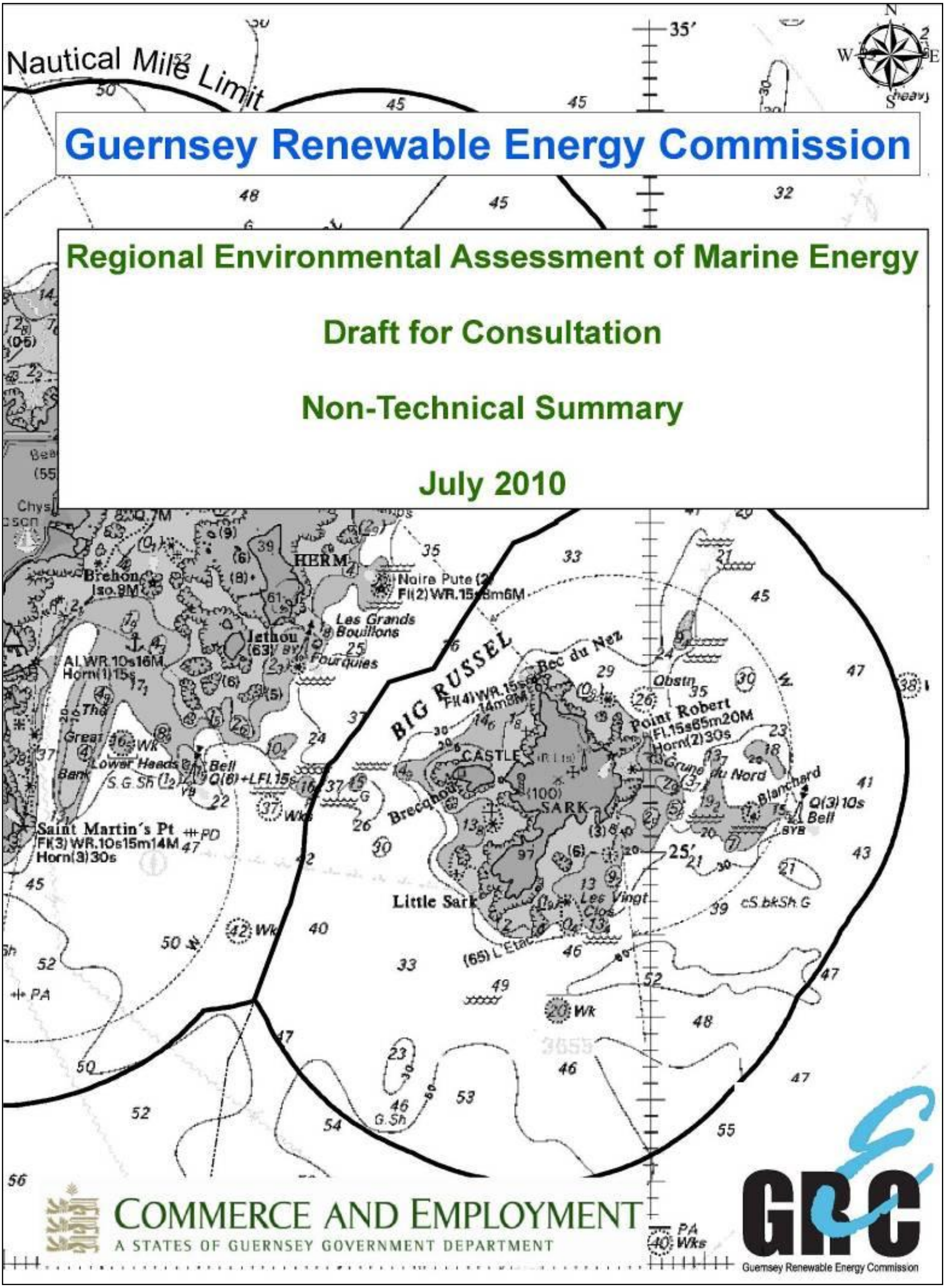

Guernsey Renewable Energy Commission

Regional Environmental Assessment of Marine Energy

Draft for Consultation

Non-Technical Summary

July 2010

COMMERCE AND EMPLOYMENT
A STATES OF GUERNSEY GOVERNMENT DEPARTMENT

GREC
Guernsey Renewable Energy Commission

GUERNSEY RENEWABLE ENERGY COMMISSION

REGIONAL ENVIRONMENTAL ASSESSMENT OF MARINE ENERGY

DRAFT FOR CONSULTATION

Non-Technical Summary

Contents Amendment Record

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GUERNSEY RENEWABLE ENERGY COMMISSION

REGIONAL ENVIRONMENTAL ASSESSMENT OF MARINE ENERGY

DRAFT FOR CONSULTATION

Non-Technical Summary

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1 Introduction

Tackling climate change is a key challenge facing our generation. It is important to move away from producing energy from fossil fuels and to find alternative renewable sources that will provide us with energy security in the future. Here in the Channel Islands, there is an opportunity to contribute towards meeting these challenges through the production of renewable energy from our seas.

The Bailiwick of Guernsey is situated in the English Channel, thirty miles west of France's Normandy coast, and is well positioned to harness the power of the sea. Potential exists to generate both tidal and wave energy; the area has some of the strongest tidal currents in the world and receives powerful waves from the Atlantic Ocean. Furthermore, the Channel Islands are very close to Continental Europe, with both Guernsey and Jersey having a direct submarine cable link via France to the European Electricity Grid.

We can improve the security of our energy supply by developing a marine renewable energy industry. This will bring employment and other environmental, economic and social benefits to the Bailiwick.

The States of Guernsey's Energy Policy Report, published in June 2008, recommended the formation of the Guernsey Renewable Energy Commission (GREC) to progress the creation of local renewable electricity generation on a large (macro) scale.

GREC has undertaken investigations into the feasibility and promotion of marine renewable energy developments within the Territorial Waters (within three Nautical Miles) of the islands of Guernsey, Herm and Sark. A States Report was presented to the States in June 2009 to establish GREC as the consenting body for the management of marine renewable energy projects. A key aspect of GREC's work is the production of a Regional Environmental Assessment (REA) to examine the likely environmental effects from the development of wave and tidal power production.

The REA is a strategic study that will underpin the development of marine environmental planning policy and will inform subsequent project specific Environmental Impact Assessments to be undertaken by individual energy developers. The results will be used to prepare and deliver the States of Guernsey's strategy for the development of marine energy generation facilities and associated infrastructure in Guernsey's waters.

In collaboration with the government of Sark, and with technical specialists from Guernsey and the UK, who have formed the Guernsey Renewable Energy Forum (GREF), GREC has now completed a draft of the REA. The REA has been prepared for the purpose of consultation with the public, technical specialists and stakeholders. This document is an abridged Non-Technical Summary (NTS) of the draft REA.

From the 30th July 2010, a printed copy of the main REA will be available for inspection at the States of Guernsey's offices at Raymond Falla House and Sir Charles Frossard House, and at the Guille-Allès Library in St Peter Port (see the final page for full addresses). Furthermore, the entire REA, will be available to download from the GREC website (www.guernseyrenewableenergy.com).

The REA has been prepared in accordance with a Scoping Report that was published in October 2009. This report defined the study area and specified the work necessary for the production of the REA. It is also available on the above website.

The Energy Policy Report of June 2008 recommended that the States should investigate targets to reduce the emissions of carbon dioxide by 30% on 1990 levels by 2020, and by 80% by 2050, and to generate 20% of electricity from local renewable sources by 2020.

The purpose of the REA is not simply to inform policy makers and the public of the possible environmental impacts of pursuing such targets. The important value of the REA is in its use as a tool to manage environmental risk. As a result, not only can appropriate mitigation measures be applied, but also Guernsey and Sark can properly benefit from reductions in greenhouse gas emissions and the security of supply that would be afforded by marine renewable energy.

Figure 1.1 – South coast cliffs, Guernsey (photo– www.guernseyimages.com)

2 Purpose, Scope and Area of Study

2.1 Introduction

The REA has been undertaken to provide a strategic assessment of the potential effects that marine renewable energy devices (wave and tidal) will have on the environment of Guernsey, Herm and Sark. The information within the REA report should be used to guide the development of strategic planning and energy policy. The report will also be used to inform the future work of regulators and energy developers to gather more information regarding the nature of our marine environment, both at a strategic level and relating to specific deployment sites. The report will allow the establishment of a legislative framework and a procedure for the consenting of development.

The REA identifies, evaluates and describes the likely significant effects, both positive and negative, of developing marine renewable energy. In keeping with best practice, the Precautionary Principle has been used throughout the assessment. This means that where there is uncertainty relating to potential effects, or a lack of information on which to make accurate predictions, then the assessment has assumed a ‘worst case’ scenario. Therefore, it should be borne in mind that, of the large number of impacts listed, it is unlikely that all of them would occur.

The term ‘significant effect’ is used throughout the REA. ‘Significance’ refers to an effect that may occur and which regulators and developers need to consider in any proposals for development. Effects have been categorised as having significance of either ‘major’, ‘moderate’, or ‘minor’. This is based on the sensitivity and value of the item that may be impacted (the ‘receptor’) together with the scale and likely change that will be brought about through the identified impact. An effect of ‘major’ significance may not necessarily prevent development, but could indicate where further action will be needed to avoid, minimise or offset environmental problems (referred to as mitigation).

The word ‘environment’ does not only refer to plant and animal life, together with their habitats. For the purposes of the REA and, in keeping with globally accepted best practice, the term also covers impacts on the sea and sea-bed, human beings and their existing health, transportation, resources, industry, culture and landscapes.

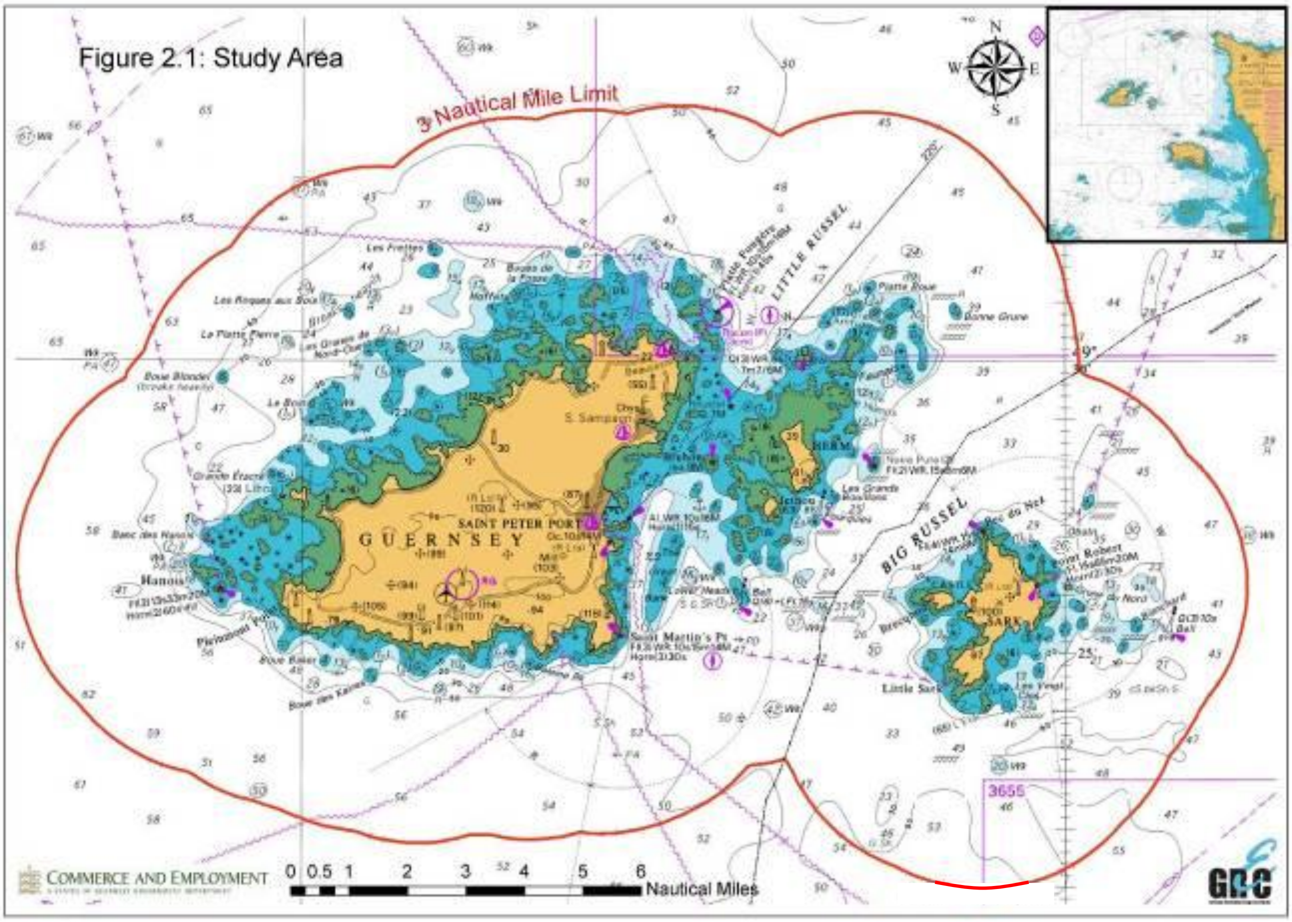
2.2 *Study Area*

The study area that will be covered by the REA includes:

- All of the territorial waters of Guernsey and Sark, to within 3 Nautical Miles of the coast;
- Intertidal and coastal areas within 200m of the shore (at MHWS) where landfall and connection infrastructure are considered to impact.

The study area is illustrated in Figure 2.1 below. An explanation as to how the study area was identified is also provided in Chapter 1 of the REA.

Figure 2.1 – Study area (image – GREC)



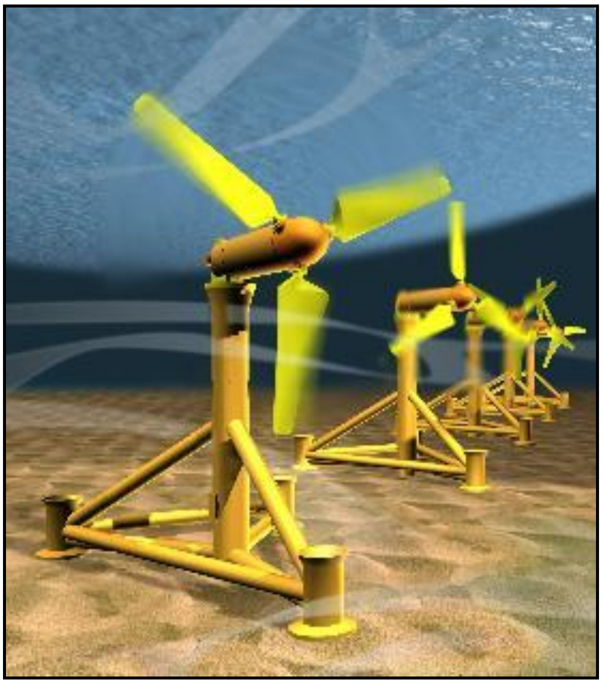
2.3 *Scope*

In the context of the REA, the term 'marine renewables' refers to wave and tidal devices only as follows:

- Shoreline wave
- Near-shore and offshore wave
- Tidal Stream

Examples of different types of device are shown below.

Figure 2.2 – Typical tidal turbine (image - www.tidalgeneration.co.uk)



The States report of June 2008 focused attention on tidal power. The REA has also covered wave energy due to its similar requirements for sub-sea cabling and the similar scale of its anticipated environmental effects. However, the assessment of wind energy devices has been specifically excluded from the scope of the REA. There are a number of reasons for this relating to their perceived environmental impact and effect on radar used in aircraft navigation. Additionally, if offshore wind were to be considered, there would be a dominance of the analysis of this technology in the REA and this would divert resources away from the assessment of tidal and wave technologies that are currently preferred by the States of Guernsey. Wind energy can be evaluated at a future date and incorporated into the REA should it become desirable to do so. Similarly, the assessment of tidal range solutions (eg. barrage, lagoon) has been specifically excluded from the scope of the REA for a number of reasons, again relating to perceived impact.

2.4 *Objectives*

As defined in the Scoping Report of October 2009, the main objectives of the REA are:

- To assess, at a strategic level, the potential effects of marine renewable energy devices on the environment.
- To advise and support the States of Guernsey in the development and implementation of strategy for marine renewable energy and to inform the future development of planning guidance for developers.
- To inform the project level decision-making process for all stakeholders (including regulators and developers).
- To identify the key issues and data gaps and to inform future phases of assessment, both at a strategic or regional level and at an individual project level.
- To provide information for use in the development of a separate marine spatial plan for Guernsey.
- To form a vehicle for public and stakeholder engagement.

2.5 *Development Scenarios*

In order to gain an understanding of the effects of marine renewable devices on the environment, certain development scenarios were established. These have allowed the team of specialists who have undertaken the assessment to have a common understanding as to the possible extent of development that could occur. They also allowed the team to identify if there were any distinct thresholds at which the development of marine renewable energy would start to have an unacceptable impact on the environment. Therefore, the following two scenarios were considered:

- A minimum development of 100 Megawatts (MW) installed capacity
- A maximum development of 230 MW installed capacity

The development scenarios reflected the potential size of the marine energy resources that exist within the waters around Guernsey, as identified in initial studies by the Robert Gordon University, Aberdeen. However, the scenarios were not specific regarding the actual location or size of any individual array or group of devices. This was so that the specialists in the various fields of investigation could reflect upon the relative sensitivity of different parts of the study area.

2.6 *Study Limitations*

There are a number of items of general interest or concern that relate to the development of Renewable Energy Policy that, although beyond the scope of the REA, are being addressed through inter-departmental discussions within the States of Guernsey. It is fully acknowledged that the development of renewable energy cannot be carried out in isolation from the many other areas of States' policy that are influenced.

Furthermore, the following should be considered when reading the REA and this NTS:

- There are gaps in our knowledge of the marine environment. The study area is extensive and there is limited information available for certain topics and locations. For example, the location and populations of benthic (sea-bed) species is generally poorly understood. It is intended that these gaps will be addressed in the future through a number of strategic surveys and investigations, or by developers during their own project specific investigative work and Environmental Impact Assessments (EIAs).
- There are many types of marine renewable energy devices, ranging in their stage of development from concept, through prototype/demonstrator to pre-commercial. For this reason, the study has focused on the generic characteristics of a number of common types of wave and tidal flow energy devices.
- Our knowledge of the effects of the devices on the environment is not well understood for some topics. Such topics include: submarine noise; the potential for collisions between fish, birds or mammals and the devices; and the likely behaviour that animals will exhibit in response to these effects.
- Given the above limitations, there are further uncertainties over the cumulative effects of two or more device arrays in any given area.
- Actual locations of wave and tidal power arrays have not been determined. The REA has focused on generic impacts.

The production of the REA will not relieve developers of their responsibility to provide project specific Environmental Impact Assessments (EIAs) in support of environmental consent applications. It is likely that these will require the preparation of Environmental Statements together with more detailed investigations, including surveys.

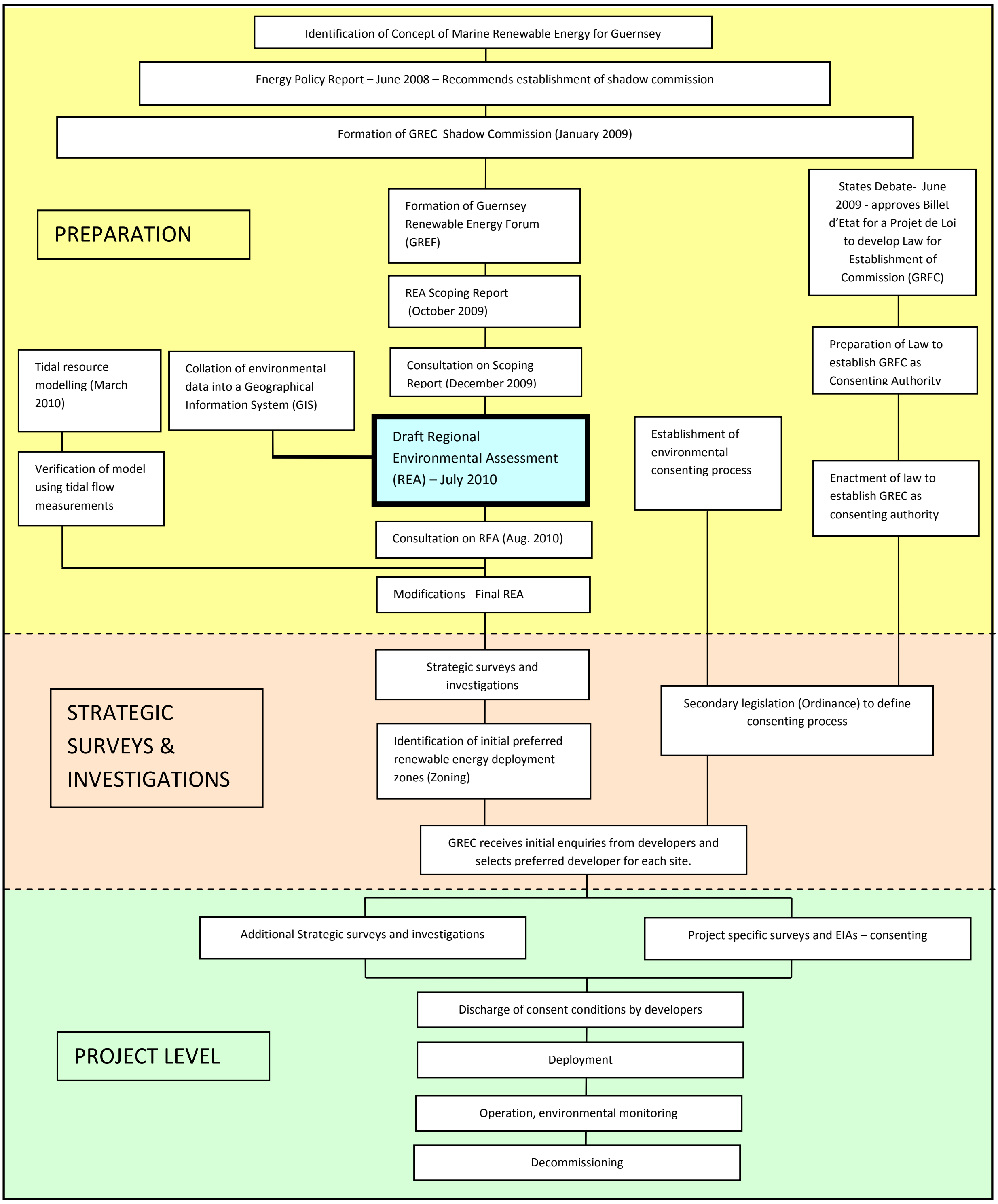
The REA is predominantly a desk study and, to date, no new survey work has been undertaken within its scope. Therefore, there remain a number of gaps in the baseline data after production of the report.

3 The Environmental Assessment Process

3.1 Overview

The development of the REA fits within the following potential strategic process to identify, monitor and control environmental impacts from marine renewable energy within Guernsey's waters.

Figure 3.1 – The environmental assessment and planning process



3.2 *Environmental Consenting*

A review of current legislation has indicated that there remain significant gaps in the law regarding the deployment of marine devices. Therefore, draft primary legislation has been prepared to allow the States of Guernsey (through the GREC) to control and provide environmental consent for marine renewable energy developments. This legislation is expected to be enacted in summer 2011.

Further to this, secondary legislation (Ordinance) will be prepared in order to define the details of the consenting process. This will be modelled on existing processes that are operating in the UK and Alderney.

3.3 *Further Strategic and Project Specific Investigations*

The REA has identified further investigative work that will be undertaken in support of the development of marine renewable energy. These are defined as either:

- **Strategic** – Surveys or further studies that will help us both to gain a better understanding of our marine environment across the whole study area, and to allow the identification of the preferred deployment sites. These surveys and studies will either provide information about the effects of the development of multiple deployment sites, or help us to understand generic impacts that will apply to a number of device types.
- **Project Specific** – Surveys or analyses that will directly benefit the development of an individual site, such as a detailed sea-bed survey or a project specific navigation risk assessment.

3.4 *Assessment Process*

The following framework provides an outline to the approach taken to the REA.

A. Establishing the scope of the REA

This was achieved both through the production of the Scoping Report in October 2009 and through the associated public consultation.

B. Assessing the effects of the marine renewable devices

The following tasks were undertaken:

- The establishment of development scenarios for assessment.
- The establishment of common assessment criteria to categorize the significance of potential environmental impacts.
- The collation and review of existing environmental information within the study area.
- The assessment of potential impacts (positive and negative). These were considered in terms of the size of impact, the sensitivity of receptors, and the likelihood and significance of the risk.
- The consideration of mitigation measures to avoid or reduce the impacts.
- The determination of what future investigations would be required to improve any gaps in knowledge, including post-construction monitoring plans.

C. Production of the Regional Environmental Assessment (REA) Report

Together with this Non-Technical Summary (NTS), the REA is the main report that records the work of the desk study. It may be downloaded from the GREC website (www.guernseyrenewableenergy.com) or viewed in paper form at the public buildings shown in section 1 of this NTS.

D. Consulting on the results of the REA

This will follow the publication of the REA in July 2010.

It should be noted that the assessment has considered all of the potential impacts that may occur. At the strategic level at which the REA is presented, this must consider all possible combinations and must assess the worst case scenario prior to mitigation. In this way, the REA may be used to identify environmental risks and to plan for their effective reduction, monitoring and control. There is much that can be done to reduce or eliminate the risk of environmental harm. If the recommendations of the REA are properly implemented, then the risks can be adequately controlled.

4 Assessment Results

This section of the NTS (pages 11 to 43) provides an overview of the key findings of the assessment, listed under each specialist topic considered. Each subsection covers the baseline (existing) data, impact assessment and potential mitigation measures. The results of each specialist investigation have been drawn together in the Summary of Key Impacts in section 5. This allows comparison and a consideration relative significance of each investigation. The following topics and specialist fields of enquiry were considered by the REA:

Table 4.1 – List of topics covered in the REA

REA Section Ref	Title	NTSSection Ref (this document)
	Physical Marine Environment	
4	*Geology and Sediment Transition*	4.1
5	*Marine Processes*	4.2
6	*Water Quality*	4.3
	Marine Biological Environment	
7	*Benthic Ecology*	4.4
8	*Pelagic Ecology*	4.5
9	*Birds*	4.6
10	*Marine Mammals*	4.7
	Marine Human Environment	
11	*Commercial Fisheries and Mariculture*	4.8
12	*Recreational Fishing*	4.9
13	*Marine and Coastal Historic Environment*	4.10
14	*Existing Submarine Cables, Electrical Grid, and Connectivity*	4.11
15	*Shipping and Navigation*	4.12
16	*Tourism and Recreation*	4.13
	Other Topics	
17	*Noise*	4.14
18	*Air Quality*	4.15
19	*Landscape and Seascape Character*	4.16

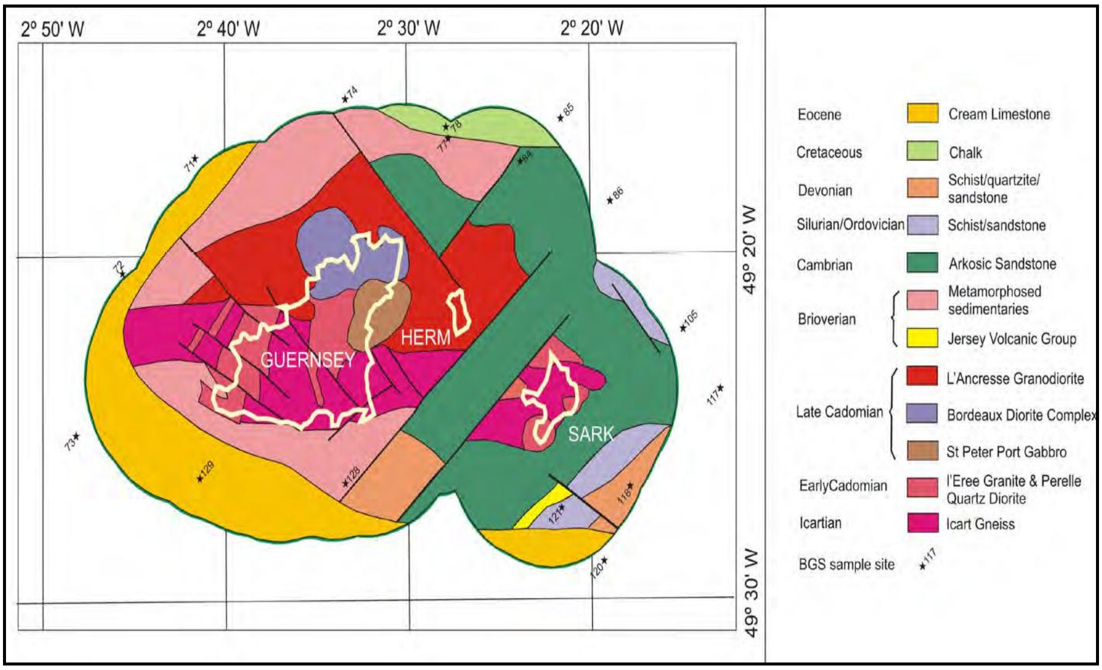
It was considered important that appropriate skills and experience were used in the production of the REA. Wherever possible, specialists were sought from within Guernsey or elsewhere in the Channel Islands, including from within the various States' departments and local consultants. If appropriate expertise was not available on-island, then certain topics were covered by academic organisations and consultants from the UK. In this way, knowledge gained in the production of the REA could be retained within Guernsey as much as possible. A full list of authors is provided in the REA.

4.1 *Geology*

Baseline –

Published information includes nautical charts, British Geological Survey (BGS) geological maps, reports and peer-reviewed scientific papers.

Figure 4.1 - Solid (bedrock) geology (image – BGS)



A general description of the solid (bedrock) geology indicates a heavily faulted area of limestone, chalk and sandstone, interrupted by a number of igneous (volcanic) intrusions. This is overlain on the seabed by a superficial (recent sedimentary) geology of various sediments. These include areas of sand, gravel and cobbles, some of which support significant amounts of sea-life. Conversely, some areas are swept clean of all sediment due to strong tidal flows.

There is good information available, which includes a classification of the sediments in terms of both grain size and distribution. The surface of the seabed ranges in topography, from large flat areas to areas of underwater cliffs and rocky pinnacles.

Potential Impacts –

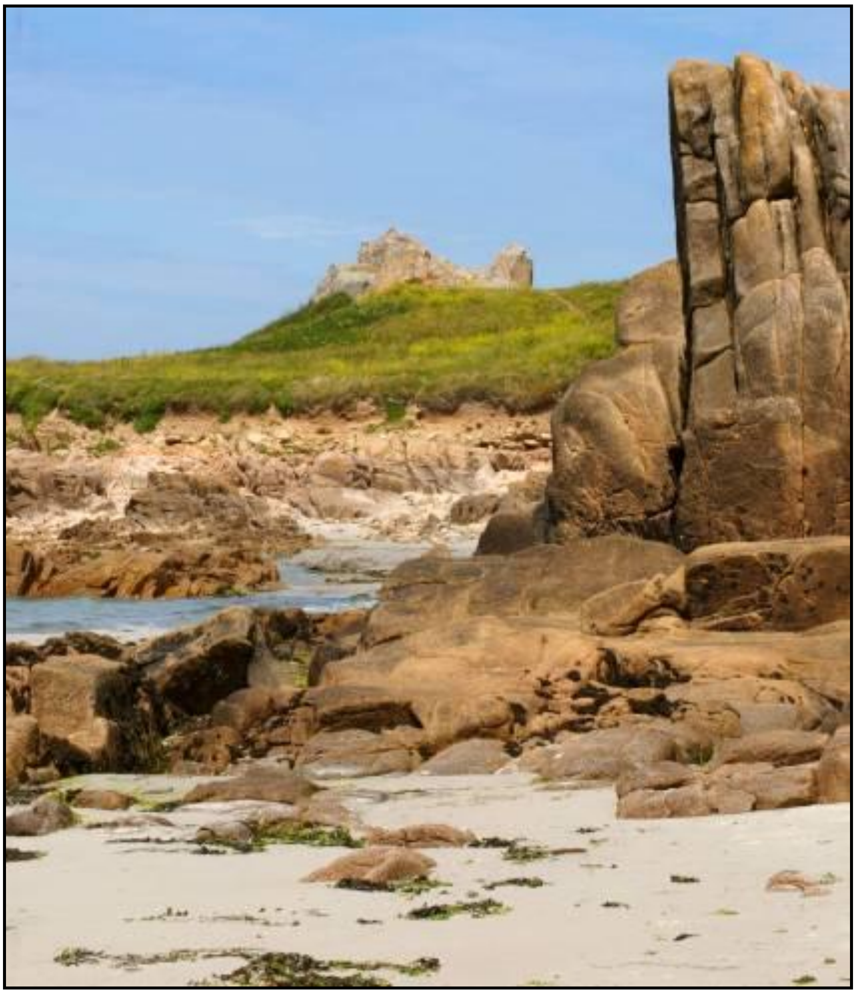
Clearly, the seabed conditions will influence the choice of foundation to be used in the construction and fixing of renewable energy devices. It will also determine the design and routing of electrical cables along the seabed. The interaction of marine energy devices with tidal flows could lead to the establishment of new areas of sediment scour or deposition, both on the seabed and onshore. This could lead to secondary engineering challenges, with regard to the design of foundations and cables, and also to secondary risks to habitat through the smothering of the sea-bed.

Mitigation (actions to eliminate or reduce environmental impacts) –

Primary mitigation measures include careful site selection in combination with achieving a better understanding of the sea-bed conditions across the study area. This may be achieved through strategic surveys of the sea-bed to improve on the information currently available on nautical charts.

In order to address gaps in the data available to any specific project, detailed bathymetric (seabed depth) and geophysical (sound reflection and magnetic) surveys should be completed, together with activities to model sediment movements. Borehole investigations should be undertaken in order to provide samples for testing and analysis. These measures would allow a better understanding of the engineering parameters of the seabed and the significance of any risk of scour.

Figure 4.2 – Granite outcrop at La Saline Bay, Guernsey (photo - www.guernseyimages.com)



4.2 *Marine Processes*

Baseline –

This chapter of the REA identifies and quantifies the marine energy resources that are available for exploitation. It draws heavily on the Atlas of UK Marine Energy Resources published by the UK Government. It uses wave energy information from the Met Office Channel Light Vessel and data from the tidal energy modelling study undertaken by the Robert Gordon University in Aberdeen, Scotland. The results of the quantification indicate a moderate, but useable, wave energy resource off the northwest coast of Guernsey and strong tidal energy resources within the Big Russel and to the southeast of Sark.

Figure 4.3 – Tidal Flow to the south of Sark (Photo– David Wilkinson)

Potential Impacts –

The deployment of a device to extract energy from the sea will reduce the available energy in the vicinity of the device. The marine renewable energy industry is in the early stages of testing full-scale prototypes and there is a lack of knowledge regarding the impacts of large groups (or arrays) of devices. Similarly, the reaction of a marine environment to an array will vary depending on the characteristics of the seabed in the deployment area.

There are concerns that by extracting tidal energy, the effectiveness of adjacent deployment sites might be reduced. There is also a risk that the extraction of wave energy could change the height of surfing waves on nearby beaches.

Figure 4.4 – Waves on the west coast of Guernsey (photo - David Wilkinson)

Mitigation –

As well as careful site selection, mitigation measures include obtaining a better understanding of the marine processes in the vicinity of potential deployment sites. This can be achieved through strategic surveys to measure the potential wave and tidal energy resources, together with computer modelling of tidal flows and wave energy propagation. The behaviour of both individual energy devices and whole arrays will be better understood as more prototype tests are undertaken within the renewable energy industry.

It is likely that, prior to deployment, developers will wish to undertake project specific energy resource surveys to prove the suitability of the wave, or tidal, energy available at a specific site.

4.3 *Water Quality*

Baseline –

Water quality testing is undertaken by the States with regard to the risk of biological and chemical contamination. This testing is in accordance with EU standards which apply to Guernsey. The States maintain a strong focus on both Blue Flag Beach status and on the management of shellfish farms, as these have significant potential impacts on human health. There have been relatively few failures in recent years. This supports a view that Guernsey enjoys clean waters. However, there are a number of untreated sewage outfalls, agricultural runoffs, and occasional algal blooms at sea, all of which are potential threats to water quality.

Particulate matter suspended in the marine environment has three main constituent parts: living organic material, organic detritus and inorganic material. The quantity of suspended material in the water depends on energy levels in the water (due to waves and tidal currents) and is higher closer to shore. In addition, plankton and algal blooms occur during the summer months, which can also contribute to increased turbidity.

Figure 4.5 – La Saline Bay, GrandesRocques, Guernsey (photo– www.guernseyimages.com)

Potential Impacts –

There is potential for a number of effects to occur from the installation, operation and decommissioning of marine renewable energy devices. Due to the dynamic nature of the marine environment, especially in areas where there is the potential to harvest energy, it is likely that potential contaminants could be dispersed.

Potential sources of particulate contamination include excavation work, the dragging of equipment or anchors, and the laying of cables. Chemical contamination might arise from the use of cements, paints and anti-fouling products. Oil pollution might result from devices' mechanical failure or leakage.

Mitigation –

Key mitigation measures to reduce the risk of pollution relate to minimising the use of potentially polluting activities and materials during the construction and operation of devices. This should be done by referring and adhering to those published lists which detail the materials that are considered safe to use in the marine environment. In addition, deployment operations should include water quality monitoring, pollution prevention procedures and emergency plans.

4.4 *Benthic Ecology*

Baseline –

Benthic ecology is the term used to describe those animals and plants which exist on the seabed. The term includes large species, such as crabs and seaweeds, as well as microscopic animals that live within the sediment. Baseline information on the benthic ecology of the REA study area was determined by searching a number of online marine biological databases. Information was also reviewed from the Guernsey Biological Record Centre, volunteer research programmes, and UK government sources. Consideration was given to the conservation-importance status of the identified species, in accordance with guidance from sources such as the UK Biological Action Plan (BAP) and the European Nature Information System (EUNIS) classification systems.

It must be noted that the sea bed of the REA study area has not yet been surveyed. This is particularly the case in water deeper than 30m, where the largest energy resource may exist. The information available has either large gaps or low confidence in data quality.

Despite the lack of scientific data, it is clear that the Bailiwick of Guernsey benefits from an unusual marine environment. The Bailiwick is located on the convergence of Boreal (cold temperate) and Lusitanian (warm temperate) marine biogeographical regions of the sea. In addition, the strong tidal currents and varying coastal and sea bed topography means that a multitude of species-rich habitat types exist. Key species are eelgrass, Pink sea fan, and the green ormer (Abalone).

Figure 4.6 – Hydroid (photo - Richard Lord)

Potential Impacts –

During the installation, operation and decommissioning of renewable energy devices and cables, it is likely that there will be direct benthic habitat losses and disturbance to the footprint area of the development. They will also apply to more remote locations through the deposition of any sediment (smothering) that may arise from excavation works. Further possible impacts may be caused by noise and vibrations generated during the installation and operation of devices.

Conversely, there may also be a potential increase in benthic habitats and species numbers within the deployment locations after construction. This could be due to the devices acting as potential artificial reef structures and attracting colonising species.

As mitigation for navigational safety risks, a Safety Zone may be established around an array. This may act as a no-fishing zone, in the manner of a marine protected area. This could encourage population increases in some species within the Safety Zone.

Mitigation –

A number of possible mitigation measures have been considered to reduce the effects. These include:

- Physical avoidance. After the completion of planned benthic habitat mapping work (see below), GREC will be well placed to identify the least environmentally sensitive sites in relation to the energy resources available. This will allow the avoidance of key habitats.
- Minimising the development areas (footprints).
- Seasonal (temporal) avoidance. The timing of construction and deployment works can be designed to avoid important reproduction, feeding and migration periods within chosen marine renewable technology sites.
- Method-related mitigations. These are measures of reducing impact during the deployment and operation of devices. They include careful selection of materials and reducing wastage, fuel and vessel activities.

In advance of the selection of renewable energy deployment sites (zoning), a clear understanding should be gained of the benthic habitats which already exist in the study area. Habitat mapping should be undertaken at a strategic level to establish the links between geology, sediment type, water depth, wave and tidal flow conditions, and the benthic habitats and species present. In this way, areas of greatest sensitivity can be identified and avoided in the selection of renewable energy sites. This work should include improved bathymetry (sea bed depth and geometry) and targeted towed-camera surveys that may be supported by grab-sampling. A programme of long-term monitoring of the sea bed should also be introduced to identify any changes in populations of key species in the vicinity of deployment sites.

4.5 *Pelagic Ecology*

Baseline –

Pelagic ecology covers the life that exists in the water column above the sea bed. This life includes everything from microscopic plankton communities to various species of fish, including large varieties such as Basking sharks. Although they are present in the water column, marine mammals are covered specifically in the next subsection of this NTS.

As described in the previous section on Benthic Ecology, Guernsey has an unusual marine environment. The island's location at the boundary of warm and cold marine climates allows species to exist at the northern and southern limits of their distributions. This enables the study area to support both species which are rare or absent from British coasts as they are normally associated with the warmer waters of southern Europe, and species that are normally associated with the colder northern waters of the United Kingdom.

The main pelagic species present around the Channel Islands are sea bass, black bream, pollack, sandeel and mackerel. Demersal species (those species which live on or near the bottom of the sea) include brill, ray, dogfish, tope and conger.

Basking sharks around Guernsey are strictly protected by fisheries' regulations. Although Guernsey itself is not recorded as one of the main hotspots for Basking shark activity, the entrance to the Casquets'(North of Alderney) traffic separation scheme in the English Channel is known as an area of high basking shark activity.

Figure 4.7 – Clingfish (Photo– Richard Lord)

Potential Impacts –

There will be a temporary impact on fish species from the increased vessel traffic and associated noise disturbance of construction and deployment activities. These activites could affect fish feeding, movement and breeding behaviour. There would also be an enhanced risk of pollution during this period. There is the potential that sediment, having been disturbed from deployment sites, might be deposited over spawning areas (smothering).

There would be some potential for long-term impacts, namely, the small risk of fish colliding with devices, and noise. Although fish species are highly mobile, there is a lack of industry data on whether vulnerable species can or cannot detect devices.

Also considered is the emission of Electro-magnetic Fields (EMFs) from electrical power cables and generator devices. Concern has been expressed that some species may be unable to detect their prey in the vicinity of such fields. Whilst the scale of development in Guernsey's waters is unlikely to lead to the use of large but lightly armoured cables that could cause elevated EMFs, there remains uncertainty as to the effects of some types of generator devices.

The presence of underwater structures, and associated 'artificial reefs', could attract fish species. As for Benthic Ecology, renewable energy devices might have a positive effect through the creation of habitat. Furthermore, a Safety Zone may be established as mitigation for navigational safety risks associated with the development of arrays of generators. This may act as a no-fishing zone in the manner of a marine protected area. This could encourage population increases in some species within the Safety Zone.

Mitigation –

The location and scale of construction should be carefully considered. The timing of construction and deployment works should be planned to avoid the spawning season of key species, where possible. Construction materials and methodology should be selected to minimise risk of pollution.

There should be further strategic studies into existing spawning, migration and feeding behaviour. Existing data may be improved by making use of the fishing industry and of recreational vessels to record sightings of key species such as Basking sharks. Reference should be made to ongoing industry studies to identify the risks presented to fish by Electro-magnetic Fields (EMF).

Developers who plan to deploy renewable energy devices in Guernsey's waters should be required to undertake their own device-specific noise impact assessments.

4.6 *Birds*

Baseline –

Despite its restricted land mass, the Bailiwick of Guernsey is host to a wide variety of birdlife. With its variety of habitats, around 60 species breed in a typical year and the full list of recorded breeding birds is around 100 species. Coastline habitats, in particular cliffs and small islets, are well represented and provide widespread opportunities for seabirds to breed. Local waters provide feeding areas for both breeding and non-breeding seabirds, with each species having unique foraging requirements.

The recording of local birdlife is generally adequate. Breeding species have been formally surveyed on several occasions in the past and casual recording also contributes to the provision of a more comprehensive database. However, the REA found that data on how birdlife uses local waters is extremely limited as most seabird activity occurs in areas which are not viewable from land. There are also variables such as tidal cycles, seasonal changes, the effects of wind and weather, and man's activities (specifically fishing) to consider.

Figure 4.8 – Guillemot (photo Paul Hillion www.islandbirds.co.uk)

Potential Impacts –

Visual and noise disturbance will be apparent during the installation, operation and decommissioning stages. Depending on the location, this may affect the colonies and breeding behaviour of birds.

Many seabird species feed offshore. Whereas feeding grounds can cover very large areas in relation to that of any potential deployment site, birds may be attracted to specific areas at certain times, and their ability to dive may be affected by the permanent presence of generator devices. At present, it is unclear as to how feeding behaviour may be impacted. Diving species can commonly descend to 25m, which presents a potential collision risk.

Figure 4.9 - Puffin (Photo: Paul Hillion www.islandbirds.co.uk)

Mitigation –

The risk of disturbing breeding birds could be mitigated by the careful selection of potential deployment sites. This would avoid the locations of colonies, which are well known. Further to this, if construction and deployment work around colonies is unavoidable, then should be undertaken outside of the breeding season.

The main gap in current knowledge is the lack of information regarding which specific offshore areas are used by birds for feeding. Strategic survey work, including the use of small data-loggers attached to birds, should be undertaken to indicate the most important feeding areas. This could be used to assist the selection of deployment sites to avoid feeding areas.

Other risks relating to noise and pollution should be managed through careful selection and control of construction methodology.

4.7 *Marine Mammals*

Baseline –

As described in previous sections, the marine environment of Guernsey is unusual and species rich. This causes marine life and key prey species to flourish (e.g. mackerel and sea bass). This in turn attracts animals higher up the food chain, including cetaceans (dolphins and whales) and pinnipeds (seals).

For Grey Seals*,* Guernsey is at the southernmost limit of their natural range, with a small colony found on the Humps north of Herm. Numbers recorded around Grand Amfroque typically range between three and eight. Electronic tag tracking studies indicate that Grey Seals range widely, with tracks connecting the Channel Islands with the west of Scotland.

The waters around the Bailiwick of Guernsey are used by a diverse range of cetaceans (whales, dolphins and porpoises). Within the study area, Harbour porpoise and Bottlenose dolphins have been sighted. Also present are Minke whales, Risso's dolphins and Common dolphins and Long-finned Pilot whales. A lack of comprehensive tracking data means that it is not possible to determine if populations are resident or predominantly migratory.

The area offers a variety of habitats in close proximity as well as areas of high productivity. Despite the abundance and diversity of cetaceans in local waters, our knowledge of specific population structures and their behaviour is limited.

Figure 4.10 – Bottlenose dolphin (Photo– Chris George)

Potential Impacts –

Marine mammals are known for their complex use of sound in both communication and hunting. Therefore, greatest concern relates to the noises emitted during construction activities such as pile-driving operations, or by marine energy devices during operation. Whereas much is known of mammals' response to construction noise, little is known of their sensitivity to generator noise. Studies have shown that turbine noise from offshore wind turbines can affect cetaceans and pinnipeds. There are concerns that mammals may be damaged directly by loud noises, and that they may become disorientated and then collide with devices. There are further concerns that, in deterring marine mammals, physical disturbance and noise may also act as barriers to movement associated with feeding or migration.

There are relatively few scientific studies on the behaviour of cetaceans in the presence of boats. It is well known that some dolphins deliberately congregate around boats. It is not known if the physical presence of renewable energy devices would affect marine mammals. However, depending on the speed of blades or other moving parts, the mobility of mammals would suggest that they might be able to avoid the devices.

Like other types of marine life, marine mammals are at risk from direct physical disturbance, chemical pollution and sediment disturbance.

Mitigation –

Studies are being undertaken into the behaviour of marine mammals in the vicinity of prototype devices at Strangford Lough in Northern Ireland. These and other prototype investigations should be reviewed and lessons learnt wherever possible. These would help determine the best mitigation measures that can be applied to strategically address the risks of collision and the risk of the devices acting as a barrier to movement.

Device developers will be expected to undertake their own noise assessments specific to their devices. These assessments should include a review of the existing scientific knowledge regarding the sensitivity of key mammals present in the study area, so that impacts can be understood and controlled through design prior to installation.

There are well established procedures for monitoring and controlling construction noise (eg. soft-start procedures for piling, avoidance of explosives, and speed limits for deployment and inspection vessels) so that risks to marine mammals are minimised. In addition, a Marine Mammal Observer (MMO) should be commissioned for the duration of any construction work. The MMO can, for example, pause piling operations to allow mammals to escape the area.

4.8 *Commercial Fisheries and Mariculture*

Baseline –

Commercial fishing is an important industry to Guernsey and Sark, generating approximately £3.5M worth of first-sale landings within Guernsey ports each year. Key species of commercial importance include lobster, Edible crab, Spider crab, Scallop, European seabass, pollack, ray, brill, turbot, sole, Red mullet , Black bream and sandeels.

Mariculture is the farming of fish and shellfish in designated areas. On Guernsey, mariculture is focused exclusively on the production of Pacific oysters and mussels.

The Bailiwick commercial fishing fleet comprises of 175 vessels and is currently dominated by vessels of 10m or under in length. A variety of fishing methods are employed, including potting, scallop dredging, demersal (sea bed) trawling, pelagic (within the water column) trawling, netting, long-lining, diving, and angling with rods or hand-lines.

There is also an active recreational fishing interest, which provides an important income to local charter boat operators and equipment shops. Ormer gathering is also practiced on selected tides during winter and early spring.

Potential Impacts –

A significant potential impact is the risk of entanglement of fishing gear with devices. This is often mitigated through the establishment of Safety Zones around deployment sites. However, these would act as no-fishing zones. It is likely that if Safety Zones were implemented, fishermen who previously fished at those sites would be forced to move into adjacent areas. Potentially, this would lead to an overcrowding of the remaining areas and a subsequent reduction in the fleet. Fishermen who were forced out of their traditional grounds might take time to adapt to new grounds, methods or target species. In addition, the fishing industry would be affected to a lesser extent by the impacts listed in the previous sections on Pelagic and Benthic ecology, with impacts such as disturbance, noise and sedimentation affecting fish stocks also applying here. Similarly, the fishing industry has the potential to benefit from the establishment of no-fishing zones and the introduction of artificial reef structures to the sea bed, if these act to increase stocks.

Mariculture is exposed to minor risks associated with smothering by sediment and noise. However, the likelihood of the occurrence of these would be reduced if marine renewable energy developments were located away from the shore and therefore not in competition for space.

Figure 4.11 – fishing near St Peter Port harbour, Guernsey (Photo– David Wilkinson)

Mitigation –

The most effective mitigation measure is likely to be the avoidance of well-known fishing grounds in the selection of preferred deployment sites. Further to this, construction and deployment activities should be timed to avoid key periods of fishing activity. A further measure would be to seek employment opportunities in the new marine renewable energy industry for those fishermen who might be most affected, as the fishermen’s vessels and knowledge of the sea at deployment sites would be extremely useful.

A strategic fisheries’ impact study should be undertaken to enhance existing information and to evaluate the likely impact on fishing activity associated with the introduction of marine renewable energy. If necessary, this study could be followed by more detailed assessments of particular development sites, and these should form part of the developers’ Environmental Impact Assessments.

Discussions with fishermen and their representative organisations should commence at an early stage of the identification of potential sites for development and the design of specific projects. This is often undertaken through a designated contact person or Fisheries Liaison Officer.

4.9 *Recreational Fishing*

Baseline –

Most of the waters in the study area are fished recreationally for a variety of species. Recreational fishermen are a large but disparate group. They consist of leisure and sport anglers, hand-liners, snorkel and scuba divers, amateur potters, netters, shore-gatherers and long-liners, operating both from the shore and afloat. In many cases, the same individuals will fall into more than one, or many of these sub-groups, and as a result it is very difficult to quantify the numbers of people actively involved, or the time spent participating in these traditional activities. It is similarly difficult to calculate the actual levels of fishing effort, or indeed the effect that this might have on stocks. However, all the groups are linked by certain common factors, which make it possible to construct a cohesive broad response to the perceived impact of the various methods of renewable tidal energy.

The choice of fishing area for the recreational fisherman is determined by a combination of seasonal availability of stocks, preferred fishing methods and the target species. The majority of these activities will normally take place within short range of the operator's home and often fairly close to shore. Almost any area of sea within a mile of land will be considered by someone as their "home patch".

Figure 4.12 – Line fishing at Le Gouffre, south coast of Guernsey (Photo– Chris Green)

Potential Impacts –

Many of the impacts on navigation, pelagic and benthic ecology apply equally to recreational fishing due to shared target species and the use of boats in fishing offshore. However, a number of additional specific impacts may arise:

- Noise or direct disturbance to a discrete area of sea may force fish from that area during the deployment and operation of devices. Whilst this may impact by reducing fish stocks locally to the site, this may have a positive effect on other fishing marks.
- The establishment of Safety Zones around deployment sites may cause these areas to be no-fishing zones. Whilst this would be to the detriment of those who fish such sites, there is also the potential that the zones may act to protect and enhance populations, with a wider benefit to fishermen.
- Cable landing points and associated shore-side infrastructure may reduce access to some parts of the shoreline for fishermen.

Mitigation –

As with many of the other specialist areas of interest considered in the REA, the impacts on recreational fishing will be highly dependent on the location of deployment sites. Therefore, further information should be gathered through early consultation with recreational fishing groups and individuals to establish the sensitivities of existing fishing spots. Following this, the primary means of mitigation should be the careful selection of preferred renewable energy zones and cable landing sites.

4.10 *Marine and Coastal Historic Environment*

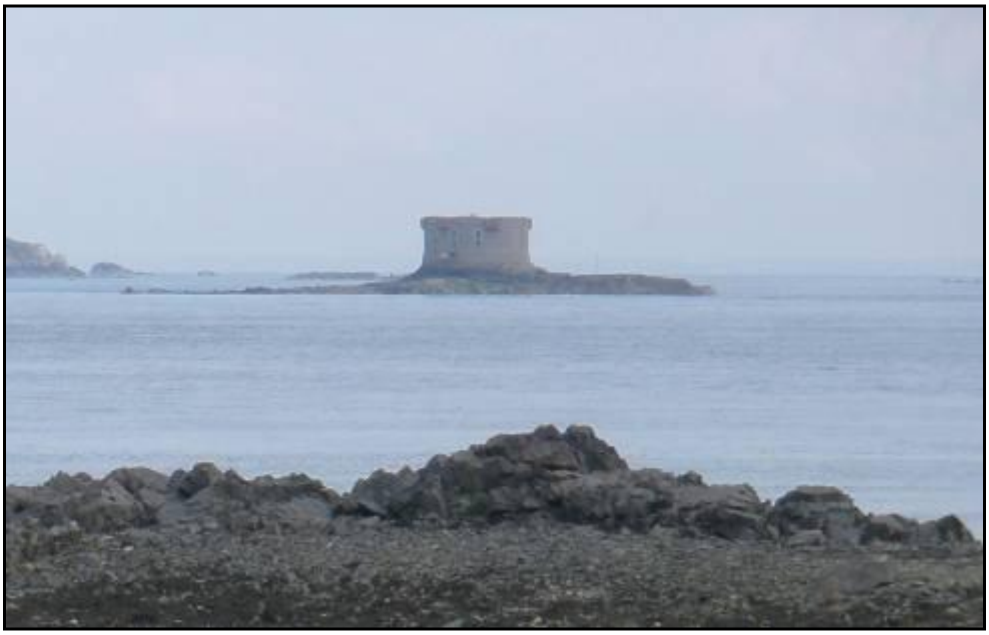
Baseline –

The islands have a rich historic and archaeological record, including many hundreds of sites and finds both on land and underwater. These sites are a finite and non-renewable resource, forming not only part of the cultural heritage of the Bailiwick, but also making a significant contribution to education, leisure and tourism in the islands.

The waters around the Bailiwick of Guernsey are known to contain several hundred historic wrecks, dating from the Roman period to the twentieth century. The locations of at least one hundred of these wrecks can be pinpointed with a reasonable degree of accuracy to within approximately 100m. Others can be associated with particular rocks or reefs. Many more wrecks are recorded (for example in medieval or post-medieval literature) but have yet to be located. In addition, the islands' coastlines have numerous fortifications, including those from the Napoleonic period and the Second World War.

Ancient land surfaces can also be preserved in the sea bed. Until at least the late Mesolithic period (10000 to 5000 BC), the Channel Islands were connected to continental Europe. People and animals lived upon some of the land which is now covered by sea, and moved across a now inundated landscape. Evidence for these ancient land surfaces can sometimes be found in sea bed or coastal excavations taking place in the Bailiwick of Guernsey.

Figure 4.13–Brehon Tower, in the Little Russel(Photo – Philip De Jersey)



Potential Impacts –

The installation of structures has the potential to damage wrecks, whether they are lying on the sea bed or are concealed in sediment. Ancient land surfaces may also be damaged during installation. Cable laying operations may also damage sites and artefacts in the marine environment.

The principal impact on the onshore historic environment will take place where the cables come ashore. Any trenches dug for this purpose could damage any underlying sites.

There are secondary impacts associated with the landscape setting of existing historic buildings and structures, and these are covered in section 4.16.

Mitigation –

Guernsey already benefits from good historical records and reports of wreck sites. This will greatly assist the avoidance of sensitive sites in the selection of preferred renewable energy deployment zones. Project specific measures to reduce the impact of construction work, either at sea or on land, are well established. These may be prioritised as follows:

- Archaeological assessment. This is a project specific investigation into the impacts of a development proposal, and would normally be undertaken by a developer as part of his Environmental Impact Assessment.
- Detection. Initially, this will simply refer to existing historic records and charts. Wrecks in shallow water are dived frequently and their locations are well recorded. Further investigations may be required to locate wrecks and artefacts at sea. These investigations will include geophysical surveys from small vessels to detect water depth, sea bed topography and metal objects.
- Avoidance. When a clear understanding of the nature of archaeological remains in a deployment zone has been achieved, efforts should be made to route cables and devices away from objects of value.
- Planned investigation. If an unavoidable deployment is required on a site of archaeological value, a planned programme of archaeological investigation would be required prior to any works commencing. This may include the recovery, documentation and storage of artefacts, or simply the surveying and recording of important information.
- Archaeological supervision and 'chance-find' procedure. If there is a risk that a deployment site or route would interact with archaeological remains, construction works might include the emergency call-out of a qualified archaeologist.

4.11 *Existing Submarine Cables, Electrical Grid and Connectivity*

Baseline –

Good digital records are available which show the location of existing active and disused telecommunication and electricity supply cables and equipment, both offshore and onshore. These are used to plan maintenance and improvement works and to assist in their avoidance.

Guernsey's grid has adequate capacity to accommodate its two existing principal sources of electrical power, namely:

- A local power station at Sampson's Guernsey. This uses both slow speed diesel engines and liquid fuelled gas-turbine generators. It has a total installed capacity of 115MW.
- An interconnector, which connects Guernsey to Jersey and provides access to the European Grid via the two submarine cables that connect Jersey to France. The interconnector operates at up to 55MW.

These sources of electrical power are considered to be sufficient to meet Guernsey's power demand, which operates at a baseload of approximately 25MW and a peak of 85MW. The existing power-distribution grid is robust and flexible.

Sark operates its own distribution grid. This is able to accommodate its single power station. The power station has four, diesel-generating sets with individual capacities of between 300 and 500 kW. This gives a total capacity of over 1.5 MW, considerably over the maximum demand of approximately 500 KW. The base load is approximately 200 kW.

Figure 4.14 – Guernsey's main power station at St Sampson's (photo – GEL)

Potential Impacts –

There is a risk that the deployment, operation and maintenance of renewable energy devices and associated cables will cause interference with, or damage to, existing subsea cable infrastructure. This may be due to direct disturbance or through secondary effects of scour, which might occur because of changes in tidal flows or wave propagation. Similarly, as new cables come ashore and are linked over land to existing infrastructure, then there are further risks of clashes with existing services.

The suitability of the existing Guernsey and Sark grids to accept new generation capacity depends upon the size and location of any new connection. Without proper investigation of the consequences of the connection of new generation equipment, there is a risk that this could overwhelm existing grid infrastructure.

Due to fluctuations in the available energy resource, the introduction of renewable energy generation would introduce a variability into the existing supply mix. By contrast, under the existing arrangements, generation is normally stable. When renewable energy devices are installed, the grid operators would be required to take more corrective action in the management of other generators in order to balance inputs.

There is the potential to generate energy at that exceeds Guernsey or Sark's domestic needs for certain periods, particularly if the energy resource peaks at a time of minimal demand. In these circumstances, it is likely that Guernsey would seek to export energy to Jersey or France using the existing and proposed new cable links. It is likely that the existing connection infrastructure would allow this, although it will be necessary to establish a demand market for the surplus energy.

Mitigation –

With reference to the risk of damaging existing cables, the primary mitigation strategy is to identify and avoid positioning new installations and cabling in close proximity to existing equipment. This will be assisted by reference to cable record charts.

To address the risks posed to existing distribution infrastructure, power system studies would be necessary. These should demonstrate that a satisfactory connection could be made to the existing grid infrastructure without causing overloading or instability. The studies should also recommend any grid infrastructure upgrades that would be necessary to support a specific project.

Due to the small electricity demand on Sark in relation to the generating capacity of most modern devices, great care should be taken in attempting to select a suitable device for connection to its grid. As with Guernsey, a power systems study would be required to identify any risks and any necessary infrastructure upgrades.

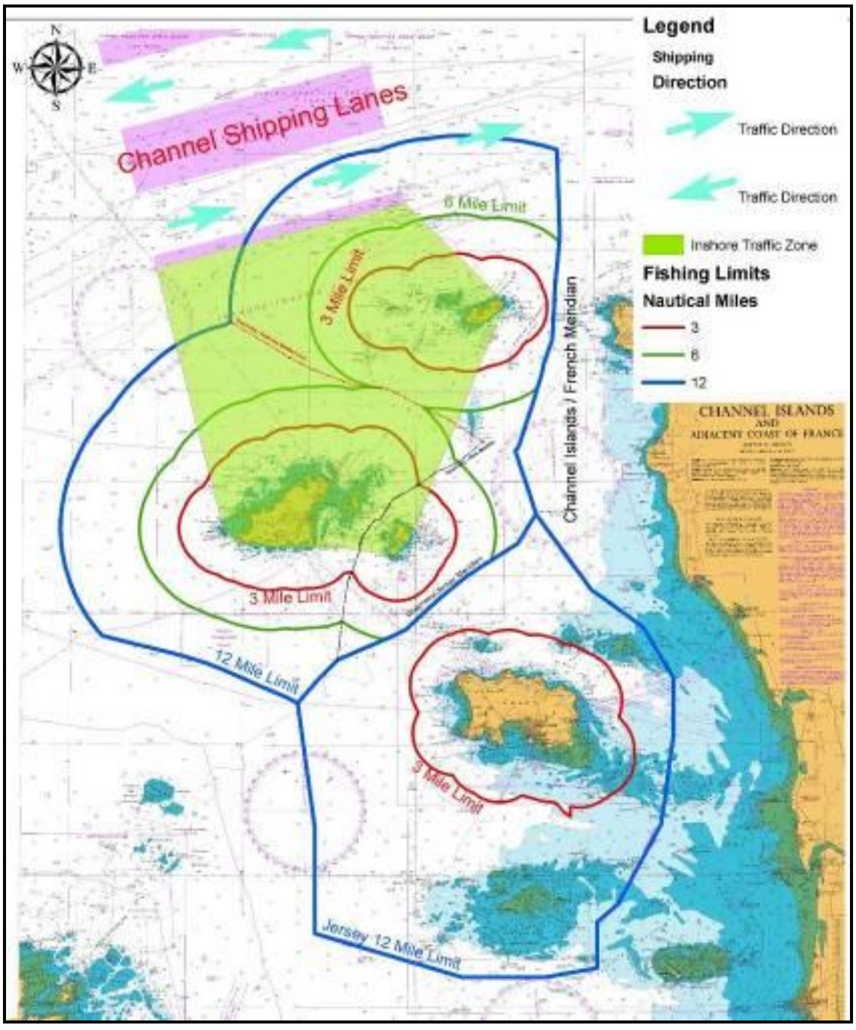
4.12 *Shipping and Navigation*

Baseline –

The coastal waters around Guernsey are used by a multitude of vessels ranging from large, cross-channel ferries through to small pleasure crafts. To the north of the Channel Islands lies Le Casquets' Traffic Separation Scheme (TSS), which assists large ocean-going vessels to navigate the shipping lanes of the southern English Channel. In addition to the TSS, there are a number of other controls in place to assist maritime safety. These include the Channel Islands Inshore Traffic Zone (ITZ), which has been established to prohibit vessels of over 20m in length from transiting through the ITZ unless they are bound for ports within the ITZ.

The above measures have dramatically improved safety. They are put in place through surveillance by the Guernsey Harbour Authority and the French Affaires Maritime. However, due to the high levels of traffic and the complex tides, weather conditions and coastal geography, the region is still regarded as one of the more hazardous in Europe. There are still shipping incidents and damaged vessels might drift into the REA study area.

Figure 4.15 – Chart with navigation controls (image – GREC)



Potential Impacts –

The impacts that a proposed renewable energy development will have on navigational safety will be very dependent on its location. The following 'pinch points' were identified as being particularly important for local marine traffic navigating between the islands or accessing the ports. Unless clear routing alternatives are identified on charts, the following should be avoided as potential deployment sites if possible:

- The Little Russel
- Certain parts of the Big Russel
- The passages between Guernsey, Herm and Sark.
- The entrances to ports and harbours
- The numerous anchorages shown on Admiralty Charts.

The risk presented will also be dependent on the extent of a device that is located above or just below the surface of the sea. Devices that are deployed in deep water directly onto the sea bed with only marker buoys on the surface are unlikely to present a significant hazard, except to vessels trying to anchor, tow or trawl. Conversely, devices near the surface could represent a collision risk.

Mitigation –

The developers of any marine renewable energy proposal would be required to examine the potential effects specific to that development. This would require the use of detailed data sources, such as vessel track logs, and detailed navigational risk studies for each phase of the development. These studies would lead onto the design and specification of navigational lighting and marking. This would ensure that the development is appropriately visible and can be easily avoided by vessels. Depending on the location of a development, a further measure that might be considered is the establishment of a Safety Zone. This would exclude all but certain vessels and activity from a deployment area.

4.13 *Tourism and Recreation*

Baseline –

Guernsey has a thriving tourist industry which underpins much of its economy. The island attracts in the region of 186,000 visitors a year. Many of these visitors take day trips to Herm and Sark. Holiday-makers take advantage of the large numbers of local hotels and, according to surveys undertaken by the States of Guernsey, account for approximately one third of the total traffic through Guernsey Airport. Visitors also increase the custom of local restaurants and retail establishments.

In addition, cruise ships bring approximately 55,000 tourists to Guernsey each year. Recreational sailors are the final major contributor to the island's tourism industry. Approximately 20,000 people stop in the island, either overnight or for longer periods of time, again contributing to the hospitality and retail industries.

Visitors are attracted to the Bailiwick of Guernsey for many reasons, but primarily to enjoy the natural and man-made beauty of the islands on the numerous footpaths and beaches. In addition, many people visit Guernsey to enjoy the cuisine or to partake in sporting activities, such as fishing, golf or watersports.

The reasons for visiting the islands overlap with those that attract and retain the permanent population. Residents of Guernsey enjoy a high quality of life. Recreation is an important part of life on Guernsey and there are many sport and activity groups and facilities.

Figure 4.16 – Herm ferry (photo www.guernseyimages.com)

Potential Impacts –

The marine and coastal environment plays a large part in tourism and recreation in the Bailiwick of Guernsey. This means that any impact on this area during the installation, operation, maintenance or decommissioning of marine renewable energy devices could have an effect on the tourism industry.

Many of the potential impacts on tourism and recreation are secondary impacts from other aspects that are covered elsewhere in the REA. Key links with other chapters include landscape and seascape character, water and air quality, bird life, recreational and commercial fishing, and navigational safety. Reference should be made to these sections within the REA and this NTS.

There is also the potential for marine renewable energy development to act to promote tourism. There are already several organisations that operate tourist sightseeing trips, including Rigid Inflatable Boat (RIB) trips to points of ecological and historic interest around the islands. These could benefit from the boost to eco-tourism that might occur as a result of people being keen to learn about the development of renewable energy.

Mitigation –

As described above, many of the potential impacts on tourism and recreation are secondary impacts from other aspects that are covered elsewhere in the REA. These will not be listed again in this section. However, there are a number of measures that are specific to tourism and recreation, including the following:

- Existing surveys of tourist opinions could be expanded to consider tourist reactions to offshore development.
- Construction and deployment activities in visually and noise sensitive areas should avoid the peak tourist season if possible.
- The provision of a visitors' centre might be considered if a large renewable energy development is undertaken.

4.14 *Noise*

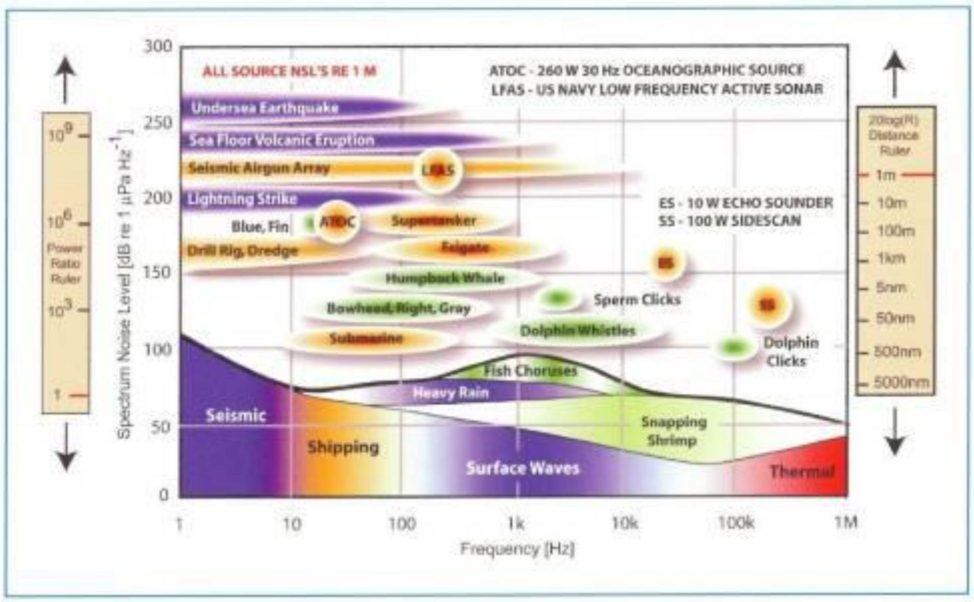
Baseline –

The REA chapter on noise deals with the effects of marine renewable energy development on ambient noise levels, both above and below the water surface.

There are two main sources of noise: ‘naturally’ occurring sources, such as wind, animals and waves breaking; and ‘human’ sources, such as shipping, aircraft and industry. Generally, levels of human noise increase with proximity to population centres. However, there are also noise hotspots along the flight paths of aircraft and close to main ports.

The measurement and analysis of noise below the water surface is complex due to the formation of horizontal boundaries between layers of water in the sea. Noise can be trapped within layers, causing sounds to be heard from a greater distance.

Figure 4.17– Marine Noise Sources (image – SCAR report on Marine Acoustic Technology and the Antarctic Environment. Information Paper IP078.ATCM XXVII.)



Potential Impacts –

There is likely to be an increase in noise during the construction and use of marine renewable energy devices. This will occur both above and below the waterline. The key activities which will produce noise are the pile-driving and drilling operations during the construction of foundations, and the movement of vessels. The increase in noise may deter species, such as dolphins and fish, from coming close to the deployment site, and this may reduce the risk of collision.

However, without appropriate mitigation measures, a sudden increase in underwater noise levels could disorientate, injure or kill some vulnerable species. The choice of foundation type for each device will also determine the amount of noise produced. Gravity structures, which use the weight of the foundation to hold it on the sea bed, are favoured because of their quick deployment time and limited requirement for drilling and piling.

The operation of devices will cause a number of impacts, depending on the design of energy generators:

- Wave energy devices will cause a splashing noise through their movement on the surface of the sea. This will increase in more energetic wave conditions.
- Oscillating-water-column-type wave devices may produce noise from air being forced through narrow openings.
- Tidal turbines may produce humming noises below the water. These would be inaudible on the surface.
- Oscillating-blade-type tidal devices may emit noise when the direction of the blades changes with each stroke.
- If not laid correctly, cables may oscillate or 'strum' within fast tidal currents.
- All devices would be prone to emitting more noise if they were not properly maintained or were broken.

Mitigation -

A strategic review should be undertaken to establish and map the vulnerability of key noise receptors within Guernsey's waters. The project should remain aware of ongoing industry research into the sensitivities of marine animals and their behavioural responses to noise.

Noise emitted during deployment may be reduced by the selection of gravity structures for foundations, which have a reduced requirement for drilling or pile-driving.

Operational noise emissions are unique to each device design. These may be reduced, tuned or eliminated through careful design. Before construction, device-specific noise assessments should be undertaken by developers, together with site-specific baseline noise surveys. There are well-established methods for controlling and monitoring noise during deployment operations. These methods include the restriction of periods of activity, the use of gradual start-up procedures during piling, and the control of construction vessel speeds.

4.15 *Air Quality*

Baseline -

Air quality is an important consideration for all air-breathing animals, especially humans.

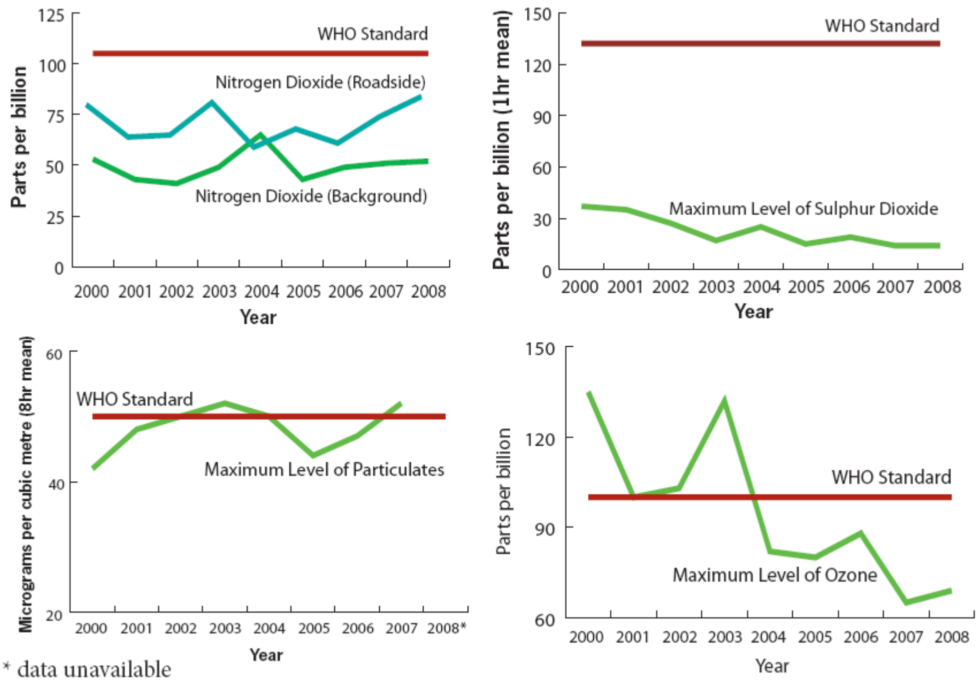
The majority of pollution is caused by human power generation, particularly through industry and vehicular transport.

In Guernsey, air quality has been monitored for the past 28 years. Initially, this was done at five sites, but this was increased to ten sites in 1995. The sites include urban, rural, and roadside areas, which are sampled monthly. This information is directly comparable to that available in the UK, and annual averages are published in the "Guernsey Facts and Figures" booklets.

Generally, Guernsey enjoys good air quality in comparison to the World Health Organisation (WHO) guidelines. In 2009, pollutant levels only occasionally peaked above their general low level. It is thought that most of Guernsey's air impurities come from road travel, especially as Guernsey has a disproportionately high number of cars per capita compared with other nations. Other contributory factors include the power station, aeroplanes, home fuel burning, and dust from construction and building works.

Unfortunately, there are no measurements of air quality taken offshore.

Figure 4.18 – Historic Pollutant Levels (image – Guernsey Facts and Figures 2009)



Potential Impacts –

During the deployment phase, there would be an increase in marine traffic in the deployment area. This in itself would lead to a small increase in the overall pollution being released in the Bailiwick. However, if deployment activities requiring the use of large vessels were to be undertaken in close proximity to a centre of population, then there could be more significant localised affects. Should any land-based construction operations occur on Guernsey, onshore transport and mechanical work would increase, also having the potential to reduce air quality.

The provision of a long-term renewable energy generation facility would lead to a reduction in the amount of energy being produced from onshore power stations, which use fossil fuels. This would lead to a long-term reduction in greenhouse gas emissions of the equivalent of 130,000 tonnes of carbon dioxide per annum. This represents approximately 20% of Guernsey's current annual emissions.

There would also be a localised improvement in air quality in the vicinity of the existing power station.

Mitigation –

There is the potential to mitigate certain air-quality-reducing factors. It would be impossible to eliminate the requirement to transport equipment to deployment sites and the utilisation of specialist deployment vessels. However, it may be possible to minimise the number of trips required.

4.16 *Landscape and Seascape Character*

Baseline –

Guernsey is well known for its distinctive and attractive landscape, which is highly valued by residents and tourists alike. A Rural Area Plan has been prepared by the States of Guernsey's Environment Department. This aims to protect and preserve the landscape and to control development.

The following landscape types are apparent:

- Coastal: cliffs, western bays and northern shores
- Lowland: wetlands, lowland hills and the central plain
- Upland: escarpment, valleys and plateaux

Of these, the coastal component is considered by the REA in greatest detail. The whole of the coastline on Guernsey is defined in the Rural Area Plan as an 'area of high landscape character', and there is an almost continuous coastal footpath around the island. Sark and Herm are similarly sensitive, although less populated.

It is likely that any offshore development in the study area that includes floating or surface piercing components will be clearly visible from at least a part of the coastal footpath, beaches or properties that enjoy coastal views.

Figure 4.19 – South Coast of Guernsey (Photo – Chris Green)

Potential Impacts –

Studies have been undertaken in the UK into the value that people place in their local coastal landscape character. Often, the expansive and unbroken horizons of sea-views are cited as being of particular importance. However, these opinions are frequently countered by those who consider renewable energy installations to be points of interest in coastal views.

Although not as dominant as offshore wind turbines, any floating or surface-piercing components of a renewable energy development would impact on landscape character. The impact would be dependent on the proximity of a development to the shore, the surface area, colour and height of the equipment above water, and the numbers of people who will be affected.

Secondary impacts may also be caused through actions taken to moderate navigational safety risks, which may require the provision of lighting and marking to increase the visibility of generating devices.

Mitigation –

The primary mitigation measure would be the careful selection of deployment areas to reduce the visual impact as much as possible. This should be followed by careful design of devices to minimise visual impact. It is clear that some devices are more visible than others, and this may preclude the selection of certain types.

On completion of site selections and initial enquiries from developers, detailed visual assessments of specific device proposals should be undertaken to inform project specific requirements. Developers should be encouraged to optimise their designs to minimise visual impact.

5 Summary of Key Findings

5.1 Introduction

The REA has undertaken an assessment of potential impacts across a very broad range of environmental disciplines. In reviewing the whole of the REA, it would be easy for the reader to become lost in the complexity of the numerous subjects covered and their interaction. Therefore, without diminishing the need to properly examine and mitigate other potential impacts, the following summary tables identify what are considered to be the most significant impacts that may occur, together with the recommended mitigation measures and areas for future study.

Some of the key objectives of the REA are for it to be used as the basis of planning future investigative work, together with the strategic planning of the use of the marine energy resource. For this, it is recognised that some further knowledge must be gained into the cumulative affects of multiple devices or multiple arrays that are located close to key environmental sensitivities.

Guernsey can contribute to gaining a better scientific knowledge of its own waters. However, it must rely on developers to produce an enhanced knowledge of their own systems and how these interact with the marine environment.

5.2 Implementation and Monitoring

The production of the REA has included the preparation of two key documents: the Regional Monitoring Plan (RMP) and the Environmental Action Plan (EAP). These may be used to manage the delivery of future investigations and the delivery of project-level mitigation measures. The documents identify the environmental survey work, studies and practical measures that should be undertaken through the development of actual projects, from their inception to decommissioning.

The RMP and EAP identify the organisations most likely to be responsible for the implementation of each of the actions. However, it is acknowledged that effective delivery of environmental mitigation can only be achieved through close collaboration between all parties involved. With this in mind, it is likely that tasks will be shared, by agreement, between the States of Guernsey and prospective developers.

The Regional Monitoring Plan –

The RMP lists all of the scientific investigative work to be undertaken throughout the development of marine renewable energy facilities. This includes strategic-level investigations, which cover the whole study area, to project specific post-construction monitoring work, which will confirm the performance of individual arrays of generators.

It is likely that early, strategic surveys will be undertaken by GREC in order to properly establish environmental constraints prior to selection of potential deployment sites. Later, details of the monitoring programme and the allocation of specific tasks will be discussed and agreed between the developers, GREC (the planned environmental consenting authority) and its technical specialists.

This REA stresses the need for a strategic, regional approach to future surveying and monitoring work. This is necessary in order to understand the context of the environmental data that will be obtained in relation to preferred deployment sites.

Guernsey’s waters are likely to provide unusual deep-water habitats. A current lack of knowledge regarding the nature of these highlights the importance of monitoring at a regional scale. If monitoring were to be only undertaken within the confines of individual deployment sites, without establishing the context of the data that was captured, there would be a risk of misinterpretation. To avoid this, the monitoring plan should maintain a strategic approach.

The Environmental Action Plan (EAP) –

The EAP lists all the physical measures that could be taken to protect the environment during the design, deployment, operation and eventual decommissioning of generator arrays, depending on the nature and location of development.

The majority of the mitigation measures would be undertaken either prior to, or during, the construction period. They mostly relate to minimising the negative environmental impacts which would arise from construction activities. However, there are also measures that might be applied to the design of the devices to minimise the environmental impacts during the operational phase of a project. Many of the measures which would be implemented during construction are also applicable to the decommissioning phase of a project.

The key recommendations from the Regional Monitoring Plan (RMP) and the Environmental Action Plan (EAP) are shown in Table 5.1 below.

These documents should remain ‘live’ throughout the development of marine renewable energy schemes and should be continuously updated to reflect new knowledge as it becomes available. This includes the operational life of all projects, right through to decommissioning.

5.3 Summary of Key Findings

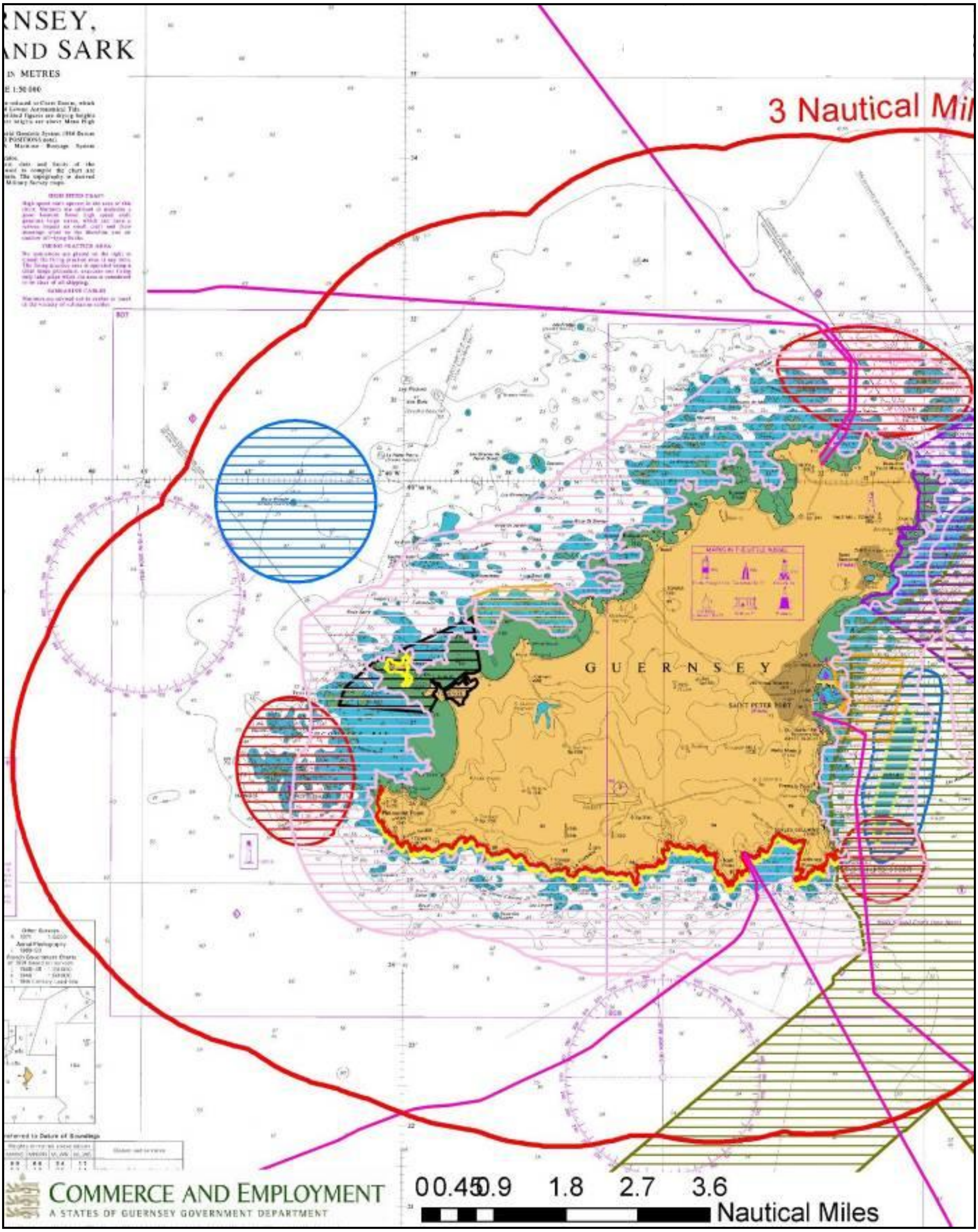
Table 5.1 – Summary of key findings

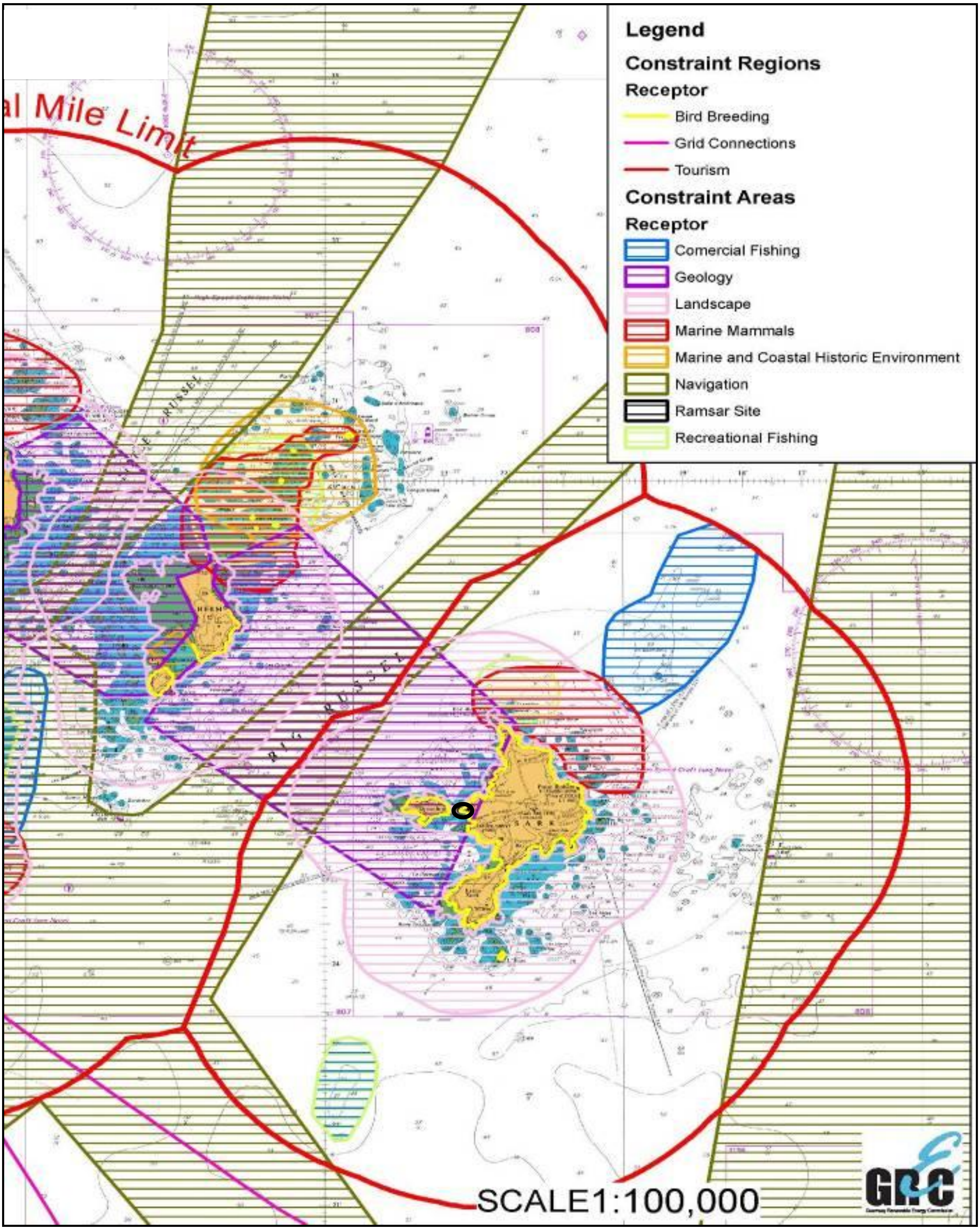
Subject	Potential Impacts	Mitigation
All	**Various**	**Careful selection of deployment zones based on mapping of energy resources together with key environmental sensitivities**
Geology and marine processes	Disturbance of existing sediment scour and deposition regimes could lead to coastal erosion	Project specific hydraulic and sediment modelling of the effects on tidal flows and wave propagation, leading to careful design of proposed developments to minimise the risk of scour or large-scale changes in sediment movements
Benthic ecology	Risk of disturbance of unknown vulnerable habitats and species	Strategic benthic habitat surveys and mapping. Careful site selection. Project specific surveys and post-construction monitoring
Pelagic ecology and marine mammals	Noise	Follow established noise mitigation methods during construction. Project specific studies into the noise likely to be emitted from energy generation devices, leading to possible design improvements to control emissions
Large pelagic ecology and marine mammals	Risk of collision	Monitor ongoing, strategic, industry research into the behaviour of key species in proximity to devices. Careful selection of devices
Benthic and pelagic ecology	Opportunity to create habitat and enhance stocks	Encourage the formation of artificial reefs and no-fishing areas
Commercial fisheries	Exclusion from fishing sites due to a possible requirement for safety zones	Try to avoid the requirement for safety zones. Early liaison with fishermen regarding site selection.
Shipping and navigation	Risk of collision	Project specific, navigation risk assessments. Consider establishing Safety Zones around development sites. Clear marking and lighting
Landscape	Obstruction or dominance of coastal views by renewable energy devices. Reduction in visual pleasure	Careful selection of devices with a preference for those that lie below the surface of the sea

5.4 Constraints Map

All of the data used in the production of the REA is described in detail in the relevant sections of the main document. Information that can be presented spatially in the form of a map has been stored and reproduced using a Geographical Information System (GIS). This allows data to be filtered and overlaid in various combinations to show different information on nautical charts. On the following pages, the most environmentally sensitive areas are shown.

Figure 5.1 – Constraints map (Image – GREC)





Legend
Constraint Regions
Receptor
Bird Breeding
Grid Connections
Tourism
Constraint Areas
Receptor
Comercial Fishing
Geology
Landscape
Marine Mammals
Marine and Coastal Historic Environment
Navigation
Ramsar Site
Recreational Fishing
al Mile Limit
SCALE1:100,000
GREC

The following explanatory notes relate to the key on the constraints map.

Bird breeding – Cliff areas are identified on all of the islands as potential breeding sites.

Grid connections – Telecommunication cables are shown connecting Guernsey to the UK and France. There is also a power cable coming from the east coast of Guernsey, which connects to France via Jersey.

Tourism / Landscape– Areas of coast on all of the islands are identified as having important landscape value.

Commercial fishing– The most important areas for commercial fishing are focused over sand banks. The Boue Blondel to the west of Guernsey is an important fish spawning ground. The Great Bank off the east coast of Guernsey is extensively fished, as are the sandbanks to the south and north of Sark.

Geology– In the context of sediment dynamics, the most critical areas of the Guernsey REA are the channels of the Big and Little Russel, where there is the highest potential for tidal generation. Although there is a general understanding of the sea bed geology and sediment distribution in these areas, the specific relationships between this and the deployment of energy devices on sedimentation is not established.

Marine mammals– There is a dolphin feeding ground off the southern tip of the Great Bank, which mostly comprises of mackerel. There is also a seal haul-out site at the Humps, north of Herm, which supports a resident population of seals. There are believed to be resident populations of common dolphins off the north of Sark and the north and east coasts of Guernsey.

Marine and coastal historic environment– The areas identified as being of greatest importance are: the area surrounding Vazon Bay on the east of Guernsey; outside Guernsey Harbour;between Herm and Jethou; and to the north of Herm. These areas have been identified as having a high concentration of wrecks.

Navigation– The area through the Little Russel is the key shipping channel into and out of Guernsey. Less sea traffic uses the Big Russel, although it is still an important route.

Recreational fishing – Key sites are the Great Bank to the east of Guernsey and the north coasts of Herm and Sark.

6 Next Steps and Response to Consultation

The main text of the Regional Environmental Assessment (REA) will be published on 30th July 2010. This coincides with the beginning of a period of public consultation, which will last six weeks. Feedback is requested from stakeholders and the general public on the content of the documents. Technical specialists are encouraged to review the chapters of the REA document which are relevant to their field of interest.

Paper copies of the REA will be available for review at the public buildings mentioned in section 1 of this NTS. Copies of the NTS will also be available to take away. Both documents will be available for download from the GRECwebsite (www.guernseyrenewableenergy.com).

Feedback is welcome and may be provided either:

- by writing to

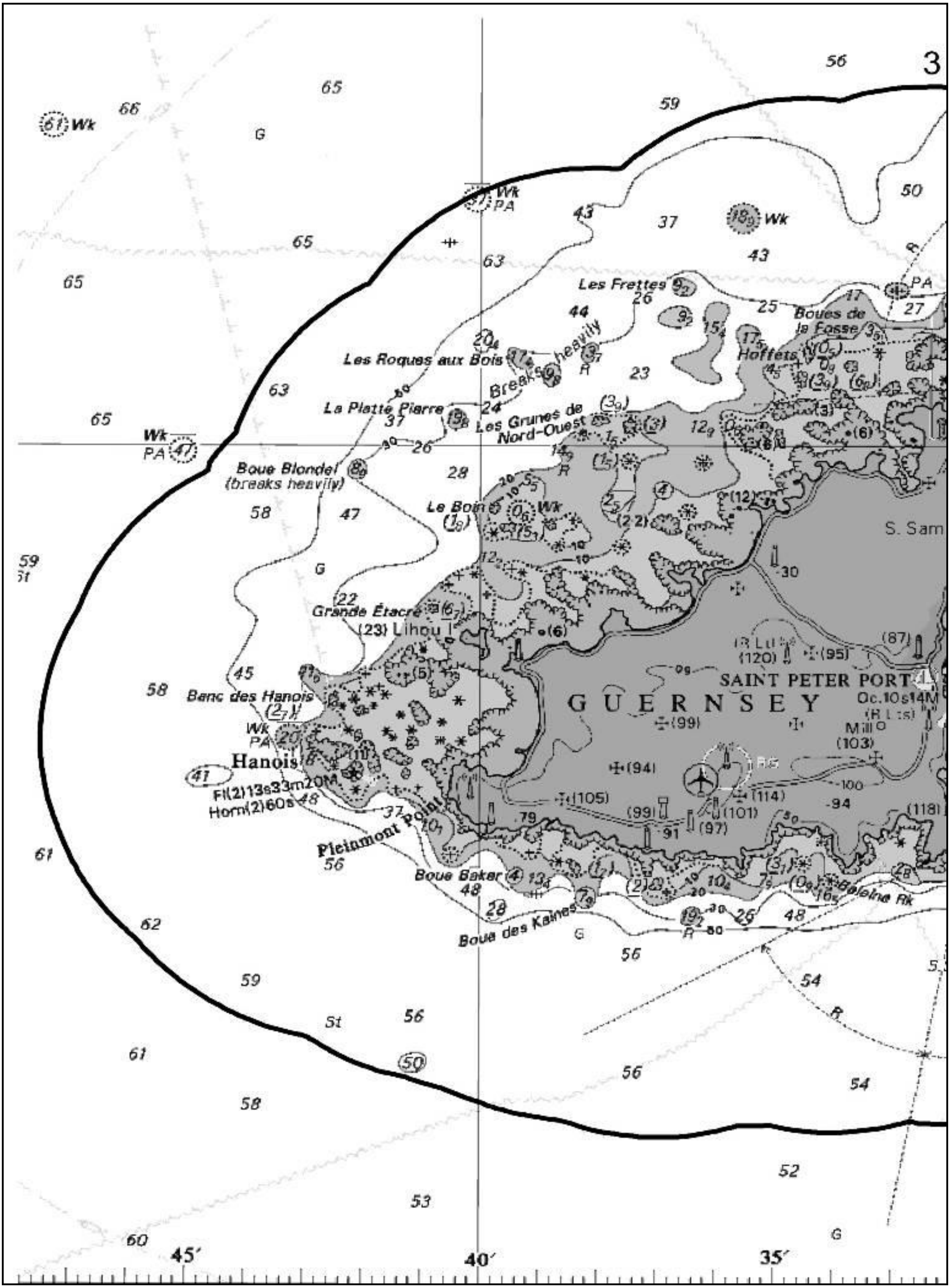
  REA Consultation
  Guernsey Renewable Energy Commission
  Raymond Falla House
  Longue Rue
  St Martin
  Guernsey
  GY16AF

- by email to enquiries@guernseyrenewableenergy.com

The feedback received will be used to prepare a revision to this version of the REA, and to plan future investigations in support of the Environmental Assessment process.

As illustrated in Figure 3.1 of this document, the REA will contribute to the selection of renewable energy deployment zones and to the formation of an environmental consenting process for development applications.

The REA should be considered as a working document. It may be reviewed and updated as necessary to account for additional survey information or the completion of research. As new technologies are developed, these may be assessed and incorporated into future versions of the REA.



GUERNSEY
SAINT PETER PORT
Oc.10s14M
Mill
S. Sam
Les Frettes
Boues de la Fosse
Hoffets
Les Roques aux Bois
Breaks heavily
La Platte Pierre
Les Grunes de Nord-Ouest
Boue Blondel (breaks heavily)
Le Boin
Grande Étacré
Lihou I
Banc des Hanois
Hanois
Fl(2)13s33m20M
Horn(2)60s
Pleinmont Point
Boue Baker
Boue des Kaines
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PA
45′
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