MeyGen Phase 1 EIA
Scoping Document

MeyGen Ltd proposed 85MW Tidal Energy Project in the
Inner Sound, Caithness, Scotland

24/05/2011

Author: Ed Rollings	Document No: 002	Revision: 1.7	Date: 24/05/2011
Project No: 3012	Project Title: MeyGen Phase 1 Tidal Energy Project		
Document Type: Consenting			
Document Title: MeyGen Tidal Energy Project EIA Scoping Document			

Document History and Status

Revision	Approved by (internally)	Date approved	Date issued	Comment
1.0	Metoc		29/09/09	Original
1.1	Metoc		14/10/09	Incorporating Atlantis comments
1.2	DP		19/05/09	Incorporating new project description
1.3	Metoc		16/06/2010	Incorporating final Atlantis comments
1.4	Xodus		17/03/2011	Updating and editing report
1.5	MeyGen		06/04/2011	Incorporating updates to project description
1.6	Xodus		20/04/2011	Finalising report
1.7	MeyGen		24/05/2001	Final Report

Distribution of Copies

Revision	Media	Issued to	Company
1.0	Electronic	Ed Rollings	Atlantis
1.2	Electronic	Sally Holroyd	Metoc
1.3	Electronic	Ed Rollings	Atlantis
1.4	Electronic	Adam Payne	Xodus
1.5	Electronic	Ed Rollings	MeyGen
1.6	Electronic	Adam Payne	Xodus
1.7	Electronic	Stakeholders	MeyGen

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Glossary

AIS	Automatic Identification System
ASFB	Association of Salmon Fisheries Board
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BODC	British Oceanographic Data Centre
BSI	British Standards Institution
CASE	Caithness and Sutherland Enterprise
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CNSRP	Caithness and North Caithness Regeneration Partnership
CO_2	Carbon dioxide
DECC	Department of Energy and Climate Change
DHI	Danish Hydraulics Institute
DSRL	Dounreay Site Restoration Limited
EC	European Community
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EPS	European Protected Species
ERI	Environmental Research Institute
ES	Environmental Statement
ESAS	European Seabirds at Sea
EU	European Union
FRS	Fisheries Research Services
HIE	Highlands and Islands Enterprise
GBS	Gravity Base Structure
IBA	Important Bird Area
JNCC	Joint Nature Conservation Committee
Kg	Kilogram
km	Kilometre
km^2	Kilometre square
LCA	Landscape Character Assessment
M	Metre
MarLIN	Marine Life Information Network
MCA	Maritime and Coastguard Agency
MESH	Marine European Seabed Habitats
MFA	Marine and Fisheries Agency
Mm	Millimetre
MoD	Ministry of Defence
MP	Member of Parliament
MS	Marine Scotland
m/s	Metres per second
MTDS	MowaT Technical and Design Services Ltd
MW	Megawatts

Natura	Network of European designated SPA and SAC sites, introduced under the Habitats and Birds Directives
NBN	National Biodiversity Network
NDA	Nuclear Decommissioning Authority
nm	Nautical miles
NO_x	Oxides of nitrogen
NSA	National Scenic Area
NVC	National Vegetation Classification survey
OBIS-SEAMAP	Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations
OIC	Orkney Islands Council
PEXA	Practice and Exercise Area
PFOW	Pentland Firth and Orkney Waters
REZ	Renewable energy zone
RNLI	Royal National Lifeboat Institution
ROV	Remotely operated vehicle
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SDI	Scottish Development International
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SO_x	Oxides of sulphur
SPA	Special Protection Area
SSSI	Special Site of Scientific Interest
UKAEA	UK Atomic Energy Authority
UKBAP	UK Biodiversity Action Plan
UKHO	UK Hydrographic Office
WFD	Water Framework Directive

1 Executive Summary

1.1 Introduction and Objectives

The MeyGen Tidal Energy Project ("Project") has been proposed by MeyGen Ltd, a project company created for the sole purpose of developing, financing, constructing and operating the 398MW tidal energy project. The Project will consist of up to 398 1MW tidal turbines located in the Inner Sound of the Pentland Firth off the northern coast of Scotland between Caithness on the Scottish mainland and the island of Stroma. The electricity generated from the Project will be exported to an onshore substation for transmission to the national grid.

MeyGen Ltd. proposes to deploy the project in a series of phases. Phase 1 will comprise an initial Phase 1a deployment 20 turbines (20MW), followed by a subsequent Phase 1b which will deploy a further 65 turbines (65MW). Using a 'survey, deploy and monitor strategy', the initial array will provide information on the interactions between the array and the environment, increasing the knowledge for subsequent phases. Phase 2, will comprise the build out of the remainder of the project and will be subject to a separate consent application

This EIA Scoping Document forms MeyGen Ltd.'s written request to the Scottish Ministers, under Regulation 7 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 and the Marine Works Regulations 2007 (as amended) for their opinion as to the information to be provided in the Environmental Statement (ES) for the proposed Phase 1 of the Project covering its offshore and onshore elements. It is intended that the Phase 1 consent applications will be submitted in Q4 2011.

The aim of this scoping document is to:

- Conduct a preliminary review of the environmental baseline and risks which require more detailed assessment; and
- Provide a framework for consultation and identify the relevant regulatory bodies and statutory and non-statutory stakeholders.

1.2 Project Description

The scoping document describes the proposed tidal energy turbine technologies, and proposed methods of construction, operation and decommissioning. The document focuses on those elements of project design and implementation that have implications for its environmental impacts. The project is in the early stages of development; therefore it is likely that the turbine layout and site design will alter as the Project continues to assess the Inner Sound.

An initial site selection process was conducted on the whole of the Pentland Firth; a flow model was created, highlighting areas of suitable resource for tidal stream energy projects. Further site evaluation was carried out, mapping constraints to the Project within the Pentland Firth including:

- Technical (accessibility, bathymetry and grid connection)
- Environmental (species and habitats)
- Other sea users (navigation, fisheries and recreation)

The Inner Sound between the island of Stroma and the mainland was assessed as the best site for the initial commercial development. The Inner Sound has an excellent tidal resource; the maximum current speed reaches 3.5 – 4 m/s. The site has good access to the grid, and suitable water depth.
The Project will utilise horizontal axis tidal energy turbine. Horizontal axis tidal turbines extracting kinetic energy from moving water in the same way as a wind turbine extracts kinetic energy from moving air. It is proposed that the project will use the Atlantis Resources Corporation (ARC) AK-1000™ and Tidal Generation Limited (TGL) 1MW tidal energy turbines. The turbines will be supported by either a gravity base or piled foundation. As part of Front End Engineering Design (FEED) MeyGen Ltd will assess the suitability of each method for the project and use a single system for both turbines.

There are two potential methods for cable landings, either a buried beach landing or horizontal direction drilling through rock. The final location of the cable landfall has not been defined, but an initial study concluded that the most likely option would route Phase 1 to the Gills Bay area via horizontally drilled bores. A cable landfall selection study has been undertaken and was based on engineering, environmental and planning guidance. A further detailed study through FEED and stakeholder consultation will continue this work.

A number of possible substation and grid connection locations have been identified but the final decision will be dependent upon environmental sensitivities and landfall location. Grid connection will be dependent on the cable landing point and the planned grid upgrades in the area.

1.3 Environmental sensitivities

The scoping document describes the marine and terrestrial environment within the project study area, and has sought to identify all receptors that have potential to be impacted by each phase of the project. The geographical scope of the EIA will include the entire development from the offshore generating array through to substation connecting into the national electricity grid. The geographical area described in terms of the environmental baseline will be varied according to the area over which there is potential to impact sensitive receptors.

It is proposed that a wide range of information sources will be consulted in order to describe the environmental baseline upon which to assess potential impacts. These include publicly available data sources, as well as the results of site specific surveys that MeyGen Ltd. has commissioned, or will commission, to inform the EIA. Details of proposed data sources, including specialist studies and surveys are included in this document.

1.4 Consultation

MeyGen Ltd. made a first visit to the Pentland Firth in April 2006. Since then the MeyGen Ltd. has made numerous trips to the area and has held meetings with local stakeholders, statutory and non-statutory bodies. The Scoping Document describes the consultation that has already been undertaken with key stakeholders and interested parties, as well as the ongoing consultation that will be undertaken on the Scoping Document to inform the scope of the EIA.

This Scoping Document is the latest phase in the ongoing consultation process and will be circulated to key stakeholders, both statutory and non-statutory consultees to inform them of the proposed EIA and invite them to comment. The aim of the consultation on the Scoping Document is to ensure that the scope of the EIA is fit for its purpose to assess the potential environmental impacts of the proposed development.

1.5 Environmental Impact Assessment and Mitigation

The Scoping Report outlines the studies that will be undertaken during the Environmental Impact Assessment (EIA) and reported in the Environmental Statement (ES) for Phase 1 of the Project. This includes both studies to characterise the environment within and around the project location, as well as studies that will be undertaken in order to predict the significant of potentially significant impacts.

Mitigation will be an integral part of the Project, and will be determined during the EIA process, informed to a large extent by the results of the EIA studies and consultation with stakeholders.

2 Introduction

2.1 The Proposed Development

The Project is a 398MW tidal stream power array. The project will consist of an estimated 398, 1MW turbines located in roughly 3.5km^2 of the Inner Sound of the Pentland Firth off the north coast of Scotland between Caithness on the Scottish mainland and the island of Stroma and related onshore infrastructure, including cables and substation. The electricity generated from the project will be exported onshore for transmission to the National Grid.

This EIA Scoping Document forms the start of the formal consenting process for the 1st phase of the project. Further details on how the project is split and consenting strategy can be found in section 2.

2.2 The Developer

MeyGen Ltd. is a company created for the sole purpose of developing, financing, constructing and operating the Project. The current shareholders of MeyGen Ltd. are investment bank, Morgan Stanley, independent power generator, International Power/GDF Suez and tidal turbine developer Atlantis Resources Corporation.

MeyGen Ltd has an in-house development team with a broad range of expertise and experience in offshore energy project development and managing the successful installation of tidal energy devices. In support of this MeyGen Ltd shareholders provide an excellent combination of development expertise, technology provider, secure financial backing and project operations experience.

2.3 Objectives

This EIA Scoping Document forms MeyGen Ltd. written request to the Scottish Ministers, under Regulation 7 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 and Marine Work Regulations 2077 (as amended) for their opinion as to the information to be provided in the Environmental Statement (ES) for Phase 1 of the Project.

The aim of this scoping document is to:

- Conduct a preliminary review of the environmental baseline and risks which require more detailed assessment; and
- Provide a framework for consultation and identify the relevant regulatory bodies and statutory and non-statutory stakeholders.

It sets out the scope of the EIA in terms of:

- The key environmental sensitivities to be assessed.
- The baseline data to be used in the assessment.
- Geographical boundaries.
- The potential environmental impacts that may arise from the proposed activities.
- The level of assessment to be undertaken in the EIA and reported in the ES.

3 Project Description

3.1 Site Selection

An investigation to identify all coastal sites globally that would see a flow rate in excess of 1.5m/s was conducted in 2008. The Pentland Firth was identified as a Tier 1 site, in terms of high flow rate and number of turbines that can be deployed. A flow model was then completed for the Pentland Firth 2 years ago. The output in terms of maximum flow rate is shown in Figure 1.

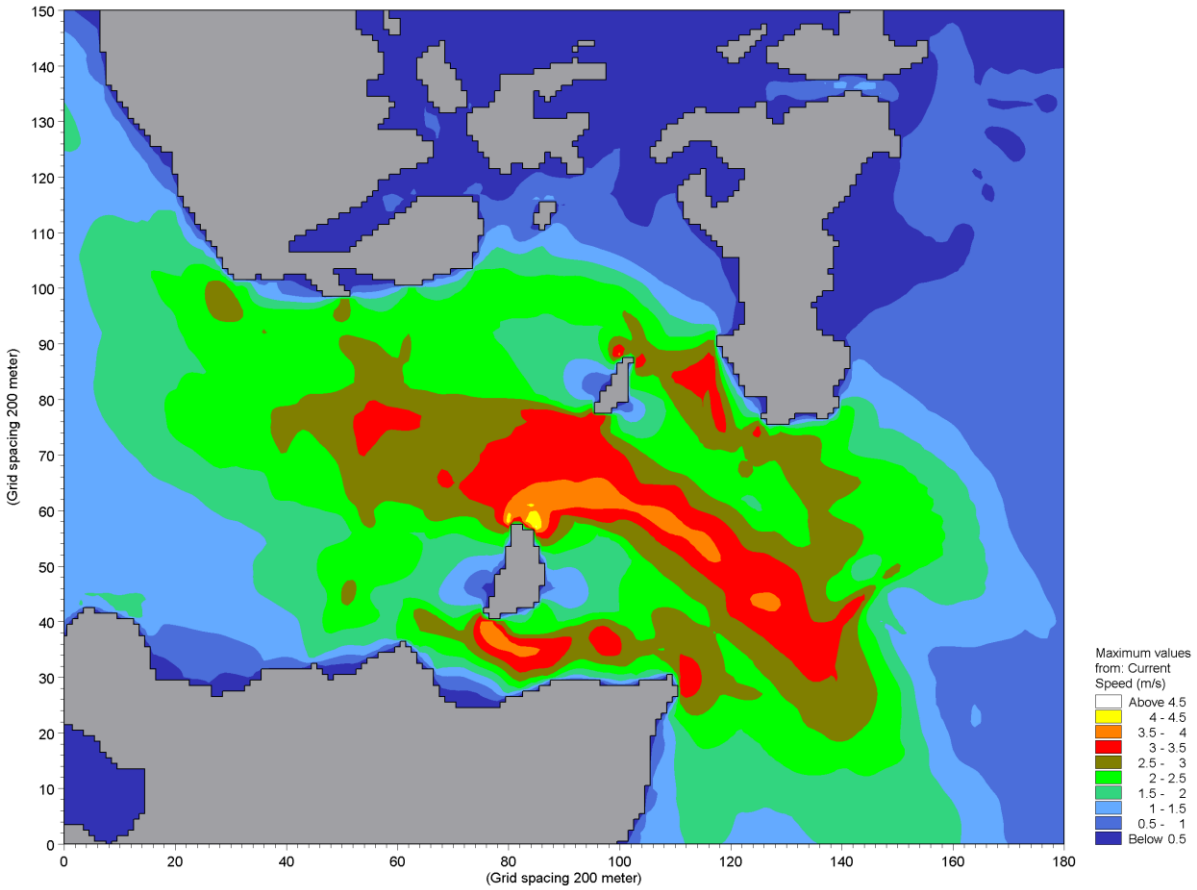

Figure 1 Maximum flow speed through the Pentland Firth

MeyGen Ltd. continued site evaluation, mapping constraints to development within the Pentland Firth including:

- Technical (accessibility, bathymetry and grid connection)
- Environmental (species and habitats)
- Other sea users (navigation, fisheries and recreation)

The Inner Sound between the island of Stroma and the mainland was assessed as an excellent site for the initial commercial development. Figure 1 shows that the Inner Sound has an excellent tidal resource; the maximum current speed reaches 3.5 – 4 m/s. The site has good access to the grid, and suitable water depth.

MeyGen Ltd. has continued to investigate the Inner Sound; collecting ADCP (Acoustic Doppler Current Profiler) data to calibrate the flow model and conducted a geophysical survey of the seabed to get accurate bathymetry data and seabed conditions.

3.1.1 The Crown Estate Inner Sound Lease Round

The Crown Estate own the rights to the UK seabed out to 12 nautical miles (nm) and the vested rights to lease the generation of renewable energy on the continental shelf within the Renewable Energy Zone out to 200nm. In 2010 MeyGen Ltd successfully tendered for the agreement to lease for the Inner Sound seabed area. The agreement to lease came into force in October 2010. The Inner Sound lease area released by the Crown Estate is shown in Figure 2**Error! Reference source not found.**.

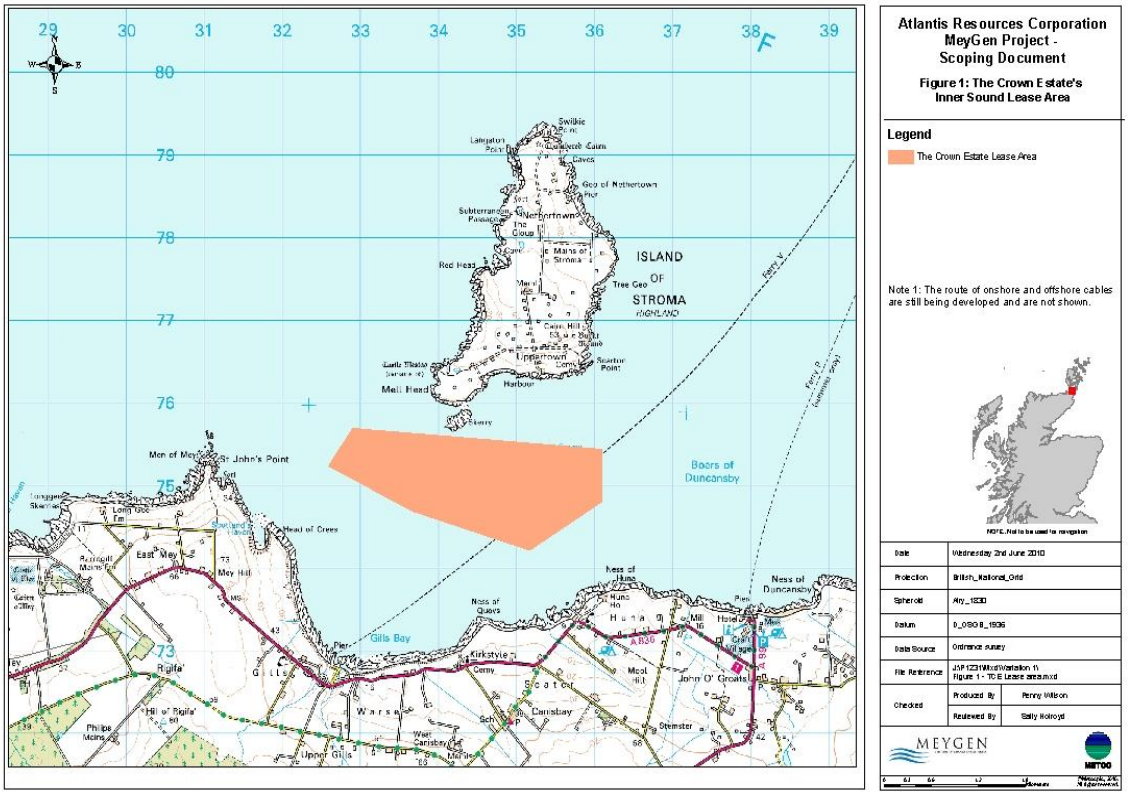

Figure 2 The Crown Estate's Inner Sound Lease Area

Following the successful tender of the Inner Sound lease, MeyGen Ltd secured the alteration of the boundary coordinates. Following the geophysical survey conducted in the Inner Sound in September 2009, the available seabed suitable for the deployment of tidal current turbines within the lease area was proven to be less than original assessments had predicted. Further investigation proved that altering the lease area to extend west and east in the sound whilst keeping the same overall area would enable the same generating capacity as previously predicted. The new lease area is shown in Figure 3.

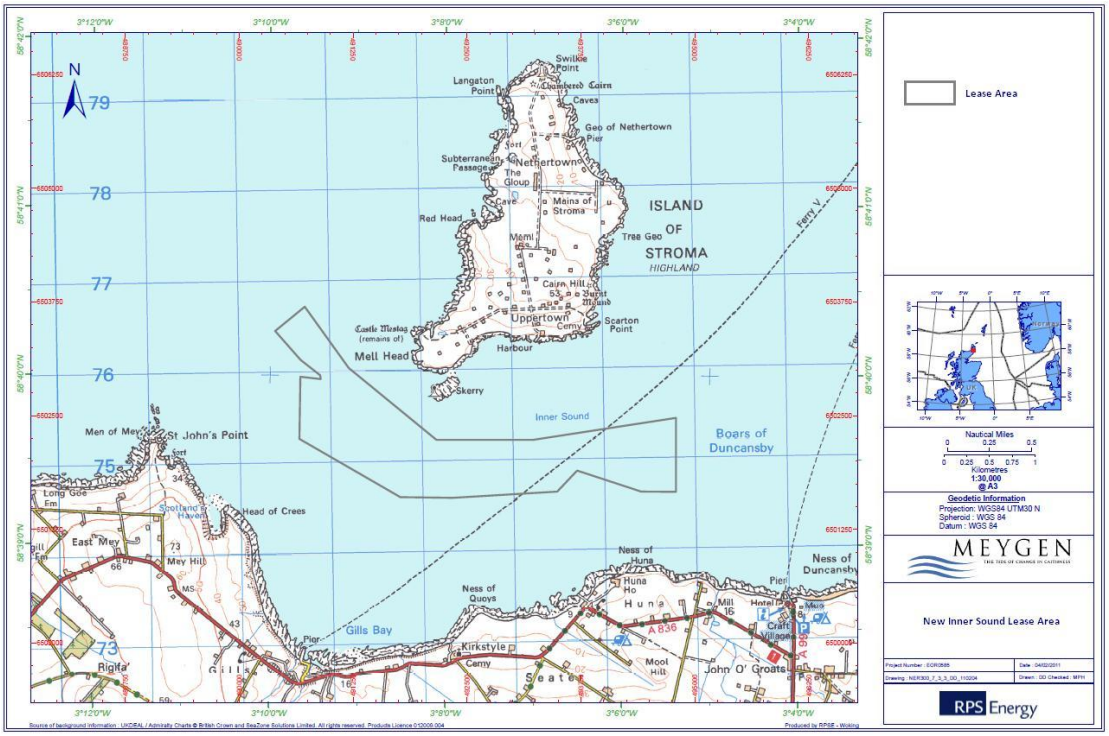

Figure 3 New Inner Sound Lease Area

3.2 The Rochdale Envelope

The project is still in the early stages of design, and as development progresses there will be more detail and certainty on the aspects of the project which have the potential to impact the environment. The most likely project base case at the time of writing is described in this section. However, certain aspects may be subject to change; any alterations will be captured and fully assessed in the EIA.

It is proposed that a 'Rochdale envelope' approach will be applied to the EIA process for all offshore and onshore works. The Rochdale Envelope arises from two cases[1]; it allows the need for flexibility in the project design whilst also giving defined project parameters for which the significant effects can be assessed. This approach has been endorsed by the Scottish Government[2].

3.3 Phased Project Development and 'Survey, Deploy and Monitor' Strategy

The current status of the marine energy industry means that there are a number of environmental impacts that are not fully understood. MeyGen Ltd. is committed to understanding these interactions in more detail and is therefore developing a strategy to roll out the project in such a way that increases the level of understanding through the project.

MeyGen Ltd. proposes to deploy the project in a series of phases (Table 2.1). Phase 1 will comprise and initial Phase 1a deployment of 20 turbines (20MW), followed by a subsequent Phase 1b which will deploy a further 65 turbines (65MW). Utilizing a 'survey, deploy and monitor strategy', the initial array

[1] R. v Rochdale MBC ex parte Milne (No.1) and R. v Rochdale MBC ex parte Tew [1999] and R. v Rochdale MBC ex parte Milne (No. 2) [2000]

[2] Letter from Scottish Government to Heads of Planning dated 22/11/2007

will provide information on the interactions between the array and the environment, increasing the knowledge for subsequent phases. Phase 2, will comprise the build out of the remainder of the project and will be subject to a separate consent application (Table 2.1).

Survey, Deploy and monitor strategies are recognised by the Scottish Government as an important mechanism for the development of marine renewable energy in Scotland. Marine Scotland has produced guidance for survey, deploy and monitor strategies and MeyGen Ltd. has, and will continue to, consult with the regulatory body to ensure the project strategy is properly aligned.

Phase	Phase Capacity (MW)	Total Capacity (MW)	Installation Date
1a	20	20	2013-14
1b	65	85	2015
2a	150	240	2016-18
2b	163	398	2019-20

Table 1 Phased development of the project

3.4 Project Assets

3.4.1 Turbine Technology

It is proposed that the project will use the Atlantis Resources Corporation (ARC) AK-1000™ (Figure 4) and Tidal Generation Limited (TGL) 1MW (Figure 5) tidal energy turbines. Both ARC's AK1000™ and TGL's 1MW device are horizontal axis turbines with 18m rotor diameters, rated at 1MW each. The turbines have very similar rotational speed and are full submerged with no surface piercing structures.

Horizontal axis tidal turbines extracting kinetic energy from moving water in the same way as a wind turbine extracts energy kinetic from moving air. Due to the density of water, tidal turbines can extract significant amounts of energy from a flow with much smaller rotor diameters and at lower rotor speeds.

Phase 1a (20MW) will consist of 10MW from each of Atlantis and TGL.

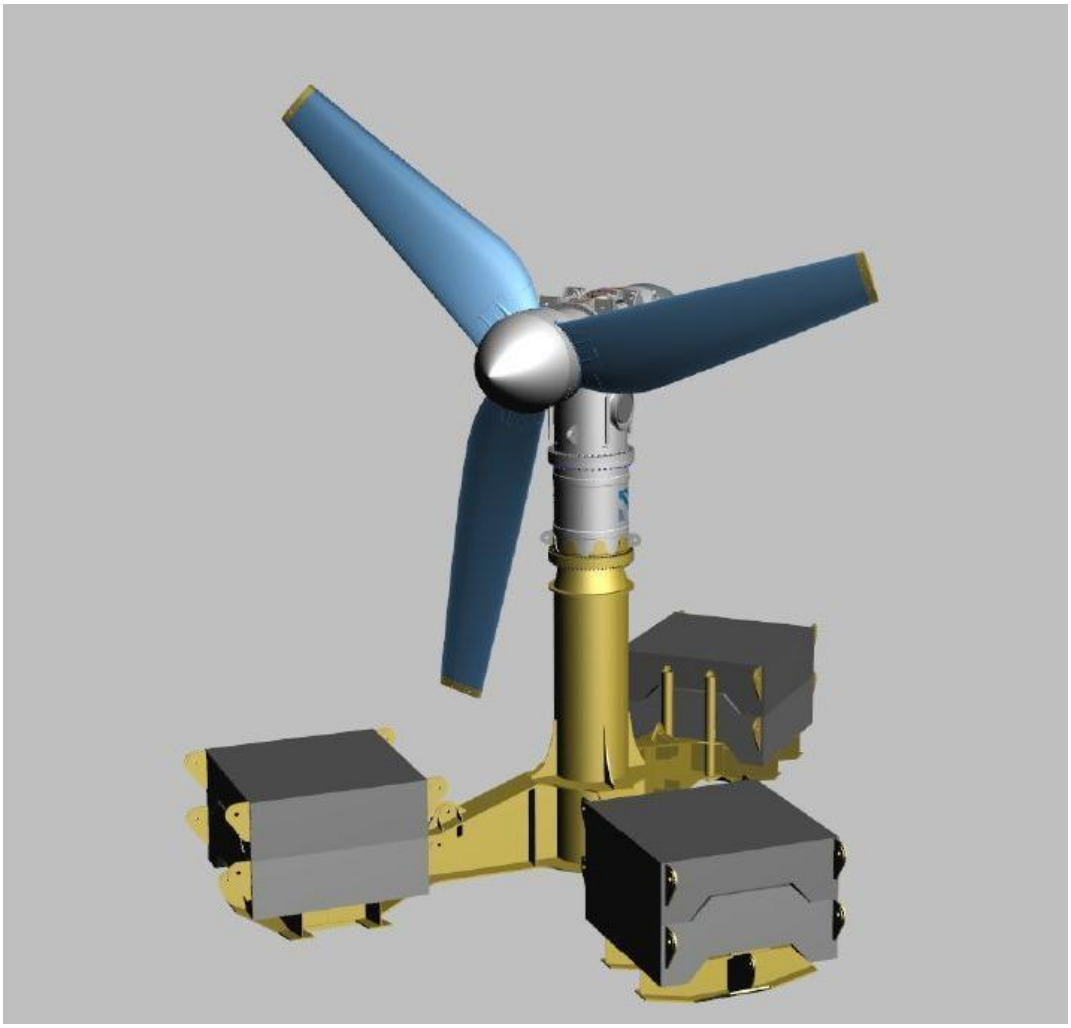

Figure 4 Atlantis AK-1000™ turbine

Figure 5 TGL 1MW turbine

ARC and TGL are both planning to deploy full scale 1MW turbines at the European Marine Energy Centre (EMEC), tidal test Facility, Orkney, in 2011. Each will undergo testing and ancillary studies relating to the installation, commissioning, operation and environmental impacts of the turbine. These will be directly feed into the project to mitigate the associated risks.

3.4.2 Turbine Support Structure

The Turbine Support Structure (TSS) will provide a platform for the operation of both turbine units. Both the Atlantis and TGL turbine will use the same TSS solution. The TSS is required to be dynamically stable under the operating and environmental loads arising during the turbine design life.

The support structure must also be designed with due regard to the method of placement. The proposed installation methodology must allow for the efficient placement of multiple units within an acceptable time period. As far as practicable, the design must allow for the placement, maintenance and eventual removal of the turbine and support structure while giving due regard to the operational difficulties inherent in the offshore installation environment.

ARC and TGL use different methods for the TSS at EMEC. ARC use a tripod steel Gravity Base System (GBS) (Figure 4) while TGL use a steel tripod pin piled to the seabed (Figure 5). As part of Front End

Engineering Design (FEED) MeyGen Ltd will assess the suitability of GBS and piled solutions for the project.

3.4.3 Turbine Array

Flow modelling of the Inner Sound will enable MeyGen Ltd. to produce optimum array configurations derived from the lease area. The latest configuration has due regard to the most recent bathymetry data and navigational safety issues. Array optimisation will continue as analysis methods develop further and new data is collected on the site and the Navigational Safety Risk Assessment (NSRA) progresses.

3.4.4 Offshore cables

All offshore cables will be specified according to the system design, equipment requirements and technology available. Offshore cable routes will be largely dependent on the selection of the landfall and detailed route analysis.

Due to the nature of the seabed in the Inner Sound it is not believed to be possible to bury the offshore cables. In those instances, MeyGen Ltd. will look to use the bedding plains and fractures in the seabed to provide support for the cabling and investigate different protection methods.

3.4.5 Onshore Cables and Grid Connection

There are two potential methods for cable landings, either the buried beach landing or Horizontal Direction Drilling (HDD) through rock. The final location(s) of the cable landfall has not been defined, but an initial study concluded that the most likely option would route Phase 1 (both Phase 1a and Phase 1b) to the Gills Bay area via HDD bores.

A cable landfall selection study has been undertaken and was based on engineering, environmental and planning guidance, a further detailed study through FEED and stakeholder consultation will continue this work.

The offshore cable(s) will come onshore at a cable vault, where the cables will be spliced and will provide access for maintenance; from there the cables are taken to the substation and grid connection point.

3.4.6 Substation location and onshore cable route

The substation location and grid connection is dependent on the decision of landfall location, grid connection point and development constraints such as environmental sensitivities. As previously indicated MeyGen Ltd. is looking to for a single substation location to serve both Phases 1a and 1b. MeyGen Ltd. is also in consultation with Scottish and Southern Energy (SSE) on the location of the substation. An initial study has identified a number of possible locations of low environmental sensitivity which relate to each landfall; a further study and stakeholder consultation to identify more precise locations will be required when the final landfall location is decided.

MeyGen Ltd. will look to bury onshore cables where possible to reduce visual and landscape impacts.

3.5 Construction Phase

The Inner Sound is an area of high tidal flow and impermeable seabed conditions that are not favoured when planning offshore operations. MeyGen Ltd. plan to use tried and tested techniques and equipment to minimise the risks associated with this environment.

Turbine Installation

ARC and TGL have different installation methodologies. ARC uses a Dynamic Positioning vessel (DP) that can safely hold station and work in up to 4 knots (2 m/s). The DP vessel will have an Active Heave Compensated (AHC) crane to conduct the lifting operations.

The TGL 1MW turbine is a floating unit which means it can be towed to site by tugs and then pulled down onto the TSS using winches from the vessels. Both installation methods will be assessed for their suitability for the site by MeyGen Ltd during FEED.

Marine works are likely to be scheduled during the spring, summer and autumn months when conditions are most favourable. Turbine installation is likely to be confined to tidal windows where the tidal flows are lowest and therefore to take advantage of the tidal windows works could be undertaken at any time within a 24 hour period. This ensures that the operations are conducted in the safest manner possible.

Offshore Cable Installation

The installation of the cables will be conducted by dedicated cable installation vessels. Cable installation is less affected by the higher tidal flows as its installation premise is to maintain a forward motion relative to the touch down point of the cable and as such can generally feather itself in the prevailing conditions.

Onshore Works

All onshore works, the export cable, cable vault, substation, and related infrastructure including work in the inter-tidal zone will be completed in line with the marine works. As specified in the relevant sections above, the investigation and selection of locations for all infrastructure will have due regard to a number of factors including the impact on the human and natural environment.

All onshore infrastructure will require temporary construction facilities and access roads; an indicative HDD site is shown in Figure 6. All land used for temporary works will be full reinstated following completion of the construction stage.

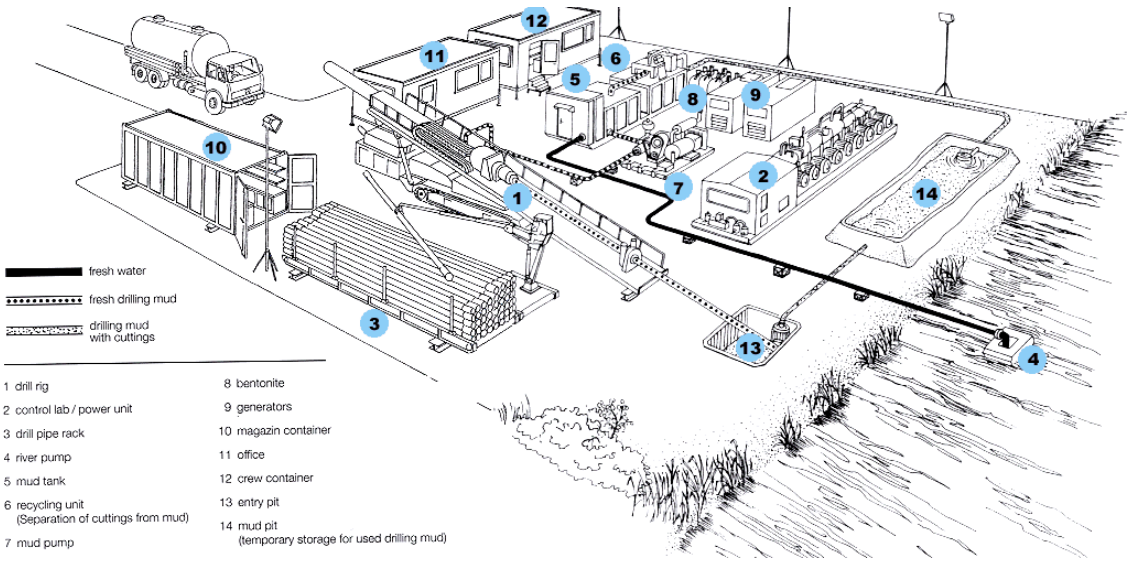

Figure 6 Indicative HDD site during construction phase

3.6 Operation Phase

The Project will have an operational life of 20-25 years. As the size of the project increases the level of operation and maintenance activity will increase.

Turbine Control

The control philosophy for the project is similar to that of currently installed offshore wind farms. Initially the system relies upon being able to control each turbine individually as well as the tidal farm as a whole. The turbine will be controlled by a Supervisory Control and Data Acquisition (SCADA) system. Each turbine will have a number of sensors contained within the nacelle and control signals will be transmitted to the onshore substation. There will be redundancy built into the system with an automatic back-up communication system.

The turbine array has a safety system that is super ordinate to the control system e.g. a safe shutdown in case set safety limits have been reached and/or the control system is incapable of keeping the installation within the normal operating limits. The system also provides safe shutdown features throughout the system in case communication or control is lost.

Maintenance Philosophy

The Project, due to the nature of the phased installation of the turbines will have to have a maintenance strategy for each phase and the required support infrastructure and services will increase over time.

Long-term maintenance of the turbines is likely to require dedicated vessels and a dedicated facility close to the tidal turbine array. Turbine maintenance will be pre-determined and scheduled as an ongoing process throughout the year.

3.7 Decommissioning Phase

The offshore elements of the Project will be decommissioned in line with the Energy Act 2004 for the decommissioning of offshore renewable energy installations. Decommissioning of the turbine array will ultimately be the reverse of the installation procedure. The onshore infrastructure will also be fully decommissioned. The decommissioning programme will ensure that the site is cleared so that environmental impacts are limited.

3.8 Port and Maintenance Facilities

The marine installation and operation and maintenance will require significant port and industrial infrastructure. In terms of facilities throughout the construction period and then for the operational period, the following will be required and is the basis of MeyGen Ltd.'s search for suitable infrastructure in Caithness:

- Marshalling yard; for the delivery and storage of equipment and turbines during construction.
- Operations and Maintenance base/quay; used during the full life of the project as a base for the installation/maintenance vessels with large sheds for maintenance of the turbines.
- Control centre for operations would be integrated into the Operations and Maintenance base and would require a few specialist people to monitor the turbine array.

MeyGen Ltd. has been in close consultation with all the ports and harbours in the vicinity of the Inner Sound, including the closest at Scrabster, Wick and Gills Bay. MeyGen Ltd. will work in conjunction with these harbours to ensure that they can provide the necessary infrastructure for the project. The maintenance facilities are likely to provide employment and business opportunities for the area. All works required to port and maintenance facilities will not be considered in the Scoping report.

3.9 Health and Safety

All operations during each phase of the project will conform to all necessary Health and Safety regulations.

This will include a full Navigational Safety Risk Assessment in accordance with MGN371 (M+F) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues;

All marine activities will be disseminated through the UK Hydrographic Office (UKHO) Maritime Safety Information System and local Notice to Mariners. Lighting, demarcation will be specified by the Northern Lighthouse Board. All installation and maintenance vessels will comply with the International Regulations for Preventing Collision at Sea (COLREGS).

3.10 Environmental Management Plan

MeyGen Ltd. recognises the Inner Sound has a number of environmental sensitivities. MeyGen Ltd. has already taken pro-active steps to understand and model these. MeyGen Ltd. will produce an Environmental Management Plan specific for each phase of the project in conjunction with the competent statutory authority and current best practice.

4 Policy and Legislative Framework

4.1 Energy and Climate Change Policy

The challenges of climate change, energy supply and security of supply are driving policy on renewable energy development. There are now a large number of national and international policies and strategies relating to climate change and the development of renewable energy in Europe, the UK and Scotland. The Project, through contributing up to 398MW installed capacity from tidal energy will therefore make a significant contribution to achieving these targets.

4.1.1 International and EU Policy

The Kyoto protocol commits ratified industrialised countries, by the year 2012, to a collective reduction in greenhouse gas emissions of 5.2% from 1990 levels. Following on from the Kyoto protocol the Copenhagen Accord was produced at the 2009 United Nations Climate Change Conference and supports the continuation of the Kyoto protocol after its expiry in 2012, it is a draft Conference of Parties decision that delegates at the conference agreed to "take note of".

The EU climate and energy package commits to addressing climate change by reducing EU emissions to a level that would limit global temperature increases to 2°C above pre-industrial levels. This will be done by committing to a 20% reduction in greenhouse gas emissions; a 20% improvement in energy efficiency; and deployment of 20% of energy generation from renewable sources, by 2020.

4.1.2 UK and Scottish Policy

At the time of writing the Conservative-Liberal Democrat coalition government is undertaking various reviews of aspects of energy policy, and UK policy is subject to change.

In November 2008 the UK adopted a target for 80% reduction in carbon emissions by 2050 and in December 2008 agreed to a legally binding target of 15% of our energy consumption from renewable energy by 2020. As part of its strategy to reduce carbon emissions, the UK government has also placed an obligation on electricity suppliers to provide 10% of their electricity from renewable sources by 2010, and 15% by 2015.

The *Climate Change (Scotland) Act 2009* commits the Scottish Government to reducing greenhouse gas emissions by 80% by 2050, with an interim target of 42% reductions by 2020. As part of this commitment to reducing emissions the Scottish Government promotes the increased use of renewable energy sources.

The development of renewable energy resources is identified in the Scottish *Climate Change Delivery Plan* as playing a vital role in reducing carbon dioxide emissions, and in the UK Energy Review in maintaining a secure energy supply. The Scottish Government has adopted a target to generate 80% of energy from renewable sources by 2020. This is supported by the consolidated *Scottish Planning* Policy (superseding the national planning guidance note, *SPP6: Renewable Energy*) which includes guidance on renewable energy developments in Scotland by directing each local authority to develop plans for renewable energy development in their area.

The Forum for Renewable Energy Development in Scotland (FREDS) Marine Energy Group (MEG) has recently published a Marine Energy Road Map document (FREDS 2009) which sets out scenarios for a range of possible deployment pathways ranging from a low scenario of 500 MW installed by 2020 to a more aspirational 2,000 MW installed capacity. The Scottish Ministers believe that a thriving

renewables industry in Scotland has the potential to develop new indigenous industries, particularly in rural areas; to provide significant export opportunities and to enhance Scotland's manufacturing capacity. The planning system has a key role in supporting Scotland's economic competitiveness and employment market. The scope for developments to contribute to national or local economic development priorities should be a material consideration when considering policies and decisions.

In its document "*A Partnership for a Better Scotland*", Scottish Executive (2003) confirms that the top priority of the Scottish Executive is to grow Scotland's economy. This includes the start up and growth of Scottish business, encouraging and supporting key manufacturing industries and supporting innovation and technology transfer to grow high value and high skills businesses with the potential for expansion. *Going for green growth: a green jobs strategy for Scotland* (Scottish Executive, 2005), sets out how this priority should be delivered through sustainable economic development.

4.2 Planning Policy and Guidance

This section details the main terrestrial planning policies relevant to the proposed project, and explains the ongoing developments relating to planning in the marine environment.

4.2.1 Terrestrial planning

All onshore works above the Mean Low Water Springs (MLWS) including the infrastructure for the Project will be subject to Town and Country Planning legislation, regulation, policy and guidance.

National Policy

Relevant Scottish policies are set out in the following documents:

- The National Planning Framework (NPF);
- The consolidated Scottish Planning Policy (SPP);
- Planning Advice Notes and Designing Places; and,
- Circulars.

Regional Policy

The Highland Structure Plan 2001

The strategic framework for the use of land and shows the scale and direction of development required to meet the needs of the region up until 2011. The structure plan includes:

- An indication of how international and national obligations affect the area;
- An overall long term development strategy;
- A complementary strategic approach to safeguarding and enhancing the environment;
- Policies and proposals that provide a sound basis for determining planning applications; and,
- Guidance for the preparation of local plans which show specific allocations of land.

The Caithness Local Plan 2002 and Highland Structure Plan 2001

Both the Highland Structure Plan and Caithness Local Plan are dated documents which are due to be replaced in spring 2012 by the Highland Wide Local Development Plan. The Caithness Local Plan translates the policies of the structure plan into more details local planning guidance for the next 10 years. The Highland Structure Plan set out the strategic framework for land use and development over a period of 10 years and beyond.

The Highland Wide Local Development Plan

The Highland Wide Local Development Plan will update and replace the Highland Structure Plan and the Caithness Local Plan which cover strategic policy issues. It is currently in the Proposed Plan stage following the completion of the consultation period on 3rd December 2010. It will set out:

- The spatial strategy and vision for the area;
- Clear policy guidance for development of all types (including reference to Supplementary Guidance where appropriate); and,
- The development principles of key action areas.

Renewable energy has been identified as one of the 22 key policy areas that the plan will address. The development plan is expected to be adopted in spring 2012.

Other local planning guidance to be considered:

- The Highland Renewable Energy Strategy 2006.
- The Highland Coastal Development Strategy 2010.

4.2.2 Marine Planning

In recent years there has been increasing international focus on the concept of marine conservation and marine spatial planning. The main piece of EU legislation is the EU Marine Strategy Framework Directive, which was passed in June 2008.

National Regulations

The Main UK regulations put in place to deliver the Marine Strategy Framework Directive are the UK Marine and Coastal Access Act 2009 and the Marine (Scotland) Act 2010. Both pieces of legislation put in place frameworks for planning within the marine environment. In addition to the development of a more streamlined consenting process for marine projects (see below), the Act includes measures for marine planning and marine conservation;

- Marine Planning – A new statutory marine planning system. Providing a planning regime for the marine environment that links to the terrestrial system. Currently all UK administrations are to agree a UK Marine Policy Statement, which will act as guidance at the highest level for all further marine planning activities. Beneath this there is likely to be a national marine plan for Scotland, prepared by Marine Scotland, the Scottish Government body charged with the implementation of the Marine (Scotland) Act 2010. The National Marine Plan for Scotland was published as a pre-consultation draft in March. This document will be the Statutory Plan for the marine environment. The national plan will inform regional plans (see below) and ultimately planning decisions.

- Marine Conservation - Improved protection for nature conservation, including new powers to establish and mange Marine Protected Areas (MPA). The MPA network is not solely for conservation, there are provisions for designating Demonstration and Research MPA as well as Nature Conservation and Historic MPAs. The development of the MPA network will take account of existing protected areas.

Regional Policy

Currently, no regional marine spatial planning bodies or any regional marine spatial plans exist for Scotland. There have been four pilot marine spatial planning activities under the Scottish Sustainable Marine Environment Imitative (SSMEI), one of which covers the Pentland Firth area.

The Pentland Firth and Orkney Waters Marine Spatial Plan Framework and Regional Locational Guidance for Marine Renewable Energy was published in June 2009. This document provides a route map which sets out the process Marine Scotland will follow to build a non statutory interim Marine Spatial Plan for the Pentland Firth and Orkney Waters.

4.3 Consents and Licensing

The following licenses and consents are required in order to construct and operate an offshore tidal array in Scotland:

- Consent under Section 36 of the Electricity Act 1989 with deemed permission under Section 57 OR separate permission under Section 28 of the Town and Country Planning (Scotland) Act 1997 (for any associated onshore developments)
- Marine Licence under Section 16 of the Marine (Scotland) Act 2010
- Permission under Section 20 of the Water Environment and Water Services (Scotland) Act 2003 (if development is within 3nm of the coast or inland waters and involves activities controlled under this act)

In certain cases European Protected Species Licence under The Conservation (Natural Habitats, & c.) Regulations 1994 may also be required.

Additionally, applicants seeking permission to construct and operate a tidal array in Scotland must:

- Submit and Environmental Statement (ES) as required by the Electricity Works (Environmental Impact Assessment) Regulations 2000;
- Provide sufficient information to enable an Appropriate Assessment, if one is required, to be undertaken under The Conservation (Natural Habitats, & c.) Regulations 1994; and
- Submit a Decommissioning Programme as required under the Energy Act 2004.

The ES submitted to the authorities should include consideration of:

- the outcome of any strategic environmental assessment (SEA), carried out under the Environmental Assessment (Scotland) Act 2005; and
- the potential effects of the project on protected sites, particularly sites designated under The Conservation (Natural Habitats, & c.) Regulations 1994 and the 1971 RAMSAR Convention of Wetlands of International Importance

The applicable legislation to the licenses and consents required for the Project is discussed in further detail in the following sections.

4.3.1 Section 36 Electricity Act 1989

Section 36 of the Electricity Act 1989 requires consent from Scottish ministers to construct, extend or operate an onshore electricity generating station exceeding (or, when extended, will exceed) 50 MW. Section 36 consent is also required for development of offshore generating stations over 50MW in the Scottish Renewable Energy Zone (REZ) and over 1MW within Scottish territorial waters.

As a tidal powered electricity generating station within 12 nautical miles (nm) of land and a capacity of over 1MW the Project will require consent from Scottish Ministers under Section 36 of the Electricity Act 1989.

No overhead lines are planned for the terrestrial cables, and so it is not envisaged that Electricity Act Section 37 consent will be required.

4.3.2 Town and Country Planning (Scotland) Act 1997

For the terrestrial aspects of the project, planning permission under Section 28 of the Town and Country Planning (Scotland) Act will be required. This can either be requested as "deemed planning permission" to be granted by Scottish Ministers with Section 36 consent, or a separate application can be made to the local planning authority (The Highland Council) under Section 57 of the Town and Country Planning (Scotland) Act.

The Planning etc. (Scotland) Act 2006 amends the 1997 act with regard to development planning and management.

For the purposes of this scoping opinion request, it is assumed that the "deemed planning permission" route will be followed, meaning that the onshore consent will be determined by Scottish Ministers. A final decision on the consenting route will be made after further discussion with the Highland Council and Marine Scotland.

4.3.3 Marine Licence

The new marine licensing regime under the Marine (Scotland) Act came into force on 6th April 2011. This regime replaces the requirement for licences under the Food and Environment Protection Act 1985 and the Coastal Protection Act 1949. The new regime is, in effect, an amalgam of these two regimes, whose requirements are briefly summarised below.

Part II Food and Environment Protection Act 1985 (as amended) (FEPA)

Marine Scotland has a statutory duty to control through the issue of licences the deposit or placement of substances or articles and materials that it is proposed to use during construction and the disposal of waste materials at sea or in tidal waters (below the level of Mean High Water Springs, MHWS). This will include the placement of foundations, turbines and associated cables for the Project.

Section 34 Coastal Protection Act 1949 (CPA)

The licensing authority, now Marine Scotland, when considering an application for consent, must weigh up the application against the potential impact on the environment.

Consent from the Scottish Ministers is required for:

- The construction, alteration or improvement of any works on, under or over any part of the seashore lying below the level of MHWS;
- The deposit of any object or material from the seashore below the level of MHWS; and,
- The removal of any object of material from the seashore below the level of MHWS;

if the works, either while being carried out or subsequently, could cause an obstruction or danger to navigation. The application will also consider the impact of the proposal on the local environment.

4.3.4 Water Environment and Water Services (Scotland) Act 2003

Section 20 of the Water Environment and Water Services (Scotland) Act 2003 and the associated Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR Regulations) apply to a development with 3 nm of the highest tide mark. These regulations apply to any activity that:

- Requires abstraction of coastal waters greater than $10m^3$ per day.
- Requires point source discharges to coastal waters greater than $0m^3$ per day.

Engineering works in coastal and transitional waters are not normally regulated by SEPA under CAR. These works will be regulated by Marine Scotland under Marine (Scotland) Act (2010).

4.3.5 Environmental Impact Assessment Regulations

There are two pieces of legislation which require an Environmental Impact Assessment to be conducted. Where an EIA is required, environmental information must be provided by the developer in an Environmental Statement (ES) submitted with the consent and licence application.

European requirements on Environmental Impact Assessment (Council Directive 85/337/EEC as amended by Council Directive 97/11/EEC) are applied for the Electricity Act regime through the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 ('the regulations').

Under the regulations a Section 36 development that is likely to have significant effect on the environment must be subject to EIA and an Environmental Statement (ES) submitted with the Electricity Act consent application.

Under the regulations the Project is a Schedule 2 development for which an ES would have to be submitted if it was likely to have significant environmental effects by virtue of factors such as its nature, size or location. Due to the fact that tidal technology is in the early stages deployment MeyGen Ltd. has decided to voluntarily submit an ES along with their application to the Scottish Ministers, and so the development will be treated as an EIA development. Consequently a Screening Opinion (Regulation 5) will not be required.

The UK-wide Marine Works Regulations came into force on 24th June 2007 transposing the Environmental Impact Assessment Directive (Directive 85/337/EEC) as last amended by Public Participation Directive (Directive 2003/35/EC) for various marine works.

The Marine Works Regulations requires that an EIA is conducted in relation to a regulated activity. In Scotland, regulatory approval under the Marine Works Regulations includes:

- A marine licence, or variation of a marine licence, under Section 16 of the 2010 Act;

Before making an application a Scoping Opinion (Regulation 7) may be sought whereby an application for a formal opinion on the information to be supplied in the ES is made to Scottish Ministers. This Scoping Document is the developers' official request for a Scoping Opinion. The Scoping Document contains the following information:

- A plan sufficient to identify the site which is the subject of the proposed development;
- A brief description of the nature and purpose of the proposed development and of its possible effects on the environment;
- Such further information or representations as the person making the request may wish to provide or make; and,
- A draft outline of the environmental statement, giving an indication of what they consider to be the main issues.

This information is used to consult the appropriate consultative bodies and any other person who, in the opinion of the Scottish Ministers, is likely to be concerned by the proposed development by reason of his specific environmental responsibilities. Based on the consultation responses the Scottish Ministers will issue a scoping opinion to the applicant stating what information should be included in the environmental statement and giving their reasons why. The opinion will be made available to the public via the Planning Authorities.

The Electricity (Applications for Consent) Regulations 1990 are relevant to the publication of notice of application for consent under Section 36. The notice should describe, by reference to a map, the location of the development and indicate where, within the locality of the development, the map maybe inspected.

4.3.6 The Conservation (Natural Habitats, & c.) Amendment (Scotland) Regulations 2007

The European Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) are transposed into Scottish law by the Conservation (Natural Habitats &c) Amendment (Scotland) Regulations 2007. European sites protected under this legislation include Special Protected Areas (SPA), Special Area of Conservation (SAC) and RAMSAR sites. A competent authority, before deciding to undertake or give any consent, permission or other authorisation for, a plan or project which:

- is likely to have a significant effect on a European site in Great Britain (either alone or in combination with other plans or projects), and
- is not directly connected with or necessary to the management of the site,
- shall make an appropriate assessment of the implications for the site in view of that site's conservation objectives.

The need for appropriate assessment extends to plans or projects *out with* the boundary of the site in order to determine their implications for the interests protected *within* the site. Competent authorities need to identify the *qualifying interests* and the *conservation objectives* for each European site involved in an appropriate assessment. There are a number of Natura 2000 sites in proximity to or within the lease area which will be considered during the EIA.

The Crown Estate has conducted an Appropriate Assessment for the Pentland Firth and Orkney waters lease round; as such MeyGen Ltd. would seek to use this to inform any site specific assessment requirements.

Certain species are listed on Annex IV of the Habitats Directive as species of European Community Interest and in need of protection. These include, in Scotland's seas, all cetaceans. Under the Habitats Regulations (through which the Habitats Directive is implemented in the UK), it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale or to deliberately or recklessly kill or injure such an animal.

4.3.7 Energy Act 2004

The decommissioning responsibilities have not been devolved to Scotland and therefore licensing requirements lie with the Department of Energy and Climate Change (DECC) and Section 105-114 Energy Act 2004 Decommissioning Programme. MeyGen Ltd. has to produce a decommissioning programme for the project, produced to a standard set of guidance notes.

4.4 Survey, Deploy and Monitor Policy for Marine Renewables

The Scottish Government's Strategic Environmental Assessment (SEA) on Marine Renewables in 2007 concluded that the deployment of new technology, particularly marine renewable devices, would carry with them a degree of uncertainty regarding the environmental impacts resulting from these types of developments. This issue of uncertain impacts provides 'regulators' and statutory advisors with difficulties when it comes to determining applications.

As a result a 'Survey, Deploy and Monitor Policy' has been developed to enable efficient, sustainable deployment of wave and tidal renewable devices. The policy is a risk based strategy which allows:

- Allow regulators to advise on licensing decisions using risk analysis based on device technology, site sensitivity and size of development.
- Ensures environmental sensitivities are properly taken account of, especially in the case of Natura Sites and European Protected Species.
- Provides developers and regulators with a framework approach to guide monitoring, assessment and licence procedures.

This Policy is not aimed at preventing development within Natura sites but rather at ensuring that development can be permitted in a sustainable way, delivering climate change objectives in a manner that is compatible with the purposes of the site.

5 Description of the Environment

5.1 Introduction

The focus of this chapter is to identify the potential areas of interaction between the development and the surrounding environment.

The main aim of this comprehensive baseline data review is to identify the key environmental sensitivities. Consultees are invited to review the key sensitivities described here, and identify if there are any additional receptors which they feel should be given specific attention in the EIA.

For proposed data sources, including specialist studies and surveys being undertaken by MeyGen Ltd, please refer to Section 7, Table 10. Table 10 also provides a summary of potential environmental impacts caused by the project on the each receptor type, and describes how these will be addressed in the ES.

MeyGen Ltd. have already undertaken a number of surveys to increase the understanding of the site, this includes a geophysical survey of the Inner Sound in September 2009 (iX Survey 2009) and the continuing monthly bird and marine mammal surveys. The geophysical survey successfully detailed the bathymetry and physical conditions of the seabed within the lease option areas and over their immediate surroundings.

The survey consisted of:

- Very high resolution swathe and single beam bathymetry surveys over the site to gain a more detailed understanding of the seabed morphology, relief and bathymetry.
- Sub-bottom surveys to determine the presence and thickness of superficial soils over the bedrock and the near surface dip of the underlying strata.
- Side scan sonar surveys to identify the presence and dimensions of features proud of the seabed elevation such as uncharted cables and pipelines, wrecks, unexploded ordnance and
- Magnetometer to identify potential igneous intrusions.

5.2 Marine Environment

5.2.1 Water Quality and Seabed Contamination

The marine and inshore water quality in Scotland is considered to be generally good. According to Water Framework Directive (WFD) classification the baseline coastal water quality for 2007 showed 48% of bathing waters achieving “excellent” status, with 41% “good” and 11% classified as “poor” (SEPA 2007). The nearest bathing water sites to the proposed development are Dunnet and Thurso, both of which are classified as having excellent water quality (SEPA website, 2009).

Fish farming can cause elevated concentrations of certain compounds and organic enrichment in seawater and seabed sediments. However, there are no shellfish or aquaculture sites near the Inner Sound.

The out of use Gills Bay disposal site is located within the area of the Inner Sound lease area. The site was once used for the disposal of dredge spoil, predominantly sandy material, following

maintenance/capital dredging at the nearby ports of Scrabster and Gills Bay. The high current velocities and scoured rock topography of the region suggests that the spoil is likely to have dispersed rapidly (RPS, 2009a). The geophysical survey confirms that there were no deposits identified relating to the disposal site (iX Survey 2009)

Munitions contamination within the proposed development is considered unlikely. The study area does coincide with the WWII Northern Mine Barrage area between the northern coast of Scotland and the Orkneys / Faeroes. The entire area was comprehensively swept for mines at the end of the war. However, as some mines were fitted with a clock, which after a pre-determined time caused a scuttling charge to be detonated and sink the mine, the possibility that some mines which scuttled themselves are still on the seabed in the region where the barrage coincides with the study area cannot be entirely discounted (Qinetiq, 2007).

The magnetometer survey recorded 16 low level anomalies, none of which were recorded on the multibeam or sidescan sonar, concluding that these contacts were only small anthropogenic debris that had become embedded in the bedrock features (iX Survey 2009).

The Dounreay nuclear site, located approximately 40km by sea from the Project, was responsible for the release of an unknown quantity of nuclear particles between the 1950s and 1970s. These particles have been identified in seabed sediments as far away as Dunnet Beach, approximately 15km to the west of the Inner Sound.

5.2.2 Bathymetry

An initial desk based study concluded that the water depth in the Inner Sound area ranges from 30-50m with the seabed slope angle shallower on the Caithness shore than the Stroma shore where depths of about 20 - 35m are reached within 500m from the shoreline (RPS, 2009a).

Following the geophysical survey the water depths within the area surveyed have been confirmed as varying between 8.9m and 48.6m below lowest astronomical tide (LAT) correct to Gills Bay (iX Survey 2009). The proposed site is situated over the main channel through the Inner Sound where the greatest depths are found and an average depth of between 34-38m (See Figure 7).

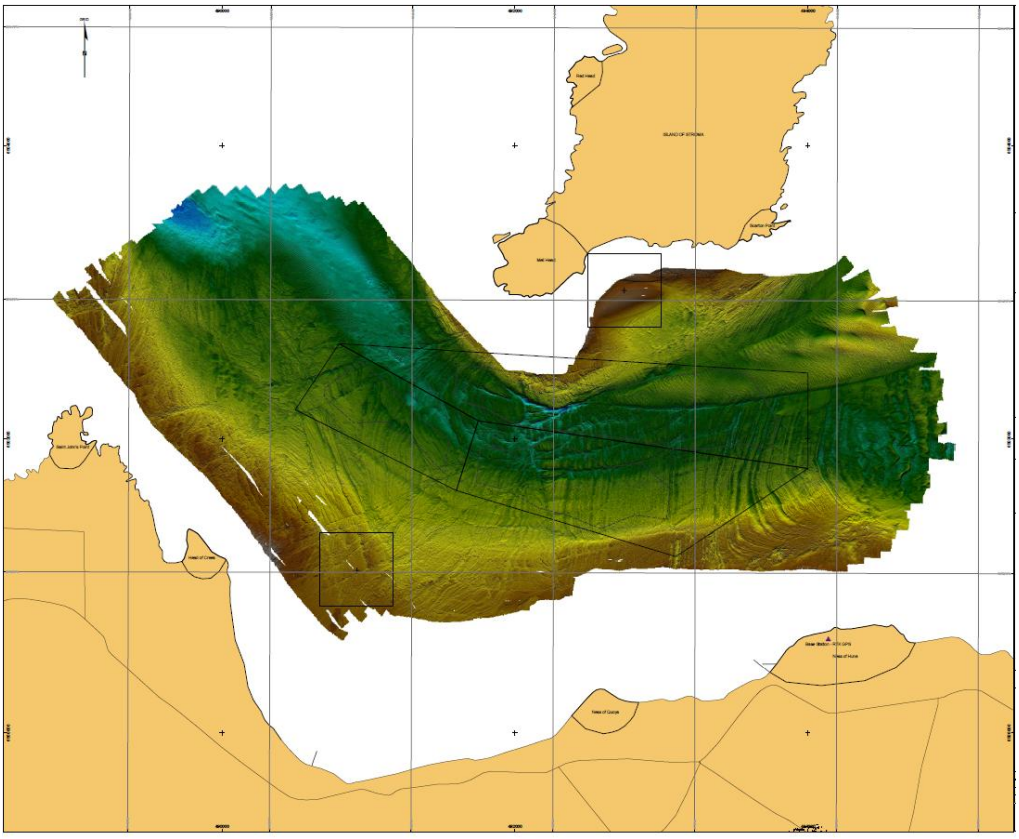

Figure 7 Bathymetry of the Inner Sound (iX Survey 2009)

5.2.3 Seabed Geology and Sediments

The geological strata in the area are from the Devonian Old Red Sandstone Group; cyclic siltstones and sandstones (flagstones) deposited roughly 370 million years ago in a lake environment with each cycle 6-10m thick and a cumulative thickness of approximately 4km (RPS, 2009a). Since deposition the bedrock has undergone uplift and erosion, faulting, intrusion by igneous material and more recently erosion by glacial action (RPS, 2009a).

The bedrock which forms the majority of the site has undergone periods of deformation and the sedimentary beds which make it up have been folded and faulted. The bedding has generally been tilted to the east and has dip angles of 11-16° with a maximum of 37.50; these have eroded to characterise a saw toothed surface to the seafloor of ridges and troughs on north-south alignment (iX Survey 2009).

There are paleo-faults that have created planes of weakness through the bedrock that have been more susceptible to long term erosion and are now marked by fissures in a north northwest and east northeast direction (iX Survey 2009).

Igneous intrusions (dykes) have also been recorded within the array area. These rocks are generally much stronger than the parent rock and more resistant to weathering, they therefore often protrude from the mother rock in a linear fashion. Initial survey data indicates that the bedrock ridges and troughs have slopes of up to 37.5° (iX Survey 2009).

The BGS Quaternary and seabed soils map of Caithness (1987) shows there is an absence of Quaternary deposits and seabed soils over the majority of the Pentland Firth area. This is largely

supported by the results of the geophysical survey. Sediment has mostly been transported away from the area due to high currents although coarse grained sediments (gravel, cobbles and boulders) deposited by glaciers in the Quaternary remain on the seabed being too heavy to be transported. The majority of the site is therefore exposed bedrock, although the project geophysical survey recorded an area of sandbank off the southeast corner of Stroma Island (Figure 8**Error! Reference source not found.**).

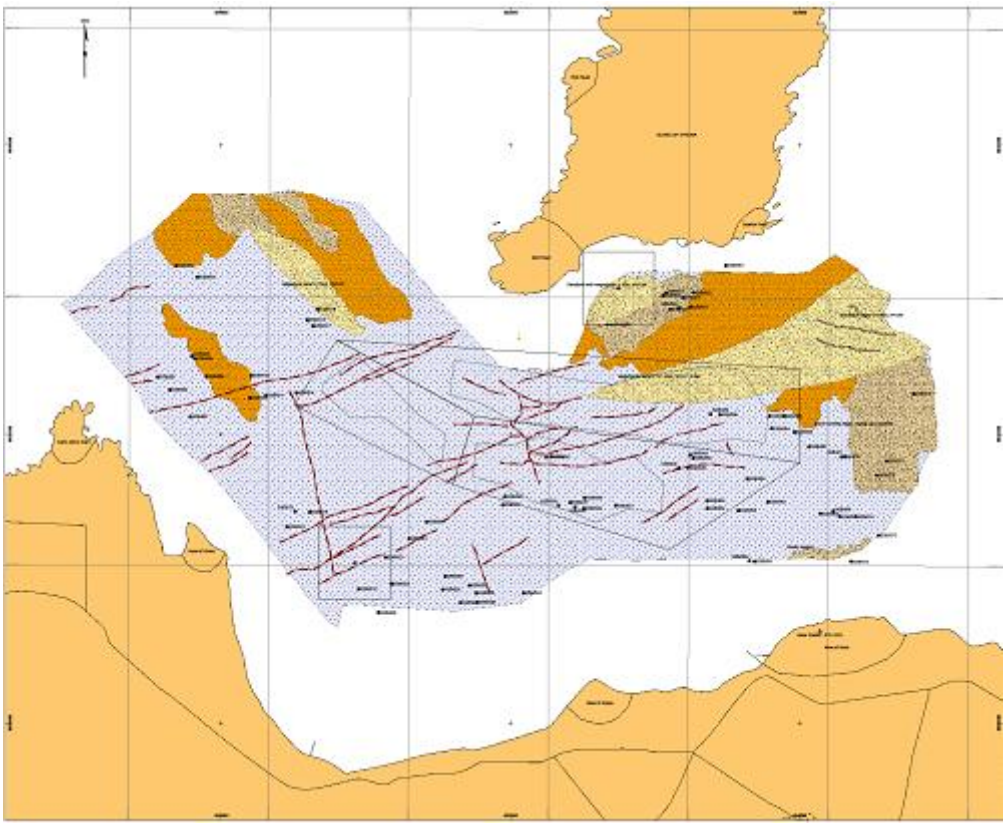

Figure 8 Seabed Composition of the Inner Sound (iX Survey 2009)

5.2.4 Coastal Geomorphology

Coastal geomorphology within the Pentland Firth is closely related to changes in the bedrock, alongside interactions between sea-level change, land uplift and resistance of coastline rocks to erosion.

From Cape Wrath to Duncansby Head the coast is comprised mainly of sea cliffs with pockets of sandy beaches, although these are usually small. In the vicinity of the proposed development there is little evidence of littoral drift or sediment accretion. Beach and cliff erosion is minor, as is longshore drift (BGS, 1996).

The John O'Groats SSSI is located ~1.6km southeast of the Project. The site is located within the intertidal area and is designated due to an exposure of sedimentary rock containing fossilised fish.

5.2.5 Hydrography

The Pentland Firth is characterised by strong tidal currents with widespread and highly energetic tidal races, eddies, overfalls and areas of general turbulence. Peak spring tidal currents in the Outer Sound between

Swona and the Island of Stroma are about 4.5m/s on both the flood and ebb tides. These flows cause an almost continuous tidal race north of the Island of Stroma, referred to as The Swilkie (Scottish Government, 2009a).

The mean maximum height of the tide above chart datum is 4.2m with the mean lowest at 1m above chart datum. The maximum range, which occurs during the equinox, is 7.2m.

The Danish Hydraulic Institute (DHI) has been engaged to undertake the modelling of tidal flows in the area of interest using an in-house software package, MIKE 21.

The Orkney Islands and the Pentland Firth, including the western and south-eastern approaches, were divided in the model by a mesh of varying spatial resolution, with reduced cell dimensions across the Inner Sound. The extent of the model outside the area directly surrounding Stroma Island is dictated by the need to understand the impact of the wider bathymetry and land masses on the development of flows into the Inner Sound.

The flow is currently modelled in two dimensions spatially, and a depth integrated current is used to represent the flow speed in the water column. This configuration is sufficient to model the general flow behaviour without the prohibitively large computational requirements of a three dimensional model with time stepping.

Having established the model mesh, bathymetry and boundary conditions, the model parameters were tuned to obtain agreement with tidal flow data gathered at the site using fixed and vessel mounted ADCPs. The root mean squared (RMS) error between the measured and simulated current speed at a fixed location was found to be typically within 0.15m/s, corresponding to 7% of the range of current speeds and falling well below the 10-20% deviation permitted under the criteria of the UK Foundation for Water Research.

A further campaign of current profiling is now proposed for the Project site to enable future refinement of the flow model. Bottom mounted ADCP devices will be deployed at three locations in the lease area, to gather wave and current data through the water column for a lunar month.

An example of a simulated easterly spring tide is shown in the vector plots in Figure 9.

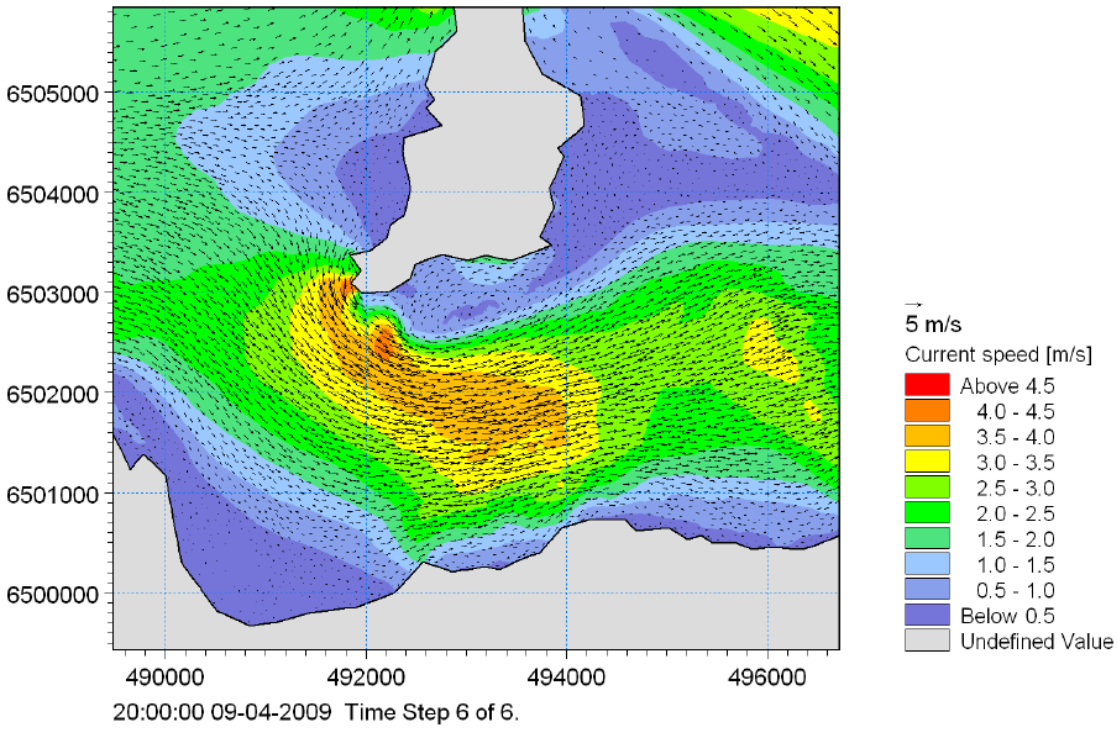

Figure 9 Peak Easterly Spring Tidal Flow

The wave climate in the area is dominated by the passage of low pressure systems from west to east across the North Atlantic. In general terms the highest waves approach the area from westerly directions. Wave periods of 4 seconds are typical of the Pentland Firth. On the northern coast of Scotland, significant wave heights throughout the year are typically within the range of 1.75-2m and 1.25-1.5m within the Pentland Firth (Scottish Government, 2009a).

DHI have estimated the heights of extreme waves based on numerical wave simulations using a spectral wave model MIKE 21 SW. The conditions imposed at two locations A and B, west and east of the Inner Sound respectively, were extracted from DHI's North Sea and Baltic Sea hindcast base covering 29 years of wind and wave data: wind speed averages 15-17m/s (max ~30m/s) and wave heights vary between 0 and 8.5m. At point A to the west the data was compared with wave conditions at the European Marine Energy Centre's (EMEC) wave test site at Billia Croo.

Using a computational mesh the wave conditions were initially propagated and transformed into the area of interest. Then using the hydrodynamic tide model developed by DHI enabled the wave conditions to be propagated into the area of interest with the inclusion of wave-current interactions, the results of which lead to the extraction of maximum waves in the area of interest; an example can be seen in Figure 10.

Mean sea surface temperature throughout the Pentland Firth is 7°C in winter to 12.5°C in summer (BODC, 1998). There is little evidence of thermoclines as there is strong mixing of currents.

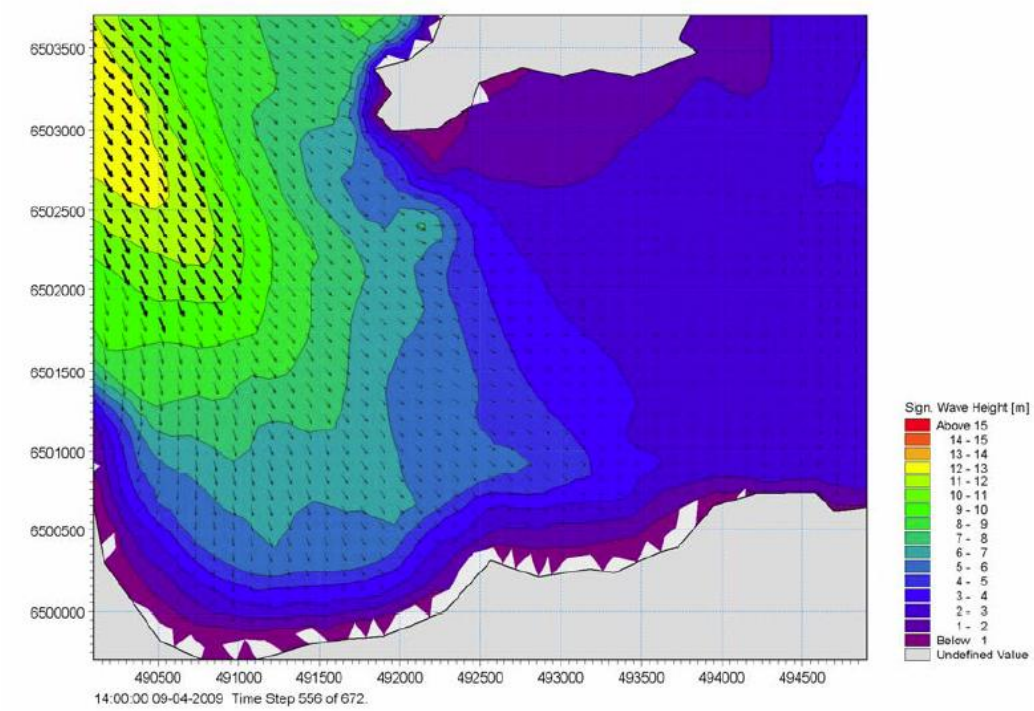

Figure 10 Significant Wave Height and Mean Direction, 1 in 100yr Storm from Westerly Direction with West-going Tide

5.2.6 Meteorology and Climate

The climate in the region is characterised by mild winters, cool summers and persistent winds, under the influence of the North Atlantic Drift (SNH, 2002). The northern coast of Scotland is not exposed to prevailing winds; however, due to the locality, strong winds are quite common.

The closest Meteorological Office (Met Office) weather station to the proposed development is Kirkwall, Orkney. Based on 1971 – 2000 averages, temperatures range between 5.3°C and 10.5°C with, on average, 47 days of sunshine per year. The annual rainfall for Kirkwall is 184 days (Met Office website).

5.2.7 Benthic Ecology

Benthic ecology incorporates the flora and fauna that inhabit the seabed and intertidal area. Protection is afforded to many of these habitats and species through Annexes I and II of the Habitats Directive, with Special Areas of Conservation (SACs) providing the main designation. Whilst there are no SACs designated within the study area, the following species are thought to occur. Blue mussels (*Mytilus edulis*), ross worm (*Sabellaria spinulosa*) and serpulid worm (*Serpula vermicularis*) are considered to occur throughout the study area (Marlin 2009) and isolated areas of horse mussel (*Modiolus modiolus*) are found around Stroma (Highland Council, 2003). Together, these are the main species which form biogenic reef in the UK, described within the Annex I habitat 'Reefs' under the Habitats Directive (JNCC, 2009).

Two SNH commissioned reports have been completed on the benthic species and habitats of the Pentland Firth and Orkney Waters. Moore (2009) and Moore (2010)

Marine Scotland has conducted seabed surveys in the Pentland Firth and Orkney Waters. These include video and still image runs in the Inner Sound. Marine Scotland is in the process of conducting biotope classification from the images. At the time of writing these were not available.

The Pentland Firth is an example of UK BAP Priority Habitat 'tidal rapids'; consisting of sand-scoured bedrock and boulders (Moore 2009 & 2010. However the common, widely distributed species composition and low diversity communities due mainly because of the extremely high tidal environment mean these are of low conservation importance (Moore 2009 & 2010).

There are some sand deposits near to the Inner Sound, notably to the east and west of Stroma. The west of Stroma was surveyed and described as shelly medium sand with no infauna (Moore, 2010).

5.2.8 Fish and Shellfish

Scottish waters are estimated to support 250 fish species, with 166 species of commercial and non-commercial species recorded from the north-eastern coast of Scotland (Barne *et al*., 1996). Of the species present within the study area, herring, common skate, basking shark and native oyster are all listed as UKBAP species, whilst the native oyster, cod and haddock are listed on The World Conservation Union (IUCN) Red List of Threatened Species. However, no protected areas have been designated for finfish or shellfish species within the study area (JNCC, 2009).

The seabed in the Inner Sound is primarily exposed bedrock, with some cobbles and boulders, and as such is unlikely to represent spawning habitat for those species that spawn on the seabed such as herring which require gravel sediment, or sandeels which require sandy sediments. Fairly low resolution data on spawning areas for commercial species exists for the whole of the UK (Coull *et al*., 1998). This data indicates that the study area is within spawning grounds for herring, lemon sole, sandeels and sprat. Of these, only herring and sandeel spawn on the seabed, the rest being pelagic spawners, and as stated above the seabed of the study area does not represent suitable spawning habitat. Nursery grounds for haddock, saithe, lemon sole, sandeel and sprat also overlap with the study area. On sandbanks to the west of Stroma there is little evidence of biota, however infaunal sampling was not conducted so this is not conclusive (Moore 2010). The sandbanks are described as medium to very coarse sands and at depths between 30-70m they fall within the preferred range of Sandeels, as described off Shetland by Wright *et al* (2000), and therefore this cannot be discounted as a potential spawning habitat.

Elasmobranches are also considered likely to be present: the Offshore Energy SEA (DECC, 2009) details several species of dogfish (e.g. lesser-spotted dogfish), shark (e.g. porbeagle), skates (e.g. common skate) and rays (e.g. cuckoo ray) present in the Pentland Firth. Edible crab, velvet crab, and lobster are also likely to be present in the area.

Migration routes for Atlantic salmon are not well understood, although the nearest salmon migration river is believed to be River Thurso which enters the sea at Thurso, ~21 km from the array area. The River Thurso is a designated Special Area of Conservation (SAC) for Atlantic salmon, an Annex II species under the Habitats Directive.

5.2.9 Marine Birds

The study area contains nationally and internationally important seabird populations of a large number of species of seabird. Wild birds are protected under the EC Birds Directive through the establishment of Special Protection Areas (SPAs), for the conservation of breeding, migrating and wintering birds. Scottish Ministers have recently classified marine extensions to a number of coastal SPA sites in Scotland. The North Caithness Cliffs SPA (designated for breeding populations of peregrine

falcon, razorbill, northern fulmar, kittiwake, puffin and guillemot) is one such site, which has been extended such that it overlaps with the Inner Sound lease area. The EIA will therefore need to consider impacts on birds in the site extension, as well as impacts on the coastal SPAs.

The study area is within the Orkney to Shetland Important Bird Area (IBA) (Skov *et al*., 1995). Whilst IBAs are not afforded any statutory protection, they provide a useful indication as to which areas of the UK are important to seabirds. Within the study area, and in addition to the species mentioned above, shag, gannet, great skua, herring gull, great black-backed gull, cormorants, grebes, seaducks and tern are also present at some point during the year. The herring gull is listed as a UKBAP priority species.

Given the importance of the area for seabirds and marine mammals (see section 5.2.10), MeyGen Ltd. has been proactive in starting surveys in the area. MeyGen Ltd. has worked closely with Scottish Natural Heritage (SNH) to develop a site specific survey methodology in the absence of any existing guidance specific to tidal energy developments (RPS 2009b). The methodology was approved by SNH and the monthly surveys began in October 2009. The surveys are being conducted across a 23km^2 area (approximately 15 times the proposed lease area) to provide data on species spatial, temporal and behavioural use of the Inner Sound. A report and analysis of the data collected so far will be available on request from mid-April.

Marine Scotland and SNH are also planning strategic bird surveys across the Pentland Firth and Orkney waters.

5.2.10 Marine Mammals

The study area contains important marine mammal species of national and European significance. Although no SACs are designated for the protection of marine mammals within the study area, 30% (8 out of 26 species) of UK cetacean have regularly been recorded off the north-eastern coast of Scotland since 1980 (Barne *et al*., 1996). The most commonly sighted species in the study area include minke whale (a UKBAP species), white-beaked dolphin and harbour porpoise (Reid *et al*., 2003).

Harbour and grey seals (EC Habitats Directive Annex II and UKBAP species) are also present in the study area, as are otters. Grey seals and harbour seals are the most frequently observed species, both of which can be found on Stroma. For grey seals in particular, the island is an important breeding site with approximately 650 pups born each year (Barne *et al*., 1996).

Otters are known to be present around river mouths along the Caithness coastline, and are likely to be present on the island of Stroma. Otters are a European Protected Species, and a priority species in the Caithness LBAP.

As with seabirds, in order to obtain a comprehensive assessment of marine mammal species in the area, monthly surveys began in October 2009, see section 5.2.9 (2009b). A report and analysis of the data collected so far will be available on request.

5.2.11 Protected Sites and Species

Protected Sites

The coasts and seas around Scotland contain areas designated under a range of national and international legislation in order to protect the biodiversity of Scottish seas and intertidal areas. Annex A details the internationally important Natura sites found in the North of Scotland, Orkney waters and Pentland Firth. At this stage it is deemed necessary to have a wide range of search when considering

conservation areas. At later stages in the EIA process the areas considered will be refined to those where impacts are considered possible and for those where species known to occur in the vicinity of the development are categorised as qualifying features.

Marine birds are also protected under terrestrial designations on the adjacent coastline, and may also be present in the study area. These include black throated diver and red throated diver (see section 5.3.5).

As mentioned above, surveys of seabird distribution adjacent to selected breeding colony SPAs in 2001 resulted in recommendations of seaward extensions for certain species (McSorley *et al*. cited in DECC 2009):

- **Extensions of 1km:** breeding guillemot (*Uria aalge*), razorbill (*Alca torda*) and puffin (*Fratercula Arctica*)
- **Extension of 2km:** gannet (*Morus bassanus*) and fulmar (*Fulmarus glacialis*)
- **Extension of 4km:** Manx shearwater (*Puffinus puffinus*)

The North Caithness Cliffs is one of the SPAs in Scotland which was affected by the proposed extensions. As it is designated for razorbill, fulmars, guillemot and kittiwake, a 2km extension to the current delineation was classified and has been taken into consideration in this report (Figure 11). This has resulted in the entire proposed Project area, being located within the SPA boundary.

Under the Marine (Scotland) Act, Marine Scotland is in the process of establishing Marine Protected Areas (MPAs) for the protection and enhancement of marine biodiversity. MeyGen Ltd will give due consideration to this process.

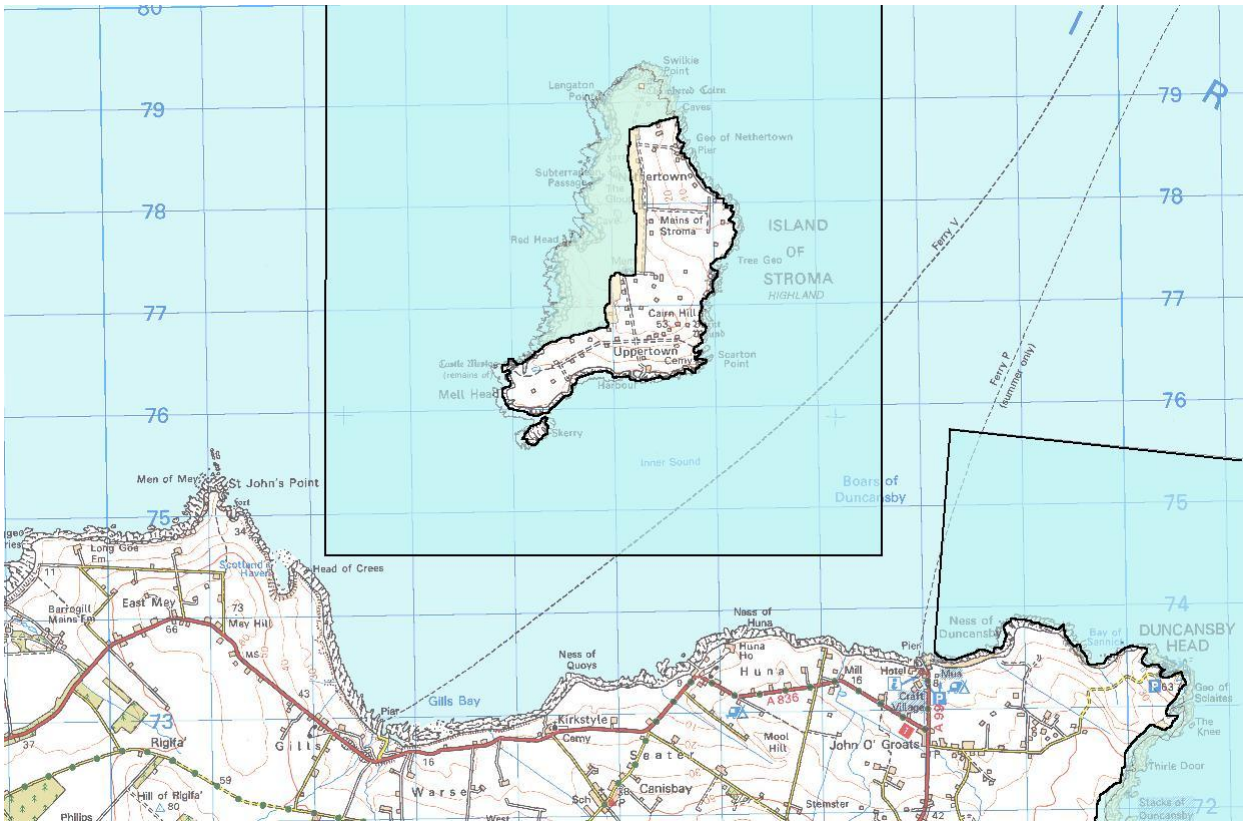

Figure 11 North Caithness Cliffs SPA Extension on Stroma Island and Duncansby Head

Protected Species

Under Annex IV of the Habitats Directive, all cetacean species have been identified as species of European Community interest and are afforded protection as European Protected Species (EPS). All EPSs are also fully protected under the Wildlife and Countryside Act (1981). For any EPS it is an offence to deliberately or recklessly capture, kill, injure or disturb any such animal. The EU Habitats Directive (1992) lists two species in Annex II: bottlenose dolphins and harbour porpoises, and requires that SACs are set up for their protection. Harbour porpoises are present in the study area, although the site is not covered by a formal designation for this species. Bottlenose dolphins from the Moray Firth SAC may occasionally be present within the study area (Scottish Executive, 2007). Otters, grey seal and harbour seal are also listed under Annex II.

The UK Biodiversity Action Plan also offers a level of protection for habitats and species. For many species, actions plans which set out priorities, actions, targets and reporting targets, have been created. Where relevant, the UKBAP has been discussed in the sections above.

Basking sharks, which are listed as 'vulnerable' on the IUCN red list are occasionally seen in the waters off the northern Scottish coastline.

5.2.12 Commercial Fisheries

Commercial fishing is an important coastal industry in Scotland with the Scottish fleet responsible for landing 66% of total UK volume of fish. Key species of commercial importance include mackerel, herring, haddock, cod, whiting, saithe, monkfish, Nephrops, lobster and scallops (Scottish Executive 2007). Scrabster is the nearest major commercial fishing port, located to the west of the proposed

development, reporting landings of 18,200 tonnes (live weight) in 2008 (Scottish Government, 2009b). Approximately 5,000 – 11,000 fishing vessels transit the area per year (Anatec, 2009).

The inshore fleet in the Orkney and Caithness region is made up of small vessels targeting shellfish such as crabs, lobsters, scallops and razorfish (SNH, 2002).

Mariculture is not an active industry in the vicinity of the proposed development, aside from Loch Eriboll, no finfish or shellfish farms are sited on the northern coast of mainland Scotland (Scottish Executive 2007).

Consultation with fishermen for the Pentland Firth Marine Spatial Plan indicated that the area may be used for lobster and brown and velvet crab pot fishing. Is has been verified by MeyGen Ltd consultation with local fishermen would indicate that the only fishing activity which occurs in the Inner Sound is creeling for crab and lobster.

5.2.13 Cultural Heritage

Within the wider Pentland Firth, especially around Orkney, there are a number of coastal Archaeological remains and submerged Archaeology of interest. Within the study area itself, admiralty chart 1954 shows that there is one wreck just off Mell Head, Stroma. This is also apparent from data presented in the Pentland Firth Marine Spatial Plan (Scottish Government, 2009a).

There could be a number of other wrecks in the area which are not marked on admiralty charts; however, the magnetometer survey recorded 16 low level anomalies, none of which were recorded on the multibeam or sidescan sonar, concluding that these contacts were only small anthropogenic debris that had become embedded in the bedrock features (iX Survey 2009).

Under the Marine (Scotland) Act, Marine Scotland is in the process of establishing MPAs some with the purpose of preserving of marine historic assets. MeyGen Ltd will give due consideration to this process.

5.2.14 Ports, Shipping and Navigation

The Pentland Firth is an exceptionally busy sea lane essential to international navigation. The main shipping channel, however, lies to the north of Stroma, between the island and Orkney. Larger cargo vessels and tankers transit the region using this route and so do not pass through the lease area. However, the recommended route for smaller vessels, when approaching the Firth during the south east-going stream, is through the Inner Sound.

Ferries regularly traverse the study area between Orkney and the mainland. The ferry running this route is the High Speed Catamaran (HSC) Pentalina (70m LOA x 20m Beam x 2.2m Draught). There is a ferry port at Gill's Bay that provides a regular service to South Ronaldsay, Orkney, with ferries passing through the proposed array area to the east and west of Stroma.

Initial consultation with local fishermen would indicate that the only fishing activity which occurs in the Inner Sound is creeling for crab and lobster. The fishing vessels are of shallow draught and predominantly active in the shallower areas (<30m).

To the west of the proposed array area is the port of Scrabster which is frequented by fishing vessels, ferries and some cargo vessels. Although the ferries and cargo vessels using the port at Scrabster tend not to transit the site of the proposed array, fishing vessels *en route* to and from North Sea fishing grounds do occasionally transit through this area (Figure 12).

There are two small harbours on the coast of Caithness adjacent to the site of the proposed development. Gills Bay, as mentioned above, is the mainland port used by the Pentland Ferries service to Orkney. A small harbour at John O'Groats operates boat tours and a summer ferry service. Although the Stroma Island is uninhabited there is a small harbour on the southern coast of Stroma which is used for island tour boats and the transport of cattle and sheep that are grazed on the island. Access to these ports will be considered in the EIA.

The MeyGen Ltd. has collated Automatic Identification System (AIS) data in 2008/09 for a 14 day period in summer and in winter (Figure 12). This data confirms the use of the site by Pentland Ferries and also used as a transit route for a small number of fishing vessels drawing up to 8m. These would typically be large pelagic trawlers returning fully laden from fishing grounds.

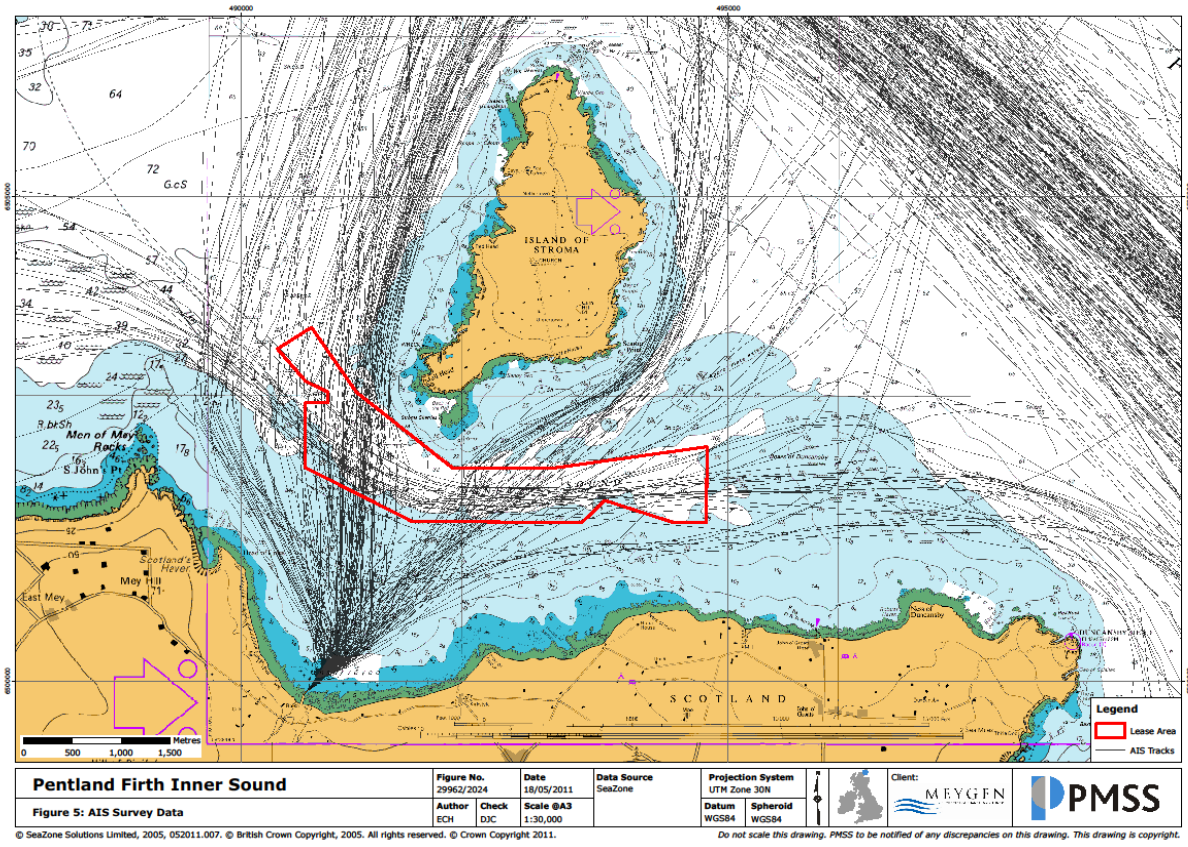

Figure 12 AIS vessel tracks in the Inner Sound

This data was used in an initial study conducted by Abbott Risk Consulting to understand the navigational issues associated with the Project and to aid the project design process (Abbott 2009).

MeyGen Ltd. has conducted a Preliminary Hazards Analysis (PHA) (Annex B) as part of the full Navigational Safety Risk Assessment (NSRA) and is submitted with the EIA Scoping Document for consultation.

5.2.15 Other Users

Recreation and Tourism

The rich and distinctive natural heritage of Caithness is an essential element in the area's tourism industry, which in turn contributes significantly to the area's economy (SNH, 2002).

The area is fringed by dramatic coastal scenery, and home to large colonies of seabirds, while the great diversity of marine life found in the sea provides much of the appeal to the area. Marine and coastal recreational activities within the study area include: boat trips (including to Stroma) to view wildlife and landscapes, sailing, angling, surfing, scuba diving, windsurfing and sea kayaking. There are no Royal Yachting Association (RYA) marinas/yacht havens in the study area and the RYA has not identified the Pentland Firth as a general sailing area. Cruising routes are mostly of light recreational use (Scottish Executive 2007).

Ministry of Defence (MOD) Exercise Area

Military activities occur across a large portion of the Pentland Firth and the study area lies entirely within an existing military practice area. The study area is not however located in an area designated as a "danger area" or a "byelawed" area which have been designated by the MOD as typically marine renewable energy development "no-go areas" (Scottish Executive, 2007).

Disposal Sites

As mentioned in Section 5.2.1 there is one disposal site located within the area of the proposed tidal development, Gills Bay. The site was once used for the disposal of dredge spoil following maintenance/capital dredging at the nearby ports of Scrabster and Gills Bay. The site is not currently active, and Marine Scotland has no record of disposal activity in this area since 2000 (RPS, 2009a). The geophysical survey did not identify any deposits in relations to the disposal site.

Further consultation with Marine Scotland will be undertaken to determine whether there are any plans for disposal at this site in the future and will assess potential conflicts with construction and operation of the Project.

Cables

Based on a review of admiralty charts and Kingfisher Cable Awareness Charts there are no known submarine cables within the proposed development area. Those that have been charted have been included in the GIS system, such as the cables running to and from Dunnet Bay and Murkle Bay.

The region contains exploitable tidal resource and as such may also be considered by others for energy generation, this will require subsea export cables. Any planned developments will be identified through discussions with other developers.

Oil and Gas

There is currently no oil and gas activity (including pipelines) within the study area. The closest oil and gas development is the Flotta terminal on Orkney (19 km to the north of the lease area) and the oil pipeline which connects it to the Piper platform in the west. Due to the importance of international trade of oil in and around Orkney, considerable movements of tanker and supply vessels occur in the area (Scottish Government, 2009a).

5.3 Terrestrial Environment

5.3.1 Air Quality

The study area is in a rural remote area where air quality is likely to be good.

5.3.2 Hydrology

Wick and Thurso can experience flooding when tides are high and rivers running full. There are also problems in parts of Wick, Lybster and Castletown with old and inadequate piped systems. The Highland Council has identified in the Caithness Local Plan (Highland Council, 2002) that potential impacts on flooding must be considered for any new development.

5.3.3 Terrestrial Ecology

The majority of the coastline adjacent to the proposed tidal site comprises beaches, coastal sand dunes and machair habitats (low lying fertile plains covered in species-rich grassland) (Highland Council 2003). Coastal cliffs and heaths also dominate areas of coastline in the region and are important habitats for a variety of bird life and maritime heath and grassland. The rare Scottish primrose and scarce species of eyebright can be found along cliff tops and in short grassland close to the coast (Highland Council 2003).

A large proportion of the land in Caithness (~78%) is used for agriculture and supports mixed farming and crofting. The rearing of cattle and sheep both along the northern coast and on Stroma is common, and contributes to the richness and variety of wildlife seen on agricultural land across the county (Highland Council 2003). As the county holds ~33.5km2 of inland water, species such as Atlantic salmon, water voles, otters and a range of aquatic plants also occur, within the rivers, lochs, peatlands and wetlands of the region.

5.3.4 Terrestrial Birds

Birds present on the northern coast of Scottish are protected by the North Caithness Cliffs SPA, and the Caithness and Sutherland Peatlands SPA and Ramsar site. A large proportion of the North Caithness Cliffs SPA comprises cliffs formed from Old Red Sandstone which provides ideal nesting sites for important populations of seabirds. The Caithness and Sutherland Peatlands SPA and Ramsar site is extensive, covering 143,500 hectares across northern Scotland. One component of the site is located 3.5km from the proposed tidal site at its closest point. The diverse peatland and freshwater habitats which make up the SPA support a wide variety of breeding birds including internationally important populations of raptors, wildfowl and waders.

5.3.5 Protected Sites and Species

In recognition of the biodiversity which is found in North East Scotland, the North East Scotland Biodiversity Group (NESBG) developed a list of priority species (which require conservation action) and species of conservation concern (SOCC) (which require monitoring as they may need conservation action in the future). Of the species identified by the NESBG, Table 2 identifies those which occur within Caithness, and which therefore may be present within the study area.

Conservation status	Species
▪ UK Priority Species	▪ Brown Hare
	▪ European Otter
	▪ Pipistrelle Bat
	▪ Water Vole
▪ UK Species of Conservation Concern	▪ Water Shrew
	▪ Adder
	▪ Palmate Newt
	▪ Common Toad

Table 2 Priority species and species of conservation concern found within Caithness

As discussed in previous sections, the closest island in the Pentland Firth Islands SPA is located approximately 8km from the array, and the North Caithness Cliffs SPA has recently been extended to include the adjacent marine area, and therefore overlaps the lease area. Annex A details the Natura sites found in the North of Scotland, Orkney waters and Pentland Firth. At this stage it is deemed necessary to have a wide range of search when considering conservation areas. At later stages in the EIA process the areas considered will be refined to those where impacts are considered possible and for those where species known to occur in the vicinity of the development are categorised as qualifying features.

5.3.6 Cultural Heritage

Within the study area, there are a large number of cultural heritage sites, both on the island of Stroma and along the coastline adjacent to the tidal development site. These include scheduled ancient monuments (SAMs) protected under the Ancient Monuments and archaeological Areas Act 1979. Pastmap (2009) indicates that there are four SAMs on Stroma, including the fortified sea-stack of Castle Mestag situated near Mell Head. On the mainland, the SAM of St John's Point (the fort and site of St John's Chapel) is also located in the vicinity of the study area, <2km due west of the proposed tidal site.

Further sites of interest include numerous national monuments in addition to several listed buildings of architectural or historic interest which are protected under the Planning (Listed Buildings and Conservation Areas)(Scotland) Act 1997. The Castle of Mey is located on the north coast of Caithness, in the parish of Canisbay, and is the former home of the Queen mother. It represents the most northerly inhabited castle on the British mainland, and is a listed building.

Sites of marine archaeological interest are considered in Section 5.2.13.

5.3.7 Landscape and Seascape

The study area is characterised by gently undulating lowland fringed by precipitous cliffs, shallow bays and sea lochs. There are no National Scenic Areas (NSAs), designated to protect Scottish landscapes in the study area (Scottish Natural Heritage, 2009).

Landscape Character Assessment (LCA) areas identify areas with a distinct composition of inter-related natural, physical, cultural and historical characteristics (Table 3). SNH has mapped 25 LCA areas in Scotland and the following LCAs are found in the vicinity of the study area.

Location	Landscape Character Assessment Area
▪ Stroma	▪ Coastal Island
▪ Caithness	▪ Sweeping Moorland
	▪ Open Intensive Farmland
	▪ Mixed Agricultural and Settlement

Table 3 Caithness Landscape Character Assessment

Based on a review of a series of landscape character assessments commissioned by SNH, The Scottish Marine Renewables Strategic Environmental Assessment (SEA) identified 10 seascape types within the SEA study area. The seascape types associated with the Project area are:

- Low coastal sand and flats
- High cliffs
- Complex indented coastline with offshore islands
- Rugged coastal shelf and headlands with open views to sea

5.3.8 Land Use

The Caithness coastal region within the study area is sparsely populated with most of the population (of around 25,000) concentrated on the coast at Wick and Thurso (Highland Council 2002). Other large villages which act as local centres in the region include Castletown and Halkirk. There is a high proportion of semi-natural vegetation along the Highland coast and many of the remaining villages are traditional crofting communities where crofting and extensive livestock keeping predominate (Highland Council 2002 and Barne *et al*. 1996).

The Island of Stroma has been uninhabited since 1962. It is currently owned by the Simpson family who graze animals there.

5.3.9 Transport and Traffic

North Caithness is a rural area which is sparsely populated. The A836 runs along the northern Caithness coast from John O'Groats at the far eastern extent and passes through Castletown to Thurso to the west. It is linked to Inverness to the south, the first major conurbation, by the A9 followed by the A99 from Thurso and the A99 from John O'Groats. The economy in Caithness relies heavily on road access to and from the south and the Caithness local plan (Highland Council 2002) identifies the need to increase investment in transport to overcome the remoteness of Caithness. The island of Stroma has been unpopulated since 1962, and has no vehicle ferry access.

Rail links are found between Thurso/Wick to Inverness and are important for the economic and social development of the area as well as providing external communications for Caithness and Orkney. The volume of freight transported has increased in recent years, which includes timber, supermarket groceries, pipelines and manufactured goods (Highland Council 2002).

There are regular daily express coaches operating between Wick/Thurso and Inverness and further south to Edinburgh and Glasgow. Locally within Caithness bus services are sparse but provide vital links between the dispersed communities.

There is an airport at Wick which is a significant transport resource providing scheduled flights to a number of destinations in the UK and a limited number to the continent.

The ports in the vicinity of the Project (Section 5.2.14) all have good road access which will be an important for the delivery of infrastructure and operation and maintenance equipment during the lifetime of the project.

5.3.10 Recreation and Tourism

Land based tourism in the vicinity of the proposed development area is largely centred on historical and environmental attractions and is heavily dependent on those features that make the area unique, namely its bird life, coastal scenery and remoteness. The market for specialist wildlife and earth heritage tours by both land and sea has significantly expanded in recent years (SNH, 2002).

Land based recreational activities and tourist attractions include: walking, cycling, bird watching, shore-based cetacean watching and visiting historical sites of interest such as the Castle of Mey.

John O'Groats is the key tourist attraction in Caithness attracting visitors for its position at the "end of the road" as the most north easterly point of Britain's four corners (www.jogroats.co.uk). It is the starting and finishing point for many end to end marathons or fund raising journeys from Lands' End. It has a museum, the famous Last house and a craft village. John O'Groats Ferries operates wildlife cruises and is used by thousands of visitors a year for day trips to the Orkney Islands (www.jogroats.co.uk).

As discussed in Section 5.2.15, tourism contributes significantly to the area's economy.

5.3.11 Economy and Employment

Fishing and agriculture have long been an important part of the economy in Caithness. Whilst they remain important parts of the local economy, most of the employment is now in the service sector, particularly in tourism. As discussed in 3.3.10 tourism contributes significantly to the economy in Caithness with John O'Groats and the Castle of Mey being the principal tourist destinations. Additionally, Caithness has a relatively large manufacturing sector relative to the Highlands and Islands (DTI 2003).

The largest employer in Caithness is Dounreay Site Restoration Limited (DSRL) at the nuclear complex at Dounreay near Thurso (DTI 2003). DSRL is the Site Licence Company (SLC) that manages and operates the site on behalf of the Nuclear Decommissioning Authority (NDA). The Dounreay site has been at the centre of the Caithness economy for more than 50 years and is currently being decommissioned. An economic baseline study undertaken in 2006 estimated that Dounreay supports one in every four jobs in Caithness. The study is currently being updated Although Dounreay is now being decommissioned, approximately 2000 people are employed in this work and it is estimated it brings £70-80 million to the local economy annually (Nuclear Decommissioning Authority, 2009).

As a result of the economic impact of the decommissioning at Dounreay, the Caithness and North Sutherland Regeneration Partnership was created in 2007 to lead the local economy away from its dependence on the nuclear industry. The Partnership consists of Scottish Government, Highlands and Islands Enterprise, Highland Council and the NDA, all working in partnership for the economic regeneration of the Caithness and North Sutherland area (Nuclear Decommissioning Authority 2009). Progress on the agreed objectives has included promoting opportunities for tidal energy generation from the Pentland Firth (Caithness Business Index, 2009).

Within the area there are a number of investments which are being undertaken to move the economy away from a Dounreay dependency which include (but not limited to):

- The expansion of Scrabster Harbour to service the marine renewables industry in the Pentland Firth & Orkney Waters and the oil & gas developments West of Shetland (approximately £20M for phase 1)
- The redevelopment of North Highland College to include a Centre for Energy & Environment and a new engineering skills centre (approximately £13M)
- A project to assist individuals and companies to transition into new employment or business areas (approximately £2.3M)
- A STEM (Science, Technology, Engineering, Mathematics) project to increase the number of young people with STEM skills and enable them to make informed career choices (approximately £100k)

6 Consultation

6.1 Background

There are a number of directives and policies dealing with consultation procedures for large infrastructure projects such as marine renewable energy development. The primary project consent application process includes consultation with key stakeholders and members of the public. MeyGen Ltd. will undertake consultation in accordance with the relevant guidance and policies. In addition to this, MeyGen Ltd. advocates early consultation maintaining full and open communications with stakeholders, and has already commenced discussions with interested parties and stakeholders, as described in Section 6.2 below.

The Public Participation Directive (Directive 2003/35/EC) was issued to provide members of the public in European member states with the opportunity to participate in consenting and ongoing regulation of certain activities within member states. The directive makes specific changes to the way EIA is undertaken, and the EIA Directive has been amended to incorporate these requirements.

Planning Advice Note PAN 81: *Community Engagement - Planning with People* also provides guidance to local authorities and developers when engaging communities through the planning process.

Where an application is made under the Marine (Scotland) Act and the Town and Country Planning (Scotland) Act 1997, statutory consultation will be undertaken in accordance with the relevant regulations as appropriate.

In addition, to legislation and guidance covering public involvement, there are statutory and non-statutory consultees relevant to specific consent and licence applications and defined in the legislation, e.g. for the Electricity Act Section 36 and Marine Licence applications.

6.2 Consultation Process

MeyGen Ltd. made a first visit to the Pentland Firth in April 2006. Since then MeyGen Ltd. has made numerous trips to the area and has held and will continue to hold meetings with local stakeholders, statutory and non-statutory organisation.

MeyGen Ltd. has a stakeholder management plan to outline the strategy for consultation and also keeps a record of all meetings and events held. MeyGen Ltd. intends to continue its consultation with stakeholders and the wider community through a variety of mechanisms, including, but not limited to:

- Face to face meetings with key stakeholders.
- Public events.
- Development of a project specific web pages/website.
- Specific communications / updates with the local Community Council.
- The MeyGen website
- Social networking.
- Use of the local Caithness media.

Public accessibility, openness and a sense of community ownership in the project is regarded as key to MeyGen Ltd. and it will endeavour to maintain its close local working relationships as the project moves on.

6.3 Questions for Stakeholders

This Scoping Document is the latest phase in the ongoing consultation process and will be circulated to key stakeholders, both statutory and non-statutory consultees to inform them of the proposed EIA and invite them to comment. The aim of the consultation on the Scoping Document is to ensure that the scope of the EIA is fit for its purpose to assess the potential environmental impacts of the proposed development.

MeyGen would find it useful if consultees could consider the following questions as part of their response to the Scoping Report:

1. **Has the project identified all regulatory requirements that need to be addressed during the project EIA?**
2. **Does the Scoping Document identify all possible environmental receptor types that need to be considered in the EIA? If not, please identify any additional receptors you feel should be considered.**
3. **Have all possible and likely environmental effects been identified in Table 5? If not, please identify any further effects that you feel should be assessed.**
4. **Does the list of proposal consultees reflect the range of stakeholders that should be considered as consultees for this project? If not, please suggest any additional organisations you feel should be consulted.**
5. **Do you feel that the scope of supporting studies is adequate to inform a**
    a. **A full assessment of the possible environmental impacts? And;**
    b. **Any Appropriate Assessment which may be required?**
6. **Do you have any comments on the proposed data sources listed in Table 5? Please identify any further data sources you think may be relevant and useful.**

6.4 Stakeholders

Table 4 presents the proposed scoping document list of statutory and non statutory consultees.

Organisations	
Government, Regulators and Councils	
Marine Scotland	The Highland Council
Scottish Government Energy Consents Unit	Orkney Islands Council
Scottish Government Ports and Harbours	Marine Planning Partnerships
The Crown Estate	Dunnet and Canisby Community Council
DECC	Scottish Government Planning
Marine Scotland Compliance	
HSE	
Health and Safety Executive	
Navigation and Transport	
Marine and Coastguard Agency	Scrabster Harbour Trust
Northern Lighthouse Board	Wick Harbour Authority
MOD Defence Estates	Gills Bay Harbour Trust
Chamber of Shipping	Pentland Ferries
British Ports Association	John O'Groats Ferries
RNLI	Northlink Ferries
Royal Yachting Association	NATS
Transport Scotland	Marine Safety Forum
The Cruising Association	CAA
Nature Conservation and Archaeology	
SNH (Scottish Natural Heritage)	Rural Scotland
SEPA (Scottish Environmental Protection Agency)	The National Trust for Scotland
Historic Scotland	Caithness Archaeology Trust
JNCC (Joint Nature Conservation Committee)	Sea Mammal Research Unit (SMRU)
Scottish Wildlife Trust	Marine Conservation Society
RSPB	Whale and Dolphin Conservation Society
Scottish Association for Marine Science (SAMS)	Castle of Mey
The Prince's Foundation	Environmental Research Institute
ICIT, Heriot Watt University	Caithness Sea Watching
Commercial Fisheries	
Association of Salmon Fisheries Board (ASFB)	Orkney Fisheries Association
Scottish Fishermen's Federation (SFF)	Orkney Fishermen's Society
Caithness District Salmon Fishery Board	Caithness Sea Angling Association
Association of Scottish Shellfish Growers	Caithness Static Gear Fishermen's Association
Scottish Fisheries Protection Agency	The Salmon Net Fishing Association of Scotland
Scottish Federation of Sea Anglers	Scottish White Fish Producers' Association
Scottish Creelers and Divers	Scottish Salmon Producers Association
Scottish Fisheries Committee	Scottish Pelagic Fishermen's Association

Seafish Industry Authority	Caithness Sea Angling Association
Scottish Fishermen's Organisation	
Industry	
Highlands and Islands Enterprise	Forestry Commission
Caithness Chamber of Commerce	Dounreay Site Restoration Limited
BT (Radio Network Protection Team)	Caithness and North Sutherland Regeneration Partnership
Scottish and Southern Energy	Caithness Chamber of Commerce
Scottish Water	Caithness Horizons
United Kingdom Cable Protection Committee	National Grid
British Marine Aggregate Producers Association	
Recreation Organisations	
Visit Scotland	Scotways
Caithness Diving Club	Scottish Surfing Federation
Scottish Canoe Association	Surfers against Sewage
Scottish Coastal Forum	

Table 4 Project Stakeholders

7 Environmental Impact Assessment

7.1 EIA Process

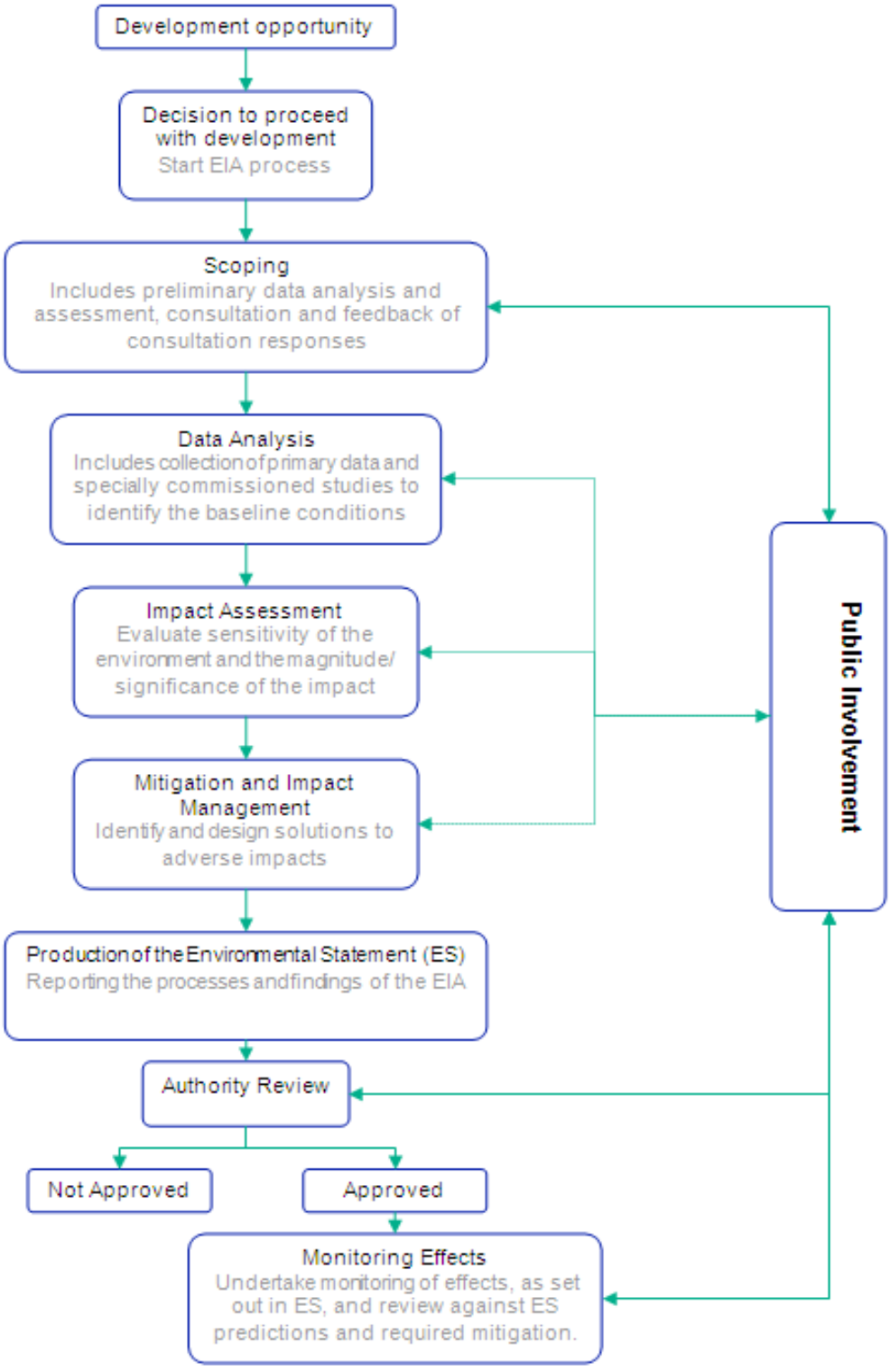

Figure 13 EIA process flowchart

7.2 Geographical Boundaries

The geographical scope of the EIA will include the entire development from the offshore generating array through to substation connecting into the national electricity grid, including marine and terrestrial cables and associated infrastructure both onshore and offshore. The geographical area described in terms of the environmental baseline will be varied according to the area over which there is potential to impact sensitive receptors.

7.3 Assessment Methodology

The environmental effects of Phase 1 of the Project will be predicted for each relevant environmental resource and receptor. Baseline environmental conditions will be compared with conditions anticipated to be experienced during and subsequent to operations.

As part of an integrated approach the impacts to the physical, biological and human environment will be assessed together. After initial examination of the most important impacts and their relevance to the project, each impact will be viewed across the three different aspects of the environment. However, in order to maintain the receptor led approach the impacts will still be discussed under the relevant subject areas. Further discussion of the broader impacts to the entire environment will then take place to ensure an integrated approach is maintained.

7.3.1 Project Phases

The EIA will consider impacts of Phase 1 of the project, including construction, operation and maintenance, and decommissioning.

7.3.2 Identification of Potential Impacts

The scoping exercise plays a role in identification of impacts. The initial overview provides an indication of the type of environment in which the project takes place. Along with the project description it is then possible to make an initial appraisal of potential impacts and their relevance to the project. Comments from consultees will also identify further impacts and be used as a tool to carry out further assessment. In this manner the scoping exercise will examine impacts relevant to the project and their potential to be significant issues, through consideration of the magnitude, severity and temporal and spatial extent of each impact can be identified. The potential impacts associated with the project will be summarised in an ENVID (environmental issues identification) matrix within the EIA.

Following receipt of the Scoping Opinion (Marine Scotland's response to this Scoping Report) the proposed scope of the EIA will be reviewed in light of the content of the Scoping Opinion. Scopes of the proposed surveys and studies will be amended if required.

Data on the baseline environmental conditions, i.e. site characterisation (physical and biological) are available from a number of sources and provide information on the biological and physical properties across the tidal array development area. Additional baseline information will be sourced from the regulatory organisation responsible and through dedicated surveys and studies. Ornithological and marine mammal data is already being collected.

Once data from site characterisation surveys and studies becomes available and the FEED engineering study progresses, the ENVID matrix will be reviewed and updated as required for inclusion in the ES.

It is noted that the determination of potential impacts consistently across different natural and human environment can be difficult. Scientific evidence as well as predictions based on observation of similar activities will be used in the impact assessment process.

7.3.3 Predicting and Evaluating Significance

The prediction of impacts and evaluation of their significance will require expert judgement of relevant specialists working together to systematically examine project activities and their effects on the environment. In addition the process involves quantifying project parameters that are pertinent to impacts, based on the information that is available. Throughout this process and development of the project description, impacts will be reassessed as required in relation to any changes or ongoing development of the Project. Impacts will be quantified using the available baseline data and relevant studies into the magnitude and temporal and spatial extent of each impact in relation to the proposed Inner Sound tidal array.

For each potentially significant impact, the nature of the environmental resource or receptor that is likely to be affected and the magnitude of the impact to it will be considered, together with (where appropriate) the probability of an impact taking place.

7.3.4 Mitigation and Residual Impact Significance

Mitigation measures are the actions or systems that are used, or have been proposed, to manage or reduce the potential negative impacts identified. They may also be used to enhance the positive benefits, especially in relation to social issues.

Mitigation will be an integral part of the project. All of the potential impacts identified from this project are subjected to either standard recognised best practice mitigation measures or to impact specific, feasible and cost effective mitigation. The mitigations measures considered pertinent for each environmental and social issue considered are outlined in the individual technical sections to follow.

As stated in Section 3, MeyGen Ltd proposes to build on the understanding gained from deploying single turbines at EMEC by installing and operating Phase 1 under a 'Survey, Deploy and Monitor strategy'. This will enable real data to be collected on the interaction between a small array of turbines and the environment and help the industry move forward.

7.3.5 Residual Impact Assessment

Any impacts remaining after mitigation measures have been applied are considered residual impacts. The significance level of the residual impacts identified for the proposed development is using the same approach described above.

7.3.6 Cumulative and In-Combination Impacts

The EIA will consider cumulative and in-combination impacts. Cumulative impacts are the combined effects of more than one comparable project (i.e. tidal energy projects) within a region over time. In-combination impacts are the combined effects of the Project and different seabed users within a region over time. In both cases incremental changes caused by past, present or reasonably foreseeable activities in the area, together with the proposed project will be considered. Examples of cumulative or in-combination impacts include:

- Cumulative loss of fishing grounds due to restrictions from the Project and other developments
- Cumulative effects with other developers on water quality
- Recurring loss of habitats in areas that are disturbed over an extended period (cumulative or in-combination)

Impacts that will be considered in this EIA relate to impacts due to the Project and:

- Other tidal energy projects (including Phase 2 of the Project)
- Other seabed users e.g., commercial fishing, wind farms, marine aggregate extraction, oil and gas

The assessment of cumulative impacts has been dependant on the public availability of information on other projects in the planning process. It is generally acknowledged that there are difficulties in assessing cumulative impacts via a single-project EIA. Where appropriate and if available within the timeframe of the EIA, MeyGen Ltd. will reference guidance on the assessment of cumulative impacts being developed by The Crown Estate.

7.4 Scope of the EIA

It is considered that the EIA scope will provide a robust appraisal of the likely significant effects of the project on the environment by:

- Establishing and reviewing the existing environmental conditions within the licence area and surrounding environment
- Identifying and assessing any likely significant environmental impacts associated with the project
- Assisting in the identification of appropriate measures to mitigate any significant adverse impacts

Table 5 presents the potential environmental effects, sources of information, identified information/data gaps and the proposed scope of assessment for each aspect of the environment that may be affected. Information sources and recommendations that have been suggested by consultees have been included, where appropriate. References to strategic studies which are underway, either through the Crown Estate or Marine Scotland or SNH have been listed. The latest publication dates for these studies are not necessarily known, but where these reports will be available within a suitable timeframe to input to the Phase 1 EIA, reference to them and their results will be made.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
A) Marine Physical Environment				
Air and climate	• Emission of gasses such as CO_2, SOx and NOx from vessels during construction O&M and decommissioning will have a localised effect on the atmosphere. • Global contribution to reducing CO_2 emissions.	• ARC	• None proposed	• Vessels will have a very localised impact during the project. Atmospheric emissions from marine vessels will be rapidly dispersed and will not be in close proximity to coastal populations. It is proposed that air quality is scoped out of the EIA.
Hydrography	• Changed tidal regime affecting sediment transfer/movement and coastal processes • Changes in wave refraction behaviour over the array area leading to changes in wave energy distribution, height and direction with impacts on the coast and seabed.	• Scottish Government (2009) Pentland Firth and Orkney Waters Marine Spatial Plan Framework and Regional Locational Guidance for Marine Renewable Energy • British Oceanographic Data Centre (BODC) • UK Hydrographic Office (UKHO) Admiralty Charts and Tidal Stream Atlas • Scottish Executive (2007) Scottish Marine Renewables SEA • Meteorological Office historic data	• iX Survey (2009) Report on the Geophysical Site Survey Stroma including sidescan sonar, multibeam swath bathymetry • Project and site specific modelling of impacts on local hydrodynamics, seabed dynamics and on the coastline (use of 2D model). Scope to be agreed with MS • Coastal processes impact assessment. Scope to be agreed with MS	• Both the regional and site specific baseline environment will be described and used as a basis on which to assess the potential spatial, magnitude, duration and frequency of impacts.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Bathymetry, Seabed Sediments (including sediment contamination), Geology and Geomorphology	• Impacts of installation on geologically and geomorphologically sensitive features • Change to hydrodynamic regime during operation causing alteration to sediment deposition system. • Disturbance of seabed sediments and increase in suspended sediments during construction and decommissioning • Change to hydrodynamic regime during operation causing increase/decrease in suspended sediments • Accidental contamination from operational devices (e.g. leakage of hydraulic fluids, and antifoulants) • Leaching of sacrificial anodes • Accidental discharge from project vessels (e.g. lubricants, fuel) • Disturbance of contaminated sediment	• UK Hydrographic Office (UKHO) Admiralty Charts and Tidal Stream Atlas • BGS seabed sediments and quaternary charts • May & Hansom (2003) Coastal Geomorphology of Great Britain, Geological Conservation Review Series • Scottish Executive (2007) Scottish Marine Renewables SEA • Marine Scotland (Fisheries Research Services (FRS) / Scottish Fisheries Protection Agency (SFPA) / Scottish Government Marine Directorate) • Scottish Environment Protection Agency (SEPA) • Bathymetric surveys of wave and tidal power resource areas in Orkney and the Pentland Firth (Marine Scotland)	• iX Survey (2009) Report on the Geophysical Site Survey, Stroma Geophysical and geotechnical seabed surveys • Hydrodynamic modeling (also see hydrography) • Site specific benthic survey collecting samples using the most appropriate methods for the area / seabed. Survey scope to be approved by SNH • Analysis of any sediment samples for relevant properties • Coastal processes impact assessment. Scope to be agreed with MS	• Both the regional and site specific baseline environment will be described and used as a basis on which to assess the potential spatial, magnitude, duration and frequency of impacts. • Nuclear waste and potential munitions contamination will be addressed as part of the EIA.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
B) Marine Biological Environment				
Benthic and intertidal ecology (and commercially important shellfish)	• Direct disturbance due to placement of gravity foundations and cable installation may lead to a reduction in habitat and species diversity, abundance and biomass • Habitat creation from seabed infrastructure • Displacement of organisms and/or alteration to community structure • Hydrodynamic regime change may cause erosion or deposition of suspended sediment impacting benthic habitat • Accidental contamination from turbine or vessels • Disturbance of contaminated sediments • Decommissioning-removal/restoration of habitat • Small scale discharges to seabed from horizontal directional drilling of cable landfall	• National Biodiversity Network (NBN) Gateway • Marine European Seabed Habitats (MESH) website. • Marine Life Information Network (MarLIN) website • JNCC Natura 2000 Sites (JNCC 2009) • JNCC SeaBedMap2010 • MFA catch statistics for commercially important shellfish species. This will provide a good indication of the type of shellfish species present in the region. • Marine Scotland survey work undertaken in and around the Pentland Firth • Analysis and assessment of marine habitats and species surveyed by Marine Scotland in the Pentland Firth and Orkney Waters (PFOW) (SNH/Colin Moore – various reports) • Monitoring of the fishery in a no take zone established at EMECs wave test site, Billia Croo, Orkney (Marine Scotland and SNH)	• iX Survey (2009) Report on the Geophysical Site Survey Stroma • Site specific benthic survey collecting samples using the most appropriate methods for the area / seabed. Scope to be agreed with MS • Analysis of any sediment samples for relevant properties e.g. macrofauna • Hydrodynamic modelling • Benthic ecology impact assessment	• The assessment of impacts on benthic marine ecology will consider the spatial extent, magnitude, duration and frequency of potential impacts. It will assess effects on specific species, communities and habitats and ecological processes including key predator-prey relationships and food webs. • The assessment will also address the reversibility of the effects (e.g. recolonisation). It will consider the predicted rate and mode of recolonisation, taking into account the initial community structure, natural temporal changes, and local hydrodynamics. • Intertidal ecology is scoped out as there will be no beach landing for the cable. The cable will be directionally drilled to a cable vault onshore • Shellfish to be assessed with benthic species as they have similar ecological characteristics and will be experience similar impacts • There are a number of strategic studies underway which once published will provide valuable input to the Phase 1 EIA

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Fish Ecology	• Physical disturbance by vessel activity (inc. spawning) during installation, maintenance and decommissioning • Risk of collision with operating turbine blades • Direct habitat loss with turbine and cable infrastructure • Habitat creation from seabed infrastructure • Direct impact from change to hydrodynamic regime, sediment deposition and suspended sediments, e.g. benthic spawning habitat and smothering. • Accidental contamination from vessels • Accidental contamination from turbine • Noise during project installation, operation and decommissioning • EMF impacts of electrical cable on electrosensitive species (e.g. elasmobranches) • Disturbance to fish migration routes	• Information on nursery and spawning grounds from the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and Coull et al. (1998). • Joint Nature Conservation Committee (JNCC) Coastal Directory for the region (Barne et al. 1996) • MFA catch statistics. This will provide a good indication of the type of species present in the region. • Technical reports on fish and shellfish from SEA 4 and the Offshore Energy SEA. • Information from the Scottish Marine Renewables SEA • Review of migratory routes and behaviours of Atlantic Salmon, sea trout and European eel in Scotland's coastal environment; implications for the development of marine renewables (Marine Scotland) • Literature review of the effects of EMF and noise arising from marine renewables developments on Atlantic Salmon, sea trout and European eel (Marine Scotland)	• Desk based fish ecology impact assessment • Acoustic monitoring and collision event analysis from monitoring of tidal turbines at EMEC, in particular in relation to basking sharks)	• The importance of the site and the surrounding area for fish populations, including spawning or nursery grounds, will be assessed giving consideration to the spatial extent, magnitude, duration and frequency of any impacts. • Impacts on migratory species such as salmon and trout will be investigated, including consideration of potential impacts on protected sites and the need for Appropriate Assessment. • The likely effect on the populations of key species (including species of conservation importance) will be addressed in the context of the wider study area, including the reversibility of the effects/recovery of populations in the area. • The EIA desk study will investigate the need for any operational monitoring requirements • There are a number of strategic studies underway which once published will provide valuable input to the Phase 1 EIA

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Marine Mammals	• Physical presence and vessel noise during construction, maintenance and decommissioning may cause disturbance or displacement. • Physical presence and operational noise of turbine may cause disturbance or displacement, including potential barrier effect. • Risk of collision with operating turbine blades • Accidental contamination from vessels • Accidental contamination from turbine • Direct impact from change to hydrodynamic regime, e.g. suspended sediment • Disturbance, displacement and loss of habitat for Otters with cable installation. • Indirect impacts from change to benthic habitat and species	• Data from the Sea Mammal Research Unit (SCANS-II) (Small Cetaceans in the European Atlantic and North Sea) • Atlas of cetacean distribution in north-west European waters (Reid et al. 2003) • UK Digital Marine Atlas (BODC 1998) • Scottish Executive (2007) Scottish Marine Renewables SEA and technical report • Deliberate disturbance of marine European protected species guidance (JNCC 2008) • Technical reports on marine mammals from SEA 4, Offshore Energy SEA • UKBAP list • JNCC Natura 2000 sites (JNCC 2009) • Review and distribution of harbour and grey seals in the Pentland Firth and Orkney (SNH/SMRU) • Review of abundance and distribution of basking sharks and cetaceans in PFOW (SNH/HEBOG) • Estimating collision risk between harbour porpoise and marine renewable energy devices (Marine Scotland/SAMS) • Acoustic outputs of tidal turbines and marine mammal responses (SNH & SEPA/SAMS)	• RPS (2009c) Marine mammal desk study. Stroma Sound – Inner Pentland Firth • Site specific marine mammal surveys to be carried out over a 2 year period. The survey methodology has been agreed with SNH. Visual observations supplemented by towed hydrophones • Site specific marine noise baseline measurements. Scope of work to be agreed with MS /SNH • Site specific collision risk analysis • Acoustic monitoring and collision event analysis from monitoring of tidal turbines at EMEC • Marine mammal impact assessment	• The assessment of impacts on marine mammals will consider the species that occur in the study area and its importance to those species, in particular protected species • Data collected will need to be sufficient to inform Appropriate Assessment required to assess impacts on protected habitats and species • Information gained during monitoring of the Atlantis and TGL activities at EMEC will be used to inform the assessment in terms of likely interactions between marine mammals and the device • There are a number of strategic studies underway which once published will provide valuable input to the Phase 1 EIA • Any requirement for European Protected Species (EPS) Licence will be assessed

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Marine Birds	• Collision risk (diving birds) • Physical disturbance during installation, maintenance and decommissioning (breeding, loafing) • Physical presence and operational noise of turbine may cause disturbance or displacement, (Breeding, feeding, loafing) • Increase in available food (potential recovery of fish stocks) • Indirect impacts from change to benthic habitat and species • Direct impact from change to hydrodynamic regime, e.g. suspended sediment	• JNCC Seabird 2000 project • Marine Scotland commissioned seabird surveys of the PFOW (APEM) • RSPB • Wetland Bird Survey data (WeBS) • Seabird vulnerability in UK waters (JNCC 1999) • Technical report on Seabirds from SEA 4, Offshore Energy SEA and Scottish Marine Renewables SEA • SPA Natura 2000 sites (JNCC) • Locations of Important Bird Areas (Skov et al. 1995) • JNCC Coastal Directory for the region (Barne et al. 1996) • UKBAP list • European Seabirds at Sea (ESAS) database, accessed through the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) • Review of techniques to detect seabird presence and movement below the sea surface and determine potential application in the vicinity of tidal turbines (SNH/RPS) • Assessment methodology for determining cumulative impacts of marine renewable energy devices on marine birds (SNH/RPS) •	• RPS (2009d) Ornithological desk study. Stroma Sound – Inner Pentland Firth • Site specific bird surveys to be carried out over a 2 year period. The survey methodology has been agreed with SNH. Visual observations supplemented by bird tagging • Site specific collision risk analysis • Acoustic monitoring and collision event analysis from monitoring of tidal turbines at EMEC • Ornithological impact assessment	• The assessment of impacts on seabirds will consider the species that occur in the study area and the importance of any concentrations, their feeding behaviour, and prey species. This will determine whether Inner Sound is likely to constitute a regionally important area and whether the project is likely to have an impact on seabirds • Data collected will need to be sufficient to inform Appropriate Assessment required to assess impacts on protected habitats and species • Significant coastal bird populations in the vicinity of the site will be identified • There are a number of strategic studies underway which once published will provide valuable input to the Phase 1 EIA

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
D) Marine Human Environment				
Commercial Fisheries	• Disruption caused by physical presence of installation, operation and decommissioning vessels. • Physical exclusion of fishing vessels from tidal array area. • Loss or damage to fishing gear on turbines and cables. • Exclusion from fishing grounds both during installation and operation may result in 'squeeze effects' on adjacent fishing areas (increased fishing pressures). • Indirect impact of changes to fish/shellfish distribution. • Impacts on fish/shellfish stocks through direct mortality or disruption of spawning, nursery areas and migratory routes.	• Marine Scotland publications and landing statistics • Marine and Fisheries Agency publications and landing statistics • Consultation with fishing organisations • SEA4 technical reports • Monitoring of the fishery in a no take zone established at EMEC's wave test site, Billia Croo, Orkney (EMEC) • Fisheries Liaison meetings organized by The Crown Estate • Potential Cumulative Navigational Risk Assessment for the PFOW (under development)	• Local working knowledge of the region as a fishing resource. • Desk based fisheries impact assessment study • TCE PFOW fishing vessel activity surveys • Project specific Preliminary Hazard Analysis (PHA) and Navigational Safety Risk Assessment (NSRA) will include consideration of fishing vessels. Scope to be agreed with MCA • Marine Scotland PFOW fisheries economic study	• The assessment will identify the species present within the study area that are commercially important and targeted by fishermen, including the quantities landed. It will also assess the likely impact on the populations and distribution of these species. • The assessment will identify the importance of the site and surrounding area as a spawning or nursery area for commercially important species. • The assessment will identify, as far as possible, the vessels that use the proposed array area, the proportion of their fishing effort located within the affected area, the value of landings taken from the area (including seasonal changes) and the ports where these fish and shellfish are landed.
Cultural Heritage	• Loss/damage to known and previously unrecorded wrecks, artefacts and historic environment features due to turbine and cable installation • Hydrodynamic change causing damage to archaeological features • Alteration in archaeological value of the region • Impacts on submerged landscapes	• UKHO Admiralty Charts and wrecks database • Maritime and Coastguard Agency (MCA) protected wrecks databases • Historic Scotland • Regional and local historic environment information resources	• iX Survey (2009) Report on the Geophysical Site Survey Stroma • Marine archaeology desk based impact assessment (including review of geophysical survey data)	• The environmental assessment will follow guidance provided by Scottish Historic Environment Policy • If any are present the assessment will consider impacts on wreck sites designated under the Protection of Wrecks Act 1973

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Ports, Shipping and Navigation	• Greater traffic density during installation, operation and decommissioning, increase collision risk, especially during installation • Greater traffic density, potential to displace smaller vessels into higher density traffic area and potentially into higher energy environments (Outer Sound) • Reduced under-keel clearance, increased collision risk with submerged turbine • Reduced under-keel clearance, displacement of vessels into higher density routes • Increased fuel consumption and CO2 emissions from alternative routes • Reduced access to local ports and harbours	• UKHO Admiralty charts • Maritime and Coastguard Agency (MCA) guidelines and reports • Automatic Identification System (AIS) data • Anatec shipping density data • Fisheries Liaison meetings organized by The Crown Estate • Potential Cumulative Navigational Risk Assessment for TCE PFOW (under development)	• Site specific Preliminary Hazard Analysis (Annex B) followed by Navigation Safety Risk Assessment (NSRA). Scope agreed with MCA	• The location and intensity of shipping in the area will be described. • Consideration will be given to the impacts of the presence of the array on ports, shipping and navigation especially given proximity to the Pentland Firth. • Initial consultation already been undertaken during preparation of the PHA
Recreation and Tourism	• Navigational safety impacts on recreational yachting • Navigational safety impacts on tourist boat/wildlife tours • Accidental contamination of recreational beaches from vessels and turbine • Increase/decrease in tourism potential of local area	• RYA Coastal Atlas • Consultation with local recreation organisations • Dive guides/site directories showing dive sites in the area. • SEA4 technical reports • Potential Cumulative Navigational Risk Assessment for TCE PFOW (under development)	• Socio economic impact assessment	• The cultural and economic importance of the largely undisturbed coastline will be taken into account when assessing the proposed development in the EIA.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Other Sea users Disposal Sites / Cables / Pipelines / Oil & Gas installations / MoD	• Project installation may cause damage to sub-sea cables • Operational noise impacts on MoD equipment • Unexploded ordnance may be encountered during project installation • Prevention of access to sites (e.g. disposal sites, ports, Stroma island) • Potential interaction with other renewable energy developments in the area	• Kingfisher Cable Awareness Charts • UK Deal Data • UKHO Admiralty and Practice and Exercise Area Charts • OSPAR Publications • SEA4 technical reports • Consultation with MOD • Consultation with Marine Scotland • Consultation with other developers in the region • Pentland Firth, Marine Spatial Plan (Scottish Government, 2009a) • Scottish Marine Renewables SEA (Scottish Government 2007)	• Site specific Preliminary Hazard Analysis (PHA) followed by Navigation Safety Risk Assessment (NSRA). Scope agreed with MCA • Socio economic impact assessment	• The baseline environment in terms of other sea users will be described, and potential interactions between the Project and existing and planned use of the marine environment in the region will be assessed. • Consultation will be carried out with stakeholders where relevant, such as discussions with the MoD to determine the extent of any possible interactions. • There are no pipelines or oil and gas installations within the array area and so the impacts will not be further assessed in the EIA.
E) Terrestrial Environment				
Terrestrial Habitats	• Direct disturbance during installation and decommissioning of cables, substation, and related infrastructure • Habitat loss and displacement associated with substation and grid connection • Accidental contamination of land or watercourses during construction	• Caithness Local Biodiversity Action Plan (Highland Council 2003) • Scottish Natural Heritage designated site data • Data from local Biological Records Centre	• Extended Phase I habitat survey • Subsequent NVC surveys (if required) • Terrestrial ecology impact assessment	• As part of the EIA, more detailed assessment will be undertaken to identify the ecological constraints present at the proposed cable landing sites and any necessary mitigation needed to minimise impacts of the project. Further to the desktop studies, an extended Phase I habitat survey will also be undertaken to identify habitats and protected species.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Hydrology, hydrogeology, geology	• Increase in silt and sediment loads resulting from construction works. • Pollution from construction equipment to watercourses • Flood risk associated with construction of hardstandings • Alteration to hydrological regime and water quality	• Caithness Local Plan (Highland Council 2002) • Consultation with SEPA • SEPA groundwater vulnerability map of Scotland (2003) • SEPA aquifer map of Scotland (2004) • SEPA river basin management plans	• Hydrology, hydrogeology and geology impact assessment (including site visit)	• The ES will include a full description of all water crossings • Impacts on watercourses, lochs, groundwater, other water feature and sensitive receptors, such as water supplies will be assessed. It will also include details of waste management proposals. • Potential implications with regards to the CAR Regulations assessed • Flood risk assessments will be undertaken if necessary.
Terrestrial birds	• Physical and noise disturbance during installation, maintenance and decommissioning (breeding, loafing) • Displacement of birds (Breeding, feeding, loafing) • Exclusion from feeding and breeding areas • Increase in available food (potential recovery of fish stocks)	• RSPB • JNCC Seabird 2000 project • Wetland Bird Survey data (WeBS) • Locations of Important Bird Areas (Skov et al. 1995) • JNCC Coastal Directory for the region (Barne et al. 1996) • UKBAP list (UKBAP 2007) • Data from local Biological Records Centre	• RPS (2009d) Ornithological desk study. Stroma Sound – Inner Pentland Firth • Once locations of onshore infrastructure defined, consideration given to the need for bird surveys • Terrestrial ecology impact assessment	• The potential for impacts on terrestrial birds is reduced by the fact that no overhead lines are planned as part of the project. • The EIA will determine the location of sensitive species such as breeding birds and identify potential impacts of project construction and operation, as well as mitigation measures, as appropriate. • The assessment of impacts on birds will consider the species that occur in the study area and the importance of any concentrations, their feeding behaviour, and prey species. • Any significant coastal bird populations in the vicinity of the site will be identified.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Mammals	• Disturbance or displacement of mammals during installation of cables and construction of cable vault and substation • Loss of mammal habitat	• Caithness Local Biodiversity Action Plan (Highland Council 2003) • Scottish Natural Heritage designated site data • Data from local Biological Records Centre	• Extended Phase I habitat survey • Subsequent protected species surveys (if required) • Terrestrial ecology impact assessment	• As part of the EIA, more detailed assessment will be undertaken to identify sensitive mammal species present at the proposed cable landing sites and any necessary mitigation needed to minimise impacts of the project. Further to the desktop studies, extended Phase I habitat survey will also be undertaken to identify habitats and protected species. • Any requirement for European Protected Species (EPS) Licence assessed
Amphibians and reptiles	• Disturbance or displacement of amphibians and reptiles during installation of cables and construction of cable vault and substation • Loss of amphibian / reptile habitat	• Caithness Local Biodiversity Action Plan (Highland Council 2003)	• Extended Phase I habitat survey • Subsequent protected species surveys (if required) • Terrestrial ecology impact assessment	• As part of the EIA, more detailed assessment will be undertaken to identify sensitive amphibian and reptile species present at the proposed cable landing sites and any necessary mitigation needed to minimise impacts of the project. Further to the desktop studies, Extended Phase I habitat survey will also be undertaken to identify habitats and protected species. • Any requirement for European Protected Species (EPS) Licence assessed

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Cultural Heritage	• Loss/damage to coastal historic environment features and sites • Negative impacts on built heritage • Alteration in archaeological value of the region	• Historic Scotland • Regional and local historic environment information resources • Aerial photography • Analysis of historical maps	• Terrestrial archaeology desk study and impact assessment • Walkover survey	• A comprehensive description of known archaeological sites and monuments will be detailed as part of the EIA in order to determine the potential impacts resulting from the proposed development on cultural heritage in the area. A site-specific desk-based study by a suitably qualified archaeologist will be used to inform the baseline description and the impact assessment. • The environmental assessment will follow guidance provided by Scottish Historic Environment Policy. • If any are present, the assessment will consider impacts on designated historic sites.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Landscape / Seascape	• Positive / negative impact on scenic value of region • Change to landscape character	• Scottish Natural Heritage • Scottish Executive (2007) Scottish Marine Renewables SEA and technical report • Caithness Local Plan (Highland Council 2002) • Highland Wide Local Development Plan • Highland Council Coastal Development Strategy	• Landscape and Visual Impact Assessment (LVIA) from viewpoints that are identified as particularly sensitive	• An assessment of potential impacts of the development on the landscape resource and visual amenity of the study area will be undertaken in the EIA. This assessment will include a description of the key components, features and characteristics that make up the various landscape types found across the site and within the wider study area. The assessment will be undertaken in accordance with the Guidance of Landscape and Visual Assessment (GLVIA). • The affects of the introduction of the proposed development on the perception of the landscape types and wider character of the study area will be reported in the Environmental Statement. Additionally, the more subtle effects on the overall pattern of elements that together determine the landscape character and regional/local distinctiveness will be included. • Consideration will be given to impacts during the cable landfall drilling and onshore infrastructure construction
Traffic and Transport	• Disturbance to transport routes during installation • Increased road traffic during installation and construction • Increased road traffic for maintenance operations	• Department for Transport	• Baseline traffic counts • Traffic assessment	• The impact assessment will be carried out in accordance with guidance from the Department for Transport (DfT) • The assessment will consider impacts on other route users, road safety and dwellings in the region.

Aspect of Environment	Potential Environmental Effects	Information Source	Specialist Studies / Surveys	Comments
Recreation and Tourism	• Accidental contamination of recreational beaches • Increase/decrease in tourism potential • Disturbance to tourist activities (boat/wildlife tours)	• SNH (Scottish Natural Heritage) (2002). Natural Heritage Futures - Orkney and Northern Caithness • Consultation with local recreation organisations	• Socio economic impact assessment	• Baseline conditions for land based recreation and tourism will be described in the ES and their importance assessed within the EIA. • Consideration will be given to impacts during the cable landfall drilling and onshore infrastructure construction
Population, economy and employment	• Positive impact on economy and employment. Creation of local employment opportunities and creation of work for local businesses. • Population retention in the region.	• DTI (Department of Trade and Industry) (2003) The Potential Socio-Economic Implications of Licensing the SEA 4 Area. • Caithness Local Plan 2002 • Nuclear Decommissioning Authority • Caithness and North Sutherland Action Plan • Caithness and North Sutherland Regeneration Partnership Programme	• Socio economic impact assessment	• The ES will include an assessment of socio-economic issues in order to quantify the potential positive effects on the local economy. • Consideration will be given to impacts during the cable landfall drilling and onshore infrastructure construction
F) Potential Cumulative & In-combination Impacts				
All receptors	• Potential for the Project to act in combination with other development in the area to increase the magnitude of impacts on relevant receptors	• Consultation with other developers • Available ESs for nearby developments • The Crown Estate commissioned work to identify the types of impacts that will require consideration from a cumulative and in combination perspective	• As identified for specific receptors	• Other tidal energy developments have the potential to cause very similar impacts to those created by the Project. This means that the potential for cumulative impacts to occur is where sites are adjacent to one another.

Table 5 Potential Environmental Effects and Data Sources

7.5 Environmental Statement Table of Contents

The proposed structure for the Environmental Statement (ES), with a description of each section, is provided below.

PART I INTRODUCTION

Development background – Background to the project and developer, need for the project, scope and structure of the report, report contributors and any significant data gaps.

Planning policy and consents framework – this section will provide an overview of the relevant planning legislation, policy and guidance that the EIA needs to take account of.

Site selection process – description of the site selection process, the main alternatives studied and the main reasons for the choice of this site, taking into account environmental issues.

Project description – details of the site and a description of the proposed project. This will include details of the size, layout and design and associated onshore / offshore infrastructure. This chapter will also outline the construction and installation, operation and maintenance and decommissioning of the project.

Environmental overview – high level environmental overview with detail in the impact chapters.

PART II ENVIRONMENTAL IMPACT ASSESSMENT

Environmental Impact Assessment Methodology

Scoping and Consultation

Impact chapters – a separate chapter will be written for each of the key topic areas. The exact chapter structure will be developed following receipt of the Scoping Opinion and finalisation of the EIA scope.

Each impact chapter will be structured in the following manner:

- Introduction;
- Legislative framework and regulatory context;
- Assessment methodology for the topic, including a summary of relevant consultation, data sources, and means of defining the topic study area. Should there be any data gaps identified when compiling the required information, this will be noted;
- Description of existing baseline conditions;
- Assessment of the nature, magnitude, duration and significance of the likely effects of the construction, installation, operation and maintenance and decommissioning of the proposed project;
- Intended mitigation and monitoring measures;
- Residual effect following mitigation; and

- Potential cumulative effects.

PART III CONCLUSIONS AND COMMITMENTS

Environmental management plan

Environmental monitoring plan

Summary and conclusions

References

Appendices

8 References

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ANNEX A. Conservation Designations

Site name	SPA	SAC	RAMSAR	Area (Ha)	Distance from Project site (km)	Qualifying feature(s) / Interest(s) SPAs: Birds Directive Article 4 SACs: EC Habitats Directive Article 3
North of Scotland and Pentland Firth						
North Caithness Cliffs	✓			14621.14	0	Under Article 4.1 Regularly supporting populations of European importance of peregrine *Falco peregrinus* Under Article 4.2 Regularly supporting populations of European importance of migratory common guillemot *Uria aalge* Regularly supporting in excess of 20,000 individual seabirds
Caithness and Sutherlands Peatlands	✓			14,358.7	3.9	Under Article 4.1 Nationally important populations of Black-throated Diver *Gavia arctica*, Golden Eagle *Aquila chrysaetos*, Golden Plover *Pluvialis apricaria*, Hen harrier *Circus cyaneus*, Merlin *Falco columbarius*, Red throated diver *Gavia stellata*, short eared owl *Asio flammenus* and wood sandpiper *Taringa glareola* Under Article 4.2 Populations of European importance during the breeding season of Common scoter *Melantita nigra*, Dunlin *Calidris alpine schinzii*, greenshank *Tringa nebularia* and wigeon *Ana penelope*.
Caithness Lochs	✓		✓	13,78.45	5.4	Under Article 4.1 Winter populations of whooper swan *Cygnus cygnus* and Greenland White fronted Goose *Anser albifrons* Under Article 4.2 Winter populations of migratory greylag goose *Anser anser*

Site name	SPA	SAC	RAMSAR	Area (Ha)	Distance from Project site (km)	Qualifying feature(s) / Interest(s) SPAs: Birds Directive Article 4 SACs: EC Habitats Directive Article 3
Pentland Firth Islands	✓			170.51	8.6	Under Article 4.1 Regularly supporting a nationally important breeding population of Arctic tern *Sterna paradisaea*
Switha	✓			57.39	13.8	Under Article 4.1 Regularly supporting an internationally important wintering population of Greenland barnacle goose *Branta leucopsis*
East Caithness Cliffs	✓			11,690.92	26.5	Under Article 4.1 Populations of European importance of peregrine *Falco peregrinus* Under Article 4.2 Supporting populations of European importance of migratory species: common guillemot *Uria aalge*, razorbill *Alca torda*, herring gull *Larus argentatus*, black-legged kittiwake *Rissa tridactyla* and European shag *Phalacrocorax aristotelis* Regularly supports in excess of 20,000 individual seabirds
North Sutherland coastal islands	✓			221.11	68.1	Under Article 4.1 regularly supporting an internationally important wintering population of Greenland barnacle geese *Branta leucopsis*
Loch of Wester		✓		69.66	15.3	Naturally nutrient rich lakes or lochs which are often dominated by pondweed
Thurso River		✓		355.58	22.5	Atlantic salmon *Salmo salar*
Loch Watten		✓		428.35	20.9	Naturally nutrient rich lakes or lochs which are often dominated by pondweed
Broubster Leans		✓		172.76	32.2	Very wet mires often identified by an unstable ‘quaking surface’
Strathy Point		✓		203.58	49.6	Vegetated sea cliffs
Berriedale and Langwell Waters		✓		57.62	58.0	Atlantic salmon *Salmo salar*

Site name	SPA	SAC	RAMSAR	Area (Ha)	Distance from Project site (km)	Qualifying feature(s) / Interest(s) SPAs: Birds Directive Article 4 SACs: EC Habitats Directive Article 3
River Borgie		✓		32.7	65.2	• Otter *Lutra lutra* • Freshwater pearl mussel *Margaritifera margaritifera* • Atlantic salmon *Salmo salar*
Moray Firth		✓		151,347.17	67.9	• Subtidal sandbanks • Bottle nose dolphin *Tursiops truncatus*
Lairg and Strathbora lochs		✓		286.3	73.0	Under Article 4.1 Supporting a population of European importance of black throated diver *Gavia arctica*
Invernaver		✓		294.54	75.0	• Base rich fens • Alpine and subalpine heaths • Alpine and subalpine calcareous grasslands • Coastal and dune heathland • Dunes with juniper thickets • Dunes with creeping willow • Dune grassland • Shifting dunes with marram
River Naver		✓		1066.66	76.6	• Atlantic salmon *Salmo salar* • Freshwater pearl mussel *Margaritifera margaritifera*
Orkney						
Hoy	✓	✓		949907	13.6	Under Article 4.1 Regularly supporting populations of European importance of Peregrine *Falco peregrinus* and Red-throated diver *Gavia stellata* Under Article 4.2 Regularly supporting populations of European importance of great skua *Stercorarius skua*

Site name	SPA	SAC	RAMSAR	Area (Ha)	Distance from Project site (km)	Qualifying feature(s) / Interest(s) SPAs: Birds Directive Article 4 SACs: EC Habitats Directive Article 3
						Regularly supports in excess of 20,000 individual seabirds SAC: • Seacliffs • Standing fresh water • Heath bog
Orkney mainland moors	✓			5342.9	29.1	Under Article 4.1 Regularly supporting populations of European importance of hen harrier *Circus cyaneus*, red throated diver *Gavia stellata* and short eared owl *Asio flammeus*
Copinsay	✓			125.42	32.8	Under Article 4.2 Regularly supports in excess of 20,000 individual seabirds
Marwick Head	✓			8.7	47.5	Under Article 4.2 Regularly supporting populations of European importance of migratory species common guillemot *Uria aalge* Regularly supports in excess of 20,000 individual seabirds
Auskerry	✓			101.97	51.2	Under Article 4.1 Regularly supporting populations of international importance of Arctic tern *Sterna paradisaea* Storm petrel *Hydrobates pelgicus*
Rousay	✓			633.41	51.2	Under Article 4.1 Regularly supporting a population of European importance of Arctic tern *Sterna paradisaea* Under Article 4.2 Regularly supports in excess of 20,000 individual seabirds
West Westray	✓			350.62	65.3	Under Article 4.1

Site name	SPA	SAC	RAMSAR	Area (Ha)	Distance from Project site (km)	Qualifying feature(s) / Interest(s) SPAs: Birds Directive Article 4 SACs: EC Habitats Directive Article 3
						Regularly supporting a population of European importance of Arctic tern *Sterna paradisaea* Under Article 4.2 Regularly supporting populations of European importance of migratory species common guillemot *Uria aalge* Regularly supports in excess of 20,000 individual seabirds
Papa Westray	✓			245.71	78.2	Under Article 4.1 Regularly supporting a population of European importance of Arctic tern *Sterna paradisaea* Under Article 4.2 Regularly supporting breeding aggregations of International importance of Arctic skua *Stercorarius skua*
Calf of Eday	✓			238.03	64.1	Under Article 4.2 Regularly supports in excess of 20,000 individual seabirds
East Sanday Coast	✓			1515.23	70.1	Under Article 4.2 Regularly supporting in winter internationally important populations of migratory species purple sandpiper *Calidris maritime* and turnstone *Arenaria interpres*
Sule skerry and Sule Stack	✓			18.9	81.2	Under Article 4.1 Regularly supporting populations of European importance of Leach's storm petrel *Oceanodroma leucorhoa* and Storm petrel *Hydrobates pelagicus*
Loch of Stenness		✓		791.87	34.4	Coastal lagoons
Stromness heaths and coasts		✓		635.78	35.4	Sea cliffs and heathland

Site name	SPA	SAC	RAMSAR	Area (Ha)	Distance from Project site (km)	Qualifying feature(s) / Interest(s) SPAs: Birds Directive Article 4 SACs: EC Habitats Directive Article 3
Faray and Holm of Faray		✓		785.68	61.1	Grey seal *Halichoerus grypus*
Sanday		✓		10971.65	70.0	• Reefs • Harbour seal *Phoca vitulina*
Loch of Isbister		✓		105.0	46.8	• Very wet mires often identified by an unstable 'quaking' surface • Otter *Lutra lutra* • Naturally nutrient rich lakes or lochs which are often dominated by pondweed

ANNEX B. Preliminary Hazards Analysis

PMSS

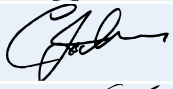
MeyGen Ltd

Pentland Firth Inner Sound
Preliminary Hazard Analysis

MeyGen Ltd

Pentland Firth, Inner Sound - Preliminary Hazard Analysis

Document Control

Responsible for	Job Title	Name	Date	Signature
Content	Marine Safety Consultant	David Cantello	2011-05-10	
Checked	[Function]	[Name]	2011-05-19	
Approval	Director of QHSE	Nick Chivers	2011-05-19	
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Signatures in this approval box have checked this document in line with the requirements of QP16

Record of Changes

Revision Number	Date	Page Number	Description	Approved
A	2011-05-11	All	First Draft	
B				
C				
D				
E				
F				
G				
0	2011-05-19		Released	
1				
2				
3				
4				
5				
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Distribution List

#	Function Title	Company	Name (optional)
1	Consents Manager	MeyGen Ltd	Ed Rollings
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1	DTI (DECC) DTI/pub 8145/0.5k/12/05/NP November 2005.	Guidance on the Assessment of the Impact of Offshore Wind Farms – Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms.
2	Admiralty Sailing Directions NP53	North Coast of Scotland Pilot, Sixth Edition, 2006
3	Admiralty Tidal Stream Atlas NP209	Orkney and Shetland Islands
4	Admiralty Tide Tables NP201	Vol.1 UK and Ireland
5	RYA UK Coastal Atlas of Recreational Boating 2005	Recreational Cruising Routes, Sailing and Racing Areas around the UK Coast
6	The Diver Guide to Scotland Vol. II	Dive North West Scotland by Gordon Ridley
7	Maritime and Coastguard Agency's (MCA) Marine General Notice MGN 371 (M+F)	Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues
8	IALA Recommendation O-139	IALA Recommendation O-139 On The Marking of Man-Made Offshore Structures Edition 1 December 2008

Abbreviations

AHC	Active Heave Compensation
AIS	Automatic Identification System.
ARC	Atlantis Resources Corporation
AtN	Aid to Navigation
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea, 1972 (as amended)
DP	Dynamic Positioning
DTI	Department of Trade and Industry
EMEC	European Marine Energy Centre
FEED	Front End Engineering Design
FMEA	Failure Modes and Effects Analysis
FMECA	Failure Modes, Effects and Criticality Analysis
GBS	Gravity based Structure
GLA	General Lighthouse Authority
HAT	Highest Astronomical Tide.
HAZOP	Hazard and Operability (Study)
MCA	Maritime & Coastguard Agency
MHWN	Mean High Water Neaps.
MHWS	Mean High Water Springs.
MLWN	Mean Low Water Neaps.
MLWS	Mean Low Water Springs.
MSL	Mean Sea Level.
NLB	Northern Lighthouse Board
NM	Notice to Mariners.
nm	(International) Nautical Mile. (1,852 metres)
NSRA	Navigational Safety Risk Assessment
OFTO	Offshore Transmission Owner
OREI	Offshore Renewable Energy Installation
PEXA	Practice Exercise Area
PHA	Preliminary Hazard Analysis
PMSS	Project Management Support Services

			Ltd
IALA	International Association of Lighthouse Authorities	RNLI	Royal National Lifeboat Institution
IMO	International Maritime Organisation	RYA	Royal Yachting Association
kn	knot	TGL	Tidal Generation Ltd
LAT	Lowest Astronomical Tide.	TSS	Tidal Support Structure
LOA	Length Overall (of a vessel)	UKC	Under-keel Clearance
m	Metre		

1. Background

1.1. Introduction

MeyGen Limited is a standalone company formed for the sole purpose of financing, developing, constructing and operating the MeyGen project. The company was formed by Atlantis Resources Corporation (ARC), International Power Marine Developments (IPMD) Limited and Morgan Stanley Capital Group Incorporated in order to develop the site allocated by The Crown Estate (TCE) in the Inner Sound of the Pentland Firth.

The MeyGen project (the "Project") is a 398MW tidal stream power array. It will be two different tidal turbine devices developed by ARC and Tidal Generation Limited (TGL) respectively. The Project will consist of an estimated 398 1MW turbines located in roughly 3.5km^2 of the Inner Sound of the Pentland Firth off the north coast of Scotland between Caithness on the Scottish mainland and the island of Stroma. The electricity generated from the Project will be exported onshore for transmission to the National Grid.

MeyGen Ltd. proposes to deploy the Project in a series of phases (Table 1). Phase 1 will comprise an initial Phase 1a deployment of 20 turbines (20MW), followed by a subsequent Phase 1b which will deploy a further 65 turbines (65MW). Utilizing a 'survey, deploy and monitor strategy', the initial array will provide information on the interactions between the array and the environment, increasing the knowledge for subsequent phases. Phase 2 will comprise the build out of the remainder of the Project and will be subject to a separate consent application. The planned operational life of the array is 20-25 years.

Phase	Phase Capacity (MW)	Total Capacity (MW)	Installation Date
1a	20	20	2013/14
1b	65	85	2015
2a	150	240	2016-18
2b	163	398	2019-20

Table 1 Project Timescales

1.2. Purpose

The purpose of this PHA report is to identify the major hazards presented by Phase 1 only of the Project and to recommend the appropriate tools and methodology for the assessment of the consequent risks to be used in the subsequent Navigational Safety Risk Assessment. As such it complies with the requirements of the DECC (DTI) Guidance on the Assessment of the Impact of Offshore Wind Farms – Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms (Reference 1).

1.3. Scope

The scope of the PHA covers the identification of the hazards to shipping and other marine activities presented by the installation, operation, maintenance and decommissioning of Phase 1 and to recommend tools and methodologies, appropriate to the scale and nature of the proposed installation, to be used in the assessment of the risks to navigational safety. It does not, at this stage attempt to estimate the risks arising from those hazards or to propose control measures as that is the purpose of the subsequent NSRA.

1.4. Stakeholders

Marine organisations and individuals whose safety of navigation could be affected by the establishment of the Project have been identified. A number of meetings have taken place between MeyGen Ltd and navigation stakeholders including the MCA, Pentland Ferries and fishing groups; however, a full stakeholder consultation exercise has not been undertaken for the PHA phase of this proposed development. Full consultation will, therefore, be required as the initial part of the NSRA process which will include meetings with stakeholders to discuss and understand the impact of the proposed installation and the hazards presented.

2. Description of the Marine Environment

2.1. General

The source of much of the data in the following section is derived from:

- Admiralty Charts 2162 and 2581
- Admiralty Sailing Directions NP 52 – The North Coast of Scotland Pilot (Reference 2);
- Admiralty Tidal Stream Atlas NP 209 – Orkney and Shetland Islands (Reference 3);
- Admiralty Tide Tables NP 201 – Vol. 1 UK and Ireland (Reference 4);
- SeaZone Hydrospatial data.

The Pentland Firth separates the Orkney Islands from the Scottish Mainland. The island of Stroma divides the Firth into two passages. The Outer Sound between Stroma and Swona is 2.5nm wide and is the principal route through the firth and is the route recommended for large vessels. The Inner Sound is about 1.25nm wide and is used, with local knowledge, mainly by slow or smaller vessels. Its use is not recommended by larger vessels at any time.

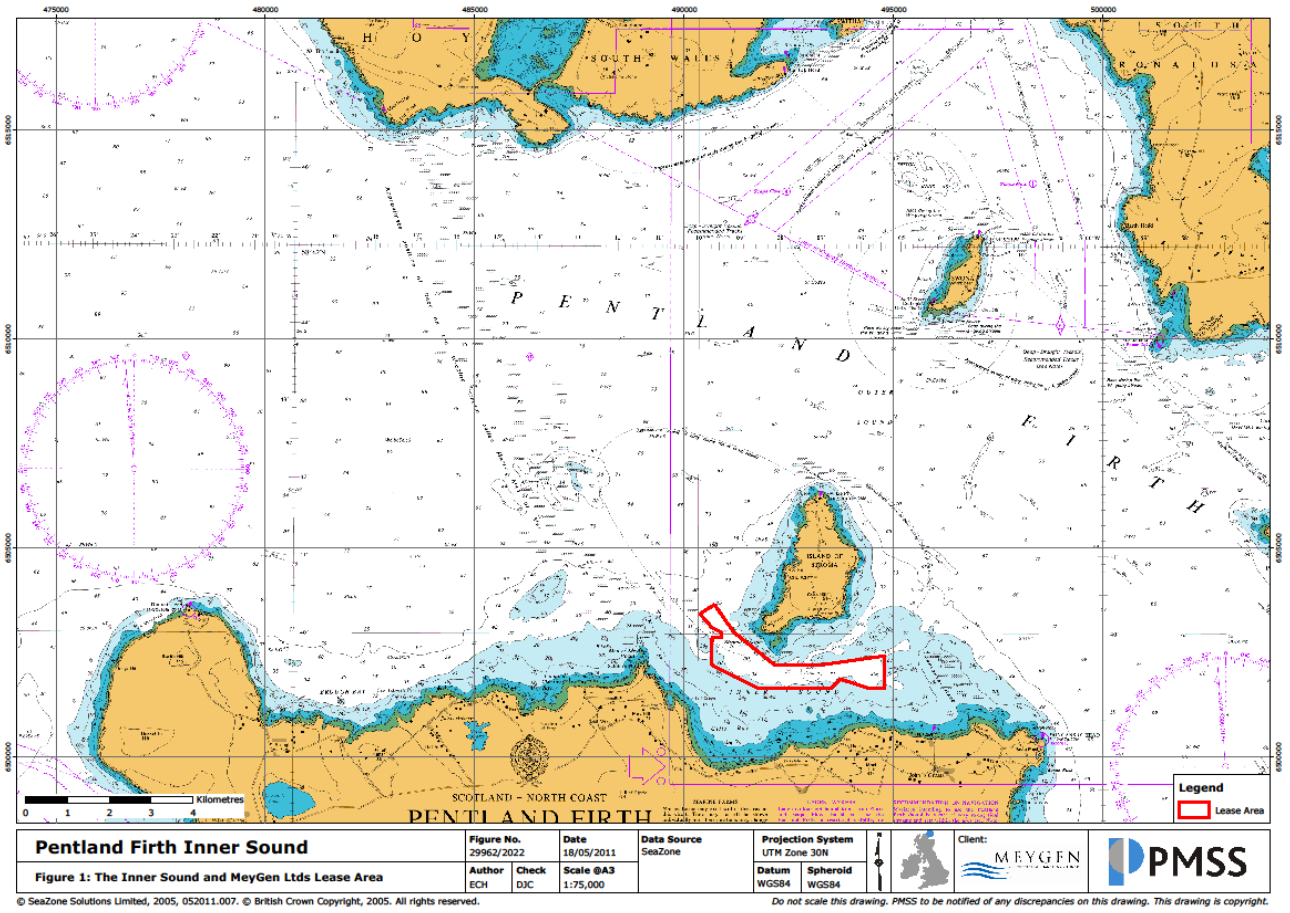

Figure 1 The Inner Sound and MeyGen Ltd's Lease Area

2.2. Harbours and Terminals

The main harbours within the Pentland Firth comprise the following:

- Scapa Flow
- Scrabster harbour;
- John o'Groats harbour;
- Gills Bay Ferry Terminal.

In the vicinity of the lease area in the Inner Sound are the following harbours/anchorages:

- An anchorage, a small harbour (The Haven) and a pier on the south of Stroma.

2.3. Wrecks

Admiralty Chart 2581 shows a number of wrecks which are dangerous to navigation, the closest of which lies to the north of the lease area, to the east of Stroma. In addition, there are a number of known wrecks in the Inner Sound, the positions of which are provided by SeaZone hydrospatial data but which are not marked on the chart as they do not constitute a hazard to shipping due to their position or condition. However, these may present a hazard to subsea infrastructure installation operations.

2.4. Subsea Cables

There are no subsea power or utility cables (e.g. telephone cables) marked on the chart in the vicinity of the proposed site. Further investigation is recommended to confirm the absence of utility cables from the island of Stroma to the mainland as any existing cabling will be a hazard during the installation phase of the Project

2.5. Spoil Ground

There is a spoil ground site currently within the lease area of approximate diameter 0.27 nm. This spoil ground is licensed by Marine Scotland and is currently active although it has not been used in recent years. MeyGen Ltd has entered discussions with Marine Scotland to look at alternative locations for the spoil ground.

2.6. Skerries

The Stroma Skerries (an area of rock formations) is located to the south east of the island of Stroma in the immediate vicinity north of the proposed lease area.

2.7. Tidal Stream

Tidal stream rates in the Pentland Firth are some of the highest in the world and, where they encounter obstructions, give rise to eddies and races which can be very strong and extremely violent. The south easterly going tidal stream achieves a rate of 9kn close off Pentland Skerries whilst rates up to 12kn have been reported. The north west-going stream achieves 8kn. Tidal streams in the Inner Sound attain a spring rate of 5kn.

Races form off the Stroma Skerries in both the east and west going tidal streams in the vicinity of the lease area. The western extent of the development area lies within the extent of the tidal eddy in the west going stream.

2.8. Tidal Height

Tidal height data is provided below at Tables 2 and 3 for Gills Bay and Stroma. As can be seen, there is notable disparity between these locations caused by local effects.

	LAT	MLWS	MLWN	MSL	MHWN	MHWS	HAT
Standard Port – (WICK)	0.0	+1.4	+2.0	+2.0	+2.8	+3.5	+4.0
Secondary Port Differences (Gills Bay)		+0.3	+0.6	-	+0.7	+0.7	
Heights relative to Chart Datum		**+1.7-**	**+2.6-**	**-**	**+3.5**	**+4.2**	
			Mean Range (Neaps) 0.9m				
		Mean Range (Springs) 2.5m					

Table 2 Tidal Height Data – Gills Bay

	LAT	MLWS	MLWN	MSL	MHWN	MHWS	HAT
Standard Port – (WICK)	0.0	+1.4	+2.0	+2.0	+2.8	+3.5	+4.0
Secondary Port Differences (Stroma)		-0.2.	-0.1	-	-0.5	-0.4	
Heights relative to Chart Datum		**+1.2-**	**+1.9-**	**-**	**+2.3**	**+3.1**	
			Mean Range (Neaps) 0.4m				
			Mean Range (Springs) 1.9m				

Table 3 Tidal Height Data - Stroma

2.9. Climatic Data

The climatic data at Tables 4 and 5 are extracts of wind speed data for Cape Wrath at the western end of the Pentland Firth and Wick on the east coast of Scotland (being the closest data points) taken from the Admiralty Sailing Directions for the North Coast of Scotland (Reference 2).

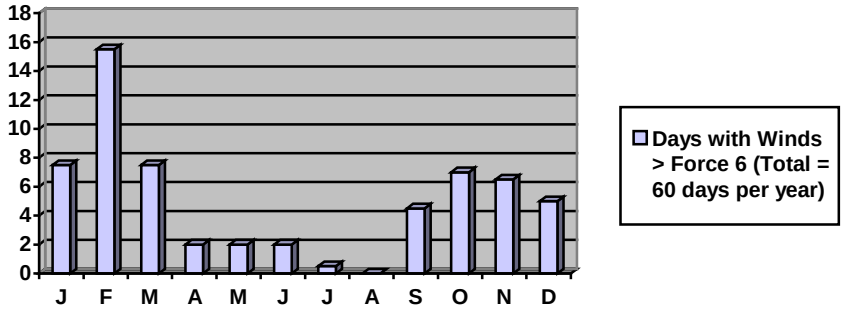

Table 4 Climatic Data (Wind Speed) for Cape Wrath

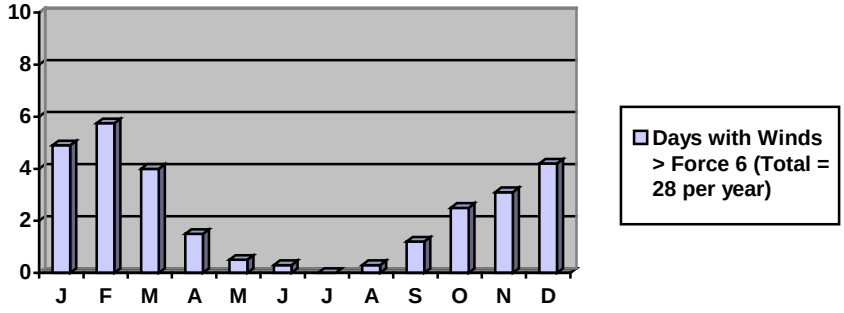

Table 5 Climatic Data (Wind Speed) for Wick

3. Description of the Proposed Site

In 2010 MeyGen Ltd successfully tendered for the agreement to lease for the Inner Sound seabed area. The agreement to lease came into force in October 2010. The Inner Sound lease area released by the Crown Estate is shown in Figure 2.

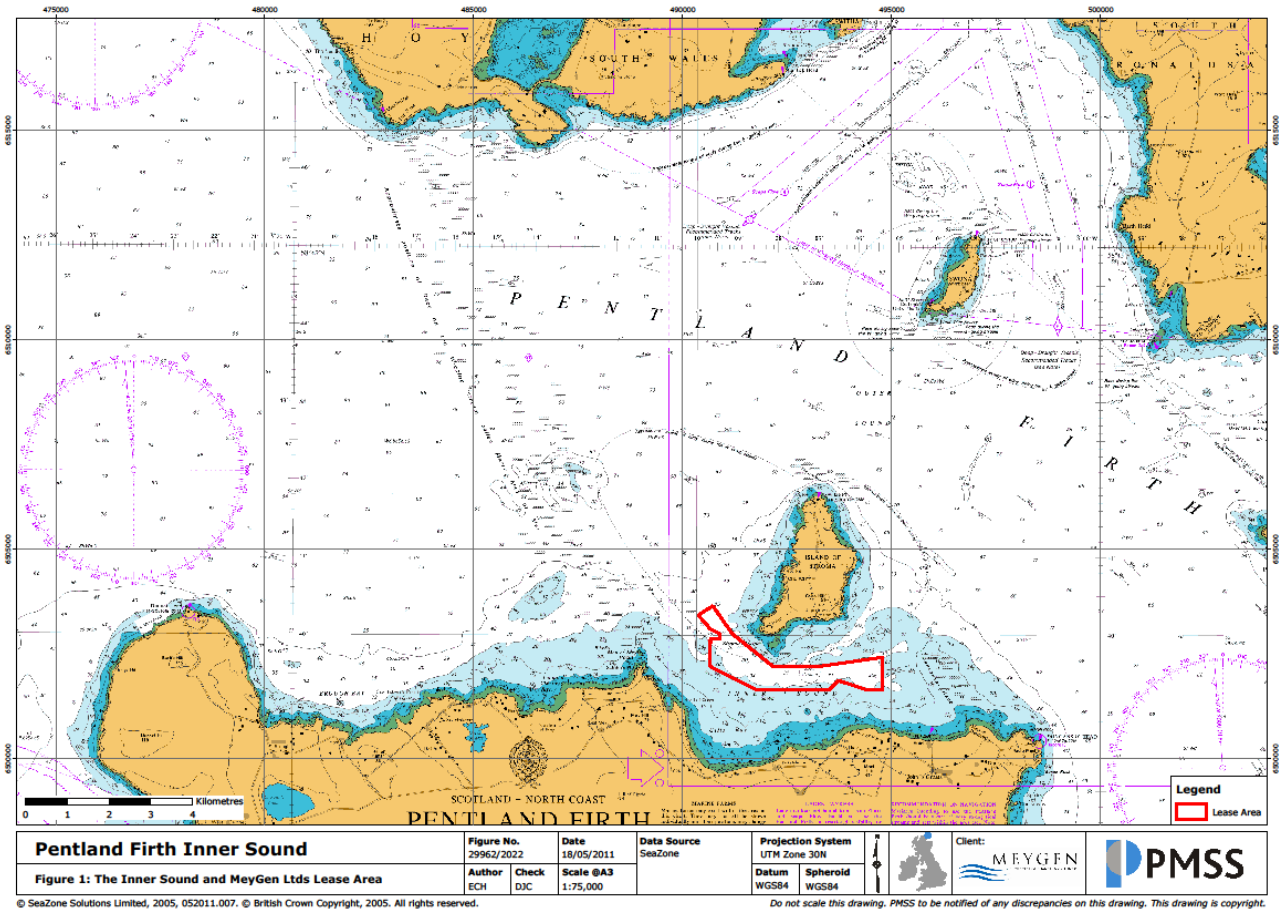

Figure 2 The Crown Estate Leased Area

4. Tidal Energy Devices and Marine Infrastructure

4.1. Turbine Technology

It is proposed that the Project will use the ARC AK-1000™ (Figure 3) and TGL 1MW (Figure 4) tidal energy turbines. Both ARC's AK1000™ and TGL's 1MW device are horizontal axis turbines with 18m rotor diameters, rated at 1MW each. The turbines have very similar rotational speeds and are full submerged with no surface piercing structures. Phase 1a (20MW) will consist of ten ARC AK-1000s and ten TGL devices.

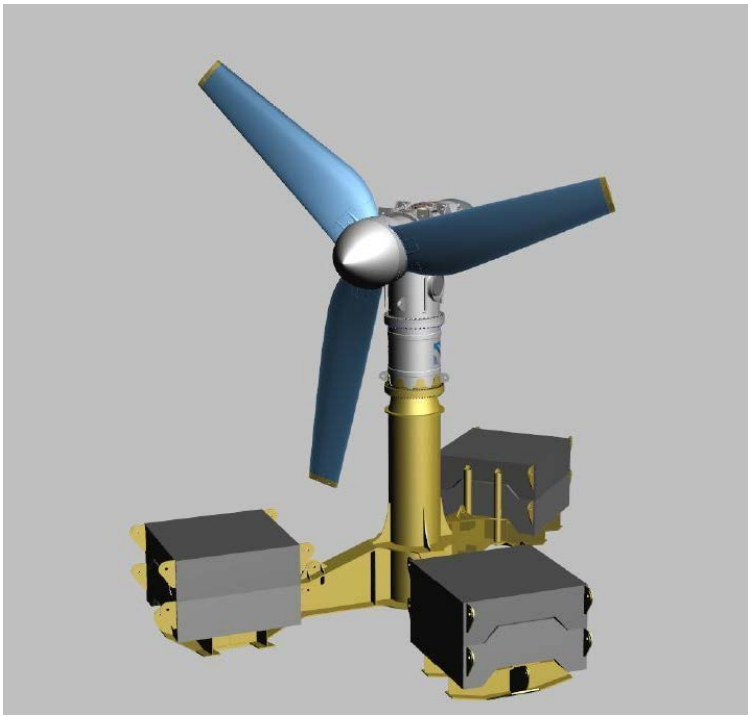

Figure 3 Atlantis AK-1000™ Turbine

Figure 4 TGL 1MW Turbine

ARC and TGL are both planning to deploy full scale 1MW turbines at the European Marine Energy Centre (EMEC) tidal test facility in 2011. Each will undergo testing and ancillary studies relating to

the installation, commissioning, operation and environmental impacts of the turbine. These will be directly feed into the Project to mitigate the associated risks.

4.2. Turbine Support Structure

The Turbine Support Structure (TSS) will provide a platform for the operation of both turbine units. Both the ARC and TGL turbine will use the same TSS solution. The TSS is required to be dynamically stable under the operating and environmental loads arising during the turbine design life.

The support structure must also be designed with due regard to the method of placement. The proposed installation methodology must allow for the efficient placement of multiple units within an acceptable time period. As far as practicable, the design must allow for the placement, maintenance and eventual removal of the turbine and support structure while giving due regard to the operational difficulties inherent in the offshore installation environment.

ARC and TGL use different methods for the TSS at EMEC. ARC uses a tripod steel Gravity Base System (GBS) (Figure 3) while TGL use a steel tripod pin piled to the seabed (Figure 4). As part of Front End Engineering Design (FEED) MeyGen Ltd will assess the suitability of GBS and piled solutions for the Project.

4.3. Turbine Array

Flow modelling of the Inner Sound will enable MeyGen Ltd. to produce optimum array configurations derived from the lease area. Array optimisation will continue as analysis methods develop further and new data is collected on the site and the NSRA study progresses.

The lease area has been determined partly on the assumption of a minimum depth of 8m of the turbine rotor swept arc relative to Chart datum. MeyGen Ltd would wish to stress that this is an initial site design criteria which will be subject to analysis and stakeholder consultation during the NSRA.

4.4. Offshore cables

All offshore cables will be specified according to the system design, equipment requirements and technology available. Offshore cable routes will be largely dependent on the selection of the landfall and detailed route analysis.

Due to the nature of the seabed in the Inner Sound it is not believed to be possible to bury the offshore cables. In those instances, MeyGen Ltd. will look to use the bedding plains and fractures in the seabed to provide support for the cabling and investigate different protection methods.

4.5. Onshore Cables and Grid Connection

There are two potential methods for cable landings, either the buried beach landing or Horizontal Direction Drilling (HDD) through rock. The final location(s) of the cable landfall has not been defined, but an initial study concluded that the most likely option would route Phase 1 (both Phase 1a and Phase 1b) to the Gills Bay area via HDD bores.

A cable landfall selection study has been undertaken and was based on engineering, environmental and planning guidance, a further detailed study through FEED and stakeholder consultation will continue this work.

The offshore cable(s) will come onshore at a cable vault, where the cables will be spliced and will provide access for maintenance; from there the cables are taken to the substation and grid connection point.

5. Construction Phase

The Inner Sound is an area of high tidal flow and impermeable seabed conditions that are not favoured when planning offshore operations. MeyGen Ltd. plan to use tried and tested techniques and equipment to minimise the risks associated with this environment.

5.1. Turbine Installation

ARC and TGL have different installation methodologies. ARC currently uses a Dynamic Positioning (DP) vessel that can hold station and work in up to 4kn (2 m/s). The DP vessel will have an Active Heave Compensated (AHC) crane to conduct the lifting operations. However, the limits of operation for the deployment of the TSS, ballast and generator nacelle will need to be determined.

The TGL 1MW turbine generator nacelle is a buoyant unit which can be towed to site by tugs and then pulled down onto the TSS using winches from the vessels. Both installation methods will be assessed for their suitability for the site by MeyGen Ltd during FEED.

Marine works are likely to be scheduled during the spring, summer and autumn months when conditions are most favourable. Turbine installation is likely to be confined to tidal windows where the tidal flows are lowest and therefore to take advantage of the tidal windows works could be undertaken at any time within a 24 hour period.

5.2. Offshore Cable Installation

The installation of the cables will be conducted by dedicated cable installation vessels. Cable installation can be less affected by the high tidal flows but the vessel may well be required to work across tide in which case operational limits of around 1.5kn (0.77m/s) may apply depending on the vessel.

6. Operation Phase

The Project will have an operational life of 20-25 years. As the size of the Project increases the level of operation and maintenance activity will increase.

6.1. Turbine Control

The control philosophy for the Project is similar to that of currently installed offshore wind farms. Initially the system relies upon being able to control each turbine individually as well as the tidal farm as a whole. The turbine will be controlled by a Supervisory Control and Data Acquisition (SCADA) system. Each turbine will have a number of sensors contained within the nacelle and control signals will be transmitted to the onshore substation. There will be redundancy built into the system with an automatic back-up communication system.

The turbine array has a safety system that is super ordinate to the control system e.g. a safe shutdown in case set safety limits have been reached and/or the control system is incapable of keeping the installation within the normal operating limits. The system also provides safe shutdown features in case communication or control is lost.

6.2. Maintenance Philosophy

Due to the nature of the phased installation of the turbines, the Project will have a maintenance strategy for each phase. Hence the extent of the required support infrastructure and services will increase over time.

Long-term maintenance of the turbines is likely to require dedicated vessels and a dedicated facility close to the tidal turbine array. Turbine maintenance will be pre-determined and scheduled as an ongoing process throughout the year.

6.3. Port and Maintenance Facilities

The marine installation and operation and maintenance will require significant port and industrial infrastructure. In terms of facilities throughout the construction period and then for the operational period, the following will be required and is the basis of MeyGen Ltd's search for suitable infrastructure in Caithness:

- Marshalling yard; for the delivery and storage of equipment and turbines during construction.
- Operations and Maintenance base/quay; used during the full life of the Project as a base for the installation/maintenance vessels with large sheds for maintenance of the turbines.
- Control centre for operations would be integrated into the Operations and Maintenance base and would require a few specialist people to monitor the turbine array.

MeyGen Ltd. has been in close consultation with all the ports and harbours in the vicinity of the Inner Sound, including the closest at Scrabster, Wick and Gills Bay. MeyGen Ltd. will work in conjunction with these harbours to ensure that they can provide the necessary infrastructure for the Project.

7. Decommissioning Phase

The offshore elements of the Project will be decommissioned in line with the Energy Act 2004 for the decommissioning of offshore renewable energy installations. Decommissioning of the turbine array will, to a great extent, be the reverse of the installation procedure. The decommissioning programme will ensure that the site is cleared so that environmental impacts are limited and that safe navigation of the site can take place.

8. Marine Traffic and Activities

8.1. Data Sources

Sources of vessel traffic data used in this Preliminary Hazard Analysis include:

- AIS survey data 2008/9
- DECC maritime data at www.maritimedata.co.uk;
- SeaZone Hydrospatial data
- Admiralty Sailing Directions NP 52 – The North Coast of Scotland Pilot (Reference 2)
- RYA UK Coastal Cruising Atlas (Reference 5)
- Marine Scotland Vessel Monitoring System Data
- Feedback from The Crown Estate organised fisheries liaison meetings
- MeyGen conducted consultation

8.2. Current Vessel Traffic and Activities

The Inner Sound around the island of Stroma is not the main traffic route for east and west going vessels through the Pentland Firth. The Admiralty North Coast of Scotland Pilot, NP 52 (Reference 2) recommends routes for passage through the Pentland Firth using the Outer Sound. However, the recommended route for smaller vessels, when approaching the Firth during the south east-going stream, is through the Inner Sound. This avoids the main force of the tide and takes advantage of comparatively slack water and even a north-going eddy of approximately 1 to 1.5kts. The recommended east and westbound routes for vessels making use of the Inner Sound pass directly through the proposed development area, as does the ferry traffic route between Gills Bay and St Margaret's Hope, Orkney. These recommended routes are reflected in the actual usage shown by the AIS survey data at Figure 5.

Data obtained from some preliminary AIS survey work undertaken in 2008/2009 indicates that, in a period comprising two weeks in August 2008 and a similar period in January 2009, 13 vessels (all fishing vessels) with a draught greater than 6.3 metres passed through the Inner Sound either on their way to fishing grounds to the north west of returning to Fraserburgh or Peterhead. The maximum draught was 8.0m.

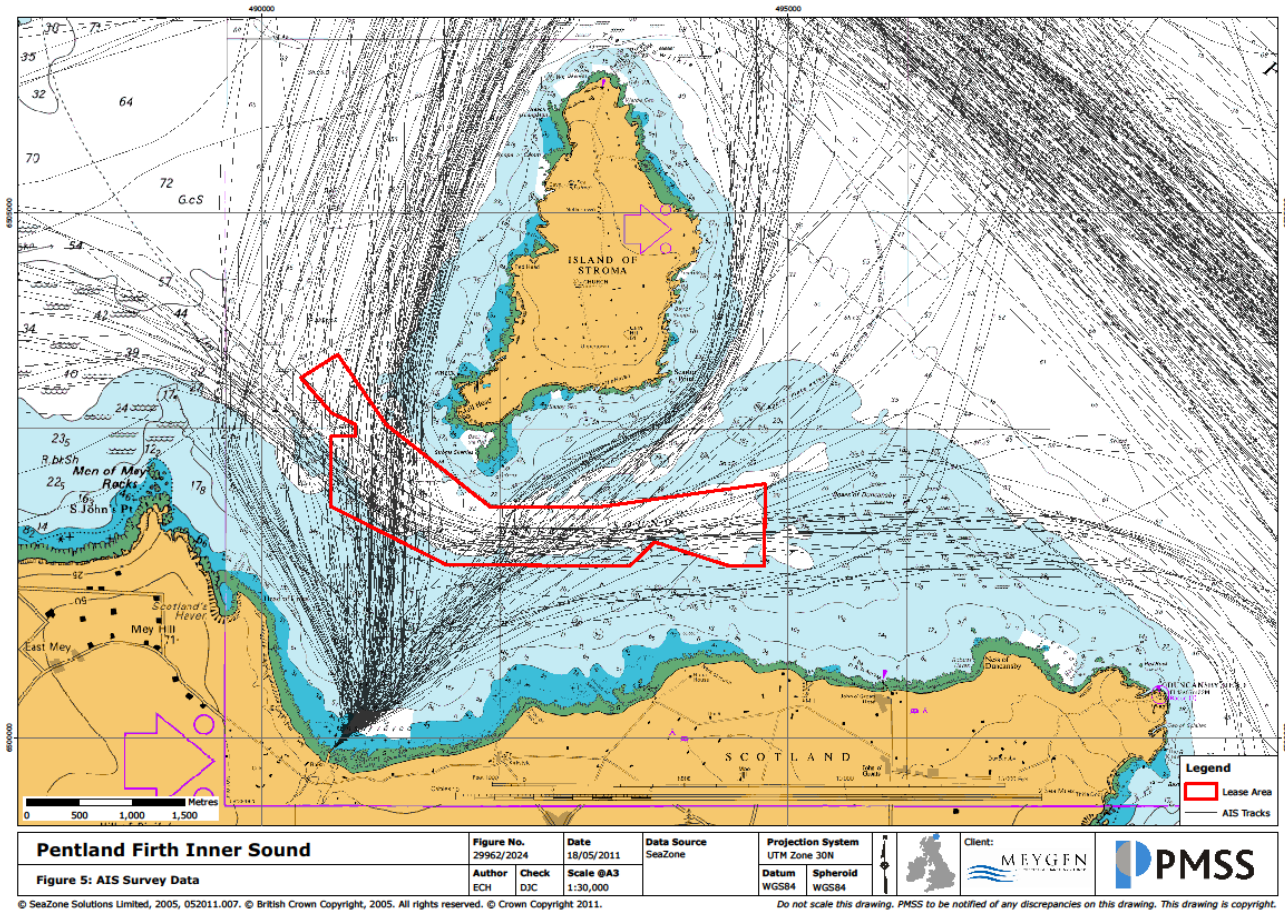

Figure 5 AIS Survey Data

8.2.1. Ferries

The proposed Project site lies directly on a designated daily ferry route between Gills Bay and St Margaret's Hope harbours run by Pentland Ferries. The daily number of movements through the Inner Sound by the ferry varies between 5 and 7 depending on the season.

The ferry running this route is the High Speed Catamaran (HSC) Pentalina (70m LOA x 20m Beam x 2.2m Draught). The routes used can be west or east-bound around the island of Stroma depending on the weather/tide.

MeyGen Ltd has held several meetings with Pentland Ferries and have a close working relationship with the company. They will continue to engage them during the Project and NSRA.

8.2.2. Fishing Activity

The AIS data shows some fishing vessels using the Inner Sound drawing up to 8m. These would typically be large pelagic trawlers returning fully laden from fishing grounds.

Initial consultation with local fishermen would indicate that the only fishing activity which occurs in the Inner Sound is creeling for crab and lobster. The fishing vessels are of shallow draught and predominantly active in the shallower areas (<30m).

Further consultation during the full NSRA will be undertaken with all local and national fishing organisations to establish the range of vessels which use the area and, in particular, their draught for calculation of under keel clearance when passing above the turbines.

8.2.3. Search and Rescue Vessels

The Royal National Lifeboat Institute (RNLI) has several lifeboat stations in the Orkney Pentland Firth area. Lifeboats are stationed at Kirkwall, Longhope, Stromness, Scrabster and Wick harbours. Consultation with the RNLI will be required during the NSRA to identify any hazards to emergency search and rescue operations in the area, presented by the proposed installation.

8.2.4. Recreational Boating

The area locally is identified in the RYA UK Coastal Atlas of Recreational Cruising (Reference 5) as a route classified as a "Light/ Medium Recreational Use"[1]. There are no anchorages recommended by the RYA in the area of the Inner Sound although such craft are known to use the anchorage at The Haven on Stroma.

Full consultation with RYA and other local recreational users is required to establish concerns and potential hazards over recreational passages in the Inner Sound during installation/maintenance activities or by surface platforms/buoys or markings. Data should be collected regarding the draughts of recreational users in the area in order to establish any potential hazard from collision/grounding under normal turbine operations, in various sea-states.

8.2.5. Diving

Diving takes place around the mainland coast in the Inner Sound and there are several dive sites in the Gills Bay area recommended in "Dive North West Scotland" by Gordon Ridley (Reference 6). Given the distance offshore and the depths in which the array is proposed to be deployed, there is considered to be little interference with recreational diving activities except, perhaps, with regard to

[1] Medium Recreational Routes: - Popular routes on which some recreational craft will be seen at most times during summer daylight hours.
Light Recreational Routes: - Routes known to be in common use but which do not qualify for medium or heavy classification.

subsea cable installation. It is recommended that a full consultation be undertaken with local dive schools/operators and national organisations as part of the NSRA to fully establish the likely impact of the proposed installation on diving activities and any hazards presented.

8.2.6. Military Usage

There are no surface Practice Exercise Areas (PEXAs) in the close vicinity of the proposed development area. The Defence Estates Safeguarding department would be consulted as part of the NSRA to discuss the proposed array design and potential impacts.

8.2.7. Marine Aggregate

The British Marine Aggregate Producers Association has indicated that there are no current or planned marine aggregate interests in the area.

8.2.8. Aquaculture

It is understood that there is no aquaculture undertaken in the area of the Inner Sound. Local authorities and associations relating to aquaculture would be consulted as part of the NSRA to discuss potential impacts.

8.2.9. Spoil Grounds

There is a large, circular spoil ground site currently within the lease area of approximate diameter 0.27 nm. MeyGen Ltd are in consultation with Marine Scotland look at alternative location for the spoil ground in order to avoid marine users depositing dredge spoil onto or around the turbines.

8.3. Other OREI Developments

In the light of the recent seabed lease agreements between The Crown Estate and other marine renewable energy developers in the Pentland Firth, there are several other marine renewable energy installations proposed in the surrounding areas of the Pentland Firth. It will be necessary to assess the cumulative and in combination impacts of such developments on navigational matters in order to propose appropriate controls which do not create additional hazards (e.g. pinch points) or confusion. The Crown Estate Pentland Firth and Orkney Waters (PFOW) Developers Forum has been set up to enable strategic studies and work to be carried out to help enable the projects. The forum has produced a scope of work for the Regional and Cumulative NSRA. The timescales for the assessment are not clear yet, but it is believed that some data and analysis will be available for the Phase 1 NSRA.

There is also a duty on The Crown Estate and the MCA to understand and mitigate the impacts on navigation to meet the requirements of IMO Resolution A.572 (14) - General Provisions on Ship Routing and IMO Resolution A. 671 (16) -Safety Zones and Safety of Navigation around Offshore Installations and Structures which require governments “to improve the safety of navigation in converging areas and in areas where density of traffic is great or where freedom of movement of shipping is inhibited by searoom, the existence of obstructions to navigation, limited depths or unfavourable meteorological conditions” and to “Ensure that the exploitation of natural resources on the continental shelf and in the EEZ does not seriously obstruct sea approaches and shipping routes”.

9. Conclusions

The conclusions of the Preliminary Hazard Analysis can be summarised as:

1. Vessels that use the Inner Sound are generally small/medium sized vessels e.g. coasters, yachts, fishing vessels in transit and the Pentland Ferry “Pentalina”. Some of these vessels types have draughts (i.e. 6-8m) which, could lead to them being put at risk of collision with the proposed array devices in certain sea states and tidal conditions.

2. Small craft conduct creeling within the Inner Sound though mainly in the areas less than 30m.

3. Further traffic survey data will be required to establish the full range of vessel and their draughts using the Inner and Outer Sounds.

4. The current planning assumption being used by MeyGen Ltd of ensuring that device rotor swept arcs are at least 8m below Chart Datum may be insufficient to make the risk of collision between some vessels and the individual devices acceptable. Determining adequacy of clearance would require further assessment and consultation including vessel motion modelling to examine under keel clearance (UKC) requirements for the traffic using the Inner Sound in various tidal conditions and sea-states.

5. Installation of Phase 1 in the Inner Sound may cause displacement of marine traffic to the Outer Sound due to installation/maintenance activities and, potentially, during normal operation due to the issues of safe under-keel clearance. Hazards presented by re-routing traffic through the Outer Sound or traffic separation/limited in the Inner Sound would need to be assessed as part of the NSRA.

6. A full stakeholder identification and consultation exercise is yet to be undertaken for this proposed Project. A full consultation will be required as part of the NSRA process including meetings with stakeholders to discuss and understand the impact of the proposed installation and any hazards presented. Information would be sought directly from these sources in order to further clarify the vessel types which use the area and, in particular, those not fitted with AIS.

7. There is potential for cumulative/in-combination navigational impact between the various marine energy installation developments being proposed for the Pentland Firth (e.g. displacement of marine traffic into “pinch points”). It is, therefore, necessary that the NSRA considers cumulative effects of neighbouring developments and assesses hazards and impacts in a holistic manner.

8. Failure of the device such that any component detaches from the support structure could, if it were to occur, present a hazard to navigation. Suitable evidence (e.g. Failure Modes and Effects Analysis, HAZOP) should be presented as part of the NSRA to demonstrate that all failure modes have been anticipated and associated hazards identified and controlled.

9. The array could present a hazard to fishing by nets, trawls, creeling or lines in the area. However, the proposed development area is generally not considered an area used for fishing or creeling as, in particular, the latter normally takes place in areas of less than 30m. This should be confirmed during the stakeholder consultation process in the NSRA.

10. There is potential for significant impact on marine operations at harbours/facilities (e.g. Gill’s Bay and Scrabster) during construction and maintenance phases of the Project.

10. Proposed NSRA Methodology

The DTI/DECC guidance (Reference 2) recognises that there are a wide range of assessment techniques available to estimate the risks presented by OREI developments. The selection of the appropriate techniques should be, according to that guidance:

- Proportionate to the scale of the development and magnitude of the risks and;
- Acceptable to the Government.

The following paragraphs present the proposed methodology for undertaking the NSRA for Phase 1 of the Project in the Inner Sound.

10.1. Understanding Base and Future Case Traffic

The risk assessment will be based on a thorough understanding of the traffic densities and types based on traffic survey data gathered as part of the NSRA. This would include:

- Survey and analysis of traffic as specified in MGN 371(M+F) (Reference 7) prior to the submission of the consents application;
- Local expert knowledge i.e. reports and sightings by fishermen, lifeboat crew and shipping representatives ashore and afloat.

AIS data for the area is currently being logged by various organisations and will be available for the conduct of the traffic analysis to meet the requirements of Reference 7. However, any radar survey, required to capture traffic data on those vessels and craft not fitted with AIS, will require to undertaken between now and the submission of the Environmental Statement (ES) in November 2011. Hence, it may not meet fully the requirements of Reference 7 in accounting for seasonal variations. However, the hazard to smaller, non-AIS fitted, craft is primarily that from installation and maintenance activities and the vessels engaged in them as their draughts are usually such that under-keel clearance will not normally be an issue. In general, such activities would occur in summer months in conditions of low tidal stream and good weather such that the risks of, say, collision are substantially reduced.

A workshop will be held with representatives of the identified stakeholders to identify activities which could be hazarded by the proposal and, in particular, consider future traffic levels.

10.2. Hazard Identification

In order to assess the risks associated with the proposed development, details and methodologies of the processes involved in the installation, operation and decommissioning of the tidal turbine site would be reviewed by means of a Hazard Identification and Risk Assessment (HIRA) process. This would require knowledge of the following:

10.2.1. Installation Hazards

For the installation phase it would be necessary to establish, for example:

- Details of the installation methodology – e.g. confirmation of vessels/barges to be used, means of stationing i.e. multi-point mooring, dynamic positioning vessels.

- Duration of installation procedure.
- Broad environmental limitations for installation operation;
- Mobilisation/out-load ports/harbours;
- Emergency response procedures during installation.

10.2.2. Operations

For the operational phase it is required to know:

- Layout and disposition of devices within the proposed area;
- Depth of deployment for each device and the clearances above the devices rotor swept arc at chart datum or, where, this is not known (e.g. for Phase 1b), the minimum clearance depth associated with the phase area;
- Operating modes and means of control;
- Planned intervention requirements and methodologies e.g. frequency of maintenance/inspection of device, support structure and cables; vessels required and time on task;
- Identification of possible device failures and effects of such failures, based on appropriate techniques e.g. Reliability, Availability and Maintainability Studies using failure mode and effects analysis (FMEA);
- Estimation of unplanned interventions resulting from failures;
- Proposed operational/maintenance support base (port/harbour).

10.3. Risk Assessment

Assessment of the risks resulting from the hazards presented by the proposed development will be undertaken in accordance with the guidance contained in the DECC (DTI) Guidance (Reference 1) and addressing the issues contained in MGN 371(M+F) (Reference 7) using the following techniques:

- Qualitative Risk Assessment using expert judgement (or modelling/simulation - see 10.3.1) on the likelihood of physical interaction between surface vessels in transit and the devices.
- Qualitative Risk Assessment using expert judgement on the likelihood of physical interaction (entanglement) between vessels creeling and the array devices.
- Qualitative Risk Assessment using expert judgement/probabilistic risk assessment on the likelihood of physical interaction (collision) between vessels in transit and vessels engaged in installation, maintenance and de-commissioning activities.
- Quantitative assessment of the risk from device failure leading to a buoyant component presenting a hazard to shipping.

10.3.1. Risk of Collision Analysis

The risk of collision analysis between vessels and the devices shall be based on vessel draught, device dimensions, depth of deployment and available environmental wave climate data. The establishment of what would constitute an adequate and appropriate clearance between vessels which use (or may use) the area and the device (Under-keel Clearance (UKC)) will be established by expert judgment or, where this cannot be agreed, by dynamic modelling of the specific vessel types in specified sea states using data for the area where this is available or some agreed, generic data applicable to the area.

10.3.2. Vessel Traffic Modelling

If the risk of collision analysis indicates that vessels would be likely to re-route (using the Outer Sound), it is considered that it may be necessary to undertake vessel traffic modelling, in order to assess fully the potential impacts of such traffic displacement.

It would be necessary to consider the cumulative/ in combination effect of other offshore renewable energy installation developments in the Pentland Firth. Traffic displacement caused by one development would have to take into account similar effects arising from other, potential developments. As other such development will be conducted by another developer, it would require both close cooperation between developers and The Crown Estate and a holistic traffic model developed in order to properly understand the risks presented by the sum of the developments. Such overall modelling of the Pentland Firth may well be best undertaken by an independent organisation acceptable to the MCA.

10.3.3. Risk Controls

Appropriate risk control measures will be developed to address the risks during all phases of the operational lifecycle to ensure that the risks are reduced to a level as low as reasonably practicable (ALARP). These will include consideration of guidance on marking and lighting contained in International Association of Lighthouse Authorities (IALA)/ General Lighthouse Authorities (GLA) publications.

10.3.4. Hazard Log

A hazard log will be created which will:

- Identify the hazards and make an assessment of the risks using an IMO Style Criticality Matrix based on that in Reference 2;
- Assess risk tolerability using a matrix based on that in Reference 2;
- Identify appropriate controls and stipulate the required level of risk tolerability on successful implementation of the controls;
- Identify the responsible person responsible for closing out the hazard log entry.

10.4. Claim for Positive Consent

The outcome of the process will be, where this is possible, a claim that the future level of risk with the presence of Phase 1 of the Project is tolerable given the application of the proposed controls such that a positive consent decision is appropriate.

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