and buffers during the year and there is the possibility that they may be disturbed and displaced from the wind farm site and its buffers during operation. Displacement issues will be addressed within the EIA and any necessary monitoring studies will be established in conjunction with the JNCC, Natural England and the Royal Society for the Protection of Birds (RSPB).

5.2.15 Collision risk: Different species vary in their WTG avoidance mechanisms and their susceptibility to collision. Species such as divers are most susceptible to the risk of collision, although they usually avoid wind farms altogether (Maclean *et al*, 2009).

5.2.16 Data collected during boat-based monitoring surveys of the GWF study area between 2008 and 2009 suggests that of all species recorded, lesser black-backed gull were most commonly recorded flying at collision risk height with WTG blades (although this could be a reflection of their higher numbers in general) (Airtricity, 2009a). Low numbers of red-throated diver were also recorded at a height considered at risk of collision (Airtricity, 20009a). Red-throated diver and lesser black-backed gull, along with other key species will, therefore, form part of a statistical collision risk assessment, the scope of which will be agreed in consultation with the JNCC, Natural England and RSPB and will inform the project's ES. Any necessary monitoring requirements will also be established with the relevant consultees.

5.2.17 Changes in habitat or prey supply: Any negative effects to the habitat or prey supply may result in indirect impacts on bird species using the affected area. However, certain species, such as gulls, which are not prone to displacement, may feed within the site preferentially, such as recorded during monitoring studies of the operational Horns Rev offshore wind farm (NERI, 2005).

Potential impacts due to decommissioning

5.2.18 The potential impacts during the decommissioning phase are envisaged to be akin to those described for the construction phase.

Potential cumulative impacts

5.2.19 Interactions between other wind farms: A number of Round 1 and Round 2 wind farm developments are currently operational, under construction or proposed within the Outer Thames Estuary SEA area. These include Kentish Flats (operational), Gunfleet I & II (operational), Thanet (in construction), Greater Gabbard (in construction) and London Array (phased consent). It is understood that from these, the only potential for temporal overlap between construction periods with GWF is for the second phase of London Array. Other potential sources of cumulative impact comprise displacement, barrier effects and collision risk during the operation phase of these projects. Assessment of cumulative effects will consider any cumulative impacts as a result of these R1 and R2 developments and will inform the ES.

5.2.20 It has been agreed in consultation with the JNCC, Natural England and the MFA, that other R2.5 and R3 projects will not be considered in the assessment, as there is not currently enough detail on the plans that will be put forward. Should more data on these projects become available during the course of the assessment, then consultation with the statutory bodies will be undertaken to establish the most appropriate way forward.

5.2.21 Interactions between other activities: A number of human activities occur within or in close proximity to the GWF site, which could result in cumulative impacts on birds. These are detailed in **Section 6** and include aggregate extraction, marine disposal sites and military exercise areas. Assessment of these impacts will be carried out and reported within the ES, to determine the extent and significance on ornithological interests.

Methodology and approach to EIA

5.2.22 Current guidance (Camphuysen *et al,* 2004) recommends the collection of at least two years of baseline survey data in order to properly characterise the ornithological interests of a proposed offshore wind farm. However, as the GWF project will form an extension to the GGOWF (of which construction is currently underway), only one year of un-impacted dedicated boat-based baseline data will be available for the GWF in order to inform the ornithological baseline and subsequent impact assessment (as discussed above).

5.2.23 Consultation with the JNCC in 2007, established that the GGOWF and GWF site were considered of relatively low importance for birds. Consequently, it was agreed with the JNCC that the boat-based data collected as part of the GGOWF baseline surveys (Banks *et al*, 2006) and during the pre-construction GGOWF monitoring, would be sufficient to inform an ornithological baseline for the GWF site if the latter was extended out to encompass the GWF area. However, this was subject to the results of the boat-based monitoring surveys of GWF suggesting comparable populations to the GGOWF area. From cursory observations made of the data, similar bird use was recorded at GGOWF and GWF, although as GWF is further offshore it appears to support larger numbers of maritime species such as gannet and guillemot and lower numbers of coastal species such as red-throated diver (Airtricity 2009a). The ES will provide statistical comparison of the data sets, to look for statistically significant differences between the two sites.

5.2.24 Following the collection of the first year of monitoring data for GWF, it was agreed in consultation with the JNCC and Natural England that boat-based surveys of the GWF would continue until at least December 2009, although SSER and NRL have continued to collect the data out to May 2010. Data from the surveys undertaken from July 2009 onwards is likely to differ from the existing baseline due to displacement effects from construction activity at GGOWF. However, it is envisaged that this data will still be of use for informing the GWF's assessment of displacement effects through a comparison of the ornithological data collected during this with the records from GGOWL on construction activity.

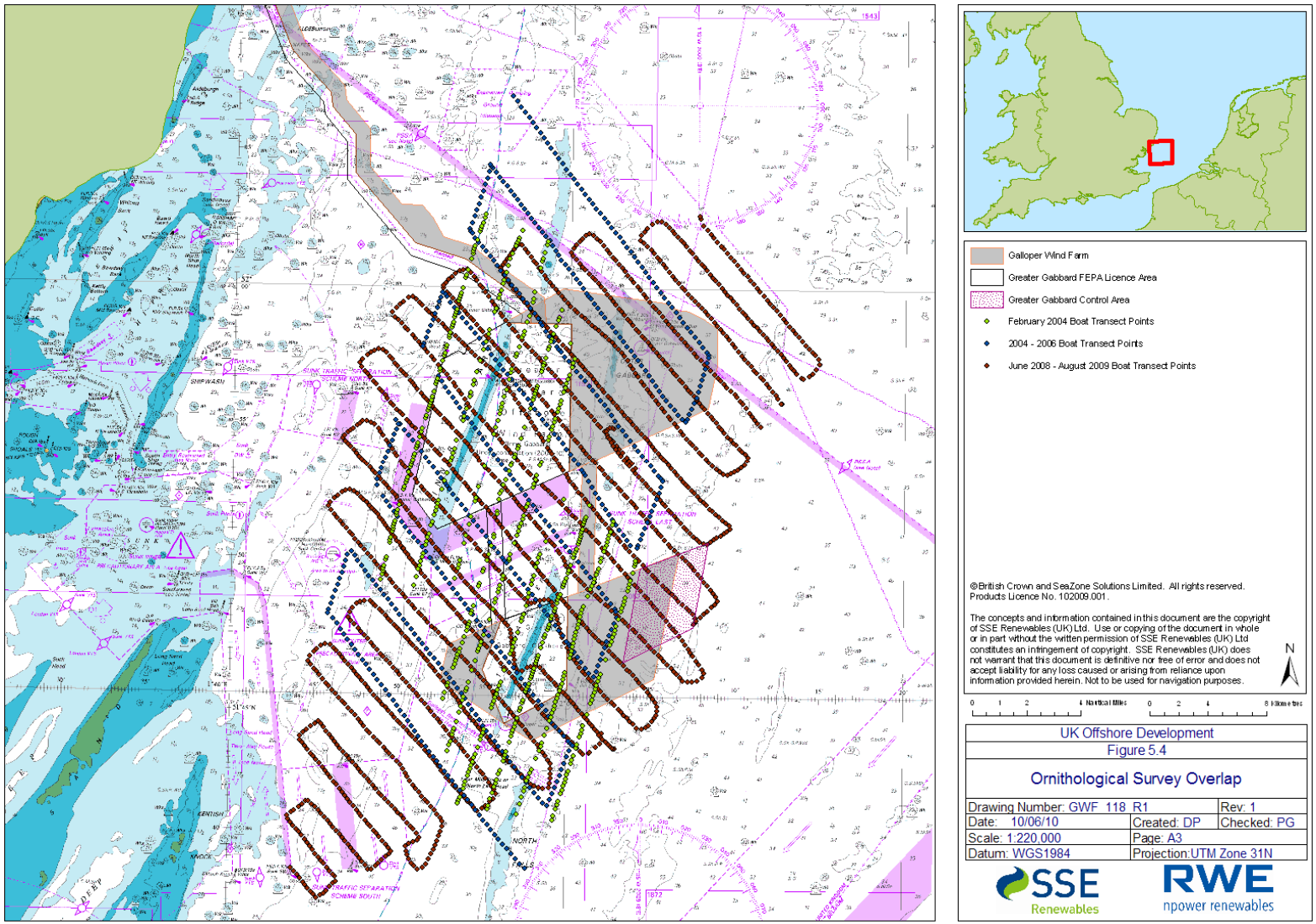
5.2.25 A total of 24 months, or two full years of boat-based baseline survey data is therefore, available for the GWF site and will be reported within the GWF ES. Although as discussed the latter 12 months of this baseline data has been collected for the GWF site whilst construction was ongoing at the adjacent GGOWF; as a result the data will be interpreted in this context.

5.2.26 **Table 5.1** and the **Figure 5.4** summarise the survey data that is available to inform the GWF ES.

Table 5.1: Boat-based surveys of GWF and GGOWF to date

Site	Survey type	Survey Period	Survey Dates	Data reference	Survey type
GWF	Baseline	12 months	June 2008 – May 2009	Airtricity, 2009a	Baseline
GWF	Construction influenced baseline	12 months	June to May 2010	Unpublished	Construction influenced baseline
GGOWF	Baseline	26 months	February 2004 – April 2006	Banks *et al*, 2006	Baseline
GGOWF	Pre-construction monitoring	12 months	June 2008 – May 2009	Airtricity, 2009b	Pre-construction monitoring
GGOWF	During-construction monitoring	Ongoing	June 2009 – Ongoing	Unpublished	During-construction monitoring

Figure 5.4: Ornithological survey overlap



5.2.27 Further to the boat based survey data, a number of recent aerial surveys have also characterised the wider area of the Greater Thames Estuary, which will be used to help inform the ES, these include:

- WWT consulting aerial surveys of the Outer Thames Estuary SEA (area TH3 covering the GWF location) between November 2004 and March 2008;
- Hi Def consulting aerial surveys of Round 3, Zone 5 (Norfolk area, 2.5km northeast of GWF) between February and March 2008; and
- NERI aerial surveys of the Outer Thames Estuary SEA between September 2004 and March 2005.

5.2.28 The ornithological baseline within the EIA will also be informed by a review of all other pertinent data sets from surrounding areas, such as other wind energy developments in the Thames SEA and broader studies of the Outer Thames SEA area, including additional data available on seabird distribution in the North Sea.

5.2.29 **Assessment of impacts:** Following the establishment of a suitable baseline, which will be agreed in consultation with the JNCC, Natural England and RSPB, a Collision Risk Assessment (CRA) and Cumulative Impact Assessment (CIA) will be undertaken. The CRA will be carried out using the mathematical model described by Scottish National Heritage (SNH) in their guidance on the assessment of collision risks (see http://www.snh.org.uk/strategy/renewable/sr-we00a1.asp and Band *et al*, 2005). The outputs of which will be fed into the project's EIA. SSER and NRL believe that the most appropriate approach to CRA is to use the un-impacted baseline (June 2008 to August 2009, i.e. 14 months of data) only to inform the study. As mentioned, data post August 2009 represents an impacted baseline due the construction activity occurring at the GGOWF. Therefore, bird flight heights recorded during the August 2009 to May 2010 period may not be reflective of baseline conditions, and would therefore, influence results of the CRA. The scope of the CRA and CIA is currently under discussion with the JNCC, Natural England and the MMO.

5.2.30 Impacts as a result of the scheme during construction, operation and decommissioning will be assessed in accordance with the Institute for Ecology and Environmental Management (IEEM) Marine ecological impact assessment draft guidance (IEEM 2008). The assessment of cumulative impacts will also be undertaken with regard to the latest COWRIE guidance (King *et al.* 2009).

5.2.31 The Alde-Ore Estuary SPA (**Section 5.1**) supports internationally important numbers of lesser black-backed gull during the breeding season, and is located within foraging distance of the GWF site. The Greater Thames Estuary pSPA, which is also within foraging distance of GWF, supports internationally important numbers of red-throated diver during the overwintering season. Whilst taking into consideration all relevant species that may forage or pass through the existing GWF site area, the EIA will provided particular focus on the potential effects on the red-throated diver and lesser black-backed gull that form primary features of the two SPA's.

5.2.32 SSER and NRL herein commit to continue working closely with the JNCC and Natural England throughout EIA process in order to ensure that ornithological data collection, analysis and interpretation is carried out and reported in a manner acceptable to all parties.

Study summary

EIA study component	Purpose
GWF boat based surveys comprising 12 months un-impacted baseline and 12 month impacted baseline (undertaken by ESS Ecology Ltd)	To help inform the ornithological baseline and also inform on likely construction impacts through experience at GGOWF.
Ornithological desk based study including Collision Risk Assessment (CRA) and Cumulative Assessment (to be undertaken by ESS Ecology Ltd)	To review all existing ornithological data sets to help characterise the GWF study area and identify potential impacts, with particular focus on the species of conservation concern (namely, lesser black-backed gull and red-throated diver). The findings will also be used to help inform suitable mitigation and monitoring measures.

5.3 Marine ecology

Existing environment

5.3.1 Sandbank habitats are generally impoverished as a result of substrate mobility and reduced complexity and this is reflected in surveys of these habitats (GGOWL, 2005, EMU Ltd, 2006 and Unicomarine, 1995) which have generally found lower taxonomic diversity compared to more widely dispersed surveys (e.g. EMU Ltd, 2009). These surveys have indicated the sediment habitats of the Outer Thames macrofauna are dominated by annelids which accounted for 36% of the total species variety and 40% of the countable fauna and are the most important contributors to overall biomass (EMU Ltd, 2009). The results are comparable to the pre-construction surveys undertaken at the GGOWF where the most abundant species were the polychaetes *Lumbrineris gracilis, Pomatoceros triqueter* and *Polynoidae indet. L. gracilis* was the most abundant taxa and one of the most evenly distributed. The genus *Lumbrineris* spp. is known to favour areas of circalittoral coarse sand or gravel and is a component of the biotope classification SS.SCS.CCS.MedLumVen (Connor *et al.,* 2004). *L. gracilis* is considered to favour smothering (Bamber, 1989), is intolerant of substrate loss (Boyd *et al.,* 2003) and may be considered a useful indicator species for post wind farm development (Gardline Environmental Ltd, 2009a).

5.3.2 The five main biotopes/communities identified as occurring in the area as presented in the GGOWF ES are as follows (GGOWL, 2005):

- *SS.SSA.IiSa.ImoSa Infralittoral mobile clean sand with sparse fauna;*
- *SS.SCS.ICS.Glap Glycera lapidum in impoverished infralittoral mobile gravel and sand;*
- SS.SCS.CCS.MedLumVen *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel;
- SS.SBR.PoR.SspiMx *Sabellaria spinulosa* on stable circalittoral mixed sediment; and
- *Scalibregma* dominated sands/muddy sands.

5.3.3 Trawl sampling used to obtain information on epibenthic faunal compositions for the GGOWF site found 274 taxa. Echinoderms and crustacea were the most common invertebrate taxa observed of which the echinoderm *Ophiura ophiura, Psammechinus miliaris* and *O. albida* were the most abundant invertebrate (Gardline Environmental Ltd, 2009a). Crustaceans were the second most common invertebrates consisting primarily of *Pandalina brevirostris,* long clawed porcelain crab *Pisidia longocornis,* bristly crab *Pilumnus hirtellus,* and common hermit crab *Pagurus bernhardus* (Gardline Environmental Ltd, 2009a). Molluscs were sparse but generally diverse with the common whelk *Buccinum undatum* and *Calliostoma zizphinum* the most frequently observed (Gardline Environmental Ltd, 2009a).

5.3.4 No protected species were observed from trawl sampling although fragments of *S. spinulosa* tubes were found. *S. spinulosa* is not a protected species although when present as reefs, it represents a priority habitat (biogenic reefs) protected under the EU Habitats Directive. Further *S. spinulosa* assessments carried out at the GGOWF site as part of the FEPA license conditions found patches of *S. spinulosa*. The majority of tubes were estimated to be less than <2cm in height, and, where visible, were patchy in their distribution (Gardline Environmental Limited, 2009b). *S. spinulosa* tubes generally constituted no more than 10% of each photograph where *S. spinulosa* was observed. As such, taking into account that *S. spinulosa* was observed in only 41 of 155 photographs taken the overall percentage cover of *S. spinulosa* in the GGOWF area were predicted to be well below 10% and hence, according to the JNCC inter agency workshop on defining and managing *S. spinulosa* reefs and reported in Gubbay (2007) the areas of *S. spinulosa* reported are not considered to form reef (Gardline Environmental Limited, 2009b). However site specific surveys during the GWF EIA will consider whether these findings are relevant to the GWF site.

Identification of key issues

Potential impacts during construction

5.3.5 Physical disturbance: The primary impacts to benthic fauna from wind farm development construction include physical disturbance from jack-up legs, piling and cable installation. These activities are likely to result in short-term localised changes to the marine environment such as increased turbidity, suspended sediments and direct disturbance from which benthic communities are likely to recover quickly as is often the experience in dredged areas (e.g. Newell *et al*, 1998).

5.3.6 Jack-up rig feet are likely to penetrate the seabed, and leave holes which may take some time to fill in and for benthic communities to re-establish. Similarly, there will be direct disturbance of benthic communities along the cable route when the cable is ploughed, jetted or trenched into the seabed (and to a lesser extent ploughed).

5.3.7 Alteration of habitat: Habitat alteration during construction may occur from a number of sources including; foundation and cable installation, as well as from the crossing of existing structures such as cables. Recovery of the seabed is, to some degree, dependent on the substrate, depth of disturbance and seabed sediment characteristics that are left following installation.

5.3.8 The EIA will assess the affect of any habitat changes that may result from the application of cable protection measures used at crossing points.

5.3.9 Smothering: The level of sediment mobilised during the installation of the wind farm piling and cabling burial operations will be dependant on the sediment characteristics present. Disturbed sands and gravels will settle back to the seabed rapidly and the footprint of any smothering is therefore likely to remain much localised. Finer sediments (such as silts and clays) will remain in suspension for a greater period of time and will be dispersed over a greater distance, depending upon the strength of the tidal currents. The level of impact resulting from this will be dependent upon the sensitivity of the receiving environment and the hydrodynamic conditions at the time of the works.

5.3.10 Cable burial represents a potential source for suspended sediment generation. Case studies for different cabling techniques at a number of UK offshore wind farms are discussed in BERR (2008) with the conclusion that the disturbance to seabed sediments during cable burial operations are likely to be short term and relatively localised, particularly if ploughing techniques are employed.

5.3.11 Re-mobilisation of contaminated sediments: Concentrations of a range of metals, including organo-tin, petroleum hydrocarbons including PAHs, PCBs, and various pesticide compounds were analysed in sediments a series of samples across the GGOWF development area, with the only contaminant found at significant levels being the naturally occurring heavy metal arsenic (GGOWL, 2005). Results from GGOWF sampling indicated that the effects of contaminated sediment disturbance would be a low severity impact of negligible magnitude. Given the similar lack of human activity within the GWF vicinity a similar chemical composition is anticipated, but nevertheless will be identified and potential for impact assessed within the EIA.

Potential impacts during operation

5.3.12 Loss of habitat: The loss habitat during the operation phase may occur through the physical presence of the foundations and any associated scour protection. There will be a permanent loss of habitat within the footprint of these structures and potential habitat alteration associated with any scouring around the structures.

5.3.13 The GGOWF ES assessed the loss of habitat in the footprint of the turbines based on the worst case scenario using gravity base foundations with a permanent footprint of seabed associated with each turbine of approximately 2,290 m^2. For the biotopes found at the GGOWF site the effects were assessed as negligible (GGOWL, 2005). Should GWF site surveys reveal similar habitats then similar impact levels would be expected with regard to loss of habitat. If these surveys reveal the presence of any *S.spinulosa* reef then micrositing of turbines to avoid these would ensure no loss of this habitat would occur.

5.3.14 Colonisation of foundations: Monitoring at other wind farm sites (e.g. North Hoyle, Horns Rev and Nysted) has indicated that the hard foundation and scour protection surfaces are likely to be colonised by species not regularly found on mobile sandy environments. Turbine foundations are likely to be colonised by high biomass species such as mussels *Mytilus edulis* with a high cover of green and brown algae.

5.3.15 Change in benthic communities: MFA overflight data for fishing activity suggests that commercial beam trawling activities occur within the area of the GWF site. Fishing gears may penetrate the seafloor to a depth of 30cm or more, changing the structure of marine habitats and influencing diversity and biomass (e.g. Auster and Langton, 1999, Jennings and Kaiser, 1998). Trawling may result in a shift in benthic communities from low productive, long lived species to high-productive, short lived species that characterise disturbed environments and lower overall biomass. The reduction of trawling activity within the site could therefore cause a shift in the benthic communities from short-lived to long-lived low productive species and allow recovery to natural, of close to natural, conditions.

Potential impacts during decommissioning

5.3.16 The potential impacts arising during the decommissioning phase are envisaged to be akin to those described for the construction phase.

Potential cumulative impacts

5.3.17 Interactions between other wind farms: Construction impacts identified are typically localised (to the vicinity of the activity) and will be short term in nature. Based on the known planned construction timescales, the only potential overlap of activity is the second phase of the London Array and, given the distance between the two projects (~16km) indirect cumulative effects on the benthos are considered unlikely.

5.3.18 The direct loss of habitat will be assessed in relation to similar habitat loss from other planned and built wind farms (where the data is available), with the adjacent GGOWF being of particular relevance to this assessment.

5.3.19 Interactions between other activities: There are limited additional human activities occurring within the vicinity of the GWF project site, with the exception of aggregate extraction, which is discussed in more detail in **Section 6**. The extents and duration of impacts from the proposed development in relation to the distance of other ongoing seabed activities, combined with the common and widespread nature of species and habitats means that potential for significant cumulative impacts is considered unlikely. However, further consultation with the aggregate industry during the EIA will establish the status of the extraction application and prospecting areas (notably Areas 498 and 452 – see **Figure 6.4**). Should any activities be identified within these in a timeframe that means potential cumulative impacts could be possible then it shall be included within the EIA.

Methodology and approach to EIA

5.3.20 Site specific studies for the GWF site, are underway to fully characterise the benthic communities of the proposed wind farm and export cable areas. These data will be supplemented by existing literature and survey data available on the composition of the macrofaunal communities in the Outer Thames Estuary, as well as from nearby wind farm sites (including GGOWF) that will be used to inform the baseline for the ES.

5.3.21 The scope of this geophysical and benthic site survey was established through consultation with the JNCC, Natural England, Cefas and MFA in 2009. The survey was planned in accordance with Cefas guidance (Cefas, 2004) and comprised the acquisition of bathymetry, seabed texture and morphology, epibenthic and benthic data.

5.3.22 Techniques used comprise the interpretation of acoustic data (as detailed in **Section 4.1**) to identify seabed texture and estimate habitat extents. These predicted habitats will then be ground-truthed using grab sampling, drop camera and epibenthic trawls, in accordance with relevant Cefas guidance.

5.3.23 The extent of the data collection ensured that it was sufficient to cover a full tidal excursion, included a reference site and that sites were targeted at specific locations based on results of the geophysical data interpretation to ensure full characterisation was possible. **Appendix B** provides an overview of the benthic survey plan.

5.3.24 The survey, which was completed in April 2010, was aimed at characterising the benthic assemblage within the wind farm area so that its sensitivity to the impacts associated with the construction, operation and decommissioning of the GWF project can be assessed within the EIA. Any features of conservation importance (such as biogenic reef) will be clearly delineated and described in accordance with accepted guidance (e.g. Gubbay, 2007).

5.3.25 Further to this site specific data collection the GWF ES will draw on the data collected and conclusions drawn from the GGOWF ES and ongoing monitoring programmes, which included a pre-construction *Sabellaria spinulosa* survey.

Study summary

EIA study component	Purpose
Geophysical and benthic survey (comprising grab and drop down camera samples and epibenthic trawls) of the GWF study area (undertaken by OSIRIS Ltd and CMACS)	To provide a characterisation for the ES of the baseline benthic habitats and species within the GWF study area. Survey included a focus on species of conservation concern such as *Sabellaria spinulosa*.
Physical processes study – sediment dispersion modelling (to be undertaken by ABPmer Ltd)	This information will be used to establish the potential for impacts on key benthic receptors.

5.4 Fish and Shellfish resource

Existing environment

5.4.1 The Outer Thames Estuary and its coastal waters are known to contain a diverse range of species. 112 marine or estuarine fish have been recorded in the region (Swaby and Potts, 1998).

5.4.2 The results from the otter trawl surveys of the GWF (Brown and May Ltd, 2009a & 2009b) recorded a total of 32 finfish species and 4 species of shellfish as occurring within the area. Survey catches in the GWF were dominated by whiting *Merlangius merlangus*, dab *Limanda limanda*, lesser spotted dogfish *Scyliorhinus canicula* and cod *Gadus morhua*, which accounted for a large (~80%) proportion of individuals caught. These data show a high degree of similarity to the results of other surveys undertaken at GGOWF (Greater Gabbard Offshore Winds Ltd, 2005), London Array (London Array Ltd, 2005), Thanet (Thanet Offshore Wind Ltd, 2005), Gunfleet Sands (GE Wind Energy, 2002) and surveys undertaken by Cefas.

5.4.3 The most important commercial fisheries in the Thames Estuary include sole *Solea solea*, herring *Clupea harengus*, rays, (particularly thornback *Raja clavata*), sea bass *Dicentrarchus labrax*, cod and plaice *Pluronectes platessa*, and more than 78 distinguishable shellfish, finfish and elasmobranch species are also recorded from commercial landings for the area.

5.4.4 The shallow water of the southern North Sea, estuaries of southeast England and sandbanks of the Thames Estuary are important feeding, spawning and nursery grounds for many species of fish.

5.4.5 Commercially important fish species that have spawning grounds in the area include; Sole (March – May); Herring (November – January); plaice (December – March); Lemon sole *Microstomus kitt* (April – September); sandeel *Ammodytes marinus* (November – February) and sprat *Sprattus sprattus* (May – August). Many of these species are understood to form key prey resource for important bird species such as red-throated diver (Natural England, 2009).

5.4.6 The Outer Thames is also considered an important area for elasmobranchs, in particular thornback ray and spurdog *Squalus acanthias*; the later of which are also thought to pup in the vicinity of the GWF site (Kent and Essex Sea Fisheries Committee, 2009).

5.4.7 The Thames estuary region has confirmed records of all seven British marine and estuarine species protected under national, European and international legislation. These include salmon *Salmo salar*, river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus*, European eel *Anguilla anguilla*, smelt *Atherina presbyter*, allis shad *Alosa alosa* and twaite shad *A. fallax*. Common skate *Raja batis*, angel shark *Squatina squatina*, basking shark *Cetorhinus maximus* and sturgeon *Acipenser sturio*, are considered as those species that either were historically present in the area and/or are considered to be occasional visitors. Of these species only twaite shad *Alosa fallax* (three individuals) were recorded during the autumn 2008 GWF fish surveys).

Figure 5.5: Fish spawning grounds

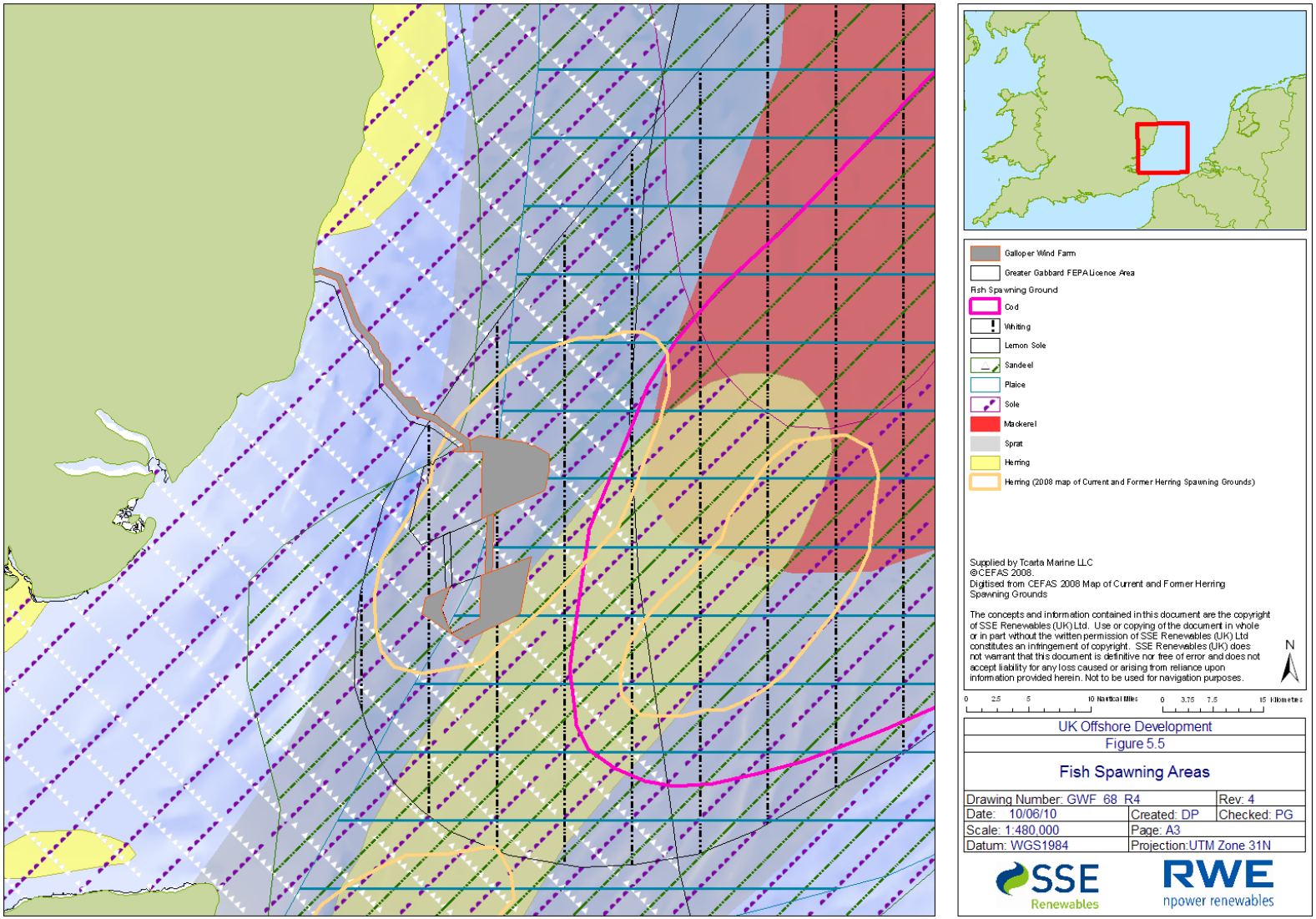
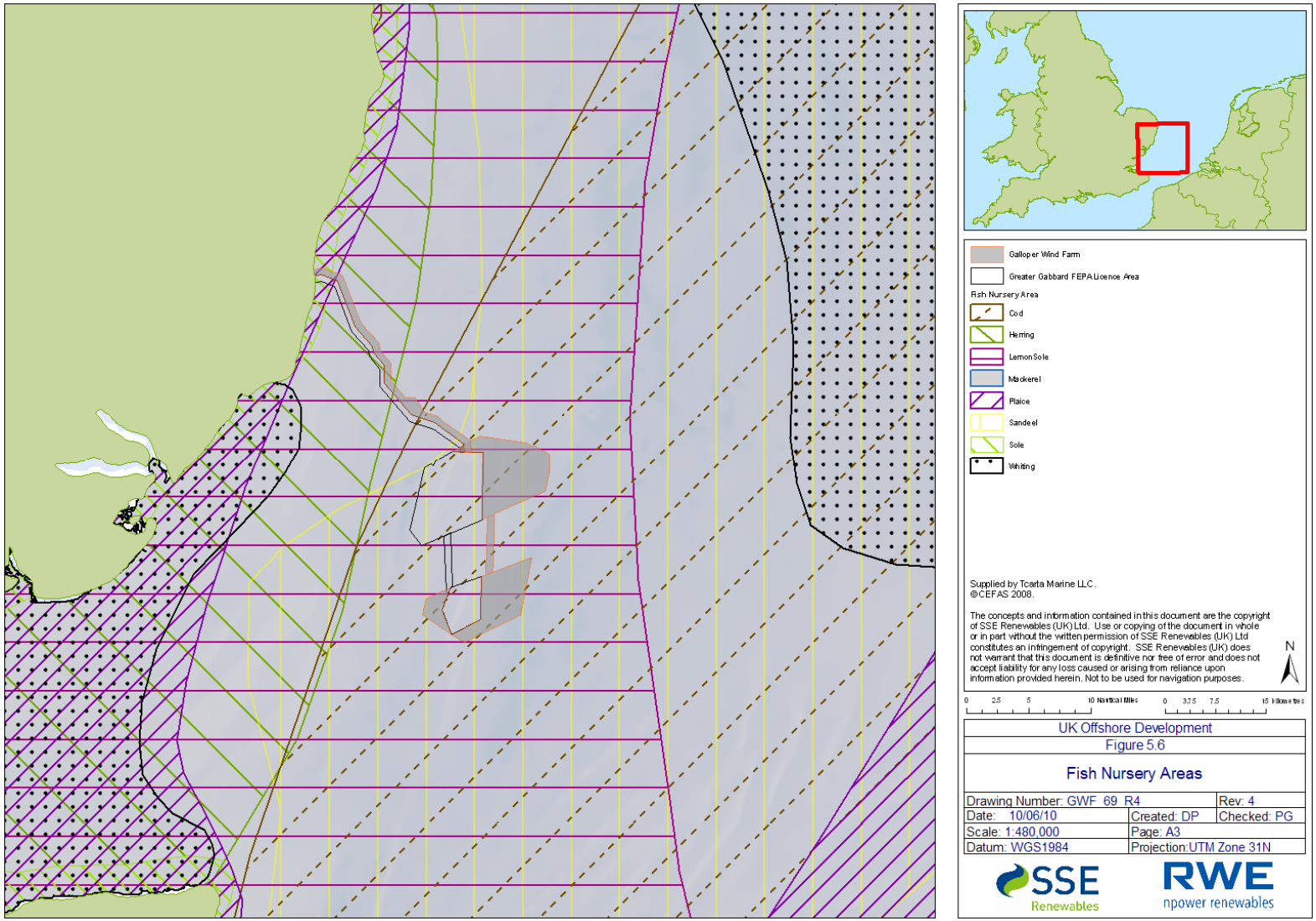


Figure 5.6: Fish nursery grounds



Identification of key issues

Potential impacts during construction

5.4.8 Physical disturbance: Direct disturbance during construction may occur from foundation installation, anchoring (if used) by installation vessels, and cable laying activities. Those organisms that are considered most prone to such effects include demersal fish and crustacean species (such as crabs and lobsters), especially where the activity overlaps with key spawning periods.

5.4.9 Noise and vibration disturbance: There is a large body of literature relating to the potential impacts of underwater piling noise associated with wind farm construction on sensitive fish species. Species such as herring are considered to be highly sensitive to noise impacts and spawning activity of these species can be disrupted through noise and vibration effects. The significance of noise impacts and the extent to which species will be affected is dependant not only on pile diameter, foundation type and installation method but also on local bathymetry as sandbank formations will affect the extent of underwater noise attenuation.

5.4.10 Part of the FEPA license requirements for GGOWF require that the underwater noise associated with piling activities for different pile diameters is monitored. The results from these and any other ongoing monitoring studies will be combined with site specific predictive modelling used to assess the potential for noise disturbance on different fish species. The preliminary results from these investigations indicate that the sandbanks that lie to the west of the GWF site have a significant effect on the extent to which noise is transmitted.

5.4.11 Suspended sediments: The cable burial and wind farm construction activities have the potential to generate suspended sediments. Under these conditions sensitive species may experience effects such as the impairment of respiratory or reproductive functions or disruption of migration/spawning activity. Juvenile and larval stages are likely to be more susceptible to these effects due to their lower mobility and higher sensitivity to such effects. Given the relatively coarse nature of the sediments combined with the proposed construction methods it is not anticipated large quantities of sediment will be brought into suspension as a result of cable and turbine installation. Furthermore, relatively high background suspended sediment concentration levels are common to the southern North Sea. Therefore, impacts of suspended sediments are not considered to have any significant effects on fish species within the vicinity of the construction works.

5.4.12 Re-distribution of contaminated sediments: As discussed in **Section 2**, contaminated sediments are unlikely to be present within the GWF site (with the exception of metallic arsenic which is known to occur widely throughout much of the North Sea and Outer Thames Estuary). Impacts from redistribution of sediments is therefore, not considered likely to result in significant impacts, but will be addressed within the EIA following analysis of sediment samples from the site.

Potential impacts during operation

5.4.13 Loss of habitat: During the operation phase there will be permanent loss of habitat for fish and crustacean species in the direct footprint of the foundations. The potential habitat loss is only likely to have significant effects if the habitat is not widely distributed elsewhere. For the GGOWF the total worse case losses in relation to the total area proposed for development are extremely small at less than 0.23% of the seabed within the proposed development areas (GGOWL, 2005). In comparison to the Greater Thames Estuary as a whole the potential worst case losses are negligible, at less that 0.006% (Greater Gabbard Offshore Winds Ltd, 2005). Given the project similarities these figures and conclusions are also likely to be applicable to the GWF site.

5.4.14 Effects of electromagnetic fields (EMF): Elasmobranchs are considered to be sensitive to the effects of EMF, although research undertaken to date has not been conclusive as to the potential impacts of buried cables associated with wind farms and their potential to interfere with the electromagnetic sensory receptors used by these species to hunt prey and navigate. The outer Thames is known to be of particular importance to ray species in particular thornback ray and also spurdog. Both of these species support commercial fisheries. Recent mesocosm studies (Gill *et al*., 2009) showed no evidence to suggest any positive or negative effect on elasmobranchs of the EMF encountered. Although the impacts associated with EMF and elasmobranch species are not anticipated to be significant given that EMF only extends to a few meters either side of cables, the latest thinking in relation to EMF will be obtained through consultation with experts in this field and incorporated into the ES along with a review of the current available literature.

5.4.15 Increase in diversity/number of individuals: Concrete and steel structures on the seabed are likely to become colonised by a range of benthic invertebrate species which will increase ecological diversity (Linley *et al*, 2007). The effects of the addition of foundation structures with any associated scour protection would likely result in a small increase in the overall diversity and productivity of the local seabed communities which could in turn facilitate an increase in mobile species. Due to the potential fishing gear restrictions within the GWF site there is some potential for the area to act as a no-take zone.

5.4.16 Physical disturbance: Operational noise impacts are considered highly unlikely to cause physical damage to the fish species (Thomson *et al*, 2006). This is further supported by studies at Nysted and Horns Rev Offshore Wind Farms indicate that the effects of operational noise and vibration from the wind farms are believed to be of minor significance. It is recommended that this aspect is 'scoped out' of the EIA.

Potential impacts during decommissioning

5.4.17 The potential impacts associated with the decommissioning phase are envisaged to be similar to those described for construction.

Potential cumulative impacts

5.4.18 Interactions between other wind farms: There is the potential for the cumulative underwater noise impacts to affect fish and shellfish resources, especially in relation to spawning activities or spawning grounds. The significance of any effects will be largely dependant upon the size and significance of any spawning grounds affected.

5.4.19 The cumulative effects could arise as a result of two or more projects undertaking piling simultaneously, two or more projects undertaking construction piling activities over consecutive spawning periods or the installation of multiple piles at the GWF site. The only known (at the time of writing) potential for construction overlap between GWF and other Outer Thames offshore wind farm projects is with the second phase of the London Array project.

5.4.20 The potential for cumulative noise impacts to arise from these two sites is currently being considered in underwater noise modelling investigations. The scope and content of these studies has been developed in close discussion with Cefas to ensure the studies meet the requirements of the regulators.

5.4.21 The potential impacts resulting from electromagnetic fields (EMF) are currently inconclusive and studies are still ongoing to establish what if any impacts exist on elasmobranch species. There will be multiple cables associated with the GWF and existing GGOWF with the potential for cumulative impacts. The issue of EMF impacts will be addressed in the EIA and will draw on the latest thinking and research carried out on the subject to ensure it is adequately addressed.

5.4.22 Interactions with other activities: The principal activity close to GWF that could have the potential to interact with the construction and cable laying phase is aggregate extraction. There is a dredging option area within the proposed cable route and dredging prospecting and application areas within close proximity to the cable corridor. Aggregate extraction activities can lead to localised areas of increased turbidity through the resuspension of fine sediments. The installation of the wind turbine foundations only cause localised disturbance of the seabed and similarly any sediment resuspension associated with the cable laying will be localised and short term in extent.

Methodology and approach to EIA

5.4.23 Existing broad scale data for the study area as collected during the GGOWF ES and from wider studies in the Thames is considered to be comprehensive in describing the fish and shellfish resource of the wider Thames Estuary. This data will be reviewed along with other sources including those from nearby wind farm sites Cefas ground fish survey stations and specifies specific research. This information will be further supplemented with the findings from industry wide studies (e.g. COWRIE funded research) such as those on EMF and piling noise impacts as well as information obtain through consultation with local sea fisheries committees and commercial fishermen.

5.4.24 Site specific surveys to inform the GWF EIA have been carried out in accordance with Cefas (2004) guidance. The scope and approach to these surveys was agreed in advance with Cefas in 2008. Spring and autumn otter and beam trawl surveys for the extension site were commissioned and undertaken by Brown and May Marine Limited in autumn 2008 and spring 2009. The location of these surveys is detailed in **Appendix C**. This will be augmented through information obtained from the epibenthic trawls (as detailed in **Section 5.3**) and consultation with the fishing industry (as detailed in **Section 6**).

5.4.25 In accordance with the Cefas (2004) guidance the assessment phase of the EIA the following aspects will be considered for fish and shellfish resource in the area:

- Spawning grounds;
- Nursery grounds;

- Feeding grounds;
- Overwintering areas for crustaceans (e.g. lobster and crab); and
- Migration routes.

5.4.26 The potential for impacts from noise will be addressed through a Technical Report into the Impact of Impulsive Underwater Noise on Marine Mammals and Fish and a specific impact piling noise modelling study for the proposed GWF project, both studies being undertaken by Subacoustech Environmental Ltd.

5.4.27 The scope of the noise modelling has been agreed through consultation with Cefas (in September 2009) and further discussions with Cefas are anticipated as the work progresses and interim results received.

5.4.28 The location of the noise modelling have been determined based on the realistic 'worse case scenario' in terms of WTG foundation size and water depths within which the foundation type will be deployed. For example, of the foundation types under consideration, the installation of monopiles will create the most underwater noise. Monopiles will be used out to a maximum depth of 35m below CD, at which point they will be replaced by either jackets or gravity base systems. Of these two options the installation of jackets represents the 'worst case' in terms of noise, for the deeper water WTGs. Therefore, the modelling has focused on monopiles out to 35m below CD and jackets beyond 35m below CD. The largest possible pile size for each of the foundation types will be modelled, thus ensuring the 'worst case' scenario is applied to all aspects.

5.4.29 Further to these studies the impact assessment will be informed by the results from noise modelling (Nedwell *et al*., 2009) and in-situ measurements of piling noise Gardline Environmental Ltd (2009) for the ongoing GGOWF construction work will be drawn on to inform the impact section of the ES in terms of the significance and extents of any impacts on fish and shellfish resources.

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

5.4.31 The findings of the sediment dispersion modelling combined with the predictions from scouring potential will be used to inform the EIA of the potential for impacts. 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 at the time of preparation of the ES.

Study summary

EIA study component	Purpose
Autumn & Spring fish surveys comprising otter and beam trawls (undertaken by Brown & May Ltd)	To characterise the baseline fish and shellfish environment.
Sub-sea noise modelling of piling activity (to be undertaken by Subacoustech Environmental Ltd)	To ascertain the likely level of impact on key spawning species in the vicinity of the project, and help inform appropriate mitigation and monitoring measures.

EIA study component	Purpose
Impact of impulsive underwater noise on marine mammals and fish (undertaken by Subacoustech Environmental Ltd)	To establish the likely thresholds of impacts against which the findings of the noise modelling work will be interpreted in order to predict impact levels.
Physical processes study – sediment dispersion modelling (to be undertaken by ABPmer Ltd)	This information will be used to establish the potential for impacts on key benthic receptors.

5.5 Marine mammals

Existing environment

Cetaceans

5.5.1 Historical data suggests that only harbour porpoise *Phocoena phocoena* and bottlenose dolphin *Tursiops truncatus* (out of a UK total of 27 species) are either present throughout the year or recorded annually as seasonal visitors to the region (Evans, 1998). No species was considered abundant, with observations most frequent in nearshore waters. Offshore, long-finned pilot whale *Globicephala melas* is recorded annually and the common dolphin *Delphinus delphis* occurs occasionally (Evans, 1998).

5.5.2 Incidental sightings of marine mammals were recorded during the ornithological surveys of the GGOWF and GWF study area (approximately 980.80km^2) throughout the year. Harbour porpoise were the only marine mammal species that were regularly recorded during the surveys, although generally in low numbers (compared to more central areas of the North Sea), with a mean encounter rate of 0.02 per square kilometre. A similar mean encounter rate of 0.04 per square kilometre was recorded during baseline surveys of the GGOWF (GGOWL, 2005).

5.5.3 Although Harbour porpoise were recorded at the site throughout the majority of the year, they were largely absent during the early summer months between May and July and numbers peaked in the winter months between December and March (Q3) with densities of 0.05 harbour porpoise per square kilometre recorded. A similar pattern was also recorded during baseline surveys of the GGOWF, with greater numbers of the species recorded during March and April, to a lesser degree (GGOWL, 2005).

5.5.4 The harbour porpoise and bottlenose dolphin are listed in Annex II of the EC Habitats & Species Directive as species whose conservation requires the designation of Special Areas of Conservation.

Pinnipeds

5.5.5 Findings from the GGOWF ES would indicate that the proposed GWF site is relatively unimportant for pinnipeds. Grey seal (*Halichoerus grypus*) are not numerous in the region of the GGOWF (GGOWL, 2005). The nearest known grey seal haul out to GGOWF is Scroby Sands where several hundred individuals may be seen during spring and summer (GGOWL, 2005).

5.5.6 The population size of common seal (*Phoca vitulina*) in the area is also low in comparison to other areas of the UK with common seal along the Essex and Kent coastlines for example accounting for only 0.3% of the British population and with no common seals breeding in Suffolk.

5.5.7 The nearest location where common seal occur regularly is understood to be Hamford Water, nearly 40km to the west of the GWF site. No pinniped species were reported in proximity to the site by the JNCC Seabirds at Sea Team.

5.5.8 These findings are supported by recent sightings recorded during the recent (2008-2009) GGOWF and GWF ornithological surveys, where harbour seal were recorded during only one survey throughout the year. A total of eight common seal were estimated to occur within the study area as whole, these were all recorded within the 1-4km buffer around the GWF site during the September survey. No grey seal were recorded within the GWF study area during the surveys.

Identification of key issues

5.5.9 The construction of offshore wind farms in particular the installation of driven piles without mitigation is likely to produce noise levels capable of causing injury and disturbance to marine mammals (JNCC, 2009). Such effects, although incidental to consented activities, have the potential to conflict with the legislative provisions of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended 2009), which applies to English and Welsh waters inside 12 nautical miles (nm), and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended 2009), which apply on the United Kingdom Continental Shelf (JNCC, 2009).

Potential impacts during construction

5.5.10 Disturbance through noise and vibration: There are a number of sources of noise and vibration associated with offshore wind farm construction. These include piling activity and the increased activity from jack-up/heavy lift plant and support vessels. Of these noise generated from piling activities has the potential to cause non-lethal behavioural effects on marine mammals at a considerable distance from the activity. On the basis of a regulatory approach hearing loss is a concern at 1.8km in porpoise and 400m in seals (Thomsen *et al.,* 2006). Further, severe injuries in the immediate vicinity of piling activities can not be ruled out.

5.5.11 Recent monitoring of piling activities for GGOWF for a 6.0m pile showed (based on the weighting approach outlined by Southall *et al.*, 2007) that for fleeing cetaceans, so long as the start range is greater than 25m, the threshold injury criteria of 198 dB re 1 μPa^2s (multiple pulse source) can be avoided (Gardline Environmental Ltd, 2009). However, for a static animal, this range increases to 2.4km. For pinnipeds in water, the lower threshold criteria of 186 dB re 1 μPa^2s leads to a required start range of 2.5km to avoid injury compared to 7.5km for a pinniped remaining static (Gardline Environmental Ltd, 2009).

5.5.12 Collision Risk: The greatest collision risk to marine mammals is likely to occur during the construction phase of the project due to the number and types of vessels operating in the area. Ship strikes are known to cause mortality to marine mammals and are far from infrequent (Wilson *et al*., 2007). Given the protected status of all marine mammals, collisions resulting in marine mammal mortality must be considered a significant impact. The potential and likelihood of this risk is low especially when considered in context with the volume of existing vessel in the southern North Sea region and the slow moving nature of construction activity. The issue will be discussed in further detail in the ES.

Potential impacts during operation

5.5.13 Disturbance through noise and vibration: Comprehensive environmental monitoring carried out at Horns Rev and Nysted wind farms in Denmark (1999 to 2006) highlighted the different reactions occurring between seals and porpoises. The operational phase did not appear to have any effect on seals.

5.5.14 The results for harbour porpoise differed between the two sites however. In Horns Rev, the population decreased slightly during construction, but recovered to the baseline situation during operation. In Nysted, porpoise densities decreased significantly during construction and only after two years of operation did the population recover. The reason for this slow recovery is unknown.

5.5.15 Noise attenuation from operational wind turbines, through vibration and attenuation through steel piles is not considered to be significant and the evidence discussed above suggests that porpoise and seals continue to pass through and forage within operational wind farm sites.

5.5.16 Collision risk: Other than routine maintenance and survey activity it is likely there will be a low density of shipping associated with the wind farm site during the operational phase. Data also indicate relatively low numbers of marine mammals occurring in the GWF area. Given these consideration the potential for collision with wind farm associated vessels during the operational phase is considered unlikely. However, given the protected status of all marine mammals, a collision resulting in the accidental death of a mammal must be considered as being of significant impact.

5.5.17 Barrier effects: Guidance on offshore wind farm development in relation to the Habitats and Bird Directives (Defra, 2005) indicates that barrier effects could be a potential issue. Post construction and operational monitoring at Nysted and Horns Rev wind farms in Denmark indicate that this issue does not represent a significant concern as cetacean and pinniped species were still recorded as occurring and foraging in the operational wind farms.

Potential impacts during decommissioning

5.5.18 The impacts associated with the decommissioning of the wind farm on cetaceans and seals would be similar to those of construction, with the exception of any need for piling, therefore the need for extensive mitigation measures would be reduced.

Potential cumulative impacts

5.5.19 Interactions between other wind farms: The most significant cumulative impact for marine mammals is likely to be associated with the construction noise. At the time of writing there is potential for the GWF construction work to overlap with that of the second phase of London Array. The cumulative effects of this potential interaction with adjacent wind farms will therefore be incorporated into the dedicated noise modelling work and assessed in detail in the GWF ES.

5.5.20 Interactions between other activities: There is the potential for other activities (such as aggregate extraction, shipping, commercial fishing, MoD exercises and seismic surveys) occurring in the outer Thames Estuary to interact cumulatively. Of these the survey techniques used for oil and gas prospecting would cause the most concern for marine mammals. The potential for these cumulative interactions during the construction phase and any potential during wind farm operation will be assessed in detail in the ES and will also be largely dependant on the distribution and abundances of marine mammals in the area.

Methodology and approach to EIA

5.5.21 The baseline environment for marine mammals will be informed through the results of the 2008 – 2009 incidental sightings recorded during the GWF ornithological boat-based surveys, historical survey data and information such as the GGOWF ES, other Outer Thames OWF studies and the JNCC SCANS II surveys. The baseline assessment for the ES will be carried out in accordance with relevant guidance such as Cefas (2004) and through consultation with relevant statutory stakeholders.

5.5.22 There are a number of sources of information that will be drawn on to inform the assessment of impacts and identify suitable mitigation and monitoring measures:

- A study involving extensive review of impact piling noise during wind farm construction; the sensitivity of marine animals to underwater sound; and the metrics and models that could be used to assess likely impacts was undertaken in 2006 by a consortium of Thames Estuary OWF developers.
- A study commissioned by GGOWL in 2007 to assess the implications of piling activity on marine mammals which included improved modelling techniques to incorporate the influence of bathymetry in the vicinity of the piling operations as well as detailed information that had become available on the pile diameters and water depth.
- Noise measurements undertaken during the installation of the first two piles to validate the studies and assessments in accordance with the subsea noise monitoring protocol for the GGOWF project (GGOWL, 2009) which has been developed in response to FEPA license condition 9.21. This report also considers the effectiveness of a number of mitigation measures and outlines the monitoring and assessment procedures to be employed during the construction and piling works.
- The use of acoustic deterrents to mitigate the impacts of underwater noise on marine mammals (SMRU, 2007).
- Assessing the responses of coastal cetaceans to the construction of offshore wind turbines (Thompson *et al*, 2010).

5.5.23 Furthermore, a dedicated noise modelling assessment that will focus on predicting the potential disturbance and behavioural effects from the 'worse case' construction scenario for the proposed GWF project has been commissioned by SSER and NRL. The scope of this study has been, and continues to be, discussed with Cefas. A more detailed account of the modelling is provided in **Section 5.4**.

5.5.24 If the construction methods and turbine sizes for the GWF are similar it is likely the monitoring protocols and documents developed for GGOWF will be used as a starting point for discussions with statutory stakeholders with regards to mitigating marine mammal impacts.

5.5.25 In accordance with agency recommendation and in order to meet the requirements of regulators an Environmental Management Plan (EMP) will be produced for all operations that include pile driving (JNCC, 2009).

5.5.26 With regards to the presence of marine mammals at the site the implications of the Amendments to the Conservation (Natural Habitats &c.) Regulations 1994 and the new Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 will be taken into consideration.

5.5.27 Additionally, new guidance on the disturbance offence and approaches to mitigation have been developed (JNCC, 2008; JNCC, 2009). As such, any potential impact and suitable mitigation for the GWF will be developed in consultation with the JNCC and Natural England and the implications of the regulations included in the ES and any relevant studies.

Study summary

EIA study component	Purpose
Incidental sighting from boat-based surveys	To help characterise the distribution of marine mammals around the GWF site.
Sub-sea noise modelling of piling activity (to be undertaken by Subacoustech Environmental Ltd)	To ascertain the likely level of impact on key species in the vicinity of the project, and help inform appropriate mitigation and monitoring measures.
Impact of impulsive underwater noise on marine mammals and fish (undertaken by Subacoustech Environmental Ltd)	To establish the likely thresholds of impacts against which the findings of the noise modelling work will be interpreted in order to predict impact levels.

5.6 Terrestrial & intertidal ecology

Existing environment

Habitats

5.6.1 **Section 3.1** provides a description of the designated habitats within or close to the study area. The dominant habitats of the surrounding area include arable farmland, semi natural broadleaved and mixed woodland, semi improved grassland, open dune, dune grassland and coastal vegetated shingle. These habitats and the surrounding areas are used for agriculture and conservation and support a variety of wildlife.

5.6.2 The onshore cable route predominantly passes through arable land, with the proposed substation locations situated in semi-improved grassland (Option 1) and arable land (Option 2). The cable landfall and route to transition pit will, however, pass through a strip of coastal and transitional habitats that are potentially of more ecological value. This area includes shingle supporting sea kale *Crambe maritime*, lesser sea spurrey *Spergularia marina* and yellow-horned poppy *Glaucium flavum* a nationally rare species; and a range of coastal / dune habitats, dominated by marram grass *Ammophila arenaria*.

5.6.3 Species known or likely to occur within the onshore footprint have been identified from existing datasets (based on the studies undertaken to support the previous EIAs and planning applications), additional desk study and survey, and consultation with Natural England.

5.6.4 The intertidal environment has been fully characterised by studies undertaken for the GGOWF project. The beach at Sizewell consists of an area of upper shore steep shingle backed by open dune habitat with a shallower gradient lower shore of sand with some overlying shingle (GGOWF, 2005). The upper shore shingle supports sea kale (*Crambe maritima*). Two main biotopes existing along this shoreline; barren littoral shingle (LS.LCS.Sh.BarSh) and barren littoral coarse sand (LS.Lsa.MoSa.BarSa) clearly dominate the upper and lower shore respectively. The only other intertidal biotope recorded in the survey was ephemeral green or red seaweed (freshwater or sand influenced) (LR.FLR.Eph) which was present on five large concrete anchor blocks to the south of the landfall location (GGOWF, 2005).

Reptiles

5.6.5 All four of the more widespread native species; common lizard *Zootoca vivipara*, grass snake *Natrix natrix*, slow worm *Anguis fragilis* and adder *Vipera berus* are present within the study area.

5.6.6 Reptile surveys undertaken in 2006 and 2007, focussed on the woodland habitat associated with Sizewell Wents, and identified that it was not suitable reptile habitat (ESL, 2007). However, it was established that the woodland edge habitat and other boundary features, such as hedge-lined paths supported populations of reptiles. This was confirmed during a reptile translocation exercise in 2007 undertaken ahead of the ground clearance works for the current substation.

5.6.7 Reptile surveys have not been undertaken throughout the study area. However, based on the 2007 findings, it is assumed that suitable habitat (boundary features, scrub, woodland edges, etc) will support populations of reptiles throughout the study area.

Bats

5.6.8 Common pipistrelle bat *Pipistrellus pipistrellus*, soprano pipistrelle bat *Pipstrellus pygmaus* and brown long-eared bat *Plecotus auritus* have been recorded in the woodlands around Sizewell.

5.6.9 The only area of woodland within the study area is Sizewell Wents. This was assessed for its potential to support roosting bats in 2006, with a further more detailed survey carried out in 2007 for potential roost trees, and the use of the woodland by bats. The surveys concluded that there were no bat roosts inside Sizewell Wents at that time. However, this does not rule out future roost potential in a small number of trees within the woodland. In addition, the Sizewell Wents woodland and the network or hedgerows in the vicinity, provide a valuable foraging resource for bats, in particular common and soprano pipistrelles.

Breeding Birds

5.6.10 Bird mapping surveys were carried out in 2005 and 2006 over a wide study area including the beach at Sizewell, part of Sizewell Marshes SSSI to the north of the proposed development, woodland between Sandy Lane and the beach to the east and agricultural land to the south and west. This study was carried out to record bird breeding activity and indicated that several species of conservation importance were present within the study area. However, none of these species had established territories in Sizewell Wents or in the footprint of the associated onshore development areas associated with the GGOWF.

5.6.11 A further breeding bird check was conducted within Sizewell Wents, in February 2008 prior to construction. Evidence of birds commencing breeding activity was recorded during this visit. The recorded species included: grey partridge; grey heron; great spotted woodpecker; skylark; pied wagtail; wren; dunnock; song thrush; fieldfare; gold crest; and long tailed tit.

Great Crested Newt

5.6.12 A desk study and consultation with local groups concluded that there were no records of great crested newt *Triturus cristatus* in the immediate area (ESL, 2007). It was also considered that they are unlikely to be present within the footprint of the proposed cable routes and substations due to the underlying geology.

5.6.13 A presence / absence survey was undertaken in 2006 for four water bodies within 500m of the study area. No great crested newt were found. The survey concluded that the area was not of value for great crested newt, as a result of large numbers of fish and predatory invertebrates within the ponds surveyed.

Water Vole

5.6.14 Water vole *Arvicola amphibius* are known to occur in the ditches in Sizewell Marshes SSSI. However, the habitats within the study area are a mix of woodland and arable fields and, therefore, not considered suitable for water vole populations.

Badger

5.6.15 The ecological baseline survey undertaken in 2006 concluded that no evidence of recent or current use by badger *Meles meles* was recorded within the Sizewell Wents woodland or along any of the boundaries within the wider study area (ESL, 2007). Specific badger surveys have not yet been undertaken for option 2.

Identification of key issues

Potential impacts during construction

5.6.16 Temporary loss of coastal/transitional habitats: The cable route between the landfall and transition pit will cross a band of shingle and dune habitats. The shingle supports yellow-horned poppy *Glaucium flavum*, which is a nationally rare species. Construction activities could result in temporary losses of the habitats themselves as well as damage / disturbance to a nationally scarce species.

5.6.17 Physical disturbance to intertidal features: The main potential source of impacts on the intertidal will be limited as the cable will installed through a technique known as horizontal directional drilling (HDD) rather than trenching. However, there is potential for localised physical disturbance to intertidal habitats through presence of the HDD rigs.

5.6.18 Physical disturbance to terrestrial features: There is the potential for physical disturbance to breeding birds, reptiles and bats to occur as a result of vegetation clearance and the construction of a new substation and associated cable route.

5.6.19 Reptiles are felt to be particularly vulnerable where there are potential impacts to roadside verges, grassland, woodland fringe and hedgerow habitats. Any works proposed within arable land are likely to have minimal impacts. Any clearance of woodland, for example within Sizewell Wents, could be particularly sensitive for both breeding birds and bats.

Potential impacts during operation

5.6.20 Permanent loss of habitat: There will be a permanent loss of habitat associated with a new substation, whereas disturbance associated with the cable route will be short-term and temporary.

5.6.21 There were no known bat roosts recorded during surveys undertaken during 2006 and 2007 within the study area, although the possibility of finding roosts cannot be ruled out at this present time, particularly if trees are to be lost as a result of the scheme. The study area supports a wide range of bird species and should woodland and hedgerow habitat be permanently lost this could be significant in what is otherwise a typical arable landscape. The hedgerow and woodland fringes are also the most suitable areas for reptile species.

Potential cumulative impacts

5.6.22 Interactions between other wind farms: The onshore aspects of GGOWF represent the only potential interaction with other wind farm development. There will be no overlap in construction timescales between the two projects and, therefore, cumulative impacts will be restricted to the operation phase and most associated with loss of habitat.

5.6.23 Interactions between other activities: The activities associated with the Sizewell Nuclear Power Stations, including the decommissioning of Sizewell A and the potential construction of Sizewell C, represent potential cumulative impact sources. All of these developments could result in the permanent loss of habitat in this area.

Methodology and approach to EIA

5.6.24 It is important to recognise that a development can affect flora and fauna directly (e.g. the land-take required) and indirectly, by affecting land beyond the development site (e.g. through noise generation or hydrological impacts). The approach will be to identify 'valued ecological receptors'. These are species and habitats that are valued in some way, and could be significantly affected by the proposed development; further valued ecological receptors may occur on or in the vicinity of the proposed development area but do not need to be considered if there is no potential for them to be affected significantly.

5.6.25 The value of species populations and habitats is assessed with reference to:

- Their importance in terms of 'biodiversity conservation' value;
- Their legal status – which is generally but not exclusively related to their biodiversity value; and
- Any social or economic benefits that species and habitats deliver (e.g. relating to enjoyment of flora and fauna by the public).

5.6.26 Subsequent stages in the assessment will include:

- Prediction of trends (consider possible future trends in the status of these habitats and species in this location);
- Identification of environmental effects (impacts associated with the development);
- Determine the nature and scale and significance of the effect; and
- Identification of mitigation measures where appropriate.

5.6.27 There is a substantial amount of available data associated with the previous GGOWF studies, and its subsequent mitigation and monitoring programmes. The data that is available includes:

- Phase 1 terrestrial and intertidal habitat surveys (2005, 2007, 2009);
- Bird mapping surveys (2005 and 2006);
- Great crested newt presence / absence (2006);
- Mammal survey (2006);
- Reptile population and translocation surveys (Sizewell Wents) (2007);
- Bat roost potential surveys (Sizewell Wents) (2007);
- Pre-construction survey (Sizewell Wents) (2007); and
- Pre-construction bird survey (Sizewell Wents) (2008).

5.6.28 The geographical extent of the above surveys encompasses all areas considered for the GWF project aspects. However, additional surveys will be undertaken during spring and summer 2010 to update these datasets. These include:

- Reptile population surveys; and
- Badger survey.

Study summary

EIA study component	Purpose
Reptile and badger field surveys.	To bring up to date those aspects of site specific data that were considered potentially out of date from the GGOWF studies. Data will be used to inform the ES of the baseline environment and help identify potentially sensitive receptors. This will be used to inform assessment of impacts and the identification of potential mitigation and monitoring measures.

6 HUMAN ACTIVITIES

6.1 Commercial fisheries

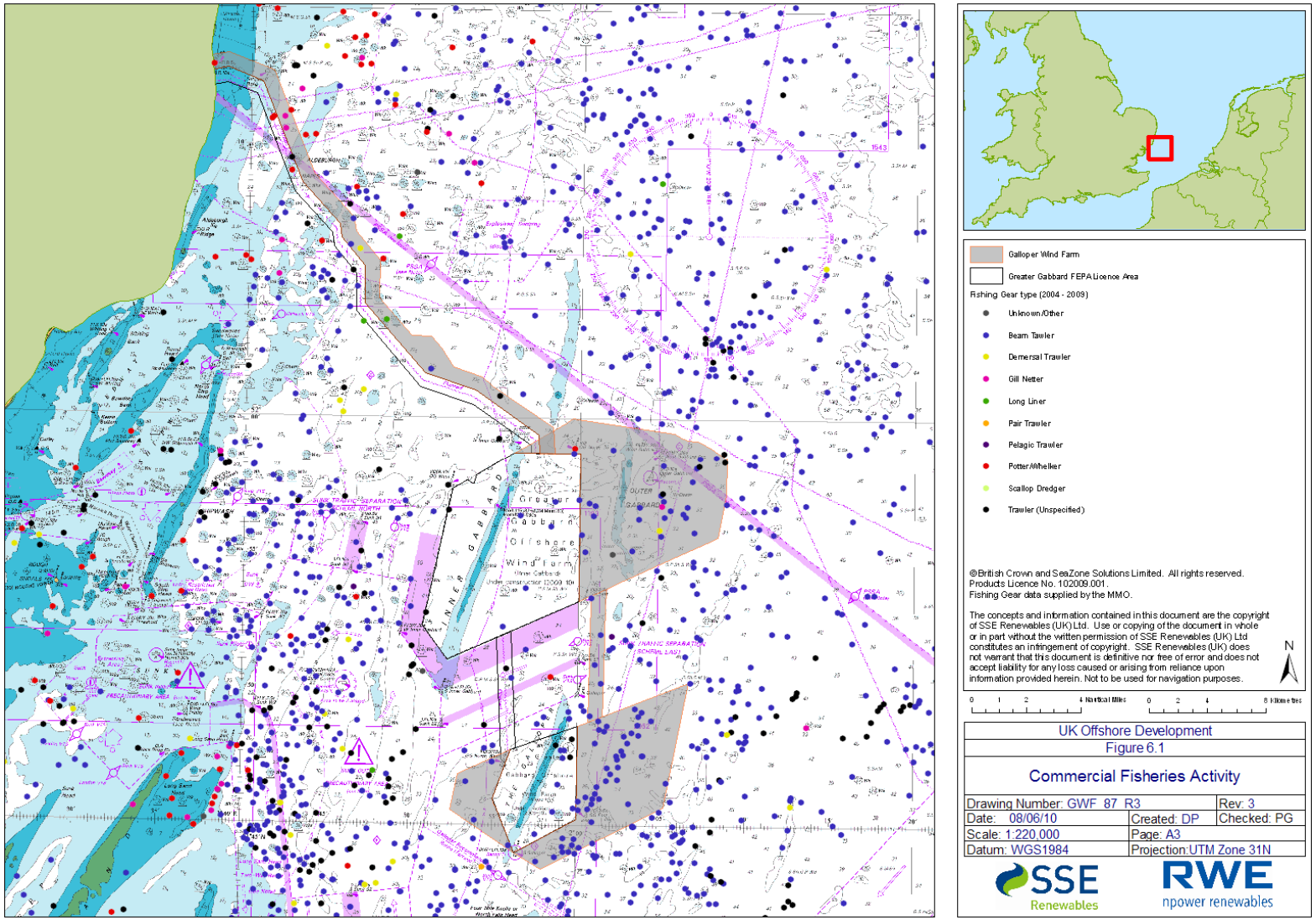
Existing environment

6.1.1 The main part of the proposed GWF site lies within ICES rectangle 32F2 with small areas extending into 33F2 and 32F1, with the cable route running to shore through 33F1 to Sizewell on the Suffolk coast. These areas are fished year round by a combination of static and moving towed gear. The majority of the static gear fishing is undertaken by the <10m UK fleet with the area of the export cable corridor being used for potting. The majority of beam trawling in the study area is carried out by Belgian and Dutch vessels.

6.1.2 Total UK landings value for the areas (2004 – 2009) indicate that, by value, 32F1 is the most important, followed by 33F2, 33F1 and 32F2. The top five demersal species landed by weight in the main area of GWF (32F2) were plaice *Pleuronectes platessa*, sole *Solea solea*, cod *Gadus morhua*, dab *Limanda limanda* and turbot *Psetta maxima* indicating a demersal fishery. The main landings for these species occur between December and April.

6.1.3 Landings from foreign fleets indicate effort in rectangles 32F1 and 33F2 where the target is primarily sole but also plaice, cod and thornback ray. The use of the area by Belgian and Dutch beam trawlers is verified by surveillance data, which also indicates the presence of French vessels.

Figure 6.1 Commercial fishing activity



Identification of key issues

Potential impacts during construction

6.1.4 Exclusion from established fishing grounds: During the construction phase SSER and NRL will look to establish 500m Safety Zones around the construction vessels, as is being implemented on the GGOWF site. This is likely to result in the short term displacement of any fishing effort occurring in the immediate vicinity. The GGOWF ES concluded that the imposition of exclusion zones during construction could potentially affect up to 20 vessels form Southwold, Orford and Harwich. Given the mobile nature of the fishing activity in the area, it is unlikely there would be a significant effect during the initial construction phase. However, as more piles are installed the significance of the impacts on the local fleet would increase. Static gear fishing also occurs along the export cable corridor and there would likely be a short term displacement of activities during instalment. The extent and effects of these displacements will be assessed in the ES and appropriate technical appendices.

6.1.5 As for the GGOWF, a Commercial Fisheries Management Plan will be established for GWF which will outline the requirements for the management of commercial fisheries during the construction phase and details the role of the Fisheries Liaison Officer (FLO) (GGOWL, 2008).

6.1.6 Increased conflict over diminished fishing ground: During the construction phase, fishing vessels will be excluded from fishing within certain areas of the cable corridor and main GWF site during the pile installation and cable laying. These vessels may be forced to fish other grounds and increase fishing pressures in certain areas.

6.1.7 Displacement of, or reduction in, fish and shellfish resource: There is the potential for a temporary displacement of sensitive fish species from the area of the construction works as a result of increased levels of underwater noise associated with construction activities. This displacement could potentially have an effect on local fishing vessels, which may have to relocate to find the target species. Given the short term nature of any construction impacts it is not anticipated that significant effects will arise.

6.1.8 Loss or damage to gear: Because of the high levels of static gear fishing occurring along the export cable corridor and, to some extent, activities such as drift netting, potting and longlining in the proposed wind farm site, the potential exists for the loss of fishing gear as a result of construction activities and increased vessel activity. The location and timing of construction activities planned, and/or hazards to fishing operations will be widely broadcast through Notice to Mariners, Kingfisher Bulletin and through frequent direct communication with the fishing industry. As such fishermen will have prior notice to allow for static gear to be removed from construction areas.

6.1.9 Effect on recreational fishing: It is not considered likely that many recreational fishing vessels will travel as far offshore as the GWF site although some vessels are known to target the offshore banks for species such as bass. However, local charter skippers will be informed of the construction activities and will be required to observe established Safety Zones.

Potential impacts during operation

6.1.10 Exclusion from established fishing grounds: Complete exclusion of fishing activity from within the proposed wind farm area is unlikely to be requested by SSER and NRL. It is anticipated that, in a similar vein to that experienced for GGOWF, SSER and NRL will look to adopt (in agreement with relevant stakeholders at the appropriate juncture) a 50m Operational Safety Zone around the WTGs and offshore substation infrastructure extended to 500m during periods of maintenance.

6.1.11 Initial consultation with the main Belgian Fish Producers Organisation (FPO) and Dutch fisheries organisation indicates that the area is used by their beam trawling fleets. Further discussion will be undertaken with relevant stakeholders during the EIA to establish the full extent of any impacts to these fisheries as well as the potential for cumulative impacts associated with displacement from other wind farms.

6.1.12 Increased conflict over diminished fishing ground: The potential conflict over diminished ground and increased competition will be similar to that discussed during the construction phase.

6.1.13 Displacement of, or reduction in, fish and shellfish resource: As part of the EIA there will be a review of existing GGOWF monitoring work to establish what the effects of construction and operation are on the composition, distribution and abundance of fish and shellfish resources within a wind farm site. During the construction and installation of piles there will be exclusion zones in place around construction. However, given that there will therefore not be any fishing vessels fishing in close proximity to the construction area any temporary displacement or fish avoidance of the area is not anticipated to have any significant impact on fishing activities.

6.1.14 Refugia for fish species: As discussed above, structures protruding above the seabed are thought to attract fish and shellfish and act as a refuge for certain species. However, whilst this effect is considered likely there is, to date, no satisfactory evidence to suggest a significant beneficial effect of the development of the wind farm.

6.1.15 Loss or damage to gear: The presence of the wind farm and any construction related debris represents a potential snagging hazard for fishing gears. The impact of debris can be effectively minimised through the development and execution of specific survey and recovery protocols within the Project Environmental Management Plan. Snagging risks associated with WTGs and other seabed infrastructure are anticipated to be minimised as far as is practicable by the imposition of Safety Zones.

6.1.16 Increased navigational risk and longer steaming distances: The issue of increased navigational risk will be assessed during the navigational risk studies undertaken as part of the GWF EIA and will be reported in the ES. Under suitable weather conditions it is likely vessels will be able to transit through the site. Longer steaming distances may occur as a result of vessel displacement especially for mobile gears such as beam trawling. The potential impacts of this will be discussed in the ES in relation to exclusion from grounds and will also be considered during the cumulative impact assessment which will assess the extent of the impacts associated with other operational wind farm sites in the area.

Potential impacts during decommissioning

6.1.17 The impacts associated with the decommissioning are expected to be similar to those during the construction phase.

6.1.18 It is likely foundations and scour protection, if used, will be left in place, which could potentially cause damage to fishing gears. However, a decommissioning plan will be developed and approved by the regulators to ensure that any hazards to fishing activities are identified and either removed or marked clearly on charts.

Potential cumulative impacts

6.1.19 Interactions between other wind farms: The cumulative impacts on static gear vessels are not anticipated to be significant, as it is expected that certain methods of static gear fishing will be able to continue in the area once the site is operational.

6.1.20 Cumulative impacts on beam trawling are expected to occur and, although these fisheries tend to be more nomadic, favoured grounds still exist and consultation with the Belgian stakeholders for GWF has indicated that this area is likely to be fished by their fleet.

6.1.21 The cumulative effects may comprise displacement of fishing effort, loss of fishing ground, increased steam times and increased fishing pressure at other fishing grounds from the GWF, the adjacent GGOWF and other offshore wind farm projects in the Outer Thames estuary. The cumulative assessment will also need to be assessed against a backdrop of decreasing commercial activity as vessels and skippers leave the industry due to increased fuel and quota pressures and decommissioning schemes.

6.1.22 Interactions between other activities: The other activities which could interact with the construction of the GWF site and fishing activities are the active and licensed aggregates dredging areas to the west. The spatial and temporal nature of aggregates dredging means that activity is usually confined to short periods in relatively small areas.

Methodology and approach to EIA

6.1.23 Guidance (Cefas, 2004) recommends that there are two issues that need consideration when assessing the impacts of an offshore wind farm development on commercial fishing activities. The first is the possibility of the development affecting populations of fish and shellfish resulting in their decline. The location of the wind farm and turbines themselves will also provide a physical obstruction to normal fishing activity.

6.1.24 It is important that local fishing industry representatives and organisations are contacted at an early stage in the EIA process to establish information on the scale and seasonality of fishing activities in the area as well as for their opinion as to the potential harm it may cause. This will be aided by the appointment of a Fisheries Liaison Officer (FLO) who will be in direct contact with the fishing industry and have a good understanding of potential impacts resulting from the construction of the Offshore Wind Farm.

6.1.25 In line with recommended guidance, the EIA will identify the major commercial fish and shellfish species in the area, describing the fisheries, species and their seasonality. This will be done through obtaining official UK landings and fishing effort data as well as foreign fishing information where possible. Specific studies and information associated with other offshore wind farm sites will also be used to support the desk based assessment, along with information collected through consultation with relevant authorities, including sea fisheries committees, Fishery Producers Organisations (FPOs) and relevant fisheries management organisations.

6.1.26 The implications of the wind farm construction, operation and decommissioning to the fishing industry and any economic impacts will also be assessed and discussed, drawing on knowledge and studies from existing wind farms. Where appropriate effective mitigation measures will also be suggested.

Study summary

EIA study component	Purpose
Desk-based Technical Report (to be undertaken by DanBrit Ship Management Ltd)	A specialist fisheries consultancy has been contracted to help undertake the consultation and baseline data collection to inform the ES of the commercial fisheries activities, potential impacts and suitable mitigation measures.

6.2 Landscape, seascape and visual resources and character

Existing Environment

6.2.1 The GWF project will be approximately 27.5km (at its closet edge) offshore from the Suffolk Coast, with the majority of the extension being further offshore than the existing GGOWF site.

6.2.2 The GWF project will be located within the Thames Estuary Strategic Environmental Area (SEA), the Thames Estuary National Seascape Unit (NSU's), and nearby to the Aldeburgh Bay, Hollesley Bay, and Felixstowe/Deben Estuary Regional Seascape Units (RSU's). Much of the landscape is within the high sensitivity Suffolk Coast and Heaths AONB, and the Suffolk Heritage Coast designation.

6.2.3 The onshore and coastal study area falls within the Suffolk Coast and Heaths AONB, a relatively flat area of the coast consisting of a mix of landscape types from subtle, low lying areas of flat, indented estuaries and shingle banks, to a sweeping series of wide bays (http://www.suffolkcoastandheaths.org). The differences in land cover have largely been dictated by the variety of soils in the area, with Scots and Corsican pine plantings on former acid heathland, the arable production on the silty clay and loam alluvium of the inter-estuarine areas, and shingle beaches and spits along the coast (Orford Ness is a particularly distinct coastal feature within the study area) (http://www.suffolkcoastandheaths.org).

6.2.4 Historically, saltmarshes were prominent features around the estuaries, though they have since been drained and ploughed for crops such as wheat, barley, sugar beet and potatoes (http://www.suffolkcoastandheaths.org). Since much of the area is for arable and grazing pastures, the landscape is punctuated by only a small number of moderate sized settlements, farmsteads, lighthouses, church towers and Martello towers. There are however, larger more visible structures, such as the Sizewell nuclear power stations, just to the north of the study area near Thorpeness.

Identification of key issues

Potential impacts during construction

6.2.5 Construction activities have the potential to affect seascape, landscape and visual amenity and will represent a temporary change away from baseline conditions.

6.2.6 These effects include:

- Presence of marine plant: the presence of marine plant equipment, such as the jack up/crane vessels that will be used to install the foundations, WTGs and substations, as well as cable installation vessels, guard vessels etc. could have a very limited impact upon the seascape, landscape and visual amenity of the Suffolk coast;
- Construction of the onshore 132kV substation and grid connection: The area impacted by the construction of a substation may take up to take two years to build and is likely to result in an increased visual impact for the surrounding areas and inhabitants during this period; and,
- Lighting during the construction period – lighting will be required both on land (132kV substation and transition pit construction) and at sea (turbine construction and cable installation) if there is a 24 hour construction programme. The extent of the impact will depend upon elements of the weather (i.e. clear weather will mean a greater impact) and types of lighting used.

6.2.7 It should be noted that during the Seascape, Landscape and Visual Impact Assessment (SLVIA) made in 2005 for the GGOWF, it was concluded that there were no significant effects on the seascape, landscape and visual amenity.

Potential impacts during operation

6.2.8 The GWF project is likely to have marine and terrestrial, direct and indirect impacts upon NSU's (e.g. Thames Estuary) and RSU's (e.g. Aldeburgh Bay), the Suffolk Coasts and Heaths AONB, the Suffolk Heritage Coast, coastal settlements (e.g. Aldeburgh, Alderton and Orford), commercial shipping, ferries and cruise ships, recreational sailors, tourists and local inhabitants. The GGOWF concluded that the operational impacts were not significant for visual effects on the grounds of the long distance over which the wind farm will be viewed, and only a localised minor impact on national seascape. As the majority of the proposed WTGs are likely to be further offshore than the existing GGOWF project it is not anticipated that the impacts of the GWF project on these receptors will be considered significant.

Potential impacts during decommissioning

6.2.9 Impacts arising during the decommissioning are expected to be similar to those experienced during the construction phase. There would be a temporary impact from the activities on site to remove structures, but this would be of relatively short duration.

Potential cumulative impacts

6.2.10 Interactions between other wind farms: Offshore wind farms are likely to become a characteristic of the seascape of the Thames Estuary SEA, as there are a number of wind farm developments (e.g. Greater Gabbard, London Array, Gunfleet I & II, Kentish Flats and Thanet) that are all planned to be operational by 2012 (with the exception of the second phase of the London Array project). Any such projects will, therefore, need to be considered within the assessment of cumulative effects, where they could cause either/both direct or indirect visual impacts.

6.2.11 Of particular relevance to the GWF project will be the GGOWF project (which is due to be operational from November 2012) given is geographical proximity. The potential cumulative visual impacts could include the following types:

- Simultaneous (or combined) visibility – where two or more sites are visible from a fixed viewpoint in the same arc of view (e.g. GGOWF and the proposed GWF project);
- Successive visibility – where two or more sites are visible from a fixed viewpoint, but the observer is required to turn to see the different sites (e.g. other Thames Estuary offshore wind farms and the proposed GWF project); and,
- Sequential visibility – where two or more sites are not visible at one location, but would be seen as the observer moves along a linear route. This is commonly experienced when travelling along a linear route, for example, a road or public right of way.

6.2.12 Interactions between other activities: The activities associated with the Sizewell Nuclear Power Stations, including the decommissioning of Sizewell A and the potential construction of two new reactors (Sizewell C), all of which will occur within an AONB, will need to be considered. In addition, National Grid plan to consent and construct a 400kV substation in the area.

Methodology and approach to EIA

6.2.13 An SLVIA will be undertaken for the GWF project in close consultation with statutory stakeholders (e.g. Natural England, AONB officers, the JNCC, Suffolk Coastal District Council and Suffolk County Council). The assessment will be undertaken in accordance with the "Guidance on the assessment of the impact of offshore wind farms: seascape and visual impact report" DTI (2005) and other relevant documentation, in particular Norman *et al.* (2007) for guidance on cumulative impact assessment.

6.2.14 Furthermore, in accordance with current guidance, landscape and visual impacts will be assessed separately, with a clear distinction drawn between landscape and visual impacts, as described below:

- Landscape impacts relate to the effects of the proposals on the landscape resource (fabric, characteristics, character, quality and value); and,
- Visual impacts relate to the effects on views experienced by people (visual receptors) e.g. residents, footpath users, tourists and on the visual amenity experienced by those people.

6.2.15 The first stage of the study will be a Desk Based Assessment (DBA) to identify and obtain information from existing databases and information sources (e.g. current statutory and non-statutory documents; existing landscape characterisation material) for both marine and terrestrial aspects. In particular, past changes in the local landscape, seascape and visual resources, as well as any present impacts from recently constructed projects in the area will be identified to assist with the cumulative impact assessment. Secondly, computer generated wireframes and photomontages showing the GWF project from the agreed representative viewpoints will be prepared. The DBA, wireframes and photomontages will enable the description of the baseline landscape / seascape and visual amenity of the area and those elements that the project has the potential to influence or to change the landscape character or the visual amenity of the area.

6.2.16 The results of the DBA and the wireframes and photomontages will inform the impact and cumulative impact assessments of the past and present sensitivity of the landscape / seascape or viewer group and the potentially significant impacts associated with the construction, operation and decommissioning of the wind farm. Most importantly a cumulative assessment of the GWF project in relation to other offshore wind farms, as well as other developments in the Thames Estuary SEA area will be part of the assessment.

Study summary

EIA study component	Purpose
SLVIA comprising both offshore and onshore aspects (to be undertaken by LDA Design Ltd)	To characterise the baseline environment and inform the impact assessment of any visual effects (including cumulative considerations with other Outer Thames projects). It will also serve to help identify where any mitigation may be required.

6.3 Shipping and navigation

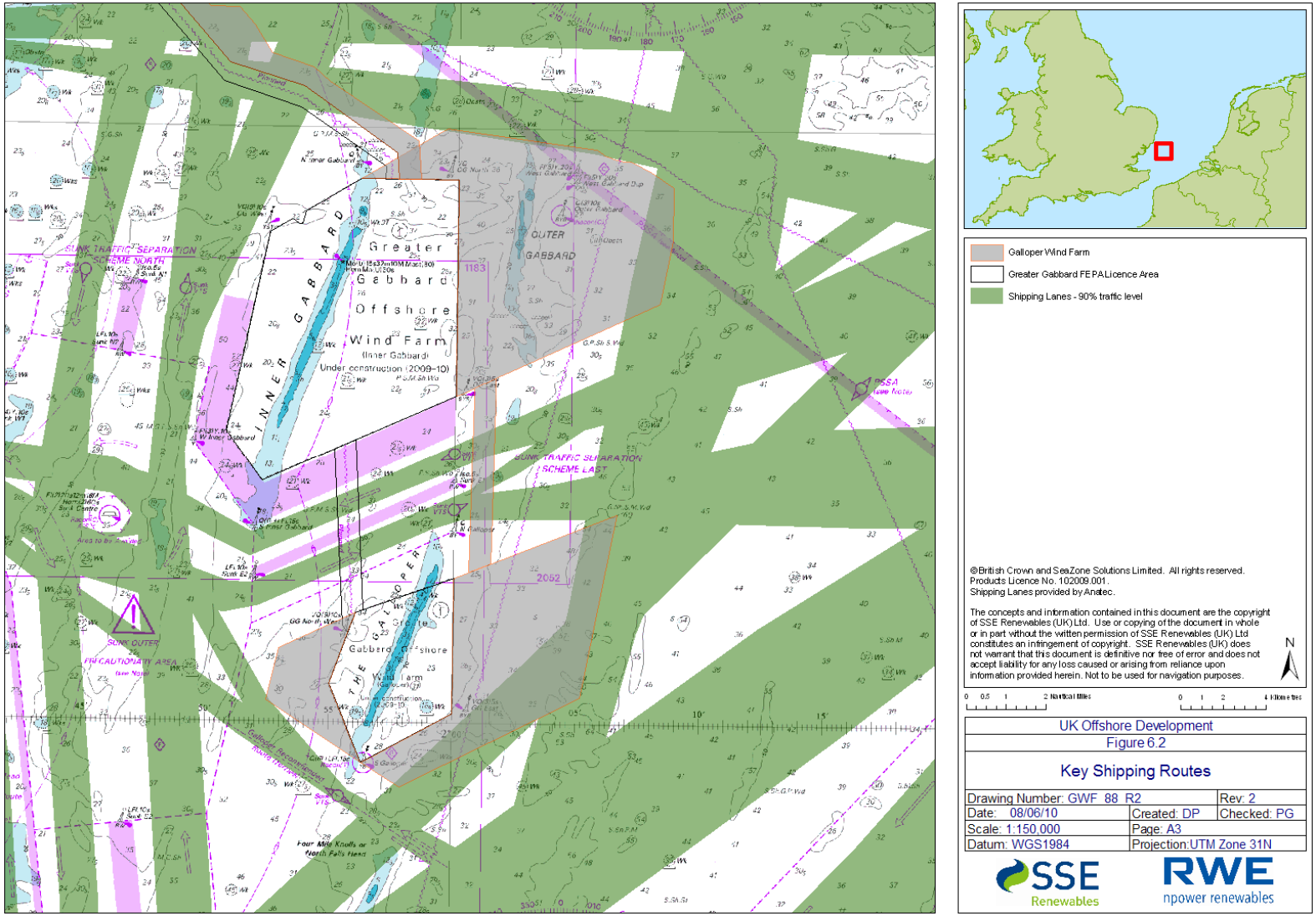
Existing environment

6.3.1 The Outer Thames Estuary is a busy shipping area, used by commercial shipping vessels and fishing vessels, recreational yachting and dredging (refer to **Section 6.1** for Commercial Fisheries, **Section 6.6** for dredging activities and **Section 6.8** for recreational activities). The proposed GWF sites lie on and around three shallow sand banks: the Inner Gabbard (ca. 20 miles to the East of Harwich), the Outer Gabbard (ca. 4.5 miles further east) and The Galloper (ca. 4.75 miles south east). There are deeper waters between these sand banks with well marked east-west navigable buoys for vessels passing into the main shipping channels of the Thames and Haven ports. There is one buoy within the northern half of the proposed GWF site known as 'Outer Gabbard' and none within the southern half.

6.3.2 Of particular importance, is the Sunk Traffic Separation Scheme (TSS), which lies to the west of the GWF project. This feature ensures that shipping movements within the vicinity are controlled, with vessels having to adhere to the designated lanes. The TSS area is monitored by a vessel traffic information service, as it is a very significant focus of shipping, with many pilot boarding and vessel crossing situations occurring each day (GGOWL, 2005).

6.3.3 Six main shipping routes, along with a number of lesser used routes were identified in 2004 in preparation for the GGOWF EIA, though some of these have since been modified due to the present construction of the GGOWF (Anatec, 2005 and GGOWL, 2005). The main shipping routes are illustrated in **Figure 6.2**.

Figure 6.2: Key shipping routes surrounding the GWF Project. Reproduced from Anatec (2009)



6.3.4 The boundaries of the proposed GWF project put forward in this Scoping Study have been greatly influenced by the Navigation Assessment (NA) that was carried out as part of the GGOWF EIA as well as the knowledge gained from ongoing consultation undertaken with the shipping industry with regard to the Extension project. The current location of the GWF project site has taken this existing information into consideration with efforts made to avoid the most significant shipping routes. Consultation to date with regard to the GWF project has been undertaken with the following bodies:

- Maritime & Coastguard Agency (MCA);
- Trinity House;
- Chamber of Shipping;
- Cemex Marine;
- Hanson Aggregates;
- Harwich Haven Authority ;
- Medway Ports;
- Cruising Association and Royal Yachting Association;
- Norfolkline (Regular User in Area);
- Port of London Authority;
- CNIS (Dover);
- Stena Line; and
- Cobelfret.

6.3.5 The outputs of this consultation, combined with an initial review of Automatic Information System (AIS) shipping data for the area, undertaken by Anatec Limited, indicate that addressing the potential impact on shipping both in terms of safety of navigation and re-routeing based on the current proposed site boundaries will be a key issue within the EIA (Anatec, 2009). However, it is considered that, through further consultation any major issues relating to the shipping and navigation aspect can be resolved.

Identification of key issues

Potential impacts during construction

6.3.6 Temporary short term obstructions to navigation: During the construction process the works will generate a temporary increase in the vessel movements in the area (both within the proposed wind farm areas and along the export cable corridor). This is expected to include small workboats, transport barges, jack-up construction vessels, mobile cranes, dredgers, service/boats, tugs, etc. Construction vessels can pose a navigation risk either when stationary or when crossing shipping lanes, in particular the Sunk TSS. However, it is anticipated that any risk can be effectively minimised via the use of temporary safety zones, works vessel control management, site monitoring by guard vessels and radar and the issue of Notices to Mariners, in accordance with standard industry practice.

6.3.7 Squeeze of sea area and interference with established navigation routes: The construction of the proposed GWF project may reduce the current width of shipping lanes in the vicinity of the development. Of particular importance is the Sunk TSS which, at present, finishes at the eastern boundary of the existing GGOWF site. Consultation is currently underway with the shipping industry to establish whether the existing Sunk TSS can be extended out to edge of the proposed GWF site.

6.3.8 Collision risk due to increases in traffic flow and installation of WTGs: Any restrictions on vessel routes that would result in the compression of vessel traffic because of construction activities could result in an increased chance of ship-to-ship collisions. There will also be an increased risk of vessels striking a fixed object, such as WTG, construction vessels, new channel marker buoys or dropped items during installation operations. It is anticipated that any risk can be effectively minimised via the use of temporary safety zones, works vessel control management, site monitoring by guard vessels and radar and the issue of Notices to Mariners, in accordance with standard industry practice.

6.3.9 Disturbance during the burial of export cables: Inter-array cables and export cables will need to be buried and they will need to cross shipping lanes. Export cable installation is a transitory process and will only affect any one area for a short period of time. In terms of other construction works, agreed protocols for crossing and working within shipping lanes and the Sunk TSS will be developed and adhered to and will be augmented via the use of temporary safety zones, site monitoring by guard vessels and radar and the issue of Notices to Mariners, in accordance with standard industry practice.

6.3.10 Impacts on search and rescue operations: There may be implications to the effectiveness of Search and Rescue (SAR) operations in the area as a result of the GWF project. To ensure that SAR operations are maintained, consultation with the MCA will be organised to modify the existing GGOWF SAR plans and procedures to encompass the construction, operational and decommissioning stages of the GWF project and maintain safe and effective procedures.

Potential impacts during operation

6.3.11 Squeeze of sea area and interference with established navigation routes: As with the construction phase, the increase in the area of seabed covered in WTGs for the GWF site will result in compressing established navigation routes, which will increase the densities of vessels and may increase any collision risks in adjacent areas. However, through continued stakeholder consultation and implementation of suitable mitigation measures (such as the extension of the Sunk TSS and design of site boundaries so that they avoid the main shipping routes where possible) it is anticipated that it will be possible resolve any significant shipping and navigation issues.

6.3.12 Changes in collision risks due to changes in traffic flow: Potential collision risks are associated with the possible effects of ship-borne radar interaction with the wind farm, and the current shipping activity passing in close proximity to the site (see **Figure 6.2**). Through the implementation of effective mitigation measures in line with industry guidance (e.g. small Safety Zones around individual WTGs to prevent fishing gear becoming entangled, issuing the MCA's MGN 372 to mariners (MCA, 2008a)) and continuing consultation, it is predicted that these potentially significant impacts can be successfully reduced to insignificant levels. Extension of the existing Sunk TSS to encompass the GWF boundaries would also serve to decrease the collision risk.

6.3.13 Impacts on communications, radar and positioning systems: Wind farms can cause reflective echoes on radar and positioning systems; this could potentially affect radar systems on certain vessels, with the consequence of deterioration in functional performance of the radar for the purposes of navigation on these vessels.

6.3.14 Impacts due to the effects of buried cables: This relates to activities such as anchoring, dredging and bottom trawling. Consultation has taken place with the aggregate extraction company Cemex, regarding the export cable corridor in relation to an aggregate extraction application area and the potential for impacts on emergency anchoring areas. Continued consultation will take place throughout the EIA to establish whether this application area will be taken forward by Cemex. Unless there is clear indication from Cemex that this area is not of interest then the issue will be duly considered within the EIA.

6.3.15 Navigation markings and impacts on visual navigation: The proposed GWF project will mean a change in existing channel navigation markings and the presence of structures that need to be marked so that they are more than sufficiently visible for vessels manoeuvring at night. The WTGs will need to be painted, marked and lit in accordance with the necessary regulations, for example, Trinity House Lighthouse Service (Trinity House) and / or as directed by the Regulatory Authorities. Continued consultation with Trinity House, MCA and HM Coastguard will ensure that there are minimal impacts to visual navigation and that all navigation aids are installed and maintained correctly over the project lifetime. Furthermore, there could be a risk that the layout design of the WTGs could significantly obstruct the lines of view to navigation buoys. Continued consultation with stakeholders and detailed vessel traffic surveys will ensure that, where significant impacts are anticipated, suitable aids to navigation are identified, agreed and deployed.

Potential impacts during decommissioning

6.3.16 The effects during decommissioning are essentially the same as those expected during the construction phase; though with an incremental reduction of impact as individual WTGs are removed from the site.

Potential cumulative impacts

6.3.17 Interactions between other wind farms: The main areas of concern with regard to the potential for cumulative impacts are considered to relate to the increased squeeze of the sea area, increased transit times as a result of avoidance of wind farm areas and increased ship-to-ship collision risk as a result of the former two aspects. However, SSER and NRL are confident that through continued consultation, following industry guidance and the development of effective mitigation measures, potentially significant impacts upon navigational interests in the Outer Thames SEA area can be successfully avoided.

Methodology and approach to EIA

6.3.18 A Navigation Assessment (NA) and a Navigation Risk Assessment (NRA) will be undertaken for the GWF project to assess the construction, operational, decommissioning and cumulative impacts of the WTGs, as well as to inform the orientation of the site boundary, WTG design layout and adjustment to existing navigation channel marker buoys. The scope of the NA and NRA has been discussed with the Maritime and Coastguard Agency (MCA) and other navigation stakeholders (e.g. The Chamber of Shipping, Trinity House, Sunk Users Group, Harwich Haven Harbour master and the Sunk Vessel Traffic Services (VTS)).

6.3.19 The NA will include a baseline review of commercial shipping and navigation, commercial fishing and recreational activities in the study area, specifically determining the proximity of the proposed extension sites to shipping routes, navigation channels/separation schemes, port entrances, marking and lighting of the site and areas of importance (e.g. the International Maritime Organisation (IMO) designated route to the west of the proposed GWF site).

6.3.20 The NA will be informed by a marine-based navigation survey to determine traffic frequency, the output of port radar traces, any past navigation surveys of the area and local Admiralty Charts. This survey was carried out from the geophysical survey vessel between 2009 and 2010, as discussed above, the scope for which was agreed in advance with the relevant authorities.

6.3.21 The NRA will be carried out in accordance with the following guidance:

- MCA Guidance Note 371" (MGN 371 (M+F)) on UK navigational practice, safety and emergency response issues - this document highlights issues that need to be taken into consideration when assessing the impact on navigational safety from offshore renewable energy developments. This is applicable to United Kingdom internal waters, territorial seas or Renewable Energy Zones (when established) and beyond territorial seas. (MCA, 2008b);
- MCA Guidance on Assessment of the Impact of Offshore Wind Farms - this document gives guidance for navigation risk assessments. The Methodology is centred on risk controls and the feedback from risk controls into risk assessment (DTI, 2005); and
- IALA's Recommendation O-131 - this document is for the guidance of marking offshore structures and created by stakeholders such as National Administrations, Lighthouse Authorities and energy extraction contractors and developers (IALA, 2005).

Summary

EIA study component	Purpose
A Navigation Assessment including site surveys (undertaken during the geophysical survey) and a Navigation Risk Assessment (to be undertaken by Anatec Ltd)	To inform the ES of the baseline shipping environment and the potential impacts on / from the proposed development

6.4 Archaeology

Existing environment

6.4.1 Prehistoric submarine archaeological remains back to a date of the order of 100,000 years can occur over almost the whole floor of the North Sea (DTI, 2002). Such sites reflect the interaction of sea-level with the terrestrial landscape via the expression of the coastline in response to changing volumes of glacial and post-glacial ice and associated sea-level.

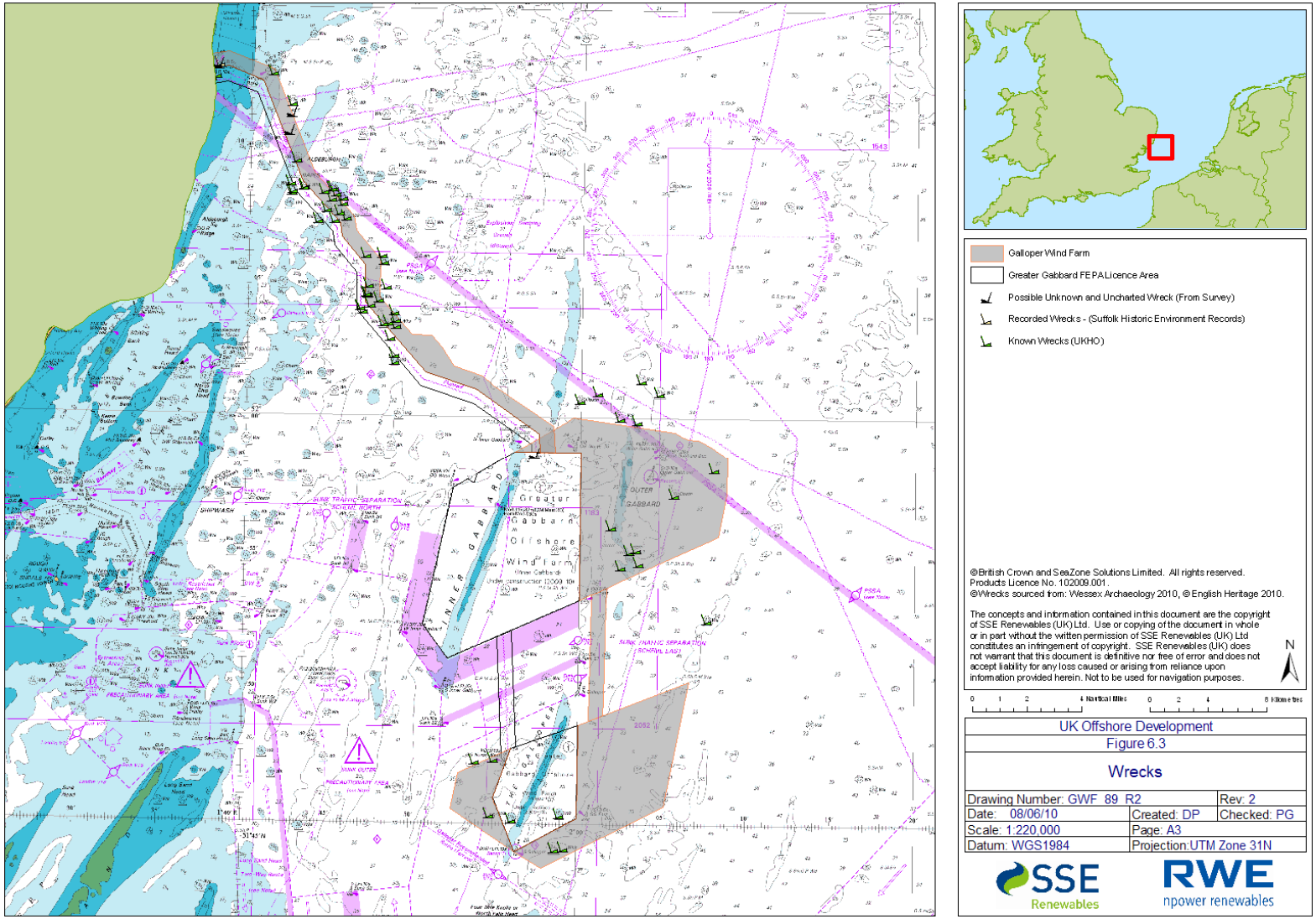
6.4.2 Of particular note, two palaeo-channels, have been identified within the study area from surveys undertaken during the GGOWF EIA process (GGOWL, 2005) and more recently through the Regional Environmental Characterisation (REC) for the Outer Thames Estuary (MALSF, 2009) and the GWF site area geophysical survey conducted for SSER and NRL.

6.4.3 Artefacts dating from the last 10,000-12,000 years have been found in sites scattered throughout the present coastal and offshore North Sea environment (DTI, 2002). Consequently, potential exists for prehistoric land surfaces and associated human artefacts and sites to exist within the study area. Recent studies have identified Neolithic, Bronze, Roman, Medieval, post Medieval and modern finds around the Sizewell vicinity (GGOWL, 2005 and MALSF, 2009), with numerous post Medieval and modern wrecks as well a number of aircraft crash sites identified off the Suffolk coast (MALSF, 2009).

6.4.4 Potential for wrecks and associated marine artefacts around the GWF study area is high, with over 300 wreck losses being identified in and adjacent to the GGOWF study area (GGOWL, 2005). **Figure 6.3** shows the charted wrecked distribution in relation to the GWF site.

6.4.5 The terrestrial archaeological resource within the study area is dominated by records of largely prehistoric and medieval date, with World War II sites prevalent in the coastal areas. The potential terrestrial archaeological resource within the study is considered to be of local to regional importance.

Figure 6.3: Charted wrecks



6.4.6 In summary, the archaeological sites within the GWF study area may include:

- Archaeological landscapes (such as palaeo-channels) formed when sea-level was much lower than that of today;
- Sites and remains of shipwrecks;
- More recent sites revealing valuable information on Britain's roles as a major naval, industrial and imperial power; and
- Features within the inter-tidal and terrestrial realms relating to past occupation and usage.

Identification of key issues

Potential impacts during construction

6.4.7 Direct physical disturbance to marine archaeological features: The installation of the foundations for the WTGs, scour protection, offshore substation(s), meteorological mast(s) and associated cables has the potential to cause direct disturbance and damage to known and undiscovered artefacts of marine archaeological significance. Similar impacts may occur on surficial and shallow archaeology as a result of anchoring and jack-up activities associated with the construction works.

6.4.8 There are a number of military losses (including the loss of life) off Sizewell (GGOWL, 2005). Disturbance to such sites is prohibited under the Protection of Military Remains Act 1986.

6.4.9 The presence of submerged palaeo-channels has been noted in previous archaeological surveys of the area (Wessex Archaeology 2005), which have the potential to contain information on past human settlement. The disturbance to archaeological sites of interest could, therefore, be an issue and will be subject to further investigation and assessment during the EIA process.

6.4.10 Indirect physical disturbance to marine archaeological features: Significant changes to currents, sediment transport and erosion patterns has the potential to impact upon archaeological sites or deposits located beyond the construction site area. Based on findings from GGOWF studies, significant changes to these regimes are considered unlikely (GGOWL, 2005) and therefore, similarly potential for effects on archaeology are also considered minimal.

6.4.11 Direct physical disturbance to terrestrial archaeological features: The potential terrestrial archaeological resource within the study is considered to be of local to regional importance. The laying of the onshore cables by trenching could have an impact on previously unknown archaeology in areas that have not previously been subject to disturbance. However, although the potential is high, given historic use of the area (Wessex Archaeology, 2005), the exact location of any features of interest is presently unknown but will be established through an archaeological DBA to identify features of archaeological significance.

Potential impacts during operation

6.4.12 Disturbance to archaeological features: No impacts are envisaged during the operational phase, as no areas that have not already been disturbed during construction will be affected. However, indirect changes to the hydrodynamic and sedimentary regimes could occur, resulting in disturbance to archaeological features via sediment transport, scouring, and smothering of from settlement of suspended sediments. Maintenance activity also has the potential to impact on features. These changes shall be assessed within the relevant hydrodynamic and sedimentary regime of the ES and assessment made of the changes to these regimes and the resultant implications to features of archaeological significance.

Potential impacts during decommissioning

6.4.13 Impacts arising during the decommissioning phase are expected to be similar to those experienced during the construction phase. As such, it is highly unlikely that any previously unidentified features of archaeological significance would be impacted.

Potential cumulative impacts

6.4.14 Potential for cumulative impact is largely restricted to construction periods.

6.4.15 Potential overlap of offshore construction activity, based on current knowledge, is limited to the second phase of the London Array project. Given the localised nature of the potential impacts, it is considered that cumulative impacts are unlikely.

6.4.16 There are a number of proposed onshore developments that will also need to be taken into account when considering the cumulative impacts; particularly the activities associated with Sizewell Nuclear Power Stations, including the decommissioning of Sizewell A and the potential construction of two new reactors (Sizewell C).

Methodology and approach to EIA

6.4.17 To provide archaeological context, a Marine Study Area (MSA) and a Coastal Study Area (CSA) will be established. The CSA will consist of a 1km buffer around the cable landfall and onshore infrastructure (transition pit, cabling and substation), while the MSA will consist of two areas: a 1km buffer zone around the offshore wind farm site and a 1km buffer zone around the export cable route.

6.4.18 Onshore, archaeological surveys and assessments will be undertaken in a phased manner, in close consultation with English Heritage, Suffolk Coastal District Council and Suffolk County Council, and in line with the latest guidance on the historic environment that has been produced by COWRIE (Wessex Archaeology, 2007).

6.4.19 The marine assessment will be informed through interpretation of the geophysical survey data (namely the bathymetry and side scan sonar data to identify seabed features, such as wrecks, magnetrometry data to identify magnetic anomalies and sub-bottom profile data to identify palaeo-features). Wessex Archaeology, have reviewed the survey scope of works to ensure that it will suitably inform the study.

6.4.20 Following collection and or provision of survey data, the marine and terrestrial archaeological desk based assessments (ADBA) will be conducted to identify evidence of archaeological sites and finds. This will include historical data/reports, cartographic and geomorphological research.

6.4.21 The ADBA and assessment of geophysical data will be used to identify areas of known and/or potential features of archaeological interest. Where such features are identified, initial archaeological exclusion zones will be defined on a precautionary basis, in areas where impacts are considered likely to manifest. Archaeological exclusion zones are not permanent features, except where they are applied to protect known features of significance, such as wrecks. It is possible that, where additional investigation is carried out, the zone will be removed, should it be shown that the feature is not of archaeological interest.

6.4.22 Areas of the seabed around the GWF area were surveyed in 2005 as part of the survey work to inform the EIA for the original GGOWF project. This data will be made available for the assessment of cumulative impacts.

Study summary

EIA study component	Purpose
Onshore archaeological study (to be undertaken by Wessex Archaeology Ltd)	To identify features of archaeological relevance in the CSA
Geophysical survey, including bathymetry, side scan sonar, magnetrometry and sub-bottom profiling (undertaken by OSIRIS Ltd)	To identify features of archaeological relevance in the MSA
Archaeological desk based assessment (to be undertaken by Wessex Archaeology Ltd)	To provide a characterisation of the baseline archaeological environment, inform the impact assessment phase of sensitive features and identify where mitigation and monitoring may be required and to what level.

6.5 Military and civil aviation radar

Existing environment

6.5.1 WTGs have the potential to affect military and civil aviation (fixed-wing and helicopters), either through their physical dimensions limiting access and affecting safeguarding or safe passage, or through their effects on primary or secondary radar systems.

6.5.2 The airspace above and adjacent to the proposed GWF site is used by civil and military aircraft, which are tracked by radar systems operated by National Air Traffic Service (NATS) and the Ministry of Defence (MoD). NATS is split into two companies, NATS (Services) Limited (NSL) and NATS (En-Route) Ltd (NERL). The former is subcontracted by airport operators to provide air traffic control (ATC), primarily for take-off and landing, as well as helicopter aviation, such as at Cromer (Norfolk) for Anglia Radar used by helicopters. The latter provides en-route ATC services and is responsible for the protection of the electronic equipment, such as radar.

Identification of key issues

6.5.3 The proposed GWF project will be over 30km from any civil aerodrome; as such, the wind farm is outside statutory notification radius for such facilities. Furthermore, no objections were raised to the GGOWF proposal by the Civil Aviation Authority (CAA), NERL or Defence Estates, and it is not anticipated that any objections would be raised to the GWF project.

6.5.4 However, further consultation will be necessary with all interested stakeholders in order to identify any potential implications of GWF, over and above those of the GGOWF. In particular, it will be important to alleviate ATC concerns such as, overhead obscuration (from small air targets above the wind farm), shadowing (small aircraft beyond the wind farm that are not detected by radar) and clutter (unwanted returns from WTGs reported by radar, thus causing distraction). All impacts will have to be considered as arising from the proposed GWF in isolation and cumulatively as additional development in the Thames Estuary SEA area.

Methodology and approach to EIA

6.5.5 A technical desk-based assessment (DBA) will be undertaken to establish the baseline conditions and assess the impacts (including cumulative effects) of the GWF project on military and civil aviation matters. The DBA will include, though is not limited to, assessing issues for the Royal Navy (surface and air), the type of airspace and associated air traffic control in the area, the technical and physical safeguarding of military airfields and nearby civil aerodromes, and initial indicative radar line of sight projections from any radar in the area, MoD Meteorological radars, Danger Areas and areas of intense air activity.

6.5.6 The assessment will involve early consultation with the CAA, NATS, NERL and the MoD and their respective aviation policies and documentation, for example:

- The CAA's 2009 updated version of 'Policy and Guidelines on Wind Turbines' – a document to ensure consistency in the assessment of the potential impacts of proposed wind turbine development on the aviation industry;
- 'ATC Air Performance Metrics' by the recently formed MoD Air Traffic Management Performance Criteria Working Group (ATMPC WG) – this document informs those in the wind farm industry of wind farm mitigation solutions; and
- The Wind Energy, Defence & Civil Aviation Interests Working Group's 2002 Report on 'Wind Energy and Aviation Interests: Interim Guidelines' – this report details both military and independent airport operator issues and consultation procedures.

6.5.7 Consultation will also be held with local airports and civil aviation infrastructure.

6.5.8 The consultations will be iterative and allow for concerns and potential objections to be raised that inform the WTG layout and optimisation process for the design of the wind farm extension. The ES will include any design changes and predicted effects on stakeholders.

Study summary

EIA study component	Purpose
Technical desk based assessment (DBA) including the submission of a proforma to the MoD and consultation with NATS (to be undertaken by Wind Power Aviation Consultants Ltd)	To characterise the baseline environment for the ES, identify where potential impacts may occur and highlight any necessary mitigation to reduce anticipated impacts.

6.6 Other human activities

Existing environment

Oil and gas operations

6.6.1 There are no oil and gas installations or abandoned exploration wells in the vicinity of the GWF. The nearest gas producing facility is the Horne and Wren platform located approximately 100km north northeast of GWF, whilst the nearest gas pipeline is located approximately 22km to the east of the site boundary (UK Deal, 2009). There will be no interaction between either the platform or pipeline and the proposed GWF project.

Sub-sea cables

6.6.2 GWF lies within an area of relatively low density cabling, with only one active subsea telecommunication cables passing directly through the site. An additional cable is located 1km north-east of the site and one sub-sea electricity cable ("BritNed") is proposed as an interconnector cable that will pass from the Isle of Grain in the Outer Thames to Maasvlakte in the Netherlands. When laid, the BritNed Interconnector cable will run parallel to the southern edge of the proposed GWF project site, with the closest point approximately 820m between the south-east corner and the cable. BritNed is expected to be operational in 2011, subject to the award of necessary consents. There are also four out of service cables that pass through the proposed GWF project site. All sub-sea cables are presented in **Figure 6.4**.

Offshore wind farms

6.6.3 Other offshore wind farm projects within the Outer Thames Estuary SEA area, include GGOWF (in construction), Gunfleet Sands (Phase 1 and 2 - in construction), Kentish Flats (operational), London Array (consented), and Thanet (in construction). Furthermore, to the northeast of the proposed GWF site lies the boundary to the Norfolk Round 3 Zone (see **Figure 6.5**). However, there is currently no information on the proposed individual projects within this Zone and whether there are any in the vicinity of the proposed GWF project. Furthermore, whilst extensions to the Kentish Flats and Thanet site are likely, following their inclusion in The Crown Estate's Round 2.5 announcement, no project information is currently available in terms of their proposed development or its programme.

Aggregate extraction, marine disposal sites and dredging areas

6.6.4 Numerous areas within the Outer Thames Estuary are licensed for aggregate extraction. Of most relevance is prospecting area 504, which overlaps the southern boundary of the proposed site (see **Figure 6.4**). All other licensed and future prospecting sites lie outside the 5km buffer zone around GWF.

6.6.5 The proposed export cable corridor passes between the licensed dredge area 498 and dredging application area 452. With regards to active licensed marine disposal areas, there are no known areas within the locations of the GWF. There is one closed disposal site, which lies across most of the western section of the proposed northern GWF area and a minor overlap on the northern edge of the proposed southern GWF area.

6.6.6 No capital or maintenance dredging takes place within the vicinity of the proposed GWF project, with the closest area of activity being 119/3, which is approximately 7km north east of the proposed GWF site.

Military exercise areas and unexploded ordnance

6.6.7 There are three Military Practice and Exercise Areas (PEXAs) (areas available for the Ministry of Defence (MoD) to train personnel) that are of relevance for the GWF project (see **Figure 6.4**). These three areas (Outer Gabbard – X5117, North Galloper – X5121 and Kentish Knock – X5119) are used for mine laying and sweeping. However, the lack of objection raised during the GGOWF project would indicate usage of these areas may now be limited.

6.6.8 The Thames Estuary has a long history of military conflict particularly during World War II, there is a small risk that during construction and operation, unexploded ordnance (UXO) may be encountered on the seabed, including items such as sunken sea mines, air delivered bombs and naval ammunition.

Figure 6.4: Human Activity

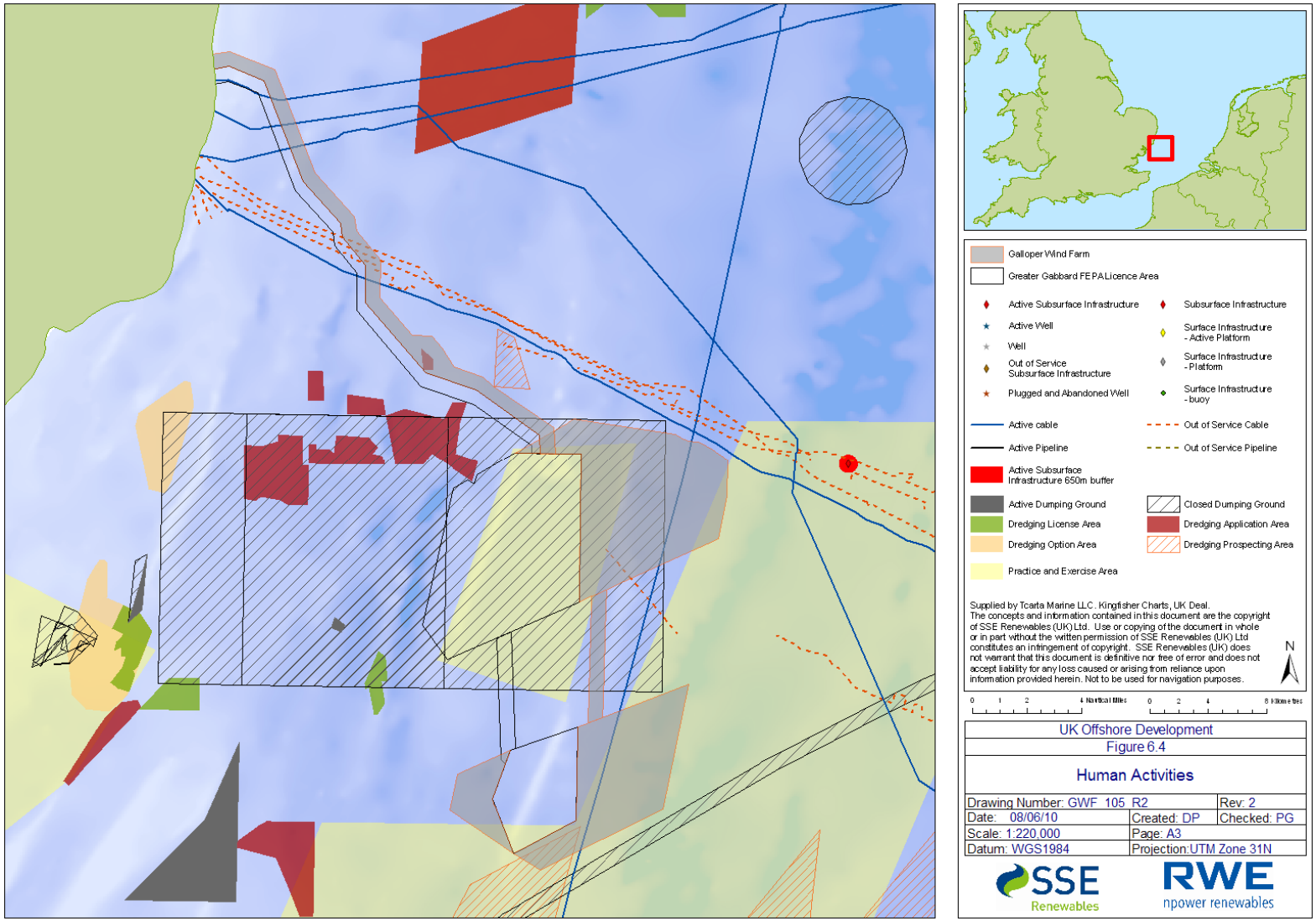
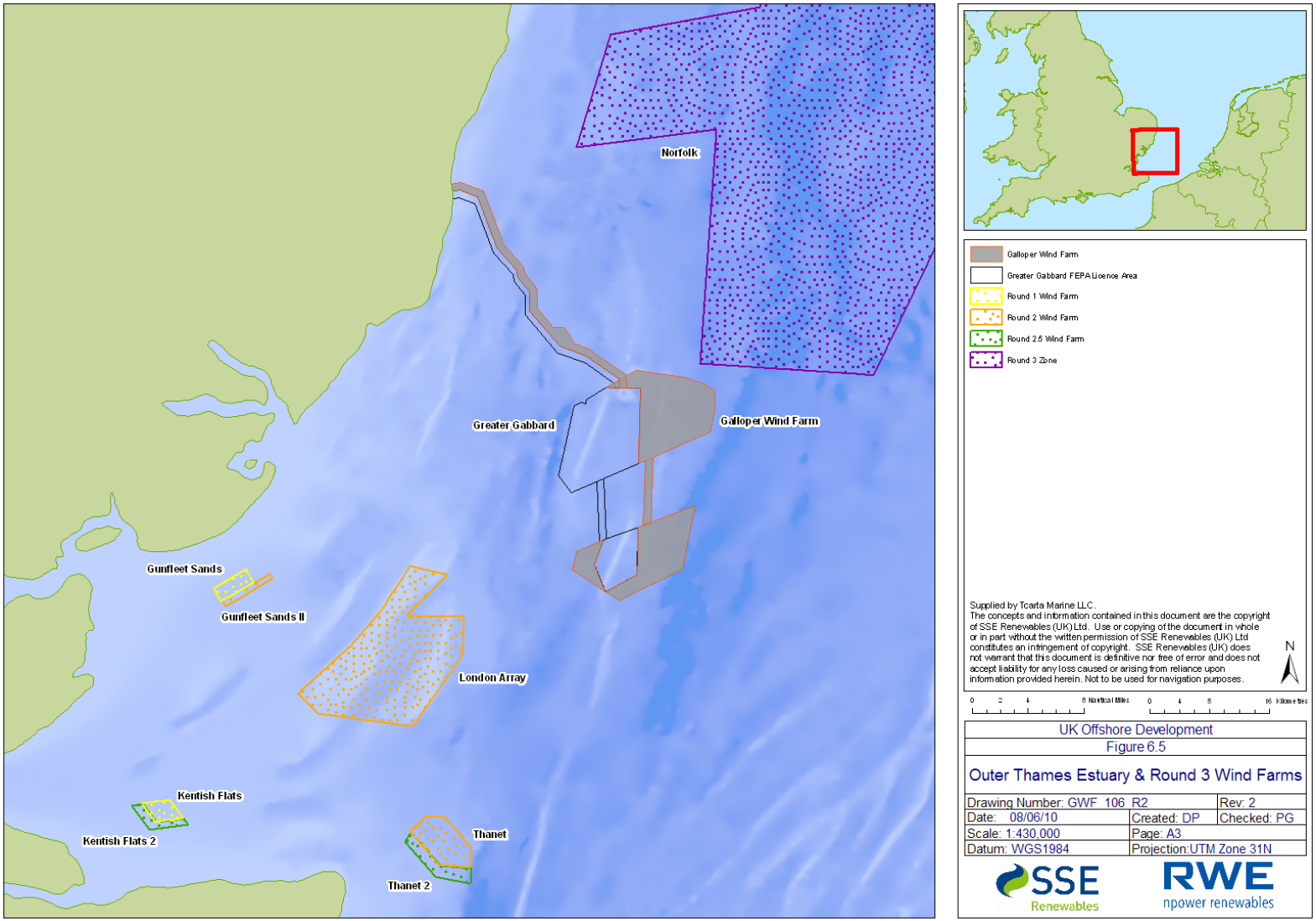


Figure 6.5: Offshore wind farms



Identification of key issues

Potential impacts during construction

6.6.9 Potential interference with oil and gas operations: No impacts are anticipated on current or future oil and gas activity as there are no nearby installations and lack of interest in the area following DECC's 25th Round oil and gas licencing programme (which included waters around the GWF area) would suggest that future development is unlikely. It is recommended that this aspect is scoped out of the EIA.

6.6.10 Physical effects on subsea cables and pipelines from construction activities: The export cable corridor will need to cross operational telecommunications cables between the UK and Europe, which will mean securing crossing agreements with the relevant cable operator. Such an agreement will need to ensure no damage is caused to the existing telecom cables, as this would affect telecom services. Appropriate protection measures will be part of this crossing agreement, experience from GGOWF and from other SSER and NRL projects will be drawn upon to ensure that the lessons learnt are carried through to the GWF project. Monitoring during the laying of the export cable would ensure that protection is carried out in accordance with the agreement. Where the export cable needs to cross out of service cables it may be necessary for some sections of these cables to be removed, and will be done so using standard industry techniques (ICPC, 2004).

6.6.11 Effects on disposal sites and dredging activities: No impacts are anticipated on capital and maintenance dredging. It is understood through consultation with Hanson Aggregates that the prospecting marine disposal area 504 that overlaps the southern boundary of the proposed GWF project has been returned to The Crown Estate and will not be progress for the foreseeable future.

6.6.12 Impacts due to unexploded ordnance: There is potential for UXO to be encountered on the seabed in the area of the wind farm and along the export cable corridor. During construction, activities which will have contact with the seabed either directly e.g. jack-up vessel, or via the placement of material such as foundations or scour protection, run the risk of disturbing UXO with potentially damaging effects.

6.6.13 Impacts on military exercise areas: Where there is overlap between the PEXAs and the GWF site there is potential for restrictions to activity. Consultation with the MoD will be undertaken. However, it should be noted, that no concerns were raised for the original GGOWF project and therefore, no major issues are anticipated for the proposed GWF project based on initial consultation with the MoD.

Potential impacts during operation

6.6.14 Potential interference with oil and gas operations: No impacts are anticipated on current or future oil and gas activity as there are no nearby installations, given the historic and current lack of interest within the area. It is recommended that this aspect is scoped out of the EIA.

6.6.15 Potential interference with marine aggregate extraction and dredging activities: The GWF has the potential to impact upon navigation and restrict access to extraction areas. Area 452, which lies within the export cable corridor (see **Figure 6.4**) has been discussed with Cemex Ltd. The concerns of potential impacts relating to navigational safety issues and are accordingly, discussed in the Shipping & Navigation section of this Scoping Study Report.

6.6.16 Potential for electromagnetic disruption to television, radio and mobile phone signals: Previous consultation with telecommunication companies during the GGOWF EIA identified that it would be highly unlikely that there would be any electromagnetic interference either offshore or onshore due to the wind farm (GGOWL, 2005). It is recommended that this aspects is therefore, 'scoped out' of the EIA.

6.6.17 Potential impacts on unexploded ordnance: Though both natural processes of the sea (e.g. tidal movement and wave action) and human activities (e.g. trawling, dredging, and cable maintenance) contribute to the movement of objects on the seabed, it is predicted that it is highly unlikely that any UXO will be affected by the presence of the WTGs.

Potential impacts during decommissioning

6.6.18 The effects on human activities during decommissioning are anticipated to be similar to those discussed during construction of the wind farm, with an incremental reduction of impact as individual WTGs are removed from the site.

Potential cumulative impacts

6.6.19 With respect to human activities, it is predicted that there is unlikely to be potential for cumulative impacts with other offshore wind farms in the Outer Thames Estuary. GGOWF will be operational by the time that GWF moves to construction phase. The only potential overlap in activity is with the second phase of London Array, but given the distance between the two projects no impacts are anticipated.

6.6.20 Potential impacts through interaction with other human activity may occur with regard to aggregate extraction and PEXAs. Assessment of these impacts will be carried out and reported in the ES to determine the extent and significance on these human activities.

Methodology and approach to EIA

6.6.21 A desk study will be conducted, which will also involve consultation with stakeholders, to establish the relevant status of the known offshore human activities that occur within the vicinity of the GWF project, and which may be subsequently impacted by the activities. Consultees will include, though not be limited to telecommunication and gas pipeline operators, the MoD, aggregate companies, oil and gas operators, and the Marine Management Organisation (MMO) for dredging and disposal issues.

6.6.22 Furthermore, a full debris survey which will be conducted to serve to identify objects that may represent UXO during the pre-construction works. Should suspected items of UXO be discovered, their location will be accurately mapped and recorded for possible removal / disposal or remediation *in situ* by a specialist contractor. The MoD and emergency services will also be consulted as appropriate.

Study summary

EIA study component	Purpose
Desk based assessment informed through review of available data sets and consultation with relevant industries.	To characterise the baseline environment for the ES, identify where potential impacts may occur and highlight any necessary mitigation to reduce anticipated impacts.

6.7 Socio-economics

Existing environment

6.7.1 For the purposes of establishing the socio-economic baseline the local, regional and wider areas have been identified as Suffolk Coastal District, Suffolk and the East of England. Reference is made with regards to the adjacent administrative districts of Norfolk and Essex. For regional comparisons the South East of England will be used.

6.7.2 The East of England has one of the fastest growing populations in the UK and is projected to continue growing at a faster rate than the UK as a whole. It has the highest total net migration rate of all the English regions (Office for National Statistics, 2009). The Suffolk Coastal District is largely rural in character with about one third being recognised nationally for its landscape quality; hence it's designation as an Area of Outstanding Natural Beauty. Outside of the larger urban centres the settlement pattern of the District is generally rural and small in scale. About one third of the population lives in parishes of less than 500 people and, overall, the settlements are varied in size and are scattered across the District.

6.7.3 The Suffolk Coastal District supports over 4,000 businesses, a high proportion of which are small and medium sized businesses that are vital to the local economy (70% of the businesses in the District employ 5 people or less). There are also large employers like:

- The Port of Felixstowe (the biggest container port in the country);
- Sizewell Power Station; and
- Martlesham Heath, centred on BT's research and development headquarters.

6.7.4 The coast of Suffolk stretches nearly 50 miles from Felixstowe to Lowestoft, with much of it designated as an Area of Outstanding Natural Beauty, which attracts numerous visitors to Orford Ness, Aldeburgh and Minsmere. However, compared to other areas within the region, Suffolk attracts a lower volume of tourists than its neighbours, Essex and Norfolk GGOWF, 2005).

Identification of key issues

6.7.5 Offshore wind farms can have significant socio-economic effects in terms of providing employment, wind energy market development and possibly local tourism. The economic impact, both direct and indirect will be most significant during the construction phase, with less direct impact on the local economy during the operation phase. The surrounding coastal environment also has the potential to be impacted upon.

Potential impacts during construction

6.7.6 Supply chain effects: The proposed wind farm would require local goods and services, which would be supplied by local businesses such as security, catering, hotel facilities or maintenance, thereby supporting local companies via the supply of goods and services throughout the development lifespan.

6.7.7 Impact on employment: The wind farm would require staff (man hours) that would be employed directly by the operator, contractors and manufacturers, at various stages of the construction phase. Furthermore, indirect employment is generated through additional demand created by the primary construction businesses. An example for the GWF project could be those involved in the supplying of building materials for new construction bases or those supplying maintenance services to the shipping that is used during the construction phase. Furthermore, local civil engineering contractors would be in a strong position to tender for the earth and building works and much of the employment would be sourced locally. There will also be a number of staff employed during the construction phase for the onshore works at Sizewell.

6.7.8 Negative impact of local spend: Local landowners and businesses around the landfall, cable route and substation location will be disrupted during the construction phase which may equate to some loss in earnings. These factors shall be assessed within the ES.

6.7.9 Positive impact of local spend: There will be a social and economic impact that relates to the new spending power generated from employees directly and indirectly attached to the wind farm. A significant amount of the earning capacity of these individuals would be expected to be spent locally, for example shopping, accommodation, leisure and local taxes. This could in turn support more local jobs and more local wealth.

Potential impacts during operation

6.7.10 Impact on employment: The wind farm will be operational for 40 years and will require the employment of a limited number of staff for operations and maintenance. These technicians would be stationed onshore, in proximity to the wind Farm. It is likely that a local operation port would be chosen to service the wind farm, such as Felixstowe, Harwich, Great Yarmouth and Lowestoft. Thereafter, at intervals there would be maintenance and service programmes, which would require teams to support the core operational team. In addition, further full time equivalent staff will be involved in the management and administration of the wind farm.

6.7.11 All staff are likely to spend fixed periods of time based within the region to service the wind farm. This would provide contributions to revenue for local hoteliers and B&Bs plus shops, restaurants and other services.

Potential impacts during decommissioning

6.7.12 Decommissioning of the project at the end of its lease would be undertaken by experienced offshore contractors. It is not anticipated that impacts on the local economy would arise, other than the loss of associated operations and maintenance jobs.

Potential cumulative impacts

6.7.13 Increase in employment: Cumulatively the development of the offshore wind industry is likely to have a significant impact in terms of increased local, regional and national employment and spend (boosting the respective economy). Given the number of proposed/planned wind farms within the region, it is possible that the need for maintenance operations would stimulate local companies to develop dedicated services for the offshore wind sector. This is particularly pertinent with the presence of the GGOWF project in the immediate vicinity. These could then be made available to other areas of the UK.

6.7.14 Cumulative impacts associated with the Sizewell A, B and C will be assessed within the final ES. Sizewell A decommissioning activities are expected to commence in 2010 and last for a period of approximately 15 years. At present the requirement for construction personnel is unknown. The Sizewell B dry fuel store construction programme shall commence in 2012 and is expected to employ 50 construction personnel with the Sizewell C construction programme commencing in 2015, at the earliest, and employing 3,500 construction personnel.

Methodology and approach to EIA

6.7.15 It is proposed that the assessment of socio-economics 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 Regional Intelligence Unit, Office for National Statistics, East of England Development Agency, Suffolk Coastal District Council and data obtained during consultation.
- Recently published studies analysing the supply chain and the economic effects of wind farms developments, together with the internal project information. Amongst other literature, the following studies will be used:
    - POWER – Offshore Wind Supply Chain Study (Douglas-Westwood, 2007);
    - UK Offshore Wind: Moving Up a Gear (BWEA, 2007);
    - Wind Energy in the UK: A BWEA State of the Industry Report (BWEA, 2009);
    - A Prevailing Wind: Advancing UK Offshore Wind Deployment (DECC 2009c);
    - Offshore wind power: big challenge, big opportunity Maximising the environmental, economic and security benefits (The Carbon Trust 2008):
    - UK Offshore Wind Report 2010 (The Crown Estate, 2010); and
    - Renewable Supply Chain Study, for the DTI (DTI, 2004).
- Consultation with key organisations 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 consulted:
    - Suffolk Coastal District Council;
    - Suffolk County Council;

- East of England Energy Group; and
- Renewables East.

Study summary

EIA study component	Purpose
Desk based assessment informed through review of available data sets and consultation with relevant bodies.	To provide an overview of the current socio-economic baseline for the ES, identify where potential impacts may occur and highlight any necessary mitigation to reduce anticipated impacts.

6.8 Coastal tourism and recreation

Existing environment

Recreational yachting & angling

6.8.1 Surveys undertaken as part of the GGOWF ES identified that there was very little recreational boating activity observed and no conclusions can be drawn from the data compiled (GGOWL, 2005). Consultation during the GGOWF project with the Royal Yachting Association (RYA) and Cruising Association identified three cruising and racing routes within the vicinity of the Inner Gabbard and The Galloper banks.

6.8.2 The route to the south of The Galloper bank is reported to have 'Medium Recreational Use', defined as 'a popular route on which some recreational craft will be seen at most times during summer daylight hours.' The second and third routes pass between the banks and across the Inner Gabbard respectively and are defined as having 'Light Recreational Use' (GGOWL, 2005).

6.8.3 These routes can be assumed to be passage routes to and from Continental ports (between the UK and Holland / Germany) and the majority of recreational traffic using these routes will be confined to the summer months.

6.8.4 The distance of the GWF site from shore limits the level of recreational angling taking place in the vicinity, however, both The Inner Gabbard and The Galloper sandbanks are known to be visited by recreational angling charter parties from Orford and Aldeburgh, for rod and line fishing (GGOWL, 2005).

Onshore environment

6.8.5 Sizewell is situated between the popular seaside towns of Aldeburgh and Southwold and within close walking distance of Minsmere and Westleton Heath Nature Reserves and National Trust land at Dunwich Heath, all of which are popular visitor attractions. Recreation is generally informal within the study area with access provided by the foreshore / beach and a network of public and permissive footpaths and bridle ways. A great number of walkers and bird watchers access this area which increases pressure for footpath improvement, signposts and car park provision.

Identification of key issues

Potential impacts during construction

6.8.6 Impact on marine based tourism and recreational activities: During construction, disruption to marine tourism and recreational activities could occur as a result of the exclusion zones around the various construction activities. Furthermore, there will also be a higher number or vessels would transit between the construction port and the site. However, consultation with the RYA (in September 2009) regarding the GWF project did not identify any significant concerns with regard to recreational sailing.

6.8.7 Impact on terrestrial based tourism and recreational activities: The onshore components of the development fall within close proximity to an Area of Outstanding Natural Beauty (AONB), which is a known area of recreational use. It is anticipated that some disruption, therefore, there will be disruption to certain recreational activities which shall impact upon socio-economic aspects within the existing environment.

6.8.8 Footpath closure or diversion: Defra has introduced new legislation (The Marine and Coastal Access Act 2009) that would align a 'coastal access corridor' around the coast and enable improved access around the English coastline. The implementation of this legislation could potentially affect any proposals to create temporary or permanent structures within this corridor. These access implications will need to be considered further within the EIA.

6.8.9 Directional drilling with ensure that the cable installation process has limited impact on the Suffolk Coastal path, that runs along the coast past Sizewell. The Sandy Lane bridleway may be affected temporarily during the construction of the cable route and substation.

Potential impacts during operation

6.8.10 Impact on tourism and recreational activities: During operation, impacts on the existing RYA vessel cruising routes in the area are considered unlikely. Consultation with held to date with the RYA has indicated that they have no major concerns providing that the extension to the Gabbard area does not extend south into waters to the east of the current Sunk TSS. Furthermore, passage within/through the wind farm would still be feasible for recreational vessels (providing safety zones are adhered to). Likewise for recreational angling, activity would still be able to occur within the proposed GWF site, assuming that any safety zones are adhered to.

6.8.11 Experience elsewhere suggests that the very presence of a renewable energy project will draw visitors who come to view it. Angling has becoming popular within the North Hoyle Wind Farm off the coast of North Wales for small boat operators based in Rhyl and Prestatyn. Pleasure boat trips from Foreland Point near Lynmouth in Devon used to detour to take in a visit to the Seaflow demonstration marine current turbine when it was installed there. It is anticipated that future tourism and recreational activities shall arise from the construction of the GWF project. These will be fully assessed within the EIA.

6.8.12 The studies undertaken as part of the GGOWF ES identified that the geographical location of the GGOWF, some distance from the coast, suggested that tourism development may not feature as a major beneficial impact (GGOWL, 2005). However, anecdotal evidence suggests that wind farms enhance local generic attractions by providing 'more to see' in the vicinity (GGOWL, 2005).

Potential impacts during decommissioning

6.8.13 The effects on human activities during decommissioning are anticipated to be similar to those discussed during construction of the wind farm, with an incremental reduction of impact as individual WTGs are removed from the site.

Potential cumulative impacts

6.8.14 Interactions between other wind farms: The main sources of potential cumulative effects are from different activities within the GWF project and overlapping activities with GGOWF. Given that construction phases (when effects on tourism & recreation are most likely) of GGOWF and GWF would not overlap, negative cumulative effects are considered unlikely. Should construction works associated with the cable installation and the substation pit for the GWF project overlap then localised cumulative effects may occur and will be assessed within the EIA.

6.8.15 Interactions between other activities: The potential for cumulative effects with other activities is largely associated with, the decommissioning of Sizewell A, the construction of the Sizewell Dry Fuel Store, and the potential construction of Sizewell C. The timelines of all these projects will need to be carefully considered to determine cumulative impacts on the tourism and recreational interests.

Methodology and approach to EIA

6.8.16 The information presented is descriptive of this area of the Suffolk coast in terms of coastal recreation and amenity. It is anticipated that the existing information with regards to coastal tourism and recreation, when supplemented with the information gathered through the SoCC process will be sufficient to inform the extension EIA. No additional baseline work is proposed at this stage, although a review of existing information and local knowledge will be carried out. A robust understanding of the issues and appropriate mitigation measures, where required, will be presented within the ES.

Study summary

EIA study component	Purpose
Desk based assessment informed through review of available data sets and consultation with relevant bodies.	To provide an overview of the current tourism and recreation baseline for the ES, identify where potential impacts may occur and highlight any necessary mitigation to reduce anticipated impacts.

6.9 Traffic and access

Existing environment

6.9.1 The closest primary road traffic route to the study area is the north-south running A12 London-Great Yarmouth road. This road has been de-trunked and is the responsibility of Suffolk County Council. From the A12, there are three routes that can be used to reach the onshore part of the development:

- B1122 at Yoxford, leading to the unclassified road (Lover's Lane) north of Leiston, onto the C228 (Sizewell Road);
- B1119 at Saxmundham, reaching the C228 via either Lover's Lane or King Georges Avenue; and
- A1094 at Farnham onto the B1069 to Leiston and the C228.

Identification of key issues

Potential impacts during construction

6.9.2 Increased traffic flows: 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. However, based on a similar scale of works to that for GGOWF, and taking into consideration the assessment in the GGOWF ES, the average lorry movements associated with the GWF works are not considered to be significant.

6.9.3 Increased traffic flows 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.

Potential impacts during operation

6.9.4 The substation and 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.

Potential impacts during decommissioning

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

Potential cumulative impacts

6.9.6 There are a number of projects and proposals that could result in increased traffic flows in the vicinity of the proposed GWF project. These include the decommissioning of Sizewell A, the construction of the Sizewell Dry Fuel Store, and the potential construction of Sizewell C. The timelines of all these projects will need to be carefully considered to determine cumulative traffic impacts.

Methodology and approach to EIA

6.9.7 A Traffic Impact Assessment (TIA) will be undertaken as part of the EIA. The TIA will examine the impact of the development's construction traffic and operational traffic. The scope of the TIA will be agreed with the relevant Local Highway Authority and will be in accordance with the following guidance documents:

- Guidelines for the Environmental Assessment of Road Traffic;
- The Design Manual for Roads and Bridges. Volume 11 – Environmental Assessment; and
- The Institute of Highways and Transportation (IHT) Guidelines for Traffic Impact Assessment.

6.9.8 The most recent Suffolk County Council automatic traffic count monitoring data will be obtained from the SCC website to inform the TIA. In addition, mean traffic speed data on local roads will be attained along with background link flow data counts.

6.9.9 The scale of the proposed development is similar in size to the GGOWF application. Therefore, a solid understanding of anticipated traffic flows, journey numbers vehicle types and work timescales associated with the construction, operation and decommissioning has been established.

6.9.10 The scope of the TIA will be agreed in consultation with the Local Highway Authority but broadly includes the following tasks:

- Establish assessment parameters and potential impacts that require further investigation with the Local Highway Authority;
- Gain an understanding of the construction/operational requirements and convert into vehicle movements, where gaps are identified professional assumptions will be required;
- Establish baseline traffic flows and growth to peak construction year and opening year;
- Manually assign the development traffic on the network and establish the peak construction flows and operation flows as necessary7;
- Appraise the effects of changes in predicted traffic flows on receptors within the assessment cordon with particular regard to the potential impacts identified at scoping stage (e.g. accidents, severance, delays, air quality etc.);
- Propose a package of mitigation measures in respect to identified significant impacts;

[7] Operational flows may not be required if it can be demonstrated that the construction flows have the largest impact.

- Appraise the effects of changes in predicted traffic flows on receptors within the assessment cordon with particular regard to the potential impacts identified at scoping stage (e.g. accidents, severance, delays, air quality etc.); and
- Propose a package of mitigation measures in respect to identified significant impacts.

6.9.11 A study of cumulative effects within the vicinity will be undertaken during the EIA.

Study summary

EIA study component	Purpose
Traffic Impact Assessment (to be undertaken by Halcrow Ltd)	To provide an overview of the current traffic baseline for the ES, identify where potential impacts may occur and highlight any necessary mitigation to reduce anticipated impacts.

6.10 Air quality

Existing environment

6.10.1 Sizewell is located on the Suffolk coast, north east of Ipswich and south of Lowestoft. The nearest towns are Leiston, Aldeburgh and Saxmundham. However, the landfall and potential substation locations are predominantly mixed rural in nature. The recent Sizewell B Dry Fuel Store EIA (British Energy, 2010) describes the air quality in this location as good and typical of a rural coastal area in Eastern England.

6.10.2 Suffolk Coastal District Council's (SCDC) 2009 Updating and Screening Assessment (USA) of Air Quality did not report the need to progress to a Detailed Assessment for any of the Air Quality Strategy pollutants within the district. There are two designated Air Quality Management Areas (AQMAs) within the district; however neither of these are located within the vicinity of the proposed cable route. SCDC does not undertake any air quality monitoring at or within the vicinity of the development site, thus the proposed onshore cable route is situated in an area where SCDC do not anticipate that the health based air quality objectives, including those for nitrogen dioxide (NO_2) and particulates (PM_{10}), are likely to be exceeded.

6.10.3 Defra's local pollutant background maps for the grid square encompassing the proposed cable route and substation locations (OS Grid Reference 647500, 262500) indicate that existing background concentrations of annual mean NO_2 (9.2 $\mu g.m^{-3}$) and PM_{10} (15.6 $\mu g.m^{-3}$) are well below the respective objectives.

Identification of key issues

6.10.4 An air quality impact assessment was not required for the GGOWF project, which is an analogous scheme to the proposed GWF. To inform this scoping report an air quality screening exercise has been undertaken to determine the potential requirement for an air quality impact assessment for the GWF.

Potential impacts during construction

6.10.5 Increased construction borne dust: Fugitive construction dust emissions have the potential to cause nuisance at nearby receptors, such as residential properties, by causing soiling of surfaces. In addition, a proportion of dust emitted will be in the form of fine particles which can have an adverse effect on human health.

6.10.6 Defra's Local Air Quality Management Technical Guidance document (LAQM.TG(09)) states that, in terms of construction dust, "*concentrations fall off rapidly on moving away from the source*" and the determination of public exposure should consider the distance to the actual source and not to the site boundary. The guidance also states that potential exposures beyond 200 m of the source can be ignored (for the purposes of assessment against the PM_{10} objective) if the background concentration is less than 26 $\mu g.m^{-3}$, as is evident for the area surrounding the development site.

6.10.7 There are three potentially sensitive receptors located within 200 m of the proposed cable route. These are:

- Coastguard Cottages, off Sizewell Gap (OS Grid Reference: 647510, 262650)
- Home Farm, off Sizewell Gap (OS Grid Reference: 647160, 262430); and
- Rosery Cottages, Sandy Lane (OS Grid Reference: 647020, 262950).

6.10.8 Construction is expected to take place for a period of 2 – 3 years, 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. Both substation locations are situated in excess of 200 m from relevant exposure. 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.

6.10.9 Dust mitigation measures will be detailed within an Environmental Management Plan (EMP) to minimise and / or negate the release of fugitive dust from all construction activities occurring along the proposed cable route and substation location, particularly where activities will occur within 200 m of the identified receptor locations. Best practice measures will be implemented for the control of dust emissions, using such guidance as:

- Greater London Authority and London Councils (2006) '*The control of dust and emissions form construction and demolition, Best Practice Guidance'*; and
- Building Research Establishment (BRE), 2004, *'Controlling Particles, Vapour and Noise Pollution from Construction Sites'*.

6.10.10 Increased construction traffic: Local background concentrations of NO_2 and PM_{10} at and surrounding the site are low, as indicated by the local pollutant background maps, therefore a large increase in road vehicles throughout the construction phase of the development would be required to have a significant adverse impact on local air quality. 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*."

6.10.11 The predicted traffic increases on the roads to be utilised by construction traffic, above the future baseline (2014), are below +/-10% with the exception of 2 links (Lover's Lane, and King George Avenue), where AADT is predicted to increase by 20 – 25%. However, these increases are predicted to occur on roads with an AADT of less than 2000, therefore the material increase in traffic is not predicted to have a significant effect on local air quality. The percentage of HDVs on each road link is predicted to remain below 0.1% of the total AADT on each road link, both for the future baseline and future baseline with construction traffic. Furthermore, any increase in traffic due to the construction of the onshore substation will be for the duration of the construction period only.

6.10.12 Given the existing good air quality in the area at and surrounding the development site and the relatively low, short-term predicted impact on local traffic flows by construction traffic, it is not considered necessary to undertake further air quality assessment of the potential impacts caused by construction vehicle exhaust emissions.

Potential impacts during operation

6.10.13 There are no operational impacts associated with the scheme as it will not lead to a change in vehicle flows to and from the site, or introduce any new emission sources.

Potential impacts during decommissioning

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

Potential cumulative impacts

6.10.15 The predicted traffic increases identified above account for the construction traffic associated with Sizewell B Dry Fuel Store and Sizewell A decommissioning. Therefore, the cumulative impact on local air quality associated with construction traffic is not considered to warrant further assessment within the Environmental Impact Assessment.

Methodology and approach to EIA

6.10.16 Given the existing good air quality in the area at and surrounding the development site and the relatively low, short-term predicted impacts, it is proposed that air quality is not specifically assessed in the Environmental Statement for the GWF, i.e. air quality is scoped out of the assessment.

6.11 Noise

Existing environment

6.11.1 Potential noise sensitive receptors are defined as any occupied premises used as a dwelling (including gardens), places of worship, educational establishment, hospital or similar institution, or any other property likely to be adversely affected by an increase in noise level.

6.11.2 The nearest receptors in relation to the onshore elements of the proposed GWF project include:

- Rosery Cottages;
- Sizewell Village;
- Reckham Lodge;
- Home Farm;
- Cliff House; and
- Halfway Cottages.

6.11.3 Other more mobile human receptors, such as recreational walkers, use the beach areas and permitted pathways during the day. Various dwellings are also present throughout the length of the construction traffic access route.

6.11.4 The offshore elements of this scheme are approximately 27.5km from the nearest onshore receptors (residences). The GGOWF ES indicated that construction noise may occasionally be audible at night given specific meteorological conditions (easterly winds and a temperature inversion). Given that the prevailing winds are westerly, construction activities were assessed to be inaudible on land for the majority of the time. Given the distance offshore of the GGOWF, operational noise was assessed to be inaudible at all times. Due to the distance between the WTGs and these receptors, noise disturbance will not be experienced and will not therefore, be assessed further within the EIA.

Identification of key issues

Potential impacts during construction (onshore substation)

6.11.5 Increased noise at key receptors: Noise associated with construction activity, particularly if piling is required; and noise along the haul route to site from increased vehicular traffic.

Potential impacts during operation (onshore substation)

6.11.6 Increased noise at key receptors: During the operation of the 132kV substation noise can be split into two kinds, 1) noise that may arise from transformers and other associated electrical plant; and 2) noise from vehicular traffic visiting the substation.

Potential impacts during decommissioning (onshore substation)

6.11.7 Increased noise experienced at key receptors: Potential noise impacts during decommissioning are anticipated to be similar to those discussed during construction. However, as there will be no requirement for piling activities any potential impacts would be expected to be lower than during construction.

Potential cumulative impacts (onshore substation)

6.11.8 Increased noise experienced at key receptors: The activities associated with the Sizewell Nuclear Power Stations, including the decommissioning of Sizewell A, the construction of the Sizewell B Dry Fuel Store, and the potential construction of Sizewell C, represent potential cumulative impact sources. All of these developments are expected to have localised construction noise impacts and will need to be considered within the GWF construction activities. In addition, the 400kV substation proposed by National Grid will have operational noise impacts that will need to be considered in combination with the 132kV substation associated with the GWF.

Methodology and approach to EIA

6.11.9 Agreement with the Local Authority Environmental Health Officer will be sought with regards to the methodology for assessment of noise impacts resulting from the construction, operation and decommissioning of the substation and associated onshore works. However, it is anticipated that the methodology for assessment of noise impacts will be as follows.

- Representative sites (those most likely to be affected) will be selected, in close consultation with the Local Planning Authority, and ambient noise surveys carried out to provide an updated baseline;
- A review of the proposed construction activities will be undertaken to highlight other properties and locations which may be affected; and
- Operational noise levels, associated with the substation, will be determined.

6.11.10 The noise levels for the construction, operation and decommissioning of onshore works will be determined based on the known noise levels experienced from similar schemes, particularly the GGOWF scheme. The construction programme for the GGOWF will inform our understanding of the type site plant, daily construction traffic movements, daily worker travel arrangements, and any marine-based activities likely to be required, in order to accurately assess the potential noise impacts from this project.

6.11.11 A study of cumulative effects with other developments within the vicinity will be undertaken during the EIA.

Study summary

EIA study component	Purpose
Onshore noise assessment	To provide an overview of the baseline onshore noise environment for the ES, identify where potential impacts may occur and highlight any necessary mitigation to reduce anticipated impacts.

6.12 Flood risk and climate change

Existing environment

Flood risk

6.12.1 The EA's flood map indicates that both potential onshore substation sites fall within Flood Zone 1, defined in Planning Policy Statement 25 Development and Flood Risk (PPS25) as the zone of low flood probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or coastal flooding in any year.

6.12.2 The Sizewell area has no known history of flooding. The last major tidal flood event occurred in January 1953 when a combination of a strong storm and spring tides resulted in widespread flooding long the east coast of England and in the Netherlands.

6.12.3 The low-lying coastal floodplain of the Minsmere Valley is protected from tidal flooding by a cordon of dunes acting as the main sea defence. The dunes are maintained by the Environment Agency. To the north of the Minsmere Sluice, an embankment runs to the back of the dunes, acting as a secondary line of defence. This embankment is owned by the RSPB. The effective crest level of the defences between Minsmere Cliffs and Sizewell Power Station is 4.1mAOD.

6.12.4 Sizewell B Power Station is set back some 100m behind the beach with a width of dune and shingle fronting a higher earth embankment. The shingle/dune bank has a crest height of 4.5mAOD and is in good condition. The embankment comprises two banks, one at 5mAOD and the other at 10.22mAOD and has a design standard of a 100-year event. Both of these defences are owned and maintained by British Energy.

6.12.5 The Sizewell village frontage is similarly set back with a lower-lying area of dune and shingle between it and the beach. The dunes are maintained by the Environment Agency.

Climate change

6.12.6 For any coastal location there are potential significant implications of climate change on:

- The site integrity due to sea level rise and more intense coastal processes; and
- Increased flooding from coastal and fluvial (rivers) sources.

6.12.7 The effects of climate change may be assessed in line with the recommended contingency allowances for net sea level rise presented in PPS25. The net sea level rise rate for the East of England is as follows:

- 4.0mm/yr from 1990 to 2025;
- 8.5mm/yr from 2025 to 2055;
- 12.0mm/yr from 2055 to 2085; and
- 15.0mm/yr from 2085 to 2115.

Identification of key issues

Potential impacts during construction, operation and decommissioning

6.12.8 There is a minimal risk of flooding from any of the development stages (construction, operation or decommissioning) at either of the proposed substation sites, as they are both on land identified as having a less than 1 in 1000 annual probability of river or coastal flooding in any year, based on the Environment Agency's website (www.environment-agency.gov.uk).

6.12.9 There is the potential for increased flood risk nearby as a result of increased surface water runoff from impermeable surfaces.

Potential cumulative impacts

6.12.10 Potential cumulative flood risk impacts: The GGOWF substation along with proposals at Sizewell Nuclear Power Station, including the construction of the Sizewell B Dry Fuel Store, and the potential construction of Sizewell C, all represent additional areas of hardstanding and therefore potential cumulative impact sources.

6.12.11 Potential cumulative climate change impacts: The GWF project would serve to increase the level of renewable energy generation by an additional 500MW_e. The production of renewable energy is seen as one of the key methods of reducing the global dependence on the consumption of fossil fuels (which contribute to the emissions of greenhouse gases, and therefore climate change). The GWF project would therefore, have a potentially beneficial effect on climate change.

Methodology and approach to EIA

6.12.12 A Flood Risk Assessment (FRA) will be undertaken as part of the EIA. As detailed within PPS25, development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, will be incorporated in the FRA.

6.12.13 This assessment will use EA flood maps and flood levels, and details on the current defences in the area.

6.12.14 Flood risk management strategies and plans such as the Suffolk Coastal District Council Strategic Flood Risk Assessment, the Suffolk Shoreline Management Plan 2 and the East Suffolk Catchment Flood Management Plan were consulted for future plans for the area regarding flooding.

Study summary

EIA study component	Purpose
Flood Risk Assessment (FRA).	To provide an assessment of the likelihood for flooding associated with the onshore infrastructure. The findings will be used to inform the impact assessment and inform the requirement for any mitigation.

7 CONCLUSION

7.1.1 The information in this study been provided to support SSER and NRL's formal request for a 'Scoping Opinion' in relation to the potential impacts of the GWF offshore wind farm project, which comprises the offshore wind farm, export cable and onshore infrastructure to connect the project to the National Grid network.

7.1.2 SSER and NRL have built up a great deal of knowledge in terms of the baseline environment and the potential impacts from offshore wind farm development in the vicinity of the GWF project, through development of the GGOWF project, which is currently under construction. Consequently a wealth of data and knowledge has been available to help inform the likely impacts for the GWF project within this study and therefore, will enable a more focused and streamlined approach to the subsequent EIA. Furthermore, many discussions have taken place with statutory consultees over the last 18 months with regard to the key issues and how best to address them for a potential extension to the GGOWF project. The outcome of these consultations has been used to shape the approach to the GWF EIA and therefore SSER and NRL are confident that the EIA methodology put forward within this scoping study is reflects the requirements to:

- Provide new data where current information from GGOWF is insufficient to inform the relevant GWF EIA parameter; and
- Enable key concerns relating to the extension of an existing project to be addressed.

7.1.3 The following table provides a high level summary of the perceived impacts associated with the key physical, environmental and human parameters covered within the EIA for the GWF project.

Table 7.1 GWF impact overview summary

Parameter	Construction	Operation	Decommissi-oning	Cumulative
Bathymetry & Hydrodynamics				
Geology				
Geomorphology				
Water Quality				
Onshore geology, water resource & land quality				
European Designated Sites				
Ornithology				
Marine ecology				
Fish & shellfish resource				
Marine mammals				
Terrestrial ecology				
Commercial fisheries				
Landscape, seascape and visual resources & character (offshore)				
Landscape and visual resources & character (onshore)				
Shipping & navigation				
Archaeology				
Military & civil aviation radar				
Other human activities				
Traffic & access				
Socio-economics				
Coastal tourism & recreation				
Air quality (onshore)				
Noise (onshore)				

Potentially significant impacts anticipated. Parameter must be included in the EIA.

No significant impacts anticipated. Further work required through EIA to confirm.

No significant impacts anticipated. Impact to be discussed within EIA but is believed not to require detailed individual investigation.

7.1.4 The following point summarise those items that SSER and NRL consider should be 'scoped out' of the EIA:

- Impacts on geology;
- Cumulative impacts between the GWF and other (non-wind farm related) activities on the hydrodynamic regime;
- Operational noise impacts on fish;
- Impacts on air quality;
- Impacts on oil and gas activity; and
- Operational impacts on television, radio and phone signal.

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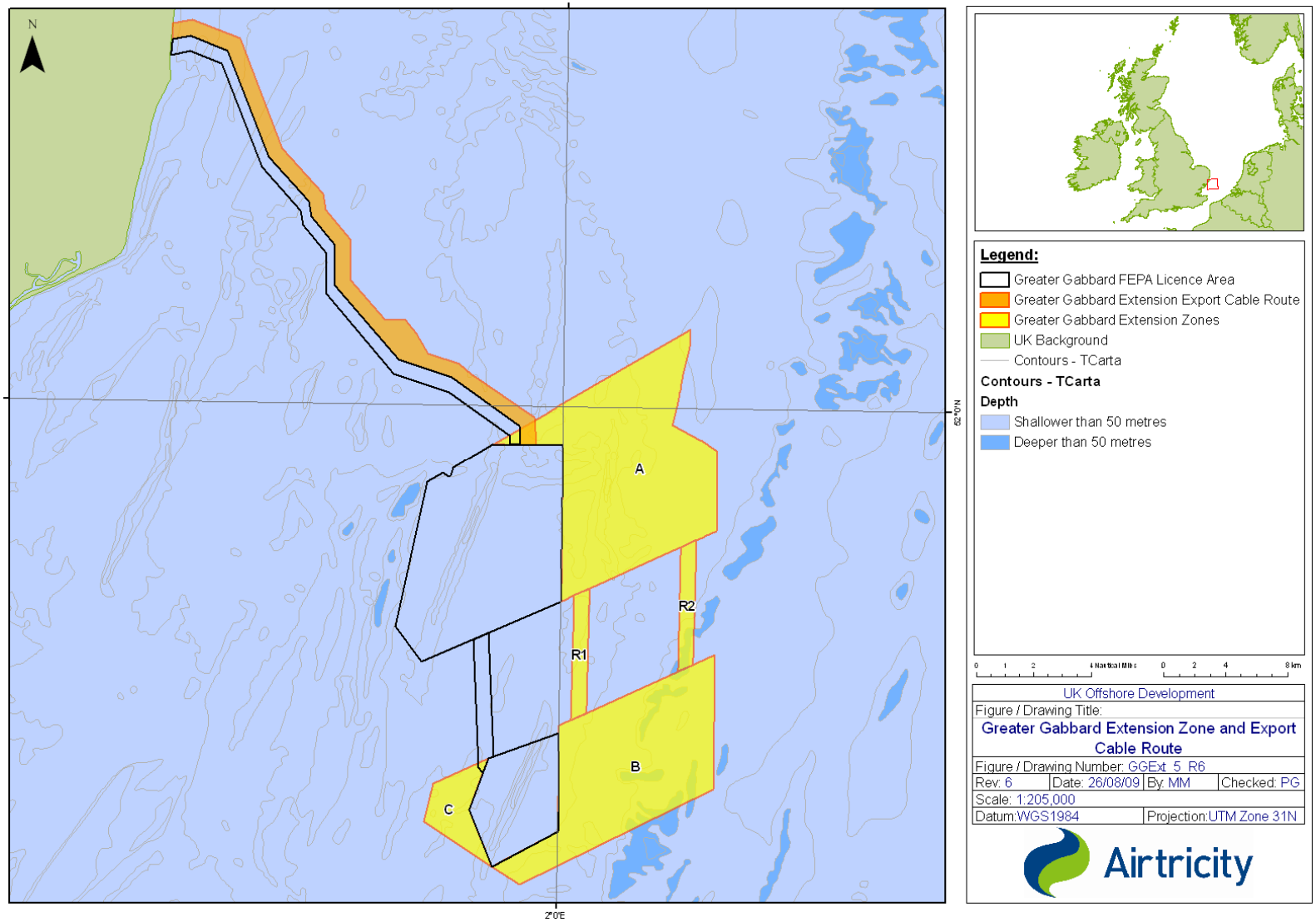
Abbreviations:

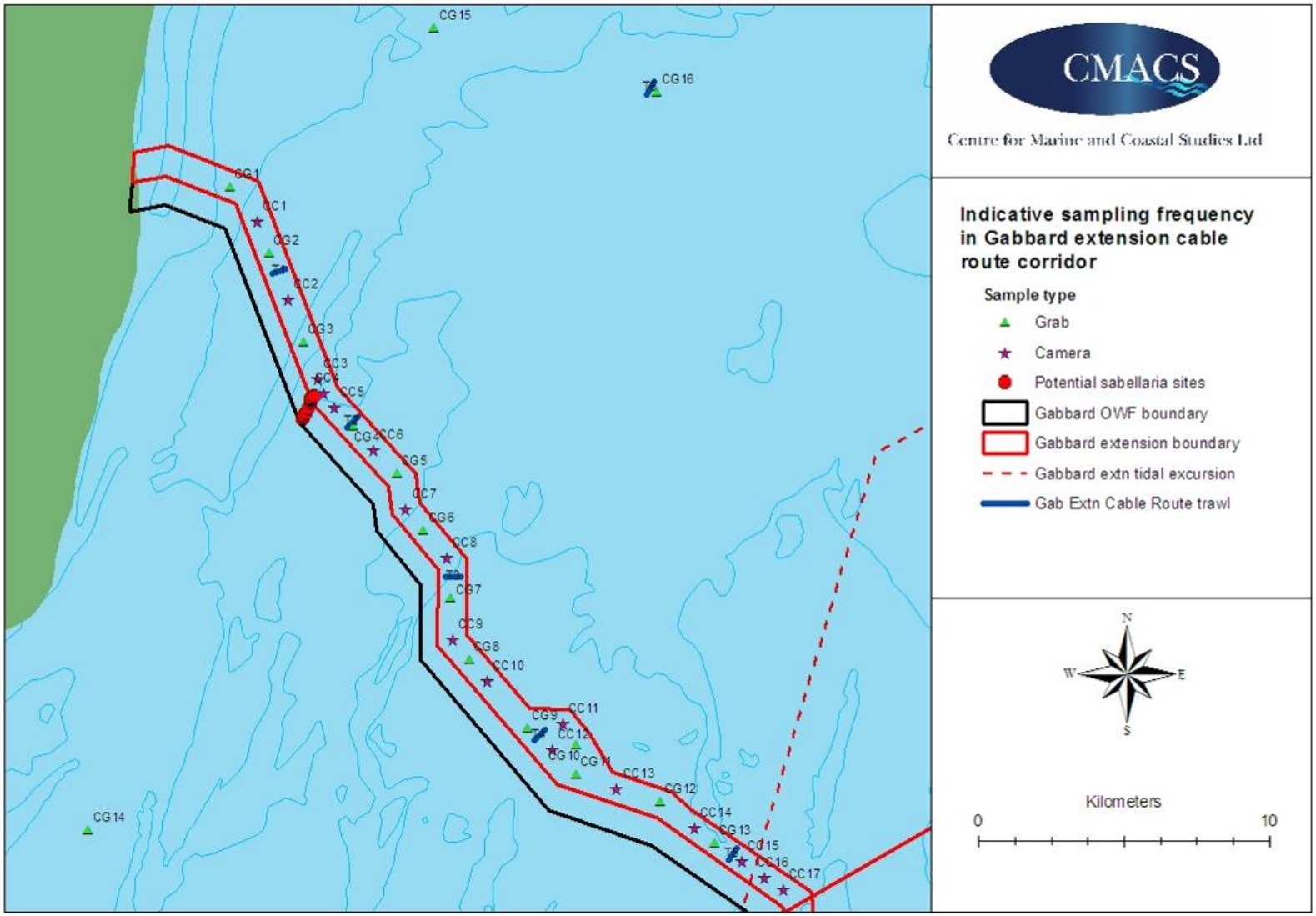
AIS	Automatic Identification System
AONB	Areas of Outstanding Natural
ATC	Air Traffic Control
ATMPC WG	Air Traffic Management Performance Criteria Working Group
AW	Ancient Woodland
BGS	British Geological Survey
BT	British Telecom
BWEA	British Wind Energy Association (now RenewableUK)
CAA	Civil Aviation Authority
CCZ	Community Consultation Zone
CD	Chart Datum
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CGS	County Geological
CIA	Cumulative Impact Assessment
COWRIE	Collaborative Offshore Wind Research Into The Environment
CPA	Coast Protection Act
CRA	Collision Risk Assessment
CWS	County Wildlife Sites
DBA	Desk Based Assessment
DECC	Department of Energy and Climate Change
DBERR	Department of Business, Energy and Regulatory Reform
DTI	Department for Trade and Industry
EC	European Council
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
ES	Environmental Statement
EU	European Union
FEPA	Food and Environmental Protection Act
FLO	Fisheries Liaison Officer
FPO	Fisheries Producer Organisation
FRA	Flood Risk Assessment
GBS	Gravity Base System
GGOWL	Greater Gabbard Offshore Wind Ltd
GGOWF	Greater Gabbard Offshore Wind Farm
GW	Gigawatt
GWF	Galloper Wind Farm
HIRTAs	High Intensity Radio Transmission Areas
IALA	International Association of Lighthouse Authorities
ICES	International Council for the Exploration of the Seas
ICPC	International Cable Protection Committee
IMO	International Maritime Organisation
IPC	Infrastructure Planning Commission
JNCC	Joint Nature Conservation Committee
LNR	Local Nature Reserves
LSVIA	Landscape, Seascape and Visual Impact Assessment
MALSF	Marine Aggregate Levy Sustainability Fund
MCA	Marine and Coastguard Agency
MFA	Marine and Fisheries Agency
MMO	Marine Management Organisation

MoD	Ministry of Defence
MSL	Mean Sea Level
MW	Megawatt
NA	Navigation Assessment
NATS	National Air Traffic Service
NERI	National Environmental Research Institute
NERL	NATS (En-Route) Ltd
NNR	National Nature Reserve
NPS	National Policy Statement
NRA	Navigation Risk Assessment
NRL	RWE npower Renewables Ltd
NSL	NATS (Services) Limited
NSU	National Seascape Units
NVZ	Nitrate Vulnerable Zone
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PEXAs	Practice and Exercise Areas
PPS	Planning Policy Statement
REC	Regional Environmental Characterisation
RSPB	Royal Society for the Protection of Birds
RSU	Regional Seascape Units
RYA	Royal Yachting Association
SAC	Special Areas of Conservation
SAR	Search and Rescue
SCC	Suffolk County Council
SCDC	Suffolk Coast District Council
SEA	Strategic Environmental Assessment
SINC	Sites of Importance for Nature Conservation
SMA	Sensitive Marine Areas
SNH	Scottish National Heritage
SoCC	Statement of Community Consultation
SPA	Special Protection Area
SSER	Scottish and Southern Energy Renewables
SSR	Secondary Surveillance Radar
SSSI	Site of Special Scientific Interest
TIA	Traffic Impact Assessment
TSS	Traffic Separation Scheme
UK	United Kingdom
UXO	Unexploded Ordnance
VTS	Vessel Traffic Services
WGS	World Geographic System
WTG	Wind Turbine Generators
WWT	Wildfowl & Wetlands Trust

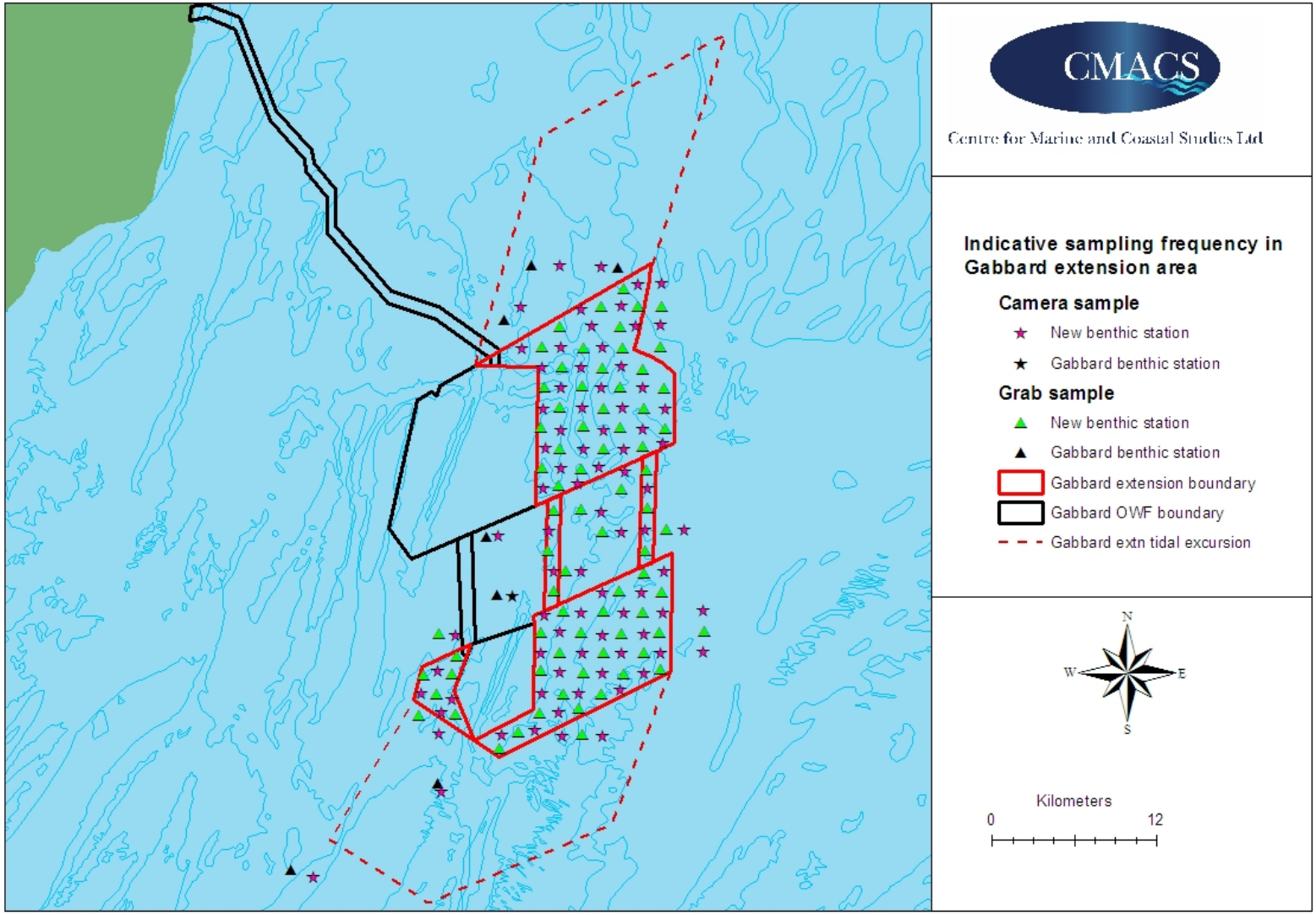
Appendix A - Geophysical survey extent



Appendix B – Benthic survey plan – cable corridor



Appendix B – Benthic survey plan – offshore wind farm



Appendix C – Seasonal fish trawl survey plan