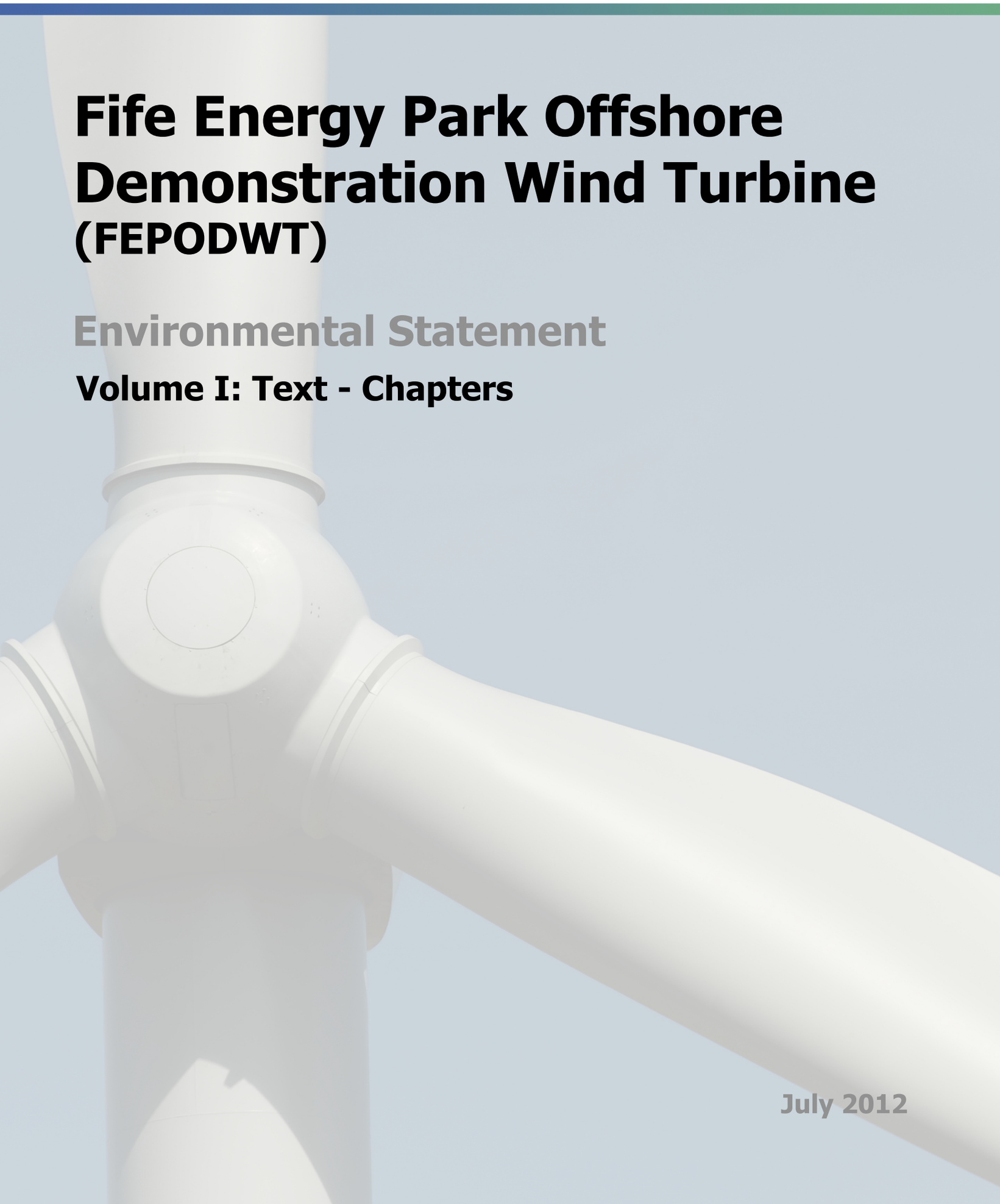
Fife Energy Park Offshore Demonstration Wind Turbine (FEPODWT)

Environmental Statement

Volume I: Text - Chapters



July 2012

PREFACE

This document is the Environmental Statement (ES) which accompanies the application by Scottish Enterprise to Marine Scotland on behalf of the Scottish Government to develop a test facility for the demonstration of new designs of offshore wind turbines on the northern shore of Firth of Forth, Scotland.

The Environmental Statement (ES) has been prepared by Arcus Renewable Energy Consulting Ltd on behalf of Scottish Enterprise and comprises the following volumes:

- Environmental Statement Volume I containing the written statement;
- Environmental Statement Volume II containing the figures; and
- Environmental Statement Volume III containing the technical appendices; and
- Non-Technical Summary.

Hard copies of the Environmental Statement may be obtained from Arcus Renewable Energy Consulting Ltd (Tel: 01904 715470) at a charge of £250 or a copy on CD for £10. Copies of a short non-technical summary are available free of from:

Arcus Renewable Energy Consulting Ltd.

507-511 Baltic Chambers

50 Wellington Street

Glasgow

G2 6HJ

The public can view the ES during normal office hours at the Scottish Government Library at Victoria Quay, Edinburgh, EH6 6QQ. The ES is also available for viewing by the public during normal opening hours at the following locations:

Buckhaven Local Services Centre

Buckhaven Local Office,

3 College Street,

Buckhaven,

Leven,

KY8 1AB

Methil Local Services Centre

Methil Library,

Wellesley Road,

Methil,

Leven,

KY8 3PA

Fife Council

Development Services,

Kingdom House

Kingdom Avenue

Glenrothes

KY7 5LY

Any representations to the application should be made by email to The Scottish Government, Marine Scotland Licensing Operations Team mailbox at Methil@scotland.gsi.gov.uk

Or by post to:

The Scottish Government,

Marine Scotland Licensing Operations Team,

Marine Laboratory,

PO Box 101,

375 Victoria Road,

Aberdeen,

AB119DB

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AA - Appropriate Assessment

AAR - Average Annual Rainfall

AGL – Above Ground Level

AGLV - Areas of Great Landscape Value

AM – Amplitude Modulation

AOD – Above Ordnance Datum

ARUP - Ove Arup & Partners Ltd

ATS - Air Traffic Services

BAA – British Airports Authority

BBC – British Broadcasting Corporation

BERR - Business, Enterprise and Regulatory Reform

BGS - British Geological Service

BTO – British Trust for Ornithology

BWEA - British Wind Energy Association

CAA – Civil Aviation Authority

CAR - Controlled Activities) (Scotland) Regulations (2011)

CD – Chart Datum

CEFAS – The Centre for Environment Fisheries and Aquaculture Science

CIRIA - The Construction Industry Research and Information Association

CMS - Construction Method Statement

CoPA - The Control of Pollution Act 1974

CPA – Coastal Protection Act 1949

CSS - CSS Spectrum Management

DECC - Department for Energy and Climate Change

DEFRA - Department for Environment, Food and Rural Affairs

DMS - Decommissioning Method Statement

DNO – Distribution Network Operator

DSO – Digital Switchover

DTI - Department of Trade and Industry

EIA – Environmental Impact Assessment

EMEC - European Marine Energy Centre Ltd

EPA – Environmental Protection Act 1990

ES – Environmental Statement

EU – European Union

FEP – Fife Energy Park

FEPA – Food and Environmental Protection Act (1985)

FPMD – Forth Ports/Methil Docks

FREDS - Forum for Renewables Development Scotland

GIS – Global Information Services

GLVIA - Guidelines for Landscape and Visual Impact Assessment

HAT - Highest Astronomic Tide

HGV – Heavy Goods Vehicle

ICES - International Council for Exploration of Seas

IEEM - Institute of Ecology and Environmental Management

IFG – Inshore Fisheries Group

IPC - Infrastructure Planning Commission

JNCC - Joint Nature Conservation Committee

JRC - Joint Radio Company

LAT - Lowest Astronomic Tide

LBAP – Local Biodiversity Action Plan

LCA - Landscape Character Assessment

LCT - Landscape/Seascape Character Types

LLA – Local Landscape Areas

LVIA - Landscape and Visual Impact Assessment

MCA – Maritime Coastguard Agency

MHWN - Mean High Water Neap

MHWS - Mean High Water Springs

MLWN – Mean Low Water Neap

MLWS – Mean Low Water Springs

MMO - Marine Mammal Observer

MoD – Ministry of Defence

MSL – Mean Sea Level

MS-LOT – Marine Scotland Licensing Operations Team

NATS – National Air Traffic Services

NBN – National Biodiversity Network

NCO - Nature Conservation Order

NERL - National Air Traffic Services En Route Plc

NHZ - Natural Heritage Zone

NNR - National Nature Reserve

NPF2 - The National Planning Framework 2 (2009)

NPPG – National Planning Policy Guidance

NPS - National Policy Statement

NRFA - The National River Flow Archive

NTS – Non-Technical Summary

OD – Ordnance Datum

ODPM - Office of the Deputy Prime Minister

OFCOM - Office of Communications

PAN – Planning Advice Note

PCH – Potential Collision Height

PPGs - Pollution Prevention Guidance Notes

PPP - Pollution Prevention Plan

PPS – Planning Policy Statement

RAF – Royal Air Force

RAP – Renewables Action Plan (2009)

RBL – Re-Broadcast Links

RCA - Regional Character Area

RGC – Redpath de Groot Caledonian

RIGS - Regionally Important Geological Sites

ROS – Renewable Obligation Scotland (2002)

RSPB - Royal Society for the Protection of Birds

RYA – Royal Yachting Association

SAC - Special Area of Conservation

SAP – Species Action Plan

SCADA - A Supervisory Control and Data Aquistition

SCWMP - The Surface and Coastal Water Management Plan

SEPA - Scottish Environmental Protection Agency

SFF – Scottish Fishermen's Federation

SHEP - Scottish Historic Environment Policy 2009

SHI – Samsung Heavy Industries

SLR – Single Lense Reflex

SMC - Scheduled Monument Consent

SMP - Sectoral Marine Plan

SMRU - Sea Mammal Research Unit

SNH – Scottish Natural Heritage

SPA - Special Protection Area

SPP - Scottish Planning Policy

SSE - Scottish and Southern Energy

SSSI - Sites of Special Scientific Interest

UK – United Kingdom

UK BAP - UK Biodiversity Action Plan (1994)

US – United States

VER - Valued Ecological Receptors

VMS - Vessel Monitoring System

VOR - Valued Ornithological Receptors

VP – View Point

WeBS - The Wetland Bird Survey

WFD - The Water Framework Directive (2000)

WHO – World Health Organisation

ZTV - Zone of Theoretical Visibility

1 INTRODUCTION

1.1 Overview

Scottish Enterprise ("the Applicant") is proposing to develop a test facility for the demonstration of new designs of offshore wind turbines on the northern shore of the Firth of Forth at Methil, Scotland (Figure 1.1). The project to be known as Fife Energy Park Offshore Demonstration Wind Turbine (hereafter referred to as "the Development") will be located approximately 35 m from the mean high water springs (MHWS) mark and 48.3 m from the Fife Energy Park (FEP) boundary as shown on Figures 1.2 and 1.3. The test facility would be operational for 5 years.

The Development will comprise of:

- A single, three bladed demonstration wind turbine with an installed capacity of up to 7 MW. The turbine will have a maximum hub height of 110 m, from mean sea level (MSL), including the jacket, with a maximum blade rotor diameter of up to 172 m, giving a maximum level from the MSL to turbine tip of up to 196 m;
- A personnel bridge connection between the FEP and turbine tower;
- Construction of an onshore crane pad on the FEP; and
- Construction of an onshore Control compound.

In addition to the above components of the operational facility, the construction phase will involve:

- Construction of four lay down areas for the blades, tower, jacket, and nacelle.

The proposed layout is shown in Figure 1.2.

The Development would be operational for 5 years. During this timescale there is potential for more than one turbine model to be tested at the site. Once one turbine had been tested it would be removed from the site and replaced with a new turbine which would fall within the same design parameters (maximum hub height of 110 m, rotor diameter of 172 m, and maximum height to turbine tip from MSL of 196 m). Only one turbine would ever be installed at any one time. The base would remain in place throughout the Development. All turbines will be removed after 5 years from the operation of the first turbine.

Further infrastructure is associated with the Development, however consent for these installations has/will be applied for under separate applications and consenting regimes as detailed below. This is to permit the phased installation of these project elements, and to comply with the consents process for the various legislative regimes which apply to applications in a near shore environment. Details of these infrastructure and associated consents are:

- Erection of a single onshore wind monitoring mast. The mast will not exceed 110 m in height and will be installed for a maximum period of 6 years. A consent for the installation of this mast will be made to Fife Council under the Town and Country Planning (Scotland) Act 1997 (as amended);
- Erection of a single offshore temporary wind monitoring mast, not exceeding 110 m in height from the MSL. This mast will be installed for a period of 3 months and will be removed prior to construction of the demonstration turbine facility. Two applications for Marine Licenses to install this mast have been made to Marine Scotland under the Marine (Scotland) Act 2010. One relates to the preparation of the sea bed and one to the installation of the met mast;
- The demonstration turbine will be connected to the grid via an underground cable which will connect to a new substation. The application for the grid connection will be made to the Distribution Network Operator (DNO), Scottish Power Energy Networks. An indicative cable route and substation location can be seen on Figure 1.2; and

- An application will be made to Fife Council under the Town and Country Planning (Scotland) Act 1997 (as amended) for the other onshore infrastructure required in connection with the turbine installation and on-going maintenance.

1.2 The Applicant – Scottish Enterprise

The Applicant is Scotland's main economic development agency and aims to deliver a significant, lasting effect on the Scottish economy. Their role is to help identify and exploit the best opportunities for economic growth. They support ambitious Scottish companies to compete within the global marketplace and help build Scotland's globally competitive sectors. The Applicant also works with a range of partners in the public and private sectors to attract new investment to Scotland and to help create a world-class business environment

1.3 Site Consenting Background

An application was submitted by 2-B Energy in April 2010 and subsequently granted consent by Marine Scotland in November 2011 for a single 185 m two bladed wind turbine with an installed capacity of 6 MW (hereafter referred as "the Consented Development"). This consent was subject to an agreement for the lease of the seabed being reached with the Crown Estate.

The Development will differ to the Consented Development by providing the opportunity to test a wider range of offshore turbines from a variety of manufacturers with varying requirements. This Application is therefore to seek consent to test slightly taller (up to 196 m to tip), three bladed turbines supported by tubular towers. These parameters represent the newest models of turbine which are currently being proposed to be used to supply forthcoming offshore projects in Scotland and the UK including the Scottish Territorial Waters sites, and Round 3 offshore wind farm development zones. The Development has been micro sited 25 m along the mean low water springs (MLWS) line from the original location of the Consented Development. This reduces any potential operational impacts on the adjacent quay to the east.

1.4 Proposed Development Summary

The Development will be located at the FEP which comprises 133 acres of industrial land some of which is utilised by the FEP's existing operators and some of which is currently semi-derelict. The FEP is currently undergoing a major redevelopment program which will create ideal industrial facilities for the offshore renewable energy sector in Scotland. The site is currently owned by Scottish Enterprise, who acquired it from Wemyss Estate Trustees and Crown Estate in 2005.

The site was historically occupied by mining and oil industries and has been regenerated from the former Kvaerner Yard in 2001. Currently, there is an active steel fabrication facility operated by Burntisland Fabrications (BiFab) that produces major components for the offshore wind industry as well as offshore oil and gas.

The purpose of the Development is to test new designs and models of offshore wind turbines, which will be used to generate electricity from a renewable source of energy, the wind in an offshore environment. The turbine dimensions which are being applied for are based on those for new designs of turbines which are planned to be marketed to supply forthcoming offshore wind farm developments including the Scottish Territorial Waters and the UK wide Round 3 wind development zones. The Round 3 wind farm projects have the capacity to generate up to 25 GW of electricity across the UK. Of these Round 3 sites, two are located in Scotland's Renewable Energy Zone.

In order to be marketed for use on offshore wind farm sites, new turbine designs must be tested and approved in accordance with the International Standard IEC 61400-12 "Wind turbine generator systems". One key output from the testing of new designs of turbine is a certified power curve, which indicates the energy output from a turbine at a given wind speed. Once tested it is also important for developers and manufacturers to fully understand the performance of the turbines, and the practicalities of maintenance in order to maximise their effectiveness in generating power in the offshore environment.

The opportunity to test and gain certification of new turbine designs are a requirement for international turbine manufacturers. An IEC certified power curve and reliability information on the turbines performance, are important pieces of information that turbine manufactures need to market their technologies. Improving the reliability of offshore turbines is a critical stage of reducing the cost of offshore wind developments.

Due to the hostile nature of the offshore environment, it is advantageous to test the new turbine designs in a location where they are easily serviceable and accessible. This is also critical in expediting the testing timescales. The Development test site will provide easy access to the installed turbine to allow it to be monitored for certification, and for improvements to be made in turbine design and reliability. This will in turn provide increased certainty in the delivery of the energy generated from these turbines when they are installed in an offshore environment.

Locating the test turbine just offshore from the FEP provides a close approximation of the required marine conditions to test the machines whilst allowing the access for testing, monitoring and maintenance.

Whilst offshore turbine technology is already installed both within the UK and global offshore environments, the turbines to be tested at the Development will utilise newly developed and improved technologies which have not yet been deployed in the offshore environment. The aim of the new design is to increase the reliability and power output and will therefore, if successful, increase the efficiency of power generation from offshore wind installations and reduce cost.

The volume of turbines required for the Scottish Territorial Waters and Round 3 zones is substantial. Should the consent process be successful, the test site will be a valuable asset for Fife and Scotland in attracting wind turbine manufacturers. The investment in the FEP to date has been geared towards providing the land and infrastructure required to support the offshore renewables sector. Strong interest has been shown by companies from Scotland and across the world in utilising the Fife Energy Park Offshore Demonstration Wind Turbine site.

The ultimate goal for Scottish Enterprise is to attract large scale manufacturing back to the site and the test site is the next step towards this.

1.5 The Environmental Statement

This Environmental Statement (ES) will accompany three applications for consent which relate to the installation and operation of the demonstration turbine test facility at the FEP:

- An application for consent to Marine Scotland as required under Section 36 of Electricity Act 1989 for the construction and operation of an electricity generation station with an installed capacity in excess of 1 MW in the offshore environment; and
- Two applications to Marine Scotland for a Marine Licenses for the placement of the turbine (including supporting structure) on the seabed seaward of the MHWS, and preparation of the sea bed for these works, as required under the Marine (Scotland) Act 2010.

A full description of the legislative requirements is provided in Chapter 2: *EIA Methodology* of this ES.

The ES has been prepared in accordance with the relevant Environmental Impact Assessment (EIA) regulations related to these applications which are:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended by The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008 (where applicable); and
- The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2011 (where applicable).

Collectively these regulations are hereafter referred to as "the EIA Regulations". Further information on the legislative requirements is provided in Chapter 2: *EIA Methodology* of this ES.

This ES is designed to inform decision makers of the nature of the Development, the likely environmental effects, the measures taken to avoid likely significant environmental effects, and the measures proposed to mitigate those remaining effects.

The methodology used to define and assess the significance of the likely environmental effects is described in detail within Chapter 2: *EIA Methodology* of this ES.

The purpose of the ES is to:

- Explain the need for the Development and describe the physical characteristics, scale and design of the Development and highlight the differences between this and the Consented Development;
- Examine the existing environmental character of the Development site and the area with the potential to be affected by the Development;
- Predict the possible significant environmental effects of the Development;
- Describe measures which would be taken to avoid, offset or reduce adverse environmental effects;
- Report the potential residual effects of the Development; and
- Provide the public, the consenting authority and other consultees with information on the Development, which would assist Marine Scotland in the determination of the submission for consent.

Where appropriate and to aid the stakeholders review of the application, attention will be drawn to the differences between the Development and the Consented Development.

1.6 Climate Change and the Need For Renewable Energy

Energy underpins virtually every aspect of the economy. However, the use of fossil fuels such as gas and coal, which currently provides the bulk of our energy, releases greenhouse gases (such as carbon dioxide (CO_2)) into the atmosphere. Due to factors such as population growth and changes in lifestyle, the demand for energy has increased to levels where the burning of fossil fuels is releasing enough greenhouse gases into the atmosphere to directly affect the climate. There is now scientific consensus that climate change is occurring and that it poses a considerable global threat.

Renewable energy is the term used to describe energy flows that occur naturally and continuously in the environment, such as energy from the wind, waves or tides. The origin of the majority of these sources can be traced back to either the sun (energy from the sun helps to drive the earth's weather patterns) or the gravitational effects of the sun and the moon. This means that these sources are continuously replenished. The key issue is how to extract this energy as effectively as possible and convert it into a usable form.

To help lessen the effects of climate change, greenhouse gas emissions must be reduced. One way of helping to achieve this is by generating energy from sources that emit low or even zero amounts of greenhouse gases, such as renewable sources.

1.6.1 Renewable Energy in Europe

The EU produces around 22% of global greenhouse gas emissions and has agreed under the Kyoto Protocol to a cut of 8% from 1990 levels by 2008-2012[1]. In December 2008, the European Parliament agreed to reduce greenhouse gas emissions by 20% (compared to 1990 levels) by 2020 and by 30% in the context of an international climate agreement. The EU 2020 Climate and Energy Package contains four parts, one of which is a Renewables Directive[2] which instructs member states to share the task of achieving the EU's 20%

[1] Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997. Available online at: http://unfccc.int/kyoto_protocol/items/2830.php

[2] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 n the promotion of the use of energy from renewable sources.

renewable target by 2020. The UK's national target is for 15% of energy consumption from renewables by 2020.

At the end of 2010, 181 Terrwatt hours (TWh) of total wind energy was generated in the EU, meeting 5.3% of overall EU electricity consumption[3]. Global Wind 2010 Report states that assuming the current level of high generation across EU, the total installed wind power capacity will reach 265 GW by 2020, meeting 16.7% of the EU's electricity demand.

1.6.2 Renewable Energy in the UK

The United Kingdom is committed to reducing greenhouse gas emissions by 12.5% from 1990 levels by 2008-2012 as part of the Framework Convention on Climate Change (the Kyoto Protocol1).

The Climate Change Act 2008[4] intends to improve carbon management in the UK, establish the move towards a low carbon economy and demonstrate the UK Government's commitment to alleviating the causes of global climate change. In the Climate Change Act 2008, the UK Government set a legally binding commitment to cut the UK's carbon emissions by 80% by 2050 and requires that limits be set on the total amount of emissions in successive five year periods (carbon budgets), so that by 2020 UK emissions will be 18% below 2008 levels and over one third below 1990 levels. This makes the UK the first country in the world to establish such a legally binding long-term and significant carbon reduction target.

Latest estimates show that in 2009, net UK CO_2 emissions were 480.9 million tonnes (Mt) compared to 592.8 Mt in 1990, or 19% lower. Emissions in 2009 were 9.8% lower than the 2008 figure of 532.8 Mt[5], primarily due to a significant fall in energy consumption as the UK economy contracted, combined with fuel switching from coal to nuclear for electricity generation.

In 2009, the main sources of UK CO_2 emissions were estimated to be from the energy supply sector (39%), followed by road transport (25%), residential fossil fuel use (16%) and business (15%). Whilst good progress has been made in meeting the Kyoto protocol targets, significant change in our energy generation and consumption patterns is needed to meet the challenging 2020 and 2050 targets.

The Renewable Energy Strategy[6], which is part of the Government's Overall UK Low Carbon Transition Plan, states that renewables could provide more than 30% of our electricity by 2020, compared to only around 6.8% in 2010[7]. Wind energy is seen as the most significant renewable energy source for achieving these targets in the short and medium term and the Government expects more than two-thirds of the target to come from onshore and offshore wind.

1.6.3 Renewable Energy in Scotland

The Climate Change (Scotland) Act 2009[8] creates a long-term framework for the current and future administrations in Scotland to ensure a reduction in Scottish greenhouse gas emissions of 80% by 2050 with an interim milestone of 42% by 2020.

The Scottish Government is committed to promoting the increased use of renewable energy sources to help tackle climate change and to support economic growth in Scotland, and has recently announced that Scotland would commit to generating 100% of its electricity from

[3]Global Wind Energy Council (GWEC). Global Wind 2010 Report, Available online: http://www.gwec.net/fileadmin/images/Publications/GWEC_annual_market_update_2010_-_2nd_edition_April_2011.pdf
[4] Climate Change Act 2008. London: HMSO
[5] Department of Energy & Climate Change (March 2010) Statistical Release 25th March 2010 UK Climate Change Sustainable Development Indicator: 2009 Greenhouse Gas Emissions, Provisional Figures [online]. Available online at: http://www.decc.gov.uk [Accessed on 03/03/2012]
[6] HM Government (2009). The UK Renewable Energy Strategy, July 2009. Surrey: OPSI
[7] DECC (2011) Digest of UK Energy Statistics 2011
[8] Climate Change (Scotland) Act 2009, OPSI: London

renewable sources within the next decade[9]. Progress towards these targets is mainly driven by the Renewables Obligation (Scotland) 2002 (ROS) which places a legal obligation on every electricity supplier in Scotland to ensure that an increasing proportion of their supplied energy is generated from eligible renewable resources.

The Scottish Government published a Renewables Action Plan (RAP) in July 2009[10] that sets out a framework for action for the next 24-36 months and is continually updated. The plan implements the above national targets by setting out a strong commitment to support and accelerate the implementation of renewable energy.

The action plan sets out the following vision for offshore wind:

"To make a significant contribution to 2020 renewables targets and beyond. To maximise economic benefits to the Scottish economy, and enable a young industry to establish, whilst working in harmony with the marine environment".

It goes on to emphasise two ambitions for offshore wind developments:

- To drive the success of the Scottish offshore wind industry, and facilitate the timely development and installation of offshore wind projects within Scottish Territorial Waters and Round 3 sites adjacent to Scottish Territorial Waters; and
- To build Scotland's position as a key base for the offshore wind, innovation, manufacturing and installation, leveraging its oil and gas experience.

The Development is directly in line with the vision and ambitions set out in the RAP through both the development of the offshore wind industry and developing Scotland as a base for innovation and manufacturing.

1.7 The Project Team

The EIA has been project managed and compiled by Arcus Renewables Energy Consultant Ltd (Arcus), with technical input from specialist consultants with renewable energy expertise. The contributors to the ES are provided in Table 1.1.

Table 1.1 The Project Team

Project Role	Organisation
Project Management	Arcus Renewable Energy Consulting Ltd
Planning Policy Framework	Arcus Renewable Energy Consulting Ltd
Landscape and Visual	RV Design
Noise	Arcus Renewable Energy Consulting Ltd
Ecology	Arcus Renewable Energy Consulting Ltd
Ornithology	Arcus Renewable Energy Consulting Ltd
Water Resources and Coastal Hydrology	Arcus Renewable Energy Consulting Ltd
Cultural Heritage	Arcus Renewable Energy Consulting Ltd
Socio-Economics, Tourism, Land-Use And Commercial Fishing	Arcus Renewable Energy Consulting Ltd
Navigation	Arcus Renewable Energy Consulting Ltd
Telecommunication and Existing Infrastructure	Arcus Renewable Energy Consulting Ltd
Shadow Flicker	Arcus Renewable Energy Consulting Ltd
Miscellaneous Issues	Arcus Renewable Energy Consulting Ltd

[9] The Scottish Government (2011) 2020 Routemap for Renewable Energy in Scotland [Online] Available at: http://www.scotland.gov.uk/Publications/2009/07/06095830/2020Routemap
[10] Renewables Action Plan (2009) http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17612/FRPIS (Accessed 16/04/2012)

The Applicant has provided key information to the process of the development design, operational parameters process and mitigation measures to minimise the environmental effects of the Development.

1.8 The Structure of the ES

The ES comprises of the following volumes:

- ES, Volume I: contains EIA text (this document) which reports the findings of the EIA;
- ES, Volume II: EIA accompanying figures and visualisations;
- ES, Volume III: Technical Appendices which contain detailed technical information supplementing the findings presented within Volume I; and
- Non-Technical Summary (NTS) providing a summary of the information presented in Volume I.

The ES, Volume I, is structured as follows:

- Chapters 1 and 2 provide an overview of the Development and the EIA process including the proposed mitigation strategy;
- Chapter 3 provides a full description of the Development, and outlines the construction and decommissioning methodologies;
- Chapter 4 provides background relating to national, regional and local planning policy; and
- Chapters 5 - 15 cover individual technical areas, with each containing a discussion of likely significant effects, proposed mitigation measures, and subsequent residual effects.

In addition to the documents above the following will be provided:

- Cover Letter;
- Advert; and
- Completed Marine Licence Application forms: Marine Renewable Energy Projects in the Territorial Sea and UK Controlled Water Adjacent to Scotland and Dredging and Deposit of Solid Waste in the Territorial Sea and UK Controlled Waters Adjacent to Scotland.

These do not form part of the formal ES.

2 EIA METHODOLOGY

Environmental Impact Assessment (EIA) is a process aimed to ensure that permissions for developments with potentially significant environmental effects are granted only after assessment of the likely significant environmental effects has been undertaken.

This chapter of the Environmental Statement (ES) details the methodology that has been followed in undertaking the assessments of the likely environmental effects of the Development and details the relevant legislative framework under which this application is made.

2.1 Legislative Context of the Application

2.1.1 Section 36 Consent

To construct and operate an electricity generating station, such as a wind farm, with a capacity greater than 1 Megawatt (MW) in Scottish Territorial Waters, consent is required under Section 36 of the Electricity Act 1989 (as amended). An application for consent under Section 36 in Scottish Territorial Waters is made to the Marine Scotland Licensing Operations Team (MS-LOT) on behalf of the Scottish Ministers.

This Application is for the testing of an offshore demonstration turbine, within Scottish Territorial Waters, which will have the capacity to generate approximately 7 MW of electricity. As such the Development requires consent under Section 36 of the Electricity Act 1989.

2.1.2 Marine License

The Marine (Scotland) Act 2010 states that a marine license is required to construct, alter or improve any works, or deposit any object in or over the sea, or on or under the seabed. A Marine License is required for these works where the works are seaward of the MHWS. As the Development is seaward of the MHWS (Figure 1.3) a Marine License will therefore be required to construct the wind turbine on the seabed and to prepare the sea bed for installation of the base.

As with the Section 36 application above, the application for the Marine Licenses will be made to MS-LOT.

2.1.3 Town and Country Planning

The Town and Country Planning regime applies to new developments located landward of the mean low water spring (MLWS) mark. As such an application will need to be made to Fife Council under the Town and Country Planning (Scotland) Act 1997 (as amended). On the advice of Fife Council the onshore infrastructure required in connection with the turbine installation and on-going maintenance would not require a formal planning application to be submitted, subject to its lifespan mirroring that of the turbine and its use only relating to the installation and maintenance of the turbine. This is with the exception of a temporary office and onshore meteorological mast which will require consent under the Town and Country Planning (Scotland) Act 1997 (as amended).

2.1.4 EIA Legislation

The European Commission Environmental Impact Assessment Directive (85/337/EEC as amended 97/11/EC) requires that an EIA is required to be undertaken for specific types of development. Offshore wind development falls under Annex II of the aforementioned Directive which defines projects as:

"installations for the harnessing of wind power for energy production (wind farms)".

Annex II projects require an EIA where they are likely to have significant effects on the environment by virtue of factors including their nature, size or location.

The Directive is enforced in the UK by a number of regulations. The following have been considered and with regard to assessing the effects of the Development:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended by The Electricity Works (Environmental Impact Assessment)

(Scotland) Amendment Regulations 2008 (where applicable) relating to the development of energy generating projects;

- The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2011 (where applicable) relating to projects being developed in the marine environment; and
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011) relating to projects falling under the Town and Country Planning regime (landward of the MLWS).

This legislation is hereafter referred to as "The EIA Regulations".

This ES presents the findings of the EIA of the Development as a whole, incorporating the offshore and onshore elements:

- A single, three bladed demonstration wind turbine with an installed capacity of up to 7 MW. The turbine will have a maximum hub height of 110 m, from mean sea level (MSL), including the jacket, with a maximum blade rotor diameter of up to 172 m, giving a maximum level from the MSL to turbine tip of up to 196 m;
- A personnel bridge connection between the FEP and turbine tower;
- Construction of an onshore crane pad on the FEP; and
- Construction of an onshore Control compound;
- Construction of four lay down areas for the blades, tower, jacket, and nacelle.

Giving consideration to EIA guidance[1], the nature and size of the Development, and the requirement for EIA for the Consented Development, the Applicant considered that an EIA should be undertaken to support the application and therefore did not seek a formal 'Screening Opinion' from Marine Scotland or Fife Council as to whether or not an EIA was required.

The EIA Regulations provide an opportunity for the Applicant to seek a Scoping Opinion from Marine Scotland on the content of the ES. A request for a Scoping Opinion was submitted to Marine Scotland on the 28th February 2012. Various scoping responses have been received and integrated into the development of this ES. A summary of the responses received within the Scoping Opinion is presented in Section 2.4.

2.2 The Rochdale Envelope

The 'Rochdale Envelope' principal derived from planning case law (R v Rochdale MBC ex. parte Tew and R v Rochdale MBC ex parte Milne 1999). The Rochdale case established that the description of the development for the purposes of EIA can set out a range of parameters within which the actual project must fall. The Rochdale case established that it is acceptable for an ES to assess the worst case likely significant effects of a development through implementing the Rochdale Envelope approach.

In the case of the Development maximum parameters regarding the size of the turbine are presented throughout this ES and have been assessed. There is potential that the turbine tested on the Development site will be smaller than these maximum parameters however the turbine dimensions will always fall within these parameters i.e. within the envelope, which has been assessed within this ES. As such the ES presents an assessment of the likely significant effects arising from the worst case scenario within the Rochdale Envelope.

The Rochdale Envelope parameters are presented in Chapter 3 of this ES.

[1] The Scottish Government, (2000), *'Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland Regulations 2000',* Paragraphs 3.2 and 3.3, Available Online at: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance/EIA-Guidance

2.3 EIA Guidance

The EIA Regulations require that an ES should include the information specified in Schedule 4 of The EIA Regulations.

Guidance in relation to good practice, which has been considered throughout the EIA process comprises of the following documents:

- Circular 3/2011 'The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011, June 2011;
- A User's Guide to the Environmental Impact Assessment (Scotland) Regulations 2011, Scottish Government, June 2011;
- CEFAS, Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements, June 2004;
- Guidelines for Environmental Impact Assessment, Institute of Environmental Management and Assessment, 2004;
- Guidelines on the Environmental Impacts of Windfarms and Small Scale Hydroelectric Schemes, SNH, 2002;
- Environmental Impact Assessment: Guide to Procedures, January 2000[2]; and
- Planning Advice Note (PAN) 58 'Environmental Impact Assessment,' Scottish Executive, September 1999[3].

2.4 Scoping and Consultation

2.4.1 Scoping

The aim of the Scoping process is to identify key environmental issues at as early a stage in the process as possible, to ascertain which elements of the Development are likely to result in significant effects on the environment and to establish the extent of survey and assessment required for the ES.

A Scoping Report was prepared that identified the potential significant environmental effects of the Development, and proposed a scope of works that would enable these to be assessed in sufficient detail to allow the determining authority, to determine the application.

The scope of works included in the Scoping Report extended to the range of technical assessments that should be undertaken, the extent of desk study and field work to be carried out and the approach that should be adopted to assess the likely effects of the Development on the receptors identified as part of these assessments.

As stated above a request for a Scoping Opinion was submitted to Marine Scotland in February 2012. Various consultation responses have been received and incorporated into this ES.

A summary of consultation responses from Marine Scotland, Fife Council and other relevant parties consulted during the Scoping stage is presented in Table 2.1.

[2] Communities and Local Government, (2000), *'Environmental Impact Assessment: Guide to Procedures',* Available Online at:
http://www.communities.gov.uk/publications/planningandbuilding/environmentalimpactassessment
[3] The Scottish Government, (2005), '*Planning Advice Note PAN 58 : Environmental Impact Assessment*', Available Online at: http://www.scotland.gov.uk/Publications/1999/10/pan58-root/pan58-pdf

Table 2.1 Consultation Responses

Consultees	No Response/No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology/Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
BT (Radio Network Protection Team)		*													
Chamber of Shipping												*			
Civil Aviation Authority (CAA)			*												*
Crown Estate	*														
Defence Estates, Ministry of Defence (MoD)		*													
East Lothian Council					*	*									
Edinburgh Council						*									
Fife Council				*	*	*		*	*	*	*		*		
Health and Safety Executive	*														
Historic Scotland		*													
Joint Radio Company (JRC)		*													
Maritime & Coastguard Agency												*			
Marine Scotland			*	*	*	*	*	*	*	*	*	*	*	*	*
Marine Scotland Science	*			*	*										
NERL Safeguarding (NATS)		*													
Northern Lighthouse Board												*			
Ports and Harbours	*														
Royal Society of Protection of Birds (RSPB)					*										
Royal Yachting Association (RYA) Scotland		*													
Scottish Canoe Association												*			*

Consultees	No Response/No Comments	No Objection	Referral to other consultees	Water Resources & Coastal Hydrology	Ecology/Ornithology	Landscape & Visual	Planning Policy	Archaeology and Cultural Heritage	Noise and Air Quality	Tourism and Socio-Economics	Telecoms and Aviation	Navigation and Commercial Fishing	Shadow Flicker	Cumulative Issues	Other Issues
Scottish Environment Protection Agency (SEPA)				*											
Scottish Fishermen's Federation (SFF)	*														
Scottish Government Planning						*								*	
Scottish Wildlife Trust	*														
Scottish Natural Heritage (SNH)				*	*	*									
South East Inshore Fisheries Group												*			
Transport Scotland	*														

Specific details of the scoping opinions in relation to each technical area are presented where appropriate in chapters 5 to15 where the responses to these scoping requests are signposted within the chapter.

2.4.2 Public Consultation

A public exhibition was held at Bayview Football Park, Methil (home of East Fife FC) on the 15th March 2012, 3pm till 7pm. The exhibition was held in order to introduce the concept of the Development to the local community.

The exhibitions displayed information about the Development, the Applicant, the EIA process and the project timetable. Six photomontages of the predicted views of the Development were also displayed to provide a visual representation.

Due to feedback received from the previous Consented Development (Arcus, 2010) exhibition boards were also provided on noise and shadow flicker.

Details of the exhibition were advertised in the following local newspapers:

- East Fife Mail (14th March); and
- The Fife Leader (13th March).

In addition to advertising details of the exhibition in the above newspapers, posters were distributed to the following publically accessible venues:

- Methil Community Centre, Bowling Green Street, Methil, KY8 3DH;
- 16, Leven Library, Durie Street, Leven, KY8 4HE;
- Methil Library, Wellesley Road, Methil, KY8 3PA;
- Levenmouth Swimming Pool, Promenade, Leven, KY8 4PA;
- Kirkland High School, Methil Brae, Methil, KY8 3LT; and
- Robert Gough Centre, Aithernie Road, Leven, KY8 4BU.

An information leaflet was provided during the exhibition outlining the Development and the differences with the Consented Development. Various other information sheets, taken from the RenewableUK website, were also provided. Feedback forms were provided by 10 attendees.

Local residents were given the opportunity to comment on the Development via feedback forms. 80% indicated they were in favour of wind turbines in general, 90% were concerned about this Development although 50% thought the demonstration turbine was a good idea.

In addition to the public exhibitions the Applicant met local councillors for a private session on the 28th March that included a presentation, outlining the Development, and a question and answer session with the Community Council.

Further consultation events are currently being scheduled for August 2012 whilst the application is under consideration by MS-LOT. The exhibition day will present the information on the Development, the EIA process undertaken and the likely consenting timeframe. Local communication and consultation initiatives with the public are planned during the determination of the application.

2.5 Identification of Issues

As a result of the scoping responses and on-going consultation, the following issues are addressed in the ES:

- Landscape and Visual;
- Ecology and Ornithology;
- Water Resources and Coastal Hydrology;
- Archaeology and Cultural Heritage;
- Noise;
- Shadow Flicker;
- Existing Infrastructure Including Aviation and Telecommunications;
- Navigation;
- Socio-economics, Recreation & Tourism, Land-Use and Commercial Fishing; and
- Climate and Carbon Balance, Healthy and Safety and Traffic Management.

All elements of the project and associated infrastructure during the construction and operation phases have been assessed in the ES.

2.6 Technical Environmental Assessments

Each of the technical assessments follows a systematic approach, with the principal steps as follows:

- Description of baseline conditions;
- Identification of receptor sensitivity;
- Prediction of potential effects including any cumulative effects;
- Assessment of potential effects;
- Identification of appropriate mitigation measures; and
- Assessment of residual environmental effects.

A summary of each of these steps is provided below.

2.6.1 Baseline Description

In order to evaluate potential environmental effects, information relating to the existing environmental conditions was collected. This is known as the baseline. It has been used to assess the changes that may take place during the construction, operation and decommissioning of the Development.

Within each technical assessment, the methods of data collection were discussed with relevant consultees. Data was also collected from public records and other archive sources and, where appropriate, field surveys were carried out. The timing of the work and the

defined study area, specifically relating to the subject matter in question, are also outlined within each chapter.

2.6.2 Prediction of Potential Effects

The prediction of potential effects covers both the construction, operation and decommissioning phases of the Development..

The nature of the potential effects are described in each chapter and include:

- Direct and indirect effects;
- Adverse and beneficial effects;
- Short, medium and long term effects;
- Permanent and temporary effects; and
- Cumulative effects.

Each technical assessment follows best practice guidance relevant to the discipline for the assessment of effects. A definition of each of the types of effect identified above are presented in the technical chapters 5 to 15 inclusive.

Following identification of potential environmental effects, baseline information was used to predict changes to existing site conditions and permit an assessment of these changes.

2.6.3 Assessment of Effects and Evaluating Significance

The potential effect that the Development may have on each environmental receptor will be influenced by a combination of the sensitivity of the environment and the predicted degree of change (the magnitude) from the baseline state. Environmental sensitivity may be categorised by a multitude of factors; for instance: status of rare or endangered species, transformation of natural landscapes, or changes to soil quality and land use. The initial assessment, consultation, and scoping stages identified these factors along with the implications of the predicted changes.

For the purposes of this ES the significance of 'effect' is generally considered in terms of:

- Negligible – no detectable change to a location, environment, species or sensitive receptor;
- Minor – a detectable change to a location, environment, species or sensitive receptor;
- Moderate – a non-fundamental change to a location, environment, species or sensitive receptor; and
- Major – a fundamental change to a location, environment, species or sensitive receptor.

A definition of what level of effect is considered to be significant in terms of The EIA Regulations is provided in each technical chapter.

This ES generally follows the aforementioned theoretical approach. Where specific technical assessment areas adopt a variation, this is identified within the methodology set out in the assessment section of the chapter. Within each assessment chapter the criteria for assessing significance of effects are made explicit.

2.6.4 Mitigation and Enhancement

Each chapter also proposes measures to avoid, reduce or potentially remedy significant adverse effects. These are termed mitigation measures. Where the assessment process has identified any potential significant adverse effects, mitigation measures have been proposed to reduce these effects where practicable. Such measures have included the consideration of alternatives, physical design evolutions, and management and operational measures.

Each specialist consultant has identified appropriate mitigation measures. These measures are either embedded into the overall design strategy or presented as additional measures. The Applicant has been flexible with the design within the technical and environmental constraints of the site and by doing so has been able to respond to the findings of consultation and EIA work as the project has progressed.

2.6.5 Assessment of Residual Effects

The residual effects of the Development are those that remain, assuming successful implementation of the identified mitigation measures. Residual effects are identified in each technical assessment alongside an assessment of their significance in terms of the EIA Regulations.

2.6.6 Cumulative Effects

In accordance with the EIA Regulations, this ES has given consideration to 'cumulative effects'. By definition these are effects that result from incremental changes caused by past, present or reasonably foreseeable actions together with the Development.

For the cumulative assessment, two types of effect have been considered:

- The combined effect of individual effects, for example noise, airborne dust or traffic on a single receptor; and
- The combined effects of several developments that may on an individual basis be insignificant but, cumulatively, have a significant effect, such as landscape and visual effects of many wind turbines.

The extent of any cumulative assessment is defined in each technical assessment chapter and can include both existing and proposed wind farm developments and other forms of development. The potential landscape and visual effects, for example that relate to the intervisiblity of individual wind farm development schemes will be much more wide ranging than noise effects which will be limited to receptors in the more immediate vicinity of the Development.

In relation to some of the technical chapters of this ES, specific guidance and policy exists advising that effects associated with existing developments should be considered as cumulative effects.

Where no cumulative effects have been identified, this is stated.

Cumulative effects from other turbine developments within a 30 km study area have been identified and can be seen in Figure 5.4.

2.6.7 Limitations of ES

A number of assumptions have been made during preparation of this ES, as set out below. Assumptions specific to certain environmental aspects are discussed in the relevant Chapters of the ES.

The assumptions are:

- The principal land uses adjacent to the site remain as they are at the time of the submission of the application, except in cases where permission has already been granted for development. In these cases, it is assumed that the approved development will take place, and these have been treated as contributing to "cumulative" effects;
- Information provided by third parties, including publicly available information and databases is correct at the time of submission of the application (April 2012);
- Baseline conditions are accurate at the time of the physical surveys but, due to the dynamic nature of the environment, conditions may change during the site preparation, construction and operational phases; and
- The assessment of cumulative effects has been reliant on the availability of known information relating to existing wind farm developments at March 2012.

3 PROJECT DESCRIPTION

3.1 Introduction

This chapter describes the site, the Development including the demonstration turbine envelope and the onshore components of the scheme. It also provides details of the turbine base and an indication of the proposed methods and timescales for the construction, operation and decommissioning phases.

3.2 General Project Description

The proposal is to construct, operate and decommissioning a site for the testing of new designs of offshore wind turbines with a capacity of up to 7 MW. The Development would be operational for 5 years. During this timescale there is potential for more than one turbine model to be tested at the site. Once one turbine had been tested it would be removed from the site and replaced with a new turbine which would fall within the same design parameters (maximum hub height of 110 m, rotor diameter of 172 m, and maximum height to turbine tip from MSL of 196 m). Only one turbine would ever be installed at any one time. The base would remain in place throughout the Development. All turbines will be removed after 5 years from the operation of the first turbine.

The Development will comprise:

- A single, three bladed demonstration wind turbine with an installed capacity of up to 7 MW. The turbine tower is up to 110 m tall, from Mean Sea Level (MSL) including the base jacket. The turbine has a maximum rotor diameter of 172 m, giving a maximum level from the MSL to turbine tip of up to 196 m (Figure 3.1);
- A personnel bridge connection between the Fife Energy Park (FEP) and turbine tower (Figure 3.6);
- Construction of an onshore crane pad on the FEP; and
- Construction of an onshore Control compound (Figure 3.2).

In addition to the above components of the operational facility, the construction phase will involve:

- Construction of a four lay down areas for the blades, tower, jacket, and nacelle.

The proposed layout is shown in Figure 1.2.

Further infrastructure is associated with the Development, however consent for these installations has/will be applied for under separate applications and consenting regimes. This is to permit the phased installation of these project elements, and to comply with the consents process for the various legislative regimes which apply to applications in a near shore environment. Details of these infrastructure and associated consents are provided in Section 1.1.

Construction would take place over approximately a 4 month period after which time the turbine would become operational. The facility would be operational for 5 years from the initial operation of the turbine to allow for testing and certification. At the end of the five year period the turbine will be decommissioned and removed from the site.

During the test period energy generated from the test facility will be transferred to the grid via new dedicated electrical infrastructure.

The connection to the grid falls under a separate consenting process and will be subject to a separate environmental investigation and consent application. As such it will not be considered at length as part of this EIA.

3.3 Site Description

The FEP site comprises 133 acres of semi-derelict industrial land in Methil. Scottish Enterprise is the landowner, having acquired the site from Wemyss Estate Trustees and Crown Estate in 2005.

FEP was originally the site of the Wellesley Colliery which operated from 1890 until closure in 1964. The site was largely established by the deposition of colliery spoil, gradually reclaiming land from the sea. Following the closure of the mine, the site was further developed in the 1970s as a North Sea Oil Fabrication Facility by Redpath de Groot Caledonian (RGC). RGC subsequently sold their interest to Kvaerner Oil & Gas who operated the yard until 2001 when production ceased.

In primary activities performed at the site was the production of drilling rigs for the offshore oil and gas industry, at its peak over 2000 people were employed on the site.

A major redevelopment programme with investment totalling over £20M is currently underway at the FEP. The vision for the FEP is to establish a state of the art industrial facility for energy in Scotland, delivering excellence in engineering, fabrication and assembly. It will incorporate a vibrant local and national supply chain and host innovation in the supporting technologies, across the energy sector.

Interim works have been completed to a 300 m stretch of coastal defences along the southern edge of the FEP site where existing defences had been breached and material was starting to slip into the sea. A draft Coastal Defence Strategy for the entire FEP has been developed along with detailed design work for the quayside and some sections of the coastal defences.

A comprehensive programme of earthworks and site levelling has been completed which has seen formation of engineered embankments between the FEP and neighbouring residential properties along with formation of approximately 70 acres of new development land which is the focus for attracting new companies and investment onto the site. Current users of the site include:

- BiFab (oil and gas and offshore wind and marine renewables fabricator);
- Professional Testing Services Ltd (heavy engineering NDT);
- Duncan Engineering (contract engineering); and
- JKF Group Ltd (civil construction).

The turbine will be located approximately 35 m from the MHWS and 48.3 m from the FEP boundary. A cross section of the existing sea bed showing the location of the turbine from MHWS is presented in Figure 3.3.

3.4 The Development

3.4.1 The Demonstration Wind Turbine

The demonstration turbine is similar in appearance to the offshore turbines currently in use. It has three blades located on the upwind side of the tubular steel tower. The turbine tower will be erected on top of a steel base known as a jacket which will be piled into the sea bed. The jacket and turbine tower will not exceed 110 m to hub from the MSL. The turbine will have a rotor diameter of up to 172 m, giving a maximum tip height of up to 196 m (Figure 3.1).

The turbine will most likely be an upwind turbine, meaning that the blades face into the wind and are upwind of the tower in the same manner as a standard 3 bladed onshore machine. It is likely that the blades would be manufactured from fibre-reinforced epoxy.

The turbine would be variable speed, so that the turbine rotor speed varies according to the energy available in the wind. The nacelle houses the gearbox and generator and is mounted on a tubular steel tower. The nacelle would be accessed via ladders/lifts located within the tower, rest platforms will be included at appropriate intervals.

The finish and colour of the nacelle and blades is likely to be a minimum reflective, semi-matt pale grey. For the purposes of navigational safety the lower sections of the turbine are required to be painted yellow to make the turbine easily visible to shipping, up to a height of 15 m above the MHWS or the height of the Aid to Navigation (whichever is greater).

Lighting and marking requirements have been taken into account. The Maritime Coastguard Agency (MCA), Civil Aviation Authority (CAA), Trinity Lighthouse Service, the Royal Yachting

Association (RYA) provide guidance ensuring that the wind turbine is appropriately marked and lit.

The turbine will be equipped with flashing yellow lights, fog horns, yellow paint and radar reflectors. Red aviation lights will also be installed.

Table 3.1 Turbine Specifications

Turbine Specification	**Dimension / Number**
Turbine Rated Capacity	Up to 7 MW
Number of Blades	3
Tower Style	Tubular
Max tower height above Mean Sea Level	110 m
Max blade diameter	172 m
Max tip height	196 m
Minimum clearance between Mean Sea Level and swept area	24.4 m

Access to the demonstration turbine would be gained via a personnel bridge structure which will provide permanent access between the shore and the personnel platform which forms part of the jacket structure, see Figure 3.6. The bridge would be fixed to the FEP using piling, a pile cap and concrete pier. All these works would be above the MHWS mark. There may also be intermediate supports that will require a borehole to be drilled to a depth of up to 30 m and steel pile inserted and grouted, if required, this would be located seaward of the MHWS and forms part of the Marine License application. This bridge would also transfer the electricity cables from the turbine to the shore. The electricity cables between the turbine and the shore would be appropriately insulated and would be attached to the underside of the bridging structure.

3.4.2 Turbine Power Output and Transformers

One of the main innovations of the demonstration turbine relates to the higher than standard power output.

When operating, the rotational speed of the blades is geared up through the gearbox which drives the generator. This produces a three-phase power output at 10 kV, which in the case of this demonstrator, will be converted at the land based sub-station transformer to grid compliant 11kV or 33 kV output.

3.4.3 Wind Turbine Foundation including Installation

The turbine will sit on a steel jacket which will be piled directly into the sea bed. To install this jacket it is likely that at high tide a jack up barge will be floated adjacent to the turbine position, where the barge will jack up out of the water in order to provide a stable platform for piling. An area of the seabed will be prepared/levelled as illustrated on Figures 3.4 and 3.7. The total volume of material which may need to be removed to achieve a level base will not exceed 1200m^3 with a maximum depth of material removal of 3.5 m. This material will be removed during the sea bed preparation and disposed of at an existing off site disposal facility under a Marine Licence. Four boreholes will be drilled to a depth of up to 20 m and steel piles inserted and grouted. The piles will be a maximum of 20 m long and approximately 2 m in diameter. The extent of the seabed preparation and the location of the boreholes can be seen in Figure 3.4 based on bathymetric data.

The final jacket design and installation would depend on the results of detailed pre-construction geo-technical investigation. A borehole investigation has been undertaken and the findings are being used to confirm the suitability of the ground conditions for the intended installation and allow a detailed design to be completed based on parameters such as stiffness and bearing values.

Any spoil arising from the drilling of the foundation piles will be removed from site and disposed of.

3.4.4 Jacket and Turbine Installation

There are three potential options for the installation of the jacket and turbine that are being considered:

- Onshore crane;
- Jack-up barge; and
- Floating crane.

3.4.4.1 Onshore crane

A potential onshore installation is being considered, this will require a crane pad on the FEP to accommodate the onshore crane. Four laydown areas will also need to be created close to the crane pad for the turbine components to be located ready for assembly and erection (Figure 1.2). The crane pad will be a maximum of 110 m x 47 m, located within the FEP boundary mitigating any required works to the quayside.

Once the crane pad is constructed one or two heavy lift cranes will be used to install the jacket and turbine, the crane(s) will be approximately 50 m from the turbine position. A separate application will be submitted under the Town and Country Planning regime. The crane pad would be left in place for the duration of the consent, in order to allow for use by similar plant, should major components need adjustment or replacement during the course of the demonstration project.

3.4.4.2 Jack up barge

A jack up barge may be located close to the turbine position where the jack-up legs will be lowered to the sea bed where they will penetrate under their own weight. This will be done during high tide.

3.4.4.3 Floating crane

Should the jack up barge be unsuitable then a floating crane will be considered.

3.4.5 Turbine Component Delivery

The majority of the turbine components will either be manufactured on site or delivered via sea. BiFab, a steel fabrication yard already making steel transition pieces for the offshore wind market, is located within the FEP, are capable of making the jacket utilised by the demonstration turbine. The tower, nacelle and blades would be delivered by sea and offloaded at Quay 2. These would be driven around to the laydown areas ready for erection.

3.4.6 Site Access

Vehicular access to the site will be via the entrance to the FEP, this route is suitable for Heavy Goods Vehicles (HGVs). It is not proposed to construct any additional tracks within the FEP, the nature of the site allows vehicular access. An indicative access route has been shown in Figure 1.2.

3.4.7 Cabling

Cable connections from the turbine to the site will be routed either on, or within the structure and across the personnel link bridge, thereby removing any need to disturb the foreshore area with cable routes. The turbine would then be connected to the grid initially via an existing 11kV circuit within the site and eventually via a new dedicated 33kV grid connection to the FEP. A Supervisory Control and Data Acquisition (SCADA) system would be installed to gather information from the turbine and would provide the facility to operate the machine remotely. A 20mm^2 fibre optic communications cable would run alongside the power cables to link the turbine to the SCADA system as shown on Figure 3.5. The cable and substation location are included in Figure 1.2.

3.4.8 On-site control compound

The turbine will be controlled from the on-site control compound. The compound will comprise a series of contained facilities housing offices and control equipment. The layout of the facilities is shown in Figure 3.2.

3.4.9 Wind Monitoring Masts

As part of the turbine certification, measurement of wind speeds on site at the height of the turbine rotor is required. A 110 m high onshore lattice meteorological mast will be erected for a period of up to 6 years. This will be applied for under a separate Town and Country Planning application. The location of the onshore meteorological mast is still to be determined but will be to the west of the turbine within a 430 m radius.

An offshore meteorological mast will be constructed for a period of 3 months 22 m from the turbine location to calibrate the onshore mast. A separate Marine Licence will be submitted with a Supporting Statement to Marine Scotland.

3.4.10 Site Accommodation and Temporary Works

Facilities and temporary construction works which would be located within the FEP include:

- Site offices and welfare facilities; and
- Laydown areas (blade, tower and nacelle).

An indicative design of these onshore works is provided in Figure 1.2.

3.4.11 Pollution Control Measures and Environmental Management

In order to ensure that all mitigation measures outlines within this ES are carried out on site, contractors would be provided with the following documents which must be adhered to throughout the construction process:

- Pollution/Spill Prevention Plan, relevant environmental procedures and method statements;
- Noise management plan;
- Planning conditions; and
- Other requirements of statutory bodies.

Selection of the construction contractor would be through a quality and price matrix which will include an assessment of their record of dealing with environmental issues. The contractor shall be required to maintain a clean and tidy site and manage the site area in accordance with best practice.

3.4.12 Foul Drainage

During construction, temporary toilet facilities for construction workers will be provided in the form of a standard 'Port-a-loo', hired during the construction phase from a local supplier and serviced at weekly intervals by a specialist pump truck which would evacuate the holding tank, clean the unit and add fresh water. No running water is required on-site as the unit's holding tank is replenished during each weekly service.

During operation and testing of the turbine, the welfare facilities with FEP will be utilised by staff attending to the turbine.

There would be no trade effluent, sewage effluent, or waste disposal into the sea, during the construction or operation of the turbine.

3.4.13 Site Safety and Emergency Procedures

Prior to construction commencing, the appointed contractor would be required to prepare a construction phase Health and Safety Plan.

An Operation and Maintenance Manual, for the design life of the turbine would also be prepared, which would cover the operation, design proving and re-location safety related procedures.

Emergency Services Vehicles and/or boat access would be addressed within the Health and Safety Plan. The contractor will liaise with all of the emergency services prior to works commencing, to ensure that access for Emergency Services vehicles or boats would be maintained at all times during construction.

3.5 Operation and Design Proofing

A site based engineering staff of 4-6 people will be required to undertake the commissioning and testing of the turbine. The engineers will require daily access to the turbine for instrumentation, maintenance and monitoring purposes. The operation and design proofing of the turbine involves no discharges, and utilises no chemicals other than lubricants such as oil. In the unlikely event of a pollution spill incident there would be an accidental spill procedure for the site. All operation and maintenance staff would be trained in the procedure. Any empty lubricant containers, waste oil and other waste would be removed from the site by the turbine engineers or by licensed waste carriers and disposed of at a licensed waste facility in accordance with current regulations.

3.6 Decommissioning

Once the 5 year permission has lapsed the demonstration turbine will be removed along with the jacket, in reverse to that of the installation methodology. The piles will remain in place below the sea bed. The onshore infrastructure will be removed in agreement with the Fife Council. The onshore met mast will be removed subject to the conditions associated with the separate Town and Country Planning consent.

4 PLANNING POLICY

4.1 Introduction

This chapter of the ES describes the planning framework and the various policies relevant to the Development. The purpose of this chapter is to provide the policy context surrounding the Development. It is not the intention of this chapter to assess whether the proposed development complies with policy.

A Scoping Report was issued to Marine Scotland in February 2012 of which Marine Scotland provided responses in relation to planning policy. These responses are summarised below in Table 6.1.

Table 6.1: Scoping Responses

Level of Value	Comments	Response
Marine Scotland	Outlined the planning policy which may be relevant to this proposal.	Where the listed policy is relevant to the application, and has not been revoked or repealed this is discussed throughout this chapter.

4.2 Policy Context

In Scotland there is a hierarchical structure of guidance and plans covering national, regional and local planning. The Government is committed to the plan led system of development management.

However, any proposal to construct or operate an offshore power generation scheme with a capacity in excess of 1 megawatt (MW) requires Scottish Ministers' consent under section 36 of the Electricity Act 1989[1]. Therefore, whilst Fife Council is a Statutory Consultee and regard must be given to the local Development Plan, the final decision rests with the Scottish Ministers.

Schedule 9, Section 3 (1) of the Electricity Act 1989 places on the developer a duty to:

"have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest".

4.3 2020 Routemap for Renewable Energy in Scotland

2020 Routemap for Renewable Energy in Scotland (2011)[2] reflects the challenge of the Scottish Government's new target to meet an equivalent 100% demand for electricity from renewable energy by 2020, as well as the target of 11% renewable heat. It presents actions which are focused on targets within the current development of UK regulatory support.

The Routemap recognises that offshore wind energy developments have huge scope for sustainable economic growth in Scotland. It recognises that there must be support for innovation in order to reduce the costs of offshore wind development.

4.4 Renewable Action Plan (2009, Updated March 2011)

The Renewables Action Plan[3] is an action plan to drive the development of renewable energy and capitalise on Scotland's natural resources to gain maximum economic benefit. It sets out the framework for action in the specific area of renewable energy, identifying what needs to happen and by when to achieve our national targets and objectives.

[1] Office of Public Sector Information (OPSI) (1989) Electricity Act 1989 [Online] Available at: http://www.opsi.gov.uk/ACTS/acts1989/ukpga_19890029_en_1
[2] The Scottish Government (2011) 2020 Routemap for Renewable Energy in Scotland [Online] Available at: http://www.scotland.gov.uk/Publications/2009/07/06095830/2020Routemap
[3] The Scottish Government (2009, updated 2011) Renewables Action Plan [Online] Available at: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Resources/20801/RAPCONS

In regard to offshore wind, the Renewables Action Plan is expecting to facilitate up to 6.4 GW of renewable power from the Crown Estate territorial waters. It has a vision to "*enable a young industry to establish, while working in harmony with the marine environment*".

4.5 A Low Carbon Economic Strategy for Scotland (Nov 2010)

The Low Carbon Economic Strategy for Scotland[4] is an integral part of the Government's Economic Strategy and a key component of the Government's broader approach in meeting Scotland's climate change targets and securing the transition to a low carbon economy in Scotland.

Section 2.2 relates to the energy sector. It states that transforming the energy sector in Scotland will play a pivotal role in the development of a low carbon economy, and also recognises that Scotland's abundant renewable resources that could be the source of international competitive advantage.

With specific regard to offshore wind, it recognises that Scotland potentially has as much as 25% of Europe's offshore energy potential. It further states:

"The large scale development of offshore wind represents the biggest opportunity for sustainable economic growth in Scotland for a generation. It is critical that Scotland exploits the opportunities being made available by the offshore wind industry. Harnessing just one third of our offshore renewable energy potential could meet Scotland's electricity needs seven times over by 2050."

4.6 Blue Seas - Green Energy - the Sectoral Marine Plan (SMP) for Offshore Wind Energy in Scottish Territorial Waters (2011)

Blue Seas - Green Energy - the Sectoral Marine Plan (SMP) for Offshore Wind Energy in Scottish Territorial Waters[5] sets out a vision for the delivery of energy from offshore wind resources and contains proposals for offshore wind development at the regional level up to 2020 and beyond. Nine short term options to be developed by 2020 and 25 medium term areas of search for development between 2020 and 2030 are identified.

The SMP states that there are generic issues which apply in all offshore wind plan regions, including shipping, fishing, environmental impact and visual impact. It recognises that the East region has favourable conditions for the development of offshore wind and, whilst significant strategic issues relating to fishing, shipping and the environment are noted, it suggests that such issues can be addressed through appropriate mitigation measures.

4.7 Climate Change (Scotland) Act 2009

The Climate Change (Scotland) Act 2009[6] creates a long-term framework for the reduction of greenhouse gas emissions of 80% by 2050. This underlines the Government's commitment to reducing greenhouse gases.

Securing low carbon energy supplies is a key element in achieving this target and in recognition of this, the Act provides a commitment to producing 80% of the country's electricity from renewable sources by 2020. The current Digest of UK Energy Statistics indicates that by the end of 2011, 31% of Scotland's energy will be from renewable sources. There is, therefore, some considerable development still required in order to meet this ambitious target.

[4] The Scottish Government (2010) A Low Carbon Economic Strategic for Scotland [Online] Available at: http://www.scotland.gov.uk/Resource/Doc/331364/0107855.pdf
[5] Marine Scotland (2011) Blue Seas – Green Energy [Online] Available at: http://www.scotland.gov.uk/Resource/Doc/346375/0115264.pdf
[6] Office of Public Sector Information (OPSI) (2009) Climate Change (Scotland) Act 2009 [Online] Available at: http://www.opsi.gov.uk/legislation/scotland/acts2009/pdf/asp_20090012_en.pdf

4.8 Marine (Scotland) Act (2010)

The Marine (Scotland) Act 2010[7] aims to protect Scotland's marine environment whilst facilitating sustainable economic growth. It provides a framework which will help balance competing demands on Scotland's seas and introduces a duty to protect and enhance the marine environment.

Part 2 sets out the general duties of the Act, one of which is the "mitigation of and adaption to climate change". It sets out the requirement for a national marine plan which must set objectives relating to the mitigation of, and adaptation to, climate change.

4.9 National Policy Statements

The Infrastructure Planning Commission (IPC) was set up under The Planning Act 2008[8] to determine applications for nationally significant infrastructure projects in England and Wales. Determination of these applications should be made in accordance with National Policy Statements (NPS) which have been issued by the Department of Energy and Climate Change.

In Scotland the IPC will not examine applications for nationally significant generating stations or electricity network infrastructure. However, paragraph 1.5.3 of EN-3 notes that "*energy policy is generally a matter reserved to UK Ministers and this NPS may therefore be a relevant consideration in planning decisions in Scotland*".

4.9.1 Overarching National Policy Statement for Energy (EN-1) (July 2011)

National Policy Statement EN-1[9] confirms the UK Government commitment to reducing greenhouse gas emissions and increasing the amount of electricity generated from renewable sources and sets out those criteria against which such applications should be determined. This policy document is aimed to inform the determination of Section 36 applications in England and Wales but may form a material consideration in the determination of the proposed development.

4.9.2 National Policy Statement for Renewable Energy Infrastructure (EN-3) (July 2011)

National Policy Statement EN-3[10] relates specifically to renewable energy developments. This document should be read alongside EN-1 and decisions made by the IPC in relation to renewable energy developments should be made in accordance with this document. The document sets out general matters which are considered material in the determination of applications for biomass combustion, onshore and offshore windfarms in England and Wales.

4.10 National Planning Framework 2 (NPF2) (Updated 2009)

The National Planning Framework[11] was given a statutory footing courtesy of the Planning etc. (Scotland) Act 2006. It provides the strategic spatial policy content for wider decision making and NPF2 guides Scotland's development to 2030.

There are four key aims of the NPF2 one of which is:

"*To promote a greener Scotland by contributing to the achievement of climate change targets and protecting and enhancing the quality of the natural and built environments*"

In respect of renewable energy the NPF2 states:

[7] The Scottish Government (2010) Marine Scotland Act [Online] Available at: http://www.legislation.gov.uk/asp/2010/5/pdfs/asp_20100005_en.pdf
[8] Office of Public Sector Information (OPSI) (2008) Planning Act 2008 [Online] Available at: http://www.opsi.gov.uk/acts/acts2008/ukpga_20080029_en_1
[9] Department of Energy and Climate Change (2011) National Policy Statement for Energy [Online] Available at: http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/consents-planning/nps2011/1938-overarching-nps-for-energy-en1.pdf
[10] Department of Energy and Climate Change (2011) National Policy Statement for Renewable Energy Infrastructure [Online] Available at: http://www.decc.gov.uk/en/content/cms/meeting_energy/consents_planning/nps_en_infra/nps_en_infra.aspx
[11] The Scottish Government (2009) National Planning Framework for Scotland 2 [Online] Available at: http://www.scotland.gov.uk/Publications/2010/02/03132605/0

"*The aim of national planning policy is to develop Scotland's renewable energy potential whilst safeguarding the environment and communities*."

NPF2 acknowledges that the longer term potential of renewable energy is likely to lie with new technologies, and that there will be growing contributions from offshore wind.

NPF2 recognises that Fife Energy Park has the potential for adapting coastal facilities created to support the oil and gas industry to new uses related to the development of renewable energy. It further states that there may also be opportunities to site new renewable energy facilities where they can take advantage of the transmission capacity released by the closure of existing power stations.

4.11 Scottish Planning Policy and Planning Advice Notes (PANs)

The Scottish Government has recently prepared a singular policy document which merges all previous SPPs and NPPGs into a singular document, the Scottish Planning Policy (SPP). The document also supersedes certain PANs, however those that are still relevant to the proposed development are listed below.

The SPP was written in an effort to produce guidance that the Local Authorities and others that relate to planning policy and the operation of the planning system. It sets the context between planning policies and other policies, which have an important bearing on issues of development and land use. Local authorities must take their contents into account when preparing new development plans and assessing planning applications.

The following documents are relevant to the Development:

- Scottish Planning Policy;
- PAN 2/2011: Planning and Archaeology;
- Advice Note on Renewable Energy – Online Replacement to Pan 45 Renewable Energy Technologies;
- PAN 51: Planning, Environmental Protection and Regulation;
- PAN 1/2011: Planning and Noise;
- PAN 58: Environmental Impact Assessment;
- PAN 60: Planning for Natural Heritage;
- PAN 69: Planning and Building Standards Advice on Flooding; and
- Marine Guidance Note 275 (M).

4.11.1 Scottish Planning Policy

Scottish Planning Policy (SPP)[12] provides a brief statement on Government policy on land use planning, setting out the purpose, principles and intended outcomes of the planning system and statutory guidance on sustainable development. It also includes subject policies, which include policy on renewable energy and the natural environment which are of relevance to the Development.

4.11.1.1 Community Engagement

The Community Engagement section (paragraphs 31 and 32) of the Scottish Planning Policy, highlights the importance of public consultation, and explains that the Scottish Government presume that this will occur from the initial stages of any planning application, in order to establish the views of the local community effectively. The requirements for such consultation are specified in The Planning etc. (Scotland) Act 2006.

The public maintain the right to comment on all planning applications once they have been submitted to the planning authority, and all "*legitimate public concern and support*" should be taken into consideration. Both the planning authority and developer are expected to ensure the necessary steps are made for situations such as planning applications. The document advises that any comments on planning applications should focus on relevant planning issues

[12] Scottish Government (2010) "Scottish Planning Policy". [Online] Available at: http://www.scotland.gov.uk/resource/doc/300760/0093908.pdf

and communicate with the developer and planning authority to act upon these comments in an appropriate manner.

4.11.1.2 Sustainable Development

This section (paragraphs 34-44) identifies the Scottish Government's commitment towards achieving sustainable development, building on what is set out in The Planning etc. (Scotland) Act 2006. The Act sets outs specific requirements for planning authorities to assess planning applications with regard to sustainable development.

All decisions on the location of new development should:

- "*promote regeneration and the re-use of previously developed land*";
- "*reduce the need to travel and prioritise sustainable travel and transport opportunities*";
- "*promote the development of mixed communities*";
- "*take account of the capacity of existing infrastructure*";
- "*promote rural development and regeneration*"; and
- "*prevent further development which would be at risk from flooding or coastal erosion*".

In addition to taking the above principles into account for location, the following should be assessed when referring to layout and design:

- "*encourage the use of and enable access to active travel networks and public transport*";
- "*promote the efficient use of land, buildings and infrastructure*";
- "*encourage energy efficiency through the orientation and design of buildings, choice of materials and the use of low and zero carbon generating technologies*";
- "*support sustainable water resource management*";
- "*support sustainable waste management*";
- "*consider the lifecycle of the development*";
- "*encourage the use of sustainable and recycled materials in construction*"; and
- "*support habitat connectivity*".

The document also recognises the need to combat climate change, referring specifically to the Climate Change (Scotland) Act 2009. In order to fulfil the targets specified in the Act, the Scottish Government recognises the need to "*contribute to reducing renewable energy consumption and to the development of renewable energy generation opportunities*".

With reference to the Climate Change (Scotland) Act 2009, the document emphasises the need for Scotland to combat against climate change, and in doing so highlights the requirements that public bodies must act:

- "*in the way best calculated to contribute to the delivery of the emissions targets in the Act*";
- "*in the way best calculated to help deliver the Government's climate change adaption programme*"; and
- "*in a way that it considers to be most sustainable*".

4.11.1.3 Coastal Planning

The Coastal Planning section (paragraphs 98 – 103) of the document is in place to highlight the need for sustainable development within coastal areas of Scotland, and emphasises that coastal planning is "*an important contributor to sustainable economic growth*".

The document also makes reference to the Marine (Scotland) Bill, which is documented in section 4.6.8 of this chapter. The Scottish Government aims to prepare a national marine plan, in co-ordination with Marine Planning Partnerships, which will set out a structured set of objectives relating to the economic, social and marine ecosystem aspects of the Scottish coasts. It is also highlighted that "*coastal areas which are likely to be suitable for*

development include existing settlements and substantial free standing industrial and energy developments".

Although areas may be suitable, there are also areas which may harbour significant constraints to new development, which may include conservation areas, coastal erosion or maintaining or enhance the historic and natural environment. Planning authorities are required to assess the various locational needs for different types of development, such as "*off-shore renewable energy generation*".

4.11.1.4 Historic Environment

The key aim of this section (paragraphs 110 – 112) of the policy is to ensure the protection and enhancement of any site or building of historic or archaeological importance within Scotland. It is highlighted that this SPP, in cohesion with the Scottish Historic Environment Policy (SHEP) and Historic Scotland's 'Managing Change in the Historic Environment' guidance note should be taken into account by the planning authority when considering planning applications for any development that may affect the historic environment.

Developers are also expected to take the relevant legislation into account when designing and siting their proposal. Legislation includes:

- Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997;
- Ancient Monuments and Archaeological Areas Act 1979;
- Town and Country Planning (Scotland) Act 1997;
- Planning etc. (Scotland) Act 2006;
- Protection of Wrecks Act 1973; and
- Protection of Military Remains Act 1986 (Designation of Vessels and Controlled Sites) Order 2008.

4.11.1.5 Landscape and Natural Heritage

This section of the SPP (paragraphs 125 – 148) is in place to protect, and where possible, enhance Scotland's Landscape and Natural Heritage. In order to do so, the policy advises planning authorities to apply the "*precautionary principle*" where a proposed development may impact upon an internationally or nationally designated site. In circumstances where the precautionary principle is reasonable, the proposed development will be required to undergo modifications in order to protect the designated area. Although this is the case, the precautionary principle should not be applied irrationally.

The landscape is defined as "*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors, and makes it clear that all landscapes require consideration and care. Different landscapes will have a different capacity to accommodate new development and the siting and design of development should be informed by local landscape character*".

The policy subsequently acknowledges that international, national and local designations receive varying levels of protection from the planning authority. Development affecting international designations will only be approved where:

- "*an appropriate assessment has demonstrated that it will not adversely affect the integrity of the site*"; or
- "*there are no alternative solutions*"; and
- "*there are imperative reasons of overriding public interest, including those of a social or economic nature*".

Development affecting national designations will only receive consent in the event that:

- *"it will not adversely affect the integrity of the area or the qualities for which it has been designated"; or*
- *"any such adverse effects are clearly outweighed by social, environmental or economic*

benefits of national importance".

Local designations should not receive a level of protection as high as that received at national or international designations.

4.11.1.6 Transport

This part of the document seeks to protect public and local transport links from any disruption which may be caused by developments. The policy sets out guidelines which must be followed at the construction phase, when development affects major roads.

4.11.1.7 Renewable Energy

This section of the SPP relates to renewable energy. The Scottish Government set a national indicator target which aims for 50% of electricity to be generated from renewable resources by 2020[13], and in doing so acknowledge that wind power is one of the main sources of renewables in the country. In line with this SPP, planning authorities are expected to support the development of various renewable energy developments as well as provide guidance on siting development and clarity on issues that relate to specific issues and sites.

Developments plans are expected to support all types of development relating to energy generation from renewable sources in an attempt to ensure the region's potential renewable energy capacity is achieved. With reference to specific renewable energy applications, the factors relevant will vary dependent on the scale of the proposal, although these are likely to include any impacts affecting following:

- Landscape;
- Historic environment;
- Natural heritage and water environment;
- Amenity and communities; and
- Cumulative impacts.

All applications are expected to include conditions relating to decommissioning, which are likely to include full site restoration once the development has completed its life cycle.

With direct relation to wind farms, the document advises that planning authorities should support the development of such proposals in situations where the wind farm will operate efficiently and any affects can be *"satisfactorily addressed".* Every Development plan should contain information relating specifically to the potential capacity for wind farm developments of all scales, in addition to stating the criteria that wind farm developments will be judged on. The SPP states that criteria is likely to include assessing the impacts upon:

- "*landscape and visual impact*;
- *effects on the natural heritage and historic environment*;
- *contribution of the development to renewable energy generation targets*;
- *effect on the local and national economy and tourism and recreation interests;*
- *benefits and disbenefits for communities*;
- *aviation and telecommunications*;
- *noise and shadow flicker*; and
- *cumulative impact.*"

4.11.1.8 Flooding

This section of the SPP seeks to direct development away from areas which are likely to flood and to facilitate the appropriate flood prevention measures into development if required.

[13] Scottish Government (2010) National Indicator [Online] Avavilable at: http://www.scotland.gov.uk/About/scotPerforms/indicators/electricity

4.11.2 PAN 2/2011: Planning and Archaeology

PAN 2/2011[14] was adopted in July 2011 and supersedes PAN 42. It provides advice to planning authorities and developers on dealing with archaeological remains.

The aim of this document is to preserve all archaeological monuments where possible. In the event that a proposed development would impact upon an archaeological artefact, the developers are recommended to discuss their proposals with the planning authority at an early stage. The document also advises that it is the role of the developer to arrange any archaeological evaluations to be undertaken to fully assess the impact any development would have.

This document also states that in determining planning applications that may impact on archaeological features or their setting, planning authorities may on occasion have to balance the benefits of development against the importance of archaeological features.

4.11.3 Advice Note on Renewable Energy – Online Replacement to Pan 45 Renewable Energy Technologies

PAN 45 Renewable Energy Technologies and Annex 2 Spatial Frameworks and Supplementary Planning Guidance for Wind Farms has been replaced with web based renewables advice[15] which will be regularly updated. It was last accessed on 11th April 2012. It currently provides no advice for offshore renewable energy generation.

The online guidance provides advice to planning authorities on a range of issues related to onshore wind energy for development planning and management purposes. The most relevant aspects of this guidance are the typical planning considerations in determining planning applications for onshore wind development. These include:

- Landscape impact;
- Impacts on wildlife and habitat;
- Impacts on communities (which includes shadow flicker, noise, electro-magnetic interference to communication systems and ice throw);
- Aviation matters;
- Military aviation and other defence matters;
- Historic environment impacts;
- Road traffic impacts; and
- Cumulative impacts.

The guidance also includes good practice during construction and decommissioning as relevant planning considerations.

4.11.4 PAN 51: Planning, Environmental Protection and Regulation

PAN 51[16] supports the existing policy on the role of the planning system in relation to the environmental protection regimes. It also summarises the statutory responsibilities of the environmental protection bodies, as well as informing these bodies about the planning system. Details of the environmental protection regimes include:

- Pollution Prevention and Control;
- Protection of the Water Environment;
- Drinking Water Quality – public and private water supplies;
- Contaminated Land;
- Radioactive Substances Statutory Nuisance including Noise;
- Litter;
- Light;

[14] The Scottish Government (2011) PAN 2/2011: Planning and Archaeology [online] Available at: http://www.scotland.gov.uk/Publications/2011/08/04132003/0
[15] The Scottish Government (updated 2012) Advice Note on Renewable Energy [online] Available at: http://www.scotland.gov.uk/topics/built-environment/planning/national-planning-policy/themes/renewables
[16] The Scottish Government (Revised 2006) PAN 51: Planning, Environmental Protection and Regulation [online] Available at: http://www.scotland.gov.uk/Publications/2006/10/20095106/0

- Local Air Quality Management; and
- Environmental Noise.

More specific guidance has been issued on several environmental topics including noise, waste, Environmental Impact Assessment and Air Quality.

4.11.5 PAN 1/2011: Planning and Noise

PAN 1/2011[17] was adopted in February 2011 and supersedes PAN 56. It provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. Information and advice on noise impact assessment methods is provided in the associated Technical Advice Note Assessment of Noise. It includes details of the legislation, technical standards and codes of practice for specific noise issues.

4.11.6 PAN 58: Environmental Impact Assessment

PAN 58[18] provides information and advice on:

- The legislative background to EIA;
- EIAs in Scotland;
- The process of environmental impact assessment;
- Environmental studies and statements;
- The evaluation of environmental information by the planning authority; and
- Implementation through the planning decision.

This PAN relates specifically to environmental impact assessment for development projects authorised under planning legislation. However the principles of EIA of the advice are relevant.

4.11.7 PAN 60: Planning for Natural Heritage

PAN 60[19] provides advice on how development and the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment and encourages developers and planning authorities to be positive and creative in addressing natural heritage issues.

4.11.8 PAN 69: Planning and Building Standards Advice on Flooding

PAN 69[20] provides good practice advice on planning and building standards in areas where there is a risk of flooding and aims to prevent future development which would have a significant probability of being affected by flooding or which would increase the probability of flooding elsewhere.

This PAN also sets out background information on the water environment and the factors which contribute to flooding. This includes watercourses, coasts, sewer surcharging, groundwater, and the influence of climate change.

4.11.9 Marine Guidance Note 371: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues (2008)

This Guidance Note[21] highlights issues that need to be taken into consideration when assessing the impact on navigational safety and emergency response (search and rescue and

[17] The Scottish Government (2011) PAN 1/2011: Planning and Noise [online] Available at: http://www.scotland.gov.uk/Publications/2011/02/28153945/0
[18] The Scottish Government (1999) PAN 58: Environmental Impact Assessment [online] Available at: http://www.scotland.gov.uk/Publications/1999/10/pan58-root/pan58
[19] The Scottish Government (2005) PAN 60: Planning for Natural Heritage [online] Available at: http://www.scotland.gov.uk/Publications/2000/08/pan60-root/part-a
[20] The Scottish Government (2005) PAN 60: Planning and Building Standards Advice on Flooding [online] Available at: http://www.scotland.gov.uk/Publications/2004/08/19805/41594
[21] Maritime and Coastguard Agency (2008) Marine Guidance 371: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues [online] Available at: http://www.dft.gov.uk/mca/mgn371.pdf

counter pollution) caused by offshore renewable energy installation developments, proposed for United Kingdom internal waters, territorial sea or in a Renewable Energy Zone beyond the territorial sea.

4.12 The Development Plan Framework

The Development Site is located within Fife Council area. The relevant Development Plan document comprises:

- The Fife Structure Plan 2006-2026 (the "Structure Plan")[22]; and
- The Mid Fife Local Plan (the "Local Plan")[23].

The Fife Structure Plan 2006-2026 was approved by the Scottish Government in May 2009.

The Mid Fife Local Plan (December 2011) was adopted on the 23rd January 2012. It complements the Structure Plan and sets out detailed policies and proposals which will guide development in the area over the period to 2021.

Fife Supplementary Planning Guidance (SPG) Wind Energy[24] was revised in June 2011 and should also be considered. It reflects Fife's desire to become 'Scotland's Leading Green Council' and supports renewable energy technologies in the right locations.

4.12.1 Sustainability and Renewable Energy

4.12.1.1 Fife Structure Plan

Policy R1: Wind Turbines, provides areas of search for wind farms over 20 MW and continues to highlight that, in all cases, applications for wind farms should be assessed in relation to criteria including, as appropriate, grid capacity, impacts on the landscape and historic environment, ecology (including birds), biodiversity and nature conservation, the water environment, communities, aviation, telecommunications, noise and shadow flicker.

Wind farm and individual turbine proposals will be considered in relation to the issues in policy R1 and the Fife Landscape Character Assessment. The extent to which the considerations in the spatial framework will be relevant to proposals below 20 MW will be dependent on the scale of the proposal, its design, location and the landscape.

4.12.1.2 Fife SPG Wind Energy

Page 51 of SPG Wind Energy recognises the importance of demonstrator wind turbines to the development of the offshore wind industry around the UK and to Fife's economy. It states:

"Locating demonstrator sites in Fife would help to promote the offshore wind industry in the area. It would allow Fife to develop strong relationships with turbine manufacturers and help attract future investment e.g. manufacturing of the turbine being tested. The site will become a focal point for training and could result in further operations and maintenance facilities being located nearby."

Policy R3: Offshore Activities states that Fife Council will support offshore renewable energy development provided that it does not have a significant adverse effect on local maritime activities, including shipping, fishing, leisure sailing, diving, on the natural environment including marine habitats and birds, on pipelines, on research activities and on the historic marine environment.

Diagram 9 of the Supplementary Planning Guidance shows the Local Seascape Units and highlights the area around Methil as having 'Potential for Offshore Turbines' within the area close to shore.

[22] Fife Council (2009) Fife Structure Plan 2006-2026 [online] Available at: http://www.fife.gov.uk/publications/index.cfm?fuseaction=publication.pop&pubid=78B2BAF7-D1D8-0700-949D2EC2B657E26B

[23] Fife Council (2012) Mid Fife Local Plan [online] Available at: http://www.fifedirect.org.uk/topics/index.cfm?fuseaction=page.display&p2sid=C1B1AE31-1CC4-E06A-52867243662458B4&themeid=2B482E89-1CC4-E06A-52FBA69F838F4D24

[24] Fife Council (2011) SPG Wind Energy [Online] Available at: http://publications.1fife.org.uk/uploadfiles/publications/c64_WindEnergyfinal1.pdf

4.12.1.3 Mid Fife Local Plan

MET 14: Energy Park Fife, the Mid Fife Local Plan Proposals Map indicates that the Development Site is allocated for Energy Park Fife, a project of national importance which is highlighted within the Scottish Government's National Planning Framework 2. This facility will create renewable energy assembly, fabrication, and research and development facilities. In addition, the potential exists to demonstrate renewable energy generation on site where appropriate.

Policy I1: Renewable Energy, supports technologies for renewable generation provided that there is no significant adverse effect upon local communities or the built and/or natural environment, they make use of brownfield land where possible and provide employment opportunities.

All proposals should provide information on the associated infrastructure required, impact during construction and operational phases and provisions for the restoration of the site.

Policy E3: Development Quality - Environmental Impact, states that *"new development must make a positive contribution to the quality of its immediate environment both in terms of its environmental impact and the quality of place it will create".* This will be achieved through a variety of measures including:

- A commitment to landscape protection and improvement;
- Measures to promote, enhance, and add to biodiversity; and
- Measures to minimise waste by design and during construction.

4.12.2 Landscape and Visual Impact

4.12.2.1 Mid Fife Local Plan

Policy E19: Local Landscape Areas, states that any development proposed within a Local Landscape Area, or out with the boundary but which may impact upon the designated area, will only be permitted where it has no significant adverse effect on the identified landscape qualities of the area and/or its overall landscape integrity and setting.

4.12.3 Ecology and Ornithology

4.12.3.1 Fife Structure Plan

Policy ENV2: Nature Conservation, International Sites states that development, whether individually or in combination with other proposals, likely to have a significant effect on a designated or proposed Natura 2000 (SPA, SAC) and/or Ramsar site will be subject to an appropriate assessment of the implications for the site's conservation objectives. The development will only be permitted where the assessment concludes that:

- It will not adversely affect the integrity of the site; or,
- There are imperative reasons of overriding public interest, including those of a social or economic nature and there are not alternative solutions.

Policy ENV4: Nature Conservation Enhancement, states that where development has the potential to impact upon designated sites at a national, regional or local level developers are required to maintain and where possible enhance this interest.

4.12.3.2 Mid Fife Local Plan

Policy E21: European Protected Species, states that development that will have a significant adverse effect on European Protected Species will not be permitted unless the developer shows that:

- The proposed development is in the interests of preserving public health or public safety or other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment;
- There is no satisfactory alternative; and

- The proposed development will not be detrimental to the maintenance of the population of the European protected species concerned at favourable conservation status in their natural range.

Policy E23: Protection of Biodiversity, states that development that may affect national and local priority habitats or species, as identified in the Scottish Biodiversity List or Fife Local Biodiversity Action Plan, will not be permitted unless the developer submits an appraisal showing that:

- There will be no adverse effect on the habitats or species; or
- Any significant adverse effect on the habitats or species is clearly outweighed by social or economic benefits of significant local importance.

4.12.4 Archaeology and Cultural Heritage

4.12.4.1 Mid Fife Local Plan

Policy E7: Conservation Areas, states that development within, or affecting the setting of, a conservation area shall preserve or enhance its character.

Policy E8 Listed Buildings, safeguards listed buildings and their settings.

Policy E11 Historic Gardens and Designed Landscapes, safeguards such places and states that development should "*not impact adversely upon their character, upon important views to, from or within them, or upon the site or setting of component features which contribute to their value*".

Policy E12: Ancient Monuments and Archaeological Sites, states that Scheduled Ancient Monuments and other identified nationally important archaeological resources shall be preserved in situ, and with an appropriate setting. Developments that have an adverse effect on scheduled monuments or the integrity of their setting shall not be permitted unless there are exceptional circumstances.

4.12.5 Water Resources and Coastal Hydrology

4.12.5.1 Mid Fife Local Plan

Policy E6: Contaminated Land, requires that where development proposals involve sites where land instability or the presence of contamination is suspected, the developer will be required to:

"(a) submit details of site investigation to assess the nature and extent of any risks presented by land instability or contamination which may be present; and

(b) where land instability risks or contamination is known to be present, notify Fife Council of the appropriate remediation measures proposed to render the site fit for its intended use.

Policy E20: Water Environment, states that development which would have an adverse effect on the ecological status of watercourses or wetlands, or the quality of groundwater, will not be permitted.

Policy I4: Flooding and Water Quality, highlights that development would not be supported if it would increase the risk of flooding or would be at risk of flooding. In areas at known risk from tidal flooding and coastal erosion, development will not be supported unless it is related to coastal defence works.

4.12.6 Socio-economics, Tourism, Recreation and Land-Use

4.12.6.1 Fife Structure Plan

Policy DC1: Developer Contributions, states that for all new development the Council will seek contributions from developers to address shortfalls in community infrastructure that mitigate adverse impacts brought about by their development.

4.12.6.2 Mid Fife Local Plan

Policy D1: Developer Contributions, seeks appropriate contributions from developers for all new development to ensure adequate infrastructure provision and to mitigate for any adverse environmental impact brought about by a proposed development.

4.12.7 Miscellaneous Issues

4.12.7.1 Fife Structure Plan

Policy BL1: Rehabilitation and Re-use of Brownfield Land, states that development securing the redevelopment and/ or re-use of derelict land or vacant land will be supported where the new use:

- Is appropriate to and compatible with the surrounding area;
- Provides environmental/community/economic benefits;
- Can be achieved in an environmentally acceptable and sustainable manner; and
- Accords with other Structure and Local Plan policies.

4.12.7.2 Mid Fife Local Plan

Policy E4: Development Quality - Design, states that new development must make a positive contribution to its immediate environment in terms of the quality of the development. This will be achieved by the development:

- Demonstrating a well thought out design, and high standards of architecture in terms of form, scale, layout, detailing, and choice of materials;
- Making best use of site attributes – particularly landform, trees, and woodland and natural and built heritage features; and
- Protecting personal privacy and amenity.

This policy supports the application of innovative design solutions and requires that all development proposals comply with the principles as described in the Fife Urban Design Guide.

5 LANDSCAPE AND VISUAL

5.1 Introduction

This chapter of the ES evaluates the effects of the Development on the landscape and visual resource.

In evaluating the effects of the Development on the landscape and visual resource, the assessment seeks to:

- Establish the existing landscape features of the Development site and its surroundings, the role of the site in the wider landscape setting and in particular its visual role;
- Identify the potential effects on those landscape features and on the wider visual role arising from the Development, whether direct or indirect, positive or negative, short or long term, permanent or reversible;
- Evaluate the significance of any residual effects remaining; and
- Determine the overall acceptability of the Development in landscape and visual terms.

The assessment is based on the Development illustrated on Figure 1.2 and specifically the design of the turbine illustrated in Figure 3.1. The turbine is a single, three-bladed turbine mounted on a tubular steel tower and painted in an off-white colour with a non-reflective finish. The Development has a maximum height to blade-tip of 196 m above MSL, based on a hub height of 110 m (above MSL) and a rotor diameter of 172 m. This represents a slight increase in height of 11 m over the Consented Development (185 m tip height), which comprises of a less conventional two-bladed turbine mounted on a steel lattice tower. The Development will be sited approximately 25 m from the location of the Consented Development in a similar offshore location.

In addition to changes to the turbine design and location, other changes have been identified to the existing baseline between both schemes and are listed below:

- Demolition of the redundant power station at Methil Docks; and
- Construction of the consented turbine at Methil Docks (1 x 81 m height).

These changes, together with changes to the turbine design and location, have been incorporated into this assessment.

5.1.1 Consultation

As detailed in Section 5.3, a scoping exercise was undertaken in relation to the Development. A Scoping Report was submitted to Marine Scotland for distribution to consultees and preparation of a Scoping Opinion. Responses relevant to the landscape and visual assessment were received from Edinburgh City Council, Fife Council, East Lothian Council and Scottish Natural Heritage. These are summarised in Table 5.1 below.

Table 5.1: Consultation Responses

Consultee	Comments	Response
Edinburgh City Council	Queried whether their guidelines for the protection of key views had been considered. Noted a ZTV larger than 25 km should be used. Requested a viewpoint from Calton Hill and noted a viewpoint from Gullane would be useful.	These guidelines were reviewed, but as their purpose is to control proposals for tall buildings within the city that might block or interrupt key views to landmark features they were not considered relevant to the assessment. The City Council acknowledged and accepted this. This viewpoints from Calton Hill and Gullane have been added to the assessment. The ZTV has been applied to a 30 km radius. Following review and site visits the study area of 15 km was defined (see Section 5.1.3). Key viewpoints outwith this 15 km area have however been assessed to address the concerns of consultees.
Fife Council	Agreed to the same study area, viewpoints and cumulative sites that were used to assess the Consented Development so that direct comparisons could be made between both schemes. Noted changes in the landscape should be assessed such as the demolition of the Methil Power Station.	This has been assessed within this chapter. Changes to the baseline are identified in Section 5.1 and are assessed throughout this chapter.
East Lothian Council	Queried the extent of the study area and lack of viewpoints from the southern shore of the Firth of Forth in particular North Berwick and golf courses such as Gullane.	Although the study area is unchanged from the Consented Scheme, two additional viewpoints have been included in the assessment to illustrate the effects of the Development from the southern shore of the Firth of Forth. This includes Gullane and North Berwick.
SNH	Noted the response to the Consented Development stated SNH did not agree with the 15 km study area. Stated the pre-application responses to the Consented Development should also be included. This response noted viewpoints should be included from: • Edinburgh Old/New Town; • Inchkeith; • Largo Law; • A917; • Gullane. Note the SNH response to the Consented Development stated the former design of a lattice tower with 2 blades "*breaks with people's familiar perception of turbines that may mean that the 2-B turbine stand out. The movement of two bladed turbines may*	The ZTV was considered initially at a 30 km radius from the turbine. Following review and site visits the study area of 15 km was defined (see Section 5.1.3). Key viewpoints outwith this 15 km area have however been assessed to address the concerns of consultees. Viewpoints suggested by SNH in response to the Consented Development have been included with the exception of Inchkeith as this is an island and logistical issues were encountered in undertaking this viewpoint assessment. The Development is for a 3 bladed turbine which would appear to be preferential in terms of the concern raised by SNH in

Consultee	Comments	Response
	appear more erratic than those with three blades".	relation to the Consented Development.
Marine Scotland	Requested the ZTV be extended from 15km to 40km to include assessment of the following key viewpoints: • Calton Hill • North Berwick Law • Gullane. Noted the cumulative assessment should include the two offshore turbines which were scoped by 2B Energy.	The ZTV was extended to 30km and the key viewpoints suggested by MS-LOT were included in the assessment as presented throughout this chapter: • Calton Hill (E326281, N683064) • North Berwick (E355116, N685343); and • Gullane (E347899, N683064). The two offshore 2B turbine are included in the cumulative assessment in Section 5.6 of this chapter.

5.1.2 Chapter Structure

This chapter is arranged into seven sections covering the following topics:

- Section 5.2 (Assessment Methodology and Significance Criteria) describes the broad approach that has been followed in undertaking the assessment;
- Section 5.3 (Baseline Conditions) sets out the existing situation with regard to the landscape and visual resources of the Development site and surrounding area. Existing studies and other information of relevance are identified;
- Section 5.4 (Assessment of Potential Effects) assesses the potential effects of the Development on the landscape and visual resources during the construction, operational and decommissioning stages as appropriate;
- Section 5.5 (Mitigation Measures and Residual Effects) considers those mitigation measures included with the Development and any residual effects remaining;
- Section 5.6 (Cumulative Effects Assessment) considers the additional effects of the Development when seen in conjunction with other wind energy developments;
- Section 5.7 (Summary of Effects) summarises the key findings of the assessment; and
- Section 5.8 (Statement of Significance) considers the overall acceptability of the Development in landscape and visual terms.

A series of figures have been prepared in support of the assessment and are included in Volume II of this ES. These illustrate:

- 30 km Radius ZTV (Figure 5.1);
- 15 km Radius Landscape Study Area (Figure 5.2);
- 15 km Radius ZTV with Viewpoints (Figure 5.3);
- 30 km Radius Cumulative Search Area (Figure 5.4);
- Cumulative ZTVs with Viewpoints (Figures 5.5a-5.5g);
- Settlements and Roads (Figure 5.6);
- Recreational Routes and Visitor Attractions (Figure 5.7);
- Landscape Character Types (Figure 5.8);
- Landscape Planning Designations (Figure 5.9);
- ZTV with Landscape Character Types (Figure 5.10);

- ZTV with Landscape Planning Designations (Figure 5.11);
- ZTV with Settlements and Roads (Figure 5.12);
- ZTV with Recreational Routes and Visitor Attractions (Figure 5.13); and
- Extent of Significant Effects (Figures 5.14a-5.14b).

Additionally, a series of photographic, wireline and photomontage viewpoints have been prepared to illustrate the Development as a standalone scheme (Figures 5.15a-5.15x) and the Development seen in conjunction with other wind energy developments (Figures 5.16a-5.16k).

This chapter is also supported by the following technical appendix, which is found in Volume III of this ES:

- Technical Appendix 5.1: Viewpoint Analysis.

5.1.3 Study Area

The area of study considered in this Chapter extends for a radius of 15 km from the Development. A 30 km radius study area was initially considered, in accordance with SNH guidance[1], and is shown on Figure 5.1 in conjunction with a zone of theoretical visibility. However, a preliminary appraisal in conjunction with site visits concluded that significant or unacceptable effects, as defined in Section 5.2.3, were highly unlikely to extend beyond 15 km even though the Development might be visible in some views beyond this distance. This is due to a number of limiting factors including, most importantly, the lack of theoretical visibility indicated beyond this distance together with the nature of the receiving environment. The assessment presented in this Chapter is therefore contained within a radius of 15 km of the Development and this has allowed a more detailed assessment to be carried out. The extent of the study area is shown on Figure 5.2 and has been agreed with Fife Council.

It should be noted that the 15 km radius study area is not intended to provide a definitive boundary beyond which the Development will not be seen, but rather an area within which the Development may potentially have a significant effect on the landscape and visual resource. The Development may still be visible in some views beyond the 15 km radius, but any effects are judged unlikely to be significant. In order to address the concerns of consultees, specific viewpoints beyond this 15 km radius have been included in this assessment including:

- Calton Hill (E326281, N683064);
- North Berwick (E355116, N685343); and
- Gullane (E347899, N683064).

5.2 Assessment methodology and significance criteria

5.2.1 Information Sources

The assessment has been carried out utilising a methodology based upon current best practice described in 'Guidelines for Landscape and Visual Impact Assessment' (GLVIA), Second Edition, as prepared jointly by The Landscape Institute and The Institute of Environmental Management & Assessment (2002). Other key documents referred to include:

- 'Landscape Character Assessment: Guidance for England and Scotland.' Prepared on behalf of The Countryside Agency and Scottish Natural Heritage by the University of Sheffield and Land Use Consultants (2002);
- 'Visual Assessment of Windfarms: Best Practice.' Scottish Natural Heritage commissioned report F01AA303A, prepared by the University of Newcastle (2002);

[1] University of Newcastle (2002), *Visual Assessment of Windfarms: Best Practice*, Scottish Natural Heritage commissioned report F01AA303A.

- 'Cumulative Effects of Windfarms.' Version 2 (revised 13 04 05). Published by Scottish Natural Heritage; and
- 'Visual Representation of Windfarms. Good Practice Guidance.' Scottish Natural Heritage commissioned report F03AA308/2, prepared by Horner, Maclennan & Envision (2006).

5.2.2 Categories of Effects

Landscape is an important national resource. It is a product of the action and interaction between a range of natural and human influences (including geology, topography, flora and fauna, land-use, settlement and cultural associations). These influences combine to produce distinctive landscape character in different places, which people experience and attach values to. How the landscape is perceived is therefore an important sensory factor to be taken into account when carrying out landscape assessments. The inter-relationship between people and the landscape also introduces other related, but different, considerations notably views that people have of the landscape and how the effects of change may alter the pleasantness of the surroundings, or visual amenity, that people enjoy.

The assessment presented in this Chapter consequently comprises of two separate but interrelated studies, in accordance with GLVIA guidance (paragraph 2.13):

- An assessment of effects on the landscape resource, in other words physical changes to existing landscape features arising from the Development, the effect this has on the character of the wider landscape and how this is perceived; and
- An assessment of effects on the visual resource, in other words changes to views and overall visual amenity arising from the Development and the reaction of viewers.

Landscape effects are a consequence of changes to the physical fabric of the landscape as a result of the Development that may affect the surrounding character and, in turn, the value placed on it (GLVIA paragraph 2.14). Assessment of landscape effects therefore needs to consider:

- Physical effects upon specific landscape elements and features within the Development site boundary, e.g. removal of trees, walls, hedgerows, etc.;
- Effects upon the overall pattern or combination of landscape elements that contribute to the landscape character of the wider area, giving it a particular sense of place; and
- Effects upon areas of acknowledged value or special interest, e.g. National Parks, National Scenic Areas, etc.

Landscape assessments require a balance of objective and subjective techniques. Objective techniques involve the measurement and quantification of the various components that make up the environment, to establish the nature or 'character' of an area. Subjective techniques rely more on judgment and responses on the part of the assessor to establish the aesthetic characteristics or 'quality' of the area and the effects on it by the Development.

Visual effects relate solely to changes in the composition of available views arising from changes to the landscape and the effects this has on people (GLVIA paragraph 2.15). Assessment of visual effects therefore needs to consider:

- Effects of the Development upon views of the landscape; and
- The reaction of viewers who may be affected, e.g. residents, walkers, road users, *etc*.

As with landscape assessments, visual assessments require a balance of objective description and subjective judgment on the part of the assessor when establishing the degree of visibility of an area and the effect on it by the Development.

The landscape and visual assessment described later in this Chapter is therefore divided into four key categories of effects:

- Effects on the landscape fabric of the Development site;

- Effects on the wider landscape character;
- Effects on areas designated for their landscape value or special interest; and
- Effects on views and viewers.

For some wind energy developments there is sometimes a fifth category of effect to consider, namely cumulative effects. These additional effects arise when the Development may be seen in conjunction with other wind energy developments. This particular effect is considered further in section 5.2.8.

5.2.3 Significance of Effects

The broad objective for identifying effects, as set out in the Environmental Impact Assessment Regulations, is to establish whether they are 'significant' or 'not significant'. Significance is described in the GLVIA (paragraph 7.39) as being a function of the:

- *Sensitivity* of the affected landscape and visual receptor; and
- *Scale* or *Magnitude* of effects that they will experience.

Definitions for the above are given in the GLVIA (paragraphs 7.16-7.23 and 7.31-7.37). In summary these are:

- *Sensitivity* – 'vulnerability of a sensitive receptor to change;'
- *Sensitive receptor* – ' physical or natural resource, special interest or viewer group that will experience an effect;' and
- *Magnitude* – 'size, geographical extent, duration and reversibility of an effect.'

These definitions recognise that landscapes vary in their capacity to accommodate different forms of development according to the nature of the receiving landscape and the type of change being proposed.

The criteria used for establishing the sensitivity of identified sensitive landscape and visual receptors to the Development and the magnitude of effect arising from the Development is described below, together with the criteria for establishing the overall significance. This is derived from an approach advocated in the GLVIA (paragraphs 7.1-7.51).

5.2.3.1 Landscape Receptors - Sensitivity and Magnitude of Effect

The effects of the Development on landscape receptors considers 'direct' effects on individual landscape elements that make up the fabric of the Development site (loss of trees, hedgerows, walls, etc.) and 'indirect' effects on the landscape character of the wider surrounding area.

Sensitivity of Landscape Elements: The determination of sensitivity in respect of landscape elements of the Development site is dependent on the value attached to individual elements; the quality of individual elements; and the potential for mitigation of individual elements. These can be described as:

- Value – This reflects the importance that the element has in the pattern of landscape elements that contribute to the character of the Development site and surrounding area. For example, the value of a hedgerow is likely to be increased if it forms an important component of the local landscape character. If a landscape element is particularly rare, has some historical significance or is otherwise protected its value is likely to be further increased. Conversely, if a landscape element is a common or widespread component of the area, its value may be reduced;
- Quality – This is a reflection of condition or state of repair. For instance, a hedgerow or woodland that is in a poor condition or neglected is likely to have a reduced quality; and
- Potential for mitigation – This reflects the degree to which elements can be restored, replaced or substituted. For example, it may be possible to restore agricultural land

following the construction and decommissioning phases of the Development, in which case the sensitivity of the element will be reduced.

Magnitude of Effect on Landscape Elements: The determination of magnitude in respect of individual landscape elements is a reflection of the degree to which the landscape element will be altered or removed by the Development, for example, whether completely removed, partially removed or largely retained intact.

Levels of sensitivity and magnitude of effect for landscape elements of the Development site are set out in Table 5.2 below together with broad definitions, in order that judgments made in the following assessment are clear.

Table 5.2 Classifications of Sensitive Landscape Elements and Magnitude of Effect

Sensitivity Capacity of landscape elements to accept the Development		**Magnitude** Degree of change to landscape elements arising from the Development	
Class	**Typical Criteria**	**Class**	**Typical Criteria**
Very High	Little or no capacity to accept the Development: Landscape elements of exceptional value and quality with no potential for restoration, substitution or enhancement.	Very Large	Total loss or alteration of key landscape elements of the Development site.
High	Low capacity to accept the Development: Landscape elements of high value and quality with limited potential for restoration, substitution or enhancement.	Large	Significant loss or alteration of key landscape elements of the Development site.
Medium	Moderate capacity to accept the Development: Landscape elements of recognised value and quality with some potential for restoration, substitution or enhancement.	Medium	Conspicuous loss or alteration of key landscape elements of the Development site.
Low	Moderately high capacity to accept the Development: Landscape elements of some value and quality with scope for restoration, substitution or enhancement.	Small	Apparent loss or alteration of key landscape elements of the Development site.
Very Low	High capacity to accept the Development: Landscape elements of limited value and quality with considerable scope for restoration, substitution or enhancement.	Very Small	Minor loss or alteration of key landscape elements of the Development site.
		Negligible	No loss or alteration of key landscape elements of the Development site, amounting to no change.

Sensitivity of Landscape Character Receptors: For landscape character receptors, the determination of sensitivity is a reflection of their ability to accommodate the Development, which is also dependent on value and quality, but also takes account of contribution to landscape character. These can be described as:

- *Value* – This is an expression of importance by general consensus and is usually defined by way of any designations that may apply. For example, a landscape character receptor that lies within an area designated for its scenic qualities will generally be of increased value due to the recognised importance attached to the landscape. The greater the value attached to a landscape the more sensitive it is likely to be;
- *Quality* – This reflects the presence of distinctive attributes that gives an area a sense of place and the extent to which these attributes remain intact. A landscape with

consistent, intact and well-defined attributes will generally be of a higher quality and sensitivity than a landscape where the same attributes have been eroded or other inappropriate elements have been introduced; and

- *Contribution to landscape character* – The existing character of a landscape character receptor determines the degree to which it can accommodate a proposed development. Key characteristics that are likely to reflect sensitivity to wind energy developments include scale and enclosure, complexity and order, manmade influences, skyline, connections with adjacent character types, remoteness and tranquillity and settlement patterns. These can be further described as:
- *Scale and enclosure* – Large-scale, open and featureless landscapes such as an upland plateau or coastal plain are less likely to be visually dominated by large structures such as turbines due to their openness and breadth of views. They also avoid awkward scale comparisons associated with small-scale, varied and enclosed valley landscapes or low-lying, settled landscapes where human scale indicators (buildings, trees, *etc.*) are characteristic.
- *Complexity and order* – Patterns of landform or land cover which are simple, ordered or hierarchical such as low-lying plains, smooth rolling hills and geometric field systems with blocks of woodland are more likely to suit the regular and standardised shapes of turbines. Conversely, turbines located in rugged or mountainous terrain with a complex mosaic of natural vegetation cover may appear unbalanced and create a confusing image;
- *Man-made influences* – The functional and engineered appearance of turbines are more likely to relate positively to contemporary working landscapes including agricultural, urban and industrial, than to more naturalistic or historic landscapes. The presence of modern, vertical structures (pylons, masts, chimneys, *etc.*) may further reinforce a positive image, whilst linear elements such as transport corridors may present a logical siting for turbines;
- *Skyline* – Skylines where vertical man-made forms are already present may reduce the influence of turbines and, equally, turbines added to simple, reposeful skylines with few vertical elements may form a point of focus and clear contrast to the horizontal emphasis. On the other hand, skylines with distinctive landmarks or which possess a confusion of existing verticals are more likely to be compromised by the addition of turbines;
- *Connections with adjacent character types* – Turbine influence on neighbouring landscapes is likely to be reduced where turbines are located within a discrete character type with broad separation from contrasting character types, or where neighbouring landscapes provide large, simple backdrops or are otherwise of a low sensitivity. Conversely, turbines are likely to exert a greater influence on adjacent landscapes where they are located within a character type that contributes to a broader scenic composition by virtue of elevation or a tight sequence of contrasting landscape types, or is close to a boundary with a landscape of high sensitivity;
- *Remoteness and tranquillity* – Busy, active rural or urban fringe landscapes may have a reduced sensitivity to turbines compared with upland landscapes where their presence, movement and noise may detract from a perceived sense of peace and isolation; and
- *Settlement patterns* – Lightly populated landscapes containing small-scale and widely dispersed settlements may have a reduced sensitivity to turbines, as few residential receptors will be affected. However, landscapes with a dense population occurring in an evenly distributed pattern of villages are more likely to be affected than if the population is concentrated in large towns or urban areas, where visibility is mostly confined to the built-up edge. Similarly, landscapes featuring linear villages located

along ridgelines commanding long views are more likely to be vulnerable than landscapes with a nucleated settlement pattern nestling in low-lying vales.

Magnitude of Effect on Landscape Character Receptors: The determination of magnitude in respect of a landscape character receptor is an expression of the scale of change that will result from the Development. This is dependent on the distance between the landscape character receptor and the Development; extent of the Development that will be seen in the landscape; the extent of area that will be affected by the Development; the degree of contrast or integration between key landscape elements and the Development; the degree to which the pattern of elements that make up the overall character will be changed by the Development; and the position of the Development in relation to the principal orientation of the landscape character receptor. These can be described as:

- Distance between the landscape character receptor and the Development – Generally, the greater the distance from a development, the smaller the magnitude of effect as it will constitute a less apparent external influence in views of the landscape;
- Extent of the Development that will be seen – Visibility may range from a single blade tip to the turbine at full height. Generally, the more of a development that can be seen the larger the magnitude of effect will be;
- Extent of the area that will be affected by the Development – The magnitude of effect will generally be smaller where only a limited part of a landscape character receptor is affected, either physically or visually;
- Degree of contrast or integration between key landscape elements and the Development – The magnitude of effect will generally be smaller where a development responds positively to key characteristics of a landscape character receptor;
- Degree to which the pattern of elements that makes up the overall character will be changed by the Development – The magnitude of effect will be larger where key features that make up the innate landscape character are altered or removed, and where many new components are added that are at odds with the existing pattern of elements; and
- Position of the Development in relation to the principal orientation of the landscape character receptor – If the landscape character receptor is orientated towards a development with clear, directional visibility, then the magnitude of effect is likely to be larger than if it is orientated away from it or at an oblique angle.

Levels of sensitivity and magnitude of effect for landscape character receptors are set out in Table 5.3 below, together with broad definitions in order that judgments made in the following assessment are clear. Terminology used to categorise levels of sensitivity (very high, high, etc.) and magnitude of effect (very large, large, etc.) generally corresponds with SNH recommendations for the visual assessment of windfarms.

Table 5.3 Classification of Sensitive Landscape Character Receptors and Magnitude of Effect

Sensitivity Capacity of landscape character receptors to accept the Development		**Magnitude** Degree of change to landscape character receptors arising from the Development	
Class	**Typical Criteria**	**Class**	**Typical Criteria**
Very High	Where the combination of value, quality and existing character results in little or no capacity to accept the Development. Includes designated landscapes of national importance where key aspects of character would be mostly conflicted by the Development.	Very Large	Introduction of features that completely redefine key characteristics of the Development site or wider landscape character and become the dominating influence.
High	Where the combination of value, quality and existing character results in a low capacity to accept the Development. Includes designated and undesignated landscapes at a regional or local level with only a few aspects of character that the Development relates to.	Large	Introduction of features that substantially alter key characteristics of the Development site or wider landscape character and become the predominant influence.
Medium	Where the combination of value, quality and existing characteristics results in a moderate capacity to accept the Development. Includes undesignated landscapes at a regional or local level with some aspects of character to which the Development relates.	Medium	Introduction of features that are conspicuous or noticeable, but the baseline characteristics of the Development site and wider landscape character generally continues to prevail.
Low	Where the combination of value, quality and existing character results in a moderately high capacity to accept the Development. Includes undesignated landscapes at a local level with many aspects of character to which the Development relates.	Small	Introduction of features that are apparent or evident and result in a limited change to key characteristics of the Development site and wider landscape character. May be missed by the casual observer.
Very Low	Where the combination of value, quality and existing character results in a high capacity to accept the Development. Includes undesignated landscapes at a local level to which the Development relates.	Very Small	Introduction of features that are inconspicuous or not obvious and result in a minor change to key characteristics of the Development site and wider landscape character.
		Negligible	Introduction of features which are faint or barely discernible and amount to no change.

5.2.3.2 Visual Receptors – Sensitivity and Magnitude of Change

Sensitivity of Visual Receptors: The determination of sensitivity in respect of a visual receptor and the view obtained from it is an expression of its ability to accommodate the Development. This is a function of the importance attached to the view or visual receptor, the nature and value of the view available, and the nature of the viewer. These can be described as:

- Importance attached to the view or visual receptor – This is determined by any recognition attached to the view or visual receptor, for example, where marked on tourist maps, signposted or through general consensus. The greater the importance attached to the view or visual receptor, then the greater its sensitivity is likely to be;
- Nature and value of the view – An attractive view with particular scenic qualities will tend to have a greater value, whilst the presence of elements that detract from the view may lead to a reduced value. The value of a view may also be increased if it lies within, or overlooks, a designated area, which implies greater value attached to the visible landscape. The greater the value attached to the view, the greater its sensitivity is likely to be; and
- Nature of the viewer – This reflects the occupation, or activity, of viewers. Those whose attention is focused on the landscape, for example, walkers or hikers, will tend to have a heightened sensitivity. Similarly, communities and residents of properties that gain views of a development will also have a higher sensitivity. Conversely, those engaged in outdoor sporting activities whose attention is focussed on their activity will have a lower sensitivity, as will viewers travelling through an affected landscape in cars or on trains as the view is transient and fast moving. The least sensitive viewers are likely to be those people at their place of work whose attention is focused on their activity.

***Magnitude of Effect on Visual Receptors*:** The determination of magnitude in respect of a visual receptor is an expression of the scale of change that will result from the Development. This is dependent on the distance between the visual receptor and the Development; the extent of the Development that will be seen; the proportion of the existing view affected by the Development; the size and prominence of the Development in the view, taking account of modifying factors that can reduce or intensify the effect; the degree of contrast or integration with the existing view; and the position of the Development in relation to the principal orientation of the view. These can be further described as:

- Distance between the visual receptor and the Development – Generally, the greater the distance from a development, the smaller the magnitude of effect as it will constitute a less apparent external influence in views;
- Extent of the Development that will be seen - Visibility may range from a single blade tip to the turbine at full height. Generally, the more of a development that can be seen the larger the magnitude of effect will be;
- Proportion of the existing view affected by the Development – This is dependent on the size of a development and width of available view, which is related to distance. Generally, the more of the existing view affected the larger the magnitude of effect;
- Size and prominence of the Development in the view taking account of modifying factors likely to reduce or intensify the effect – In addition to filtering and screening views, trees and buildings close to the viewer can have a beneficial scale effect by reducing the perceived size of turbines. On the other hand, when seen directly alongside turbines, trees and buildings can provide scale cues that increases the perceived size of turbines;
- Degree of contrast or integration with the existing view – The magnitude of effect will generally be smaller where a development fits with the visual dynamics of the view, for instance, scale, complexity, overall cohesion, etc; and
- Position of the Development in relation to the principal orientation of the view – If the visual receptor is orientated towards a development with clear, directional visibility, then the magnitude of effect is likely to be larger than if it is orientated away from it or at an angle. For journeys, the frequency and duration of views is also important.

Levels of sensitivity and magnitude of effect for visual receptors are set out in Table 5.4 below together with broad definitions, in order that judgments made in the following assessment are clear. As with Table 5.3, the terminology used to categorise levels of sensitivity and magnitude of effect generally accords with SNH recommendations.

Table 5.4: Classification of Sensitive Visual Receptors and Magnitude of Effect

Sensitivity Capacity of people at particular locations to accept the Development	**Magnitude** Degree of change to views arising from the Development
Typical Criteria	**Typical Criteria**
Where the combination of importance, value and nature of the viewer results in little or no capacity to accept the Development. Includes occupiers of residential properties, users of public rights of way, Country Parks, etc. within designated landscapes of national importance with few, if any, detracting influences.	Introduction of features which totally dominate or command the baseline view and redefine its characteristics.
Where the combination of importance, value and nature of the viewer results in a low capacity to accept the Development. Includes occupiers of residential properties, users of public rights of way, Country Parks, etc. within and outside of locally designated landscapes and with views possessing mostly scenic qualities.	Introduction of features which are prominent or stand out in the baseline view and redefine its characteristics.
Where the combination of importance, value and nature of the viewer results in a moderate capacity to accept the Development. Includes occupiers of residential properties, users of public rights of way, Country Parks, etc. with views possessing some detracting features. Also includes road or rail users passing through designated landscapes or using national scenic routes.	Introduction of features which are conspicuous or noticeable, but the baseline characteristics of the view generally continue to prevail.
Where the combination of importance, value and nature of the viewer results in a moderately high capacity to accept the Development. Includes people engaged in outdoor pursuits who are focussed on their activity, e.g. golf, etc. Also includes road or rail travellers passing through non designated landscapes.	Introduction of features which are apparent or evident, but form a limited component of the baseline view. May be missed by the casual observer.
Where the combination of importance, value and nature of the viewer results in a high capacity to accept the Development. Includes people at their place of work, shoppers, users of indoor facilities, etc. who are focussed on their activity.	Introduction of features which are inconspicuous or minor and not obvious in the view.
	Introduction of features which are faint or barely discernible, amounting to no change.

5.2.3.3 Classification of Significance

The significance of an effect on identified landscape and visual receptors is judged against those factors that combine to determine the sensitivity of each receptor and the magnitude of effect, as described above. A significant effect is judged to occur where the combination of variables results in the Development having a material effect on a landscape or visual receptor, so that the landscape character or view becomes defined by the presence of the Development. A not significant effect is judged occur where the effect of the Development is not definitive and the landscape or visual receptor continues to be defined principally by its baseline characteristics. In this instance, the Development may have an influence on the receptor and may alter its characteristics, but this influence will not be definitive.

Levels of significance are set out in Table 5.5 below as a simple matrix so that judgments made in the following assessment are consistently applied. The 6 x 5 (30 cell) matrix

illustrated follows a general approach outlined by SNH for the visual assessment of windfarms. For the purposes of this Chapter of the ES, effects assessed as being of 'moderate,' 'moderate-major' or 'major' significance are considered to be equivalent to 'significant' effects that are required to be identified under the Environmental Impact Assessment Regulations. These typically correspond with large-scale effects and effects on highly sensitive receptors, and are highlighted in a pale-grey tone in Table 5.5.

Table 5.5: Classification of Significance

Sensitivity (of the landscape or visual receptor to change)	**Magnitude of Effect** (positive or negative)					
	Very Large	**Large**	**Medium**	**Small**	**Very Small**	**Negligible**
Very High	Major	Major	Moderate - Major	Moderate	Minor - Moderate	Negligible
High	Major	Moderate - Major	Moderate	Minor - Moderate	Minor	Negligible
Medium	Moderate - Major	Moderate	Minor - Moderate	Minor	Negligible - Minor	Negligible
Low	Moderate	Minor - Moderate	Minor	Negligible - Minor	Negligible	Negligible
Very Low	Minor - Moderate	Minor	Negligible-Minor	Negligible	Negligible	Negligible

Definitions for significance thresholds in Table 5.5 are given below:

- **Major** – Where the Development will cause a significant change to the landscape or visual resource. Key issue in the decision making process.
- **Moderate / Major** – Where the Development will cause a change that falls between moderate and major significance. Very important in the decision making process.
- **Moderate** – Where the Development will cause a noticeable change to the landscape or visual resource. Important issue in the decision making process.
- **Minor / Moderate** – Where the Development will cause a change that falls between minor and moderate significance. Unlikely to be an important issue in the decision making process.
- **Minor** – Where the Development will cause a minor change to the landscape and visual resource. Unimportant issue in the decision making process.
- **Negligible / Minor** – Where the Development will cause a change that falls between negligible and minor significance.
- **Negligible** – Where the Development will cause a barely discernible change to the landscape or visual resource.

5.2.4 Nature of Effects

It is important to note that the magnitude of effects given in Tables 5.2, 5.3 and 5.4 and the classification of significance given in Table 5.5 can be both 'positive' and 'negative.' Negative effects relate to the loss of existing features and/or the introduction of features that weaken or cause deterioration in the landscape character or view. Positive effects relate to the enhancement of existing features and/or the introduction of features that create a positive improvement in the landscape character or view.

The assessment of effects on the landscape fabric of the Development site, on the character of the surrounding area and on views has indicated that the effects of the Development are anticipated to be 'negative'. The 'negative' nature of the effects is a direct result of the introduction of new and contrasting elements into the landscape and visual resource, in this case the proposed turbine with moving parts. However, this does not necessarily indicate

that the effects of the Development will be unacceptable. What is important is that the anticipated effects are systematically assessed in a clear and transparent manner that is easily understood, in order that the determining authority can make a well informed judgment that weighs up the positive effects against those negative effects of a renewable energy project.

5.2.5 Duration and Permanence of Effects

In addition to considering the nature of effects, the assessment also takes account of the duration and permanence of effects. Duration of effects considers the timescales over which identified effects will extend and are considered on a scale of 'short term', 'medium term' and 'long term'. Permanence of effects takes account of whether the identified effects are 'permanent' or 'reversible.'

The duration of effects of the Development on the landscape and visual resource are variable. The operational (testing and commissioning) life of the Development under this application is anticipated to be no more than 5 years and, during this period, the turbine and other infrastructure including an construction compound will be apparent. These effects are considered to be 'short-term.' Other infrastructure and operations such as the temporary contractor's compound and cranes will only be apparent during the construction and decommissioning stages. Each of these stages will be limited to a few months and are also considered to be 'short-term.'

The permanence of effects is also variable. The effects on the landscape and visual resource that result from the presence of the Development are 'reversible' as the turbine removed at the end of the operational period. Thus, whilst the operational effects of the Development are 'short-term', as noted above, they are also 'reversible.' Similarly, effects arising from the construction and decommissioning stages will also be 'reversible.'

In order to avoid unnecessary repetition, the construction and decommissioning stages can be assumed to be 'short-term' and 'reversible' and thus are not considered further in the assessment of effects. Similarly, the duration and permanence of the operational effects is not reiterated and can also be assumed to be 'short-term' and 'reversible' unless stated otherwise.

5.2.6 Zone of Theoretical Visibility (ZTV)

To establish the likely visibility of the Development and assist with the assessment of potential landscape and visual effects, a zone of theoretical visibility (ZTV) has been prepared to demonstrate the theoretical visibility of the Development from within the study area. The ZTV is illustrated on Figure 5.3 and is modelled on a blade-tip height of 196 m to represent the worst case scenario as it assesses the maximum height of the turbine.

ZTVs relate to the zone within which the Development is likely to be visible based on an observer height of 2.0 m. This corresponds with the height of a typical adult person on foot, rounded up to account for potential uncertainty in the mathematical calculations used to establish the ZTV (in accordance with SNH guidance[2]). The ZTV is computer generated from a 1:50,000 scale Ordnance Survey digital terrain model of the study area, which represents the ground surface as a mesh based on a grid spacing of 50 m. A 3-dimensional model of the Development is then incorporated. The final ZTV, with the Development indicated, is then reproduced on an Ordnance Survey base (in greyscale) at a scale of 1:125,000 to fit the A3 page format of this ES.

ZTVs do have a number of limitations that need to be borne in mind when considering the theoretical visibility indicated. Firstly, ZTVs illustrate the effect of bare topography on limiting views of the Development and do not take into account the screening effects of surface features including minor landform, built development and vegetation. As described in section 5.3, tree belts, woodland and urban areas are characteristic features of the study area and are important in terms of reducing actual visibility compared with the theoretical visibility indicated by the ZTV. Secondly, ZTVs are not distance sensitive, in that they do not take

[2] Horner + maclennan (2006), *Visual Representation of Windfarms: Good Practice Guidance*, Scottish Natural Heritage commissioned report F03AA308/2.

account of the decreasing size of the Development with increased distance as a proportion of the view, and the reduction in effect arising from this. The nature of what can be seen at 1 km will differ markedly from what can be seen at 10 km, under identical viewing conditions, but this will not be distinguished by a ZTV. Thirdly, whilst ZTVs may indicate the number of turbines visible at a particular location, they do not distinguish whether the turbines are seen at full height or from just the blade-tips. This can also have a considerable effect on the visual influence of a development.

Notwithstanding these limitations, ZTVs are a useful tool in representing the worst-case scenario when predicting the likely visibility of the Development. They are also particularly useful as a basis for selecting viewpoints, as identified below, from which a more detailed survey and analysis of the effects of the Development can be made.

5.2.7 Viewpoints and Visualisations

In addition to desk-based studies involving ZTVs, the landscape and visual assessment is further informed by assessing the effects of the Development on a number of sample views from which conclusions can be drawn and applied to the wider study area. When used in conjunction with ZTVs, the assessment of viewpoints allows the potential pattern of turbine visibility to be considered in three dimensions.

The study area was visited during January 2012 to establish actual visibility within the ZTV, taking account of the additional screening effects afforded by buildings, vegetation and local landform. At the same time, a number of viewpoints were identified from where the Development is likely to be visible and with potential to bring about a significant change to the landscape and visual resource. The choice of viewpoints was limited to publicly accessible areas and, as such, was constrained by the level of access afforded. The landscape and visual assessment presented in this Chapter is, therefore, a study of the Development's visibility from roads, public footpaths and other public open spaces. It should also be noted that the seasonal filtering and screening effects afforded by vegetation when in leaf was not apparent during the visits and therefore views obtained generally represent the worst-case scenario. Weather conditions at the time of the visits were mostly cloudy, grey and slightly overcast and this had a limiting effect on visibility for some distant viewpoints.

A total of 24 viewpoints were selected following consultations with Edinburgh City Council, Fife Council, East Lothian Council and SNH. Twenty-one viewpoints correspond with viewpoints chosen for the Consented Development in order that direct comparisons can be made between both schemes. Three additional viewpoints have been included, one from Edinburgh and two along the southern shore of the Firth of Forth at North Berwick and from the A198. A further requested viewpoint (Inchkeith Island) has not been included due to issues of access and private ownership. The locations of these viewpoints are shown in conjunction with the ZTV on Figure 5.3. As noted in the Fife Council Scoping Response (Table 5.1) the viewpoint location have been kept as close as practicable to those of the Consented Development for comparison.

From each viewpoint a comprehensive 360^{o} photographic survey was taken using a digital SLR camera with a fixed 50 mm focal lens, with the camera mounted on a tripod 1.8 m above ground level. This follows GLVIA recommendations. The photographs have been taken with a fifty percent overlap and then been stitched together using proprietary computer software to create a panorama. From this panorama, a single 75^{o} horizontal field of view has been chosen of the existing view from each viewpoint orientated in the direction of the Development. The 75^{o} field of view reflects the approximate widest vision splay that can be obtained by a static person without moving their head and allows the Development to be seen in context with the surrounding view. A 75^{o} field of view (in conjunction with a 300 mm viewing distance) also follows SNH guidance in defining the printed size of visualisations to fit an A3 page format[3].

[3] Horner + maclennan (2006), *Visual Representation of Windfarms: Good Practice Guidance*, Scottish Natural Heritage commissioned report F03AA308/2.

For each viewpoint a simple computer generated line drawing (wireline) has been produced of the Development set within the digital terrain model to indicate potential visibility. Computer rendered images (photomontages) have also been prepared for some of the viewpoints in close proximity to the Development to provide a more realistic image that illustrates the likely effect of the Development on the particular photographic view following construction. It is important to stress, however, that photomontages are not 'true to life' and a degree of caution should be exercised when interpreting them. Nevertheless, along with ZTVs, photomontages are a useful tool in informing the assessment of the likely effects of the Development.

A brief overview of the representative viewpoints is given in Table 5.6 below with reference to location, distance from the Development and reason for selection. A detailed analysis of the viewpoints is given in Technical Appendix A5.1 of this ES and this has been extrapolated to inform the assessment of effects described later in this Chapter. The viewpoint analysis in conjunction with the ZTV and site visits, suggests that the transition from significant effects to not significant effects is around 5 km from the Development, depending on the degree of visibility obtained. This is unchanged from the assessment of effects for the Consented Development.

Table 5.6 Viewpoints (VPs)

VP Ref	Location	Grid Ref	Dist to Turbine	Rationale for Selection
1	B931/Fife Coastal Path, Buckhaven	E336546 N698829	500 m	Closest available view of the Development from the long distance footpath and from some houses on the coastal edge of the settlement.
2	Shore Street, Buckhaven	E335933 N697836	900 m	Represents close range views from some houses on the coastal edge of the settlement.
3	A955, Buckhaven	E335901 N699281	1.5 km	Close view from some houses within the settlement and from Buckhaven High School.
4	Fife Coastal Path, East Wemyss	E334387 N697192	2.5 km	Close view from the long distance footpath south-west of the Development and from some houses on the eastern edge of the settlement.
5	Fife Coastal Path, Leven	E338521 N700655	3.0 km	Close view from the long distance footpath north-east of the Development. There is unlikely to be any direct visibility from Leven itself.
6	Kennoway	E335618 N701941	4.0 km	View from some houses on rising ground north of the Development.
7	Fife Coastal Path, Wemyss Castle	E332945 N695079	5.0 km	View from the long distance footpath south-west of the Development and from the edge of Wemyss LLA/Garden & Designed Landscape.
8	Local road west of Kennoway	E333214 N702644	5.5 km	View from the road and representing effects on local visual amenity north-west of the Development.
9	Fife Coastal Path, Lower Largo	E340759 N702543	6.0 km	View from the long distance footpath north-east of the Development, from some houses on the coastal edge of the settlement & Lundin

VP Ref	Location	Grid Ref	Dist to Turbine	Rationale for Selection
				golf course.
10	Minor road east of Coaltown of Balgonie	E330570 N699768	6.5 km	View from some houses on the eastern edge of the settlement and closest available views from Glenrothes.
11	A916, north-east of Kennoway	E336994 N704771	6.5 km	View from the road and representing effects on local visual amenity north of the Development.
12	Largo Law	E342674 N704970	9.0 km	View from a local high point on the edge of Largo Law LLA.
13	Fife Coastal Path, King Craig Point	E346176 N699827	9.5 km	First available views of the Development from the long distance footpath approaching from the east on the edge of East Neuk LLA.
14	Local road east of Montrave	E340324 N707256	9.5 km	View from the road and representing effects on local visual amenity north of the Development close to the limit of the ZTV. Also represents views from the edge of Tarvit and Ceres LLA.
15	A917	E345522 N702896	10.0 km	View from the road and representing effects on local visual amenity in the vicinity of a number of designed landscapes. Views further east are precluded by low-lying landform and vegetation.
16	A921/Fife Coastal Path, Kirkcaldy	E327955 N690297	12.0 km	View from the long distance footpath, Regional Cycle Route 63, the A921 and from some houses on the coastal edge of the town.
17	Local road north of Kinglassie	E323564 N699742	13.5 km	View from the road and representing effects on local amenity west of the Development.
18	Fife Coastal Path, Kinghorn	E327614 N687573	14.0 km	First available views of the Development from the long distance footpath approaching from the south west on the edge of Cullaloe Hills & Coast LLA
19	East Lomond Hill (Lomond Hills)	E324446 N706174	14.5 km	View from Lomond Hills Regional Park and LLA north west of the Development and close to the limit of the ZTV.
20	Local road north-west of Kinghorn	E326111 N687867	15.0 km	View from the road and representing effects on Cullaloe Hills and Coast LLA south west of the Development close to the limit of the ZTV.
21	Gullane	E347899 N683064	19.0 km	Represents the closest available views from the southern shore of the Firth of Forth. Also represents views from some houses on the northern edge of the settlement.
22	Calton Hill,	E326281	26.0 km	Long view from the historic landmark within

VP Ref	Location	Grid Ref	Dist to Turbine	Rationale for Selection
	Edinburgh	N674253		the city
23	North Berwick	E355116 N685343	22.5 km	Long view from some houses on the northern edge of the coastal settlement.
24	A198, at Gosford Bay	E344908 N678873	21.0 km	View from the road where it coincides with a section of the southern shore of the Firth of Forth.

5.2.8 Cumulative Effects

In addition to assessing the effects of the Development on the landscape and visual resources of the study area, it is also important to consider any cumulative effects that might arise from the addition of the Development to other wind energy developments. Individually the effects of these may be not significant, but, when considered together, they may create an unacceptable effect on the landscape and visual resource (GLVIA paragraphs 7.12-7.13).

Cumulative effects occur when the study areas of two or more wind energy developments overlap with visibility indicated for each so that they are experienced together at a proximity where they might have an indirect effect. In order that sufficient consideration is given to important receptors on the limit of the 15 km radius study area that might have visibility of one or more wind energy developments beyond the study area boundary, the search area for cumulative effects is increased to 30 km radius from the Development. Experience shows that significant cumulative effects are highly unlikely to occur where there is more than 30 km between wind energy developments and this extended area allows for an important receptor to be located midway between the Development and another wind energy development on the limit of the search area, i.e. 15 km from each.

The 30 km radius cumulative search area is shown on Figure 5.4. For the purposes of this assessment, it has been agreed with Fife Council to restrict the number of cumulative sites to those that were used to assess the Consented Development, although the two offshore wind turbines associated with the 2-B Energy Proposed Development have been included. These sites are identified on Figure 5.4 and are listed in Table 5.7 below, together with their current status.

Table 5.7: Wind Energy Developments with Overlapping ZTVs within 15 km Radius of the Development (Wind energy details obtained from Fife Council and developer applications)

Wind Energy Site	Planning Authority	Status	Turbine Nos	Height to Tip	Distance (approx)*	Direction (approx)**
Methil Docks	Fife	Operational	1	81 m	1.7 km	North East
Little Raith	Fife	Consented	9	100 m	18.5 km	South West
Lochelbank	Perth & Kinross	Consented	12	91 m	28.8 km	North West
Westfield	Fife	Undetermined	5	110 m	15.0 km	West
2-B Energy	Fife	Undetermined	2	168.5 m/ 172.5 m***	1.5-1.7 km	South

*Distance is calculated from the Development to the nearest turbine on an adjacent site.
**Direction is based on the principal points of the compass relative to the Development.
***Tip heights are based on mean sea level

For each wind energy development identified on Figure 5.4 and listed in Table 5.7, a 15 km radius circle is drawn around it to illustrate the extent of individual ZTVs and potential overlapping, or cumulative visibility, with the Development study area. From this, a series of paired and grouped cumulative blade-tip ZTVs have been prepared in accordance with SNH guidance to show the Development ZTV added to the ZTV of each individual wind energy development (Figures 5.5a to 5.5e); to the ZTVs of all operational and consented wind energy developments together (Figure 5.5f); and to the ZTVs of all undetermined wind energy developments together (Figure 5.5g). Each cumulative ZTV covers a radius of 15 km from the Development and is calculated to blade-tip, based on information made available at the time of the assessment.

In addition to the ZTVs, a series of wirelines have also been prepared to illustrate the nature and extent of cumulative effects of the Development added to those operational, consented and undetermined wind energy developments as seen from a number of key viewpoints.

Eleven viewpoints have been selected for this purpose and ten of these correspond with the cumulative viewpoints used in the assessment of the Consented Development for ease of comparison. One additional viewpoint (viewpoint 21) has been included to illustrate the 2-B Energy Proposed Development. The selected viewpoints are listed below, together with their approximate distance from the Development. An analysis of these cumulative viewpoints is given in Appendix 5.1 of this ES.

- Viewpoint 6: Kennoway (4.0 km to the Development);
- Viewpoint 7: Fife Coastal Path, Wemyss Castle (5.0 km to Development);
- Viewpoint 9: Fife Coastal Path, Lower Largo (6.0 km to Development);
- Viewpoint 10: Coaltown of Balgonie (6.5 km to the Development);
- Viewpoint 11: A916, north-east of Kennoway (6.5 km to the Development);
- Viewpoint 12: Largo Law (9.0 km to the Development);
- Viewpoint 13: Fife Coastal Path, King Craig Point (9.5 km to the Development);
- Viewpoint 17: Local road north of Kinglassie (13.5 km to the Development);
- Viewpoint 19: East Lomond Hill (14.5 km to the Development);
- Viewpoint 20: Local road north-west of Kinghorn (15.0 km to Development); and
- Viewpoint 21: Gullane (19.0 km to Development).

For each viewpoint two wirelines have been prepared, each covering a 180^{o} arc of view. When combined, these wirelines illustrate a complete 360^{o} arc of view around the viewpoint. The various wind energy developments visible in each wireline are identified in differing colours to reflect their status. These wirelines are illustrated on Figures 5.16a to 5.16j.

The ZTVs and wirelines have then been analysed to identify the extent of cumulative effects. As with the standalone assessment, the assessment of cumulative effects considers additional effects on the landscape and visual resources of the study area. The assessment of cumulative landscape effects considers additional effects on:

- Landscape character; and
- Landscape-related planning designations and special interests.

The assessment of cumulative visual effects considers additional effects on views experienced by a range of viewers (residents, walkers, road users, etc.). These are considered in relation to three types of cumulative effect:

- Combined: Where more than one wind energy development is seen from a single, static viewpoint in the same arc of view without the viewer turning their head (views from residential properties, etc.);
- Successive: Where more than one wind energy development is seen from a single, static viewpoint but where the viewer is required to turn their head to encompass more than one arc of view (views from elevated or open locations, properties, etc.); and
- Sequential: Where more than one wind energy development is seen from a series of viewpoints, typically as part of a journey (views from roads, railways, footpaths, etc).

The significance of a cumulative effect arising from the addition of the Development is dependent on the sensitivity of the affected landscape or view to wind energy developments and the magnitude of effect they will experience, as described in 5.2.3. A significant cumulative effect will occur where the addition of the Development will result in the impression of a landscape or view that is defined by the presence of more than one wind energy development and is characterised primarily by wind energy developments so that other patterns and components are no longer definitive. This varies from the definition of a

significant effect in the main assessment, where the effect of the Development by itself may result in a material change to the landscape and visual resource of the study area. If the Development by itself is judged to have a significant effect, it does not necessarily follow that there will also be a significant cumulative effect. This is because it is the addition of the Development to the cumulative situation of other existing and proposed wind energy developments that is assessed here, and not the overall cumulative situation with the Development included.

The effects of the Development on identified landscape and visual receptors are considered further in Sections 5.4 (Assessment of Effects), 5.5 (Mitigation Measures and Residual Effects) and 5.6 (Cumulative Effects Assessment).

5.3 Baseline Conditions

5.3.1 Introduction

The baseline study aims to record, classify and evaluate the existing landscape and visual resources of the Development site and surrounding area. This process helps gain an understanding of the key components or characteristics of the study area and is instrumental in identifying valued and potentially sensitive landscape and visual receptors, against which the predicted landscape and visual effects of the Development can be assessed.

The baseline assessment has involved:

- A desk-based study of current Ordnance Survey mapping (1:50,000 scale), planning designations and published landscape character assessments to define the broad character of the study area and to identify any valued landscape and visual receptors;
- A desk-based study of the ZTV to identify potential viewpoints for further assessment;
- An initial site visit to establish actual visibility of the Development from identified viewpoints; and
- Further site visits to conduct a field survey of the final set of viewpoints against which the effects of the Development are later assessed.

The baseline conditions section sets out:

- A brief description of the Development site (5.3.2);
- A description of the principal settlements, routes, features and attractions within the wider study area (section 5.3.3);
- A classification of the study area into areas of distinct and recognisable landscape character (section 5.3.4); and
- An overview of relevant landscape-related planning designations and other special interests that apply to the study area (section 5.3.5).

5.3.2 The Development Site

The Development will be located at Fife Energy Park (FEP), which lies on the northern shoreline of the Firth of Forth at Methil in Fife. The FEP site lies at approximately 30 m Above Ordnance Datum (AOD) and covers approximately 54 hectares of semi-derelict industrial land. The site boundaries are defined by residential properties bordering the B931 Wellesley Road to the west, a large steel fabrication facility to the north and by the coastline to the east and south. The site is mostly made up of colliery spoil having originally been the location of a deep coal mine and includes several tall (80 m) lighting columns. However, infrastructure works associated with the FEP are in progress and include new site roads, utilities, upgraded coastal defences and the creation of development platforms defined by engineered embankments. The Development will be located approximately 20 m offshore with access to the quayside provided by existing internal site roads.

North and west of the FEP site the landform rises up to heights of between 200 and 250 m AOD as a series of steep sided hills and ridgelines separated by narrow, incised river valleys of

which the River Eden is the most significant. Largo Law (290 m AOD) represents a locally prominent and isolated hill north east of the Development site, whilst further to the west the Lomond Hills cover a more sizeable area and achieve heights of between 300 and 500 m AOD. East and south of the FEP site, the study area comprises of open water associated with the Firth of Forth. When visibility is good, it is possible to see the southern shoreline, beyond the study area boundary, and more distant Lammermuir Hills silhouetted on the skyline.

Land use across the study area is predominantly agricultural and mostly arable in nature. Fields are typically medium to large sized, broadly geometric in shape and enclosed by hedgerows with some dry-stone walls. On the Lomond Hills, pasture predominates and this gives way to rough grazing and open moorland on the highest parts. Vegetation is a mixture of small-scale woodlands and shelterbelts, with larger and more geometric blocks of commercial forestry on the higher ground. Settlement consists of a number of large towns, villages, clusters of houses and more isolated houses and farms as identified in Section 5.3.3 below. The larger settlements tend to be found on the coast where they are linked by the main routes that cross the study area. Pylons and overhead power lines are a detracting influence across western parts, whilst telecommunications masts are a noticeable feature of many of the hilltops.

5.3.3 Settlements, Routes, Features and Attractions

Within the wider study area there are a number of settlements, routes and attractions that might have views affected by the introduction of the Development. These 'visual receptors' are described briefly below and are identified on Figures 5.6 and 5.7.

5.3.3.1 Settlements

Settlements of various sizes occur across the study area. The largest include the towns of Glenrothes and Kirkcaldy, to the west of the Development, as well as the coastal settlements of Buckhaven, Leven and Methil which lie immediately adjacent to the Development and have effectively coalesced. In addition to these main settlements, there are a number of smaller towns and villages mostly located on the coast. Those closest to the Development include East Wemyss, Kennoway and Lower Largo.

Beyond these settlements, there is a fairly continuous but low density distribution of small villages, clusters of houses, isolated houses and farms scattered across all but the highest parts of the study area. These all require to be considered in the assessment since residential occupiers are normally considered to have a high sensitivity to development. The main settlements included in the assessment are shown on Figure 5.6. Effects on small communities and properties that are in close vicinity to the Development are considered separately in the assessment of effects on local visual amenity.

5.3.3.2 Roads

The developed nature of the study area is such that there are a number of roads running through it, some of which may have visibility of the Development. Road users are generally considered to have a limited sensitivity to development in view of their transient nature, but are nevertheless considered in the assessment. However, the density of roads and the minor nature of many of them are such that it is impractical to consider all routes. The assessment therefore focuses on the main A-class roads that run through the study area for a prolonged distance, as identified on Figure 5.6. These are the A92, A911, A912, A914, A915, A916, A917, A921 and A955. Effects on local roads that are in close vicinity to the Development are considered in the assessment of effects on local visual amenity.

5.3.3.3 Walking Routes

Users of long distance and sign-posted walking routes are usually included in the assessment as they are considered to have a high sensitivity to development as they pass slowly through an area and focus on views of the landscape. Within the study area, one long distance footpath has been identified and is shown on Figure 5.7. This is Fife Coastal Path, which closely follows the northern coastline of the Firth of Forth between Kinghorn in the south west and Ellie in the east, and passes within 500 m of the Development.

Many other shorter public footpaths are found within the study area, however, these are too numerous to assess individually. The assessment therefore focuses on those routes within the general vicinity of the Development, which are considered in the assessment of effects on local visual amenity.

5.3.3.4 Cycle Routes

As with long distance footpaths, users of dedicated cycle routes have a higher sensitivity to development as they pass through an area and are usually included in the assessment. Within the study area, two National Cycle Routes (Nos 1 and 76) and one Regional Cycle Route (No 63) have been identified and are also shown on Figure 5.7. These routes follow a series of local roads, passing to the west and north of the Development.

5.3.3.5 Country Parks

Country Parks are designated areas of attractive countryside close to major population centres with opportunities for informal recreation. Users of these recreational areas have an interest in and focus on views of the landscape and are normally considered to have a high sensitivity to development. Within the study area, one Country Park has been identified and is also shown on Figure 5.7. This is Lomond Hills Regional Park, which adjoins the northern built-up edge of Glenrothes and extends beyond the north western study area boundary.

A number of gardens and associated landscapes of historical interest are also found within the study area. These are considered in Section 5.3.5.

5.3.3.6 Beaches

As with Country Parks, users of beaches have an interest in and focus on views of the coast and are normally considered to have a high sensitivity to development. Within the study area, three main beaches have been identified along the northern shore of the Firth of Forth and are included in the assessment. These are at Elie and Earlsferry, around Largo Bay and along the seafront at Kirkcaldy. These are shown on Figure 5.7.

5.3.4 Landscape Character

This section considers the way in which the landscape of the study area has been categorised into distinct and recognisable patterns of landscape character, the perception of which might be altered by the visible presence of the Development. For the purposes of this assessment, information relating to landscape character is based upon the following published landscape character assessment:

- Fife Landscape Character Assessment. SNH Review No 113, prepared by David Tyldesley Associates (1999).

This assessment forms part of a series of studies carried out by SNH in the 1990s that have identified, mapped and described the landscape character for the whole of Scotland in a hierarchical context from a national and regional level down to a local level. Within the study area, five Regional Character Areas have been identified and these have been sub-divided into fourteen Landscape/Seascape Character Types.

Character type is a generic term used to describe broadly similar and recognisable patterns of landform, vegetation, land use and settlement that can occur in different places in different parts of the country. Each of the character types found within the study area is described in detail in the Fife Landscape Character Assessment, along with guidelines for future development. In some instances the Landscape Character Types are further sub-divided into smaller Landscape Character 'Areas' or 'Units'. These relate to specific geographical locations, which, although sharing the same generic characteristics as a Landscape Character Type, have their own individual or unique character which gives them a local sense of place. The distinction is reflected in the naming of Character Types and Areas, the former having generic names such as 'Uplands' with the latter having specific names such as the 'Lomond Hills'.

A brief description is given below of the characteristics of each of the Regional Character Areas (RCAs) found within the study area, to demonstrate how this assessment relates to the larger scale. The descriptions provided mainly draw upon descriptions contained in the Fife

Landscape Character Assessment. This is followed by a listing of those Landscape/Seascape Character Types (LCTs) found within each RCA. The LCTs that are found within the study area are shown on Figure 5.8. It should be noted that the boundaries drawn around the various LCTs have been interpreted from figures contained within the Fife Landscape Character Assessment rather than physical features on the ground and are approximate.

5.3.4.1 Volcanic Uplands of the Midland Valley RCA

The Volcanic Uplands of the Midland Valley RCA covers a narrow band that extends broadly east-west across central parts of the study area. This is a large-scale, open and exposed landscape that represents the highest hills in Fife and neighbouring Perth & Kinross. Landform typically lies above 150 m AOD as smooth, rounded hills with occasional craggy peaks reaching 250 m AOD or more. However, in the far west of the study area, in the vicinity of the Lomond Hills, the land rises up steeply and dramatically to over 400 m AOD.

Open moorland grazed by sheep is the principal land-use of the highest areas, together with large blocks of commercial forestry on the steeper side slopes. On the more extensive foothills that cover much of the study area, land-use is a mixture of rough hill grazing with improved pastures and some arable cultivation on the lower slopes as small-scale enclosures. Woodland cover is also relatively widespread across the foothills as small blocks of coniferous and deciduous woodland and this gives the area a wooded character despite its open nature. Settlement is largely absent on the highest hills, but across the lower foothills it is a fairly continuous but low density mix of isolated houses, farmsteads and small hamlets linked by a network of minor roads.

Within the Volcanic Uplands of the Midland Valley RCA, four Landscape Character Types are found within the study area:

- Uplands;
- Upland Slopes;
- Upland Foothills; and
- Pronounced Volcanic Hills and Craigs.

5.3.4.2 Midland Valley Lowland Landscapes RCA

The Midland Valley Lowland Landscapes RCA extends east-west across the study area as a relatively narrow band that separates the Volcanic Uplands and Foothills in the north from coastal areas to the south, although it also extends to the coast in places. This regional character area also encroaches into the far north of the study area as the 'Howe of Fifth' river basin.

This is a more settled, working landscape that is typical of many parts of Central Scotland. The landform is more subdued, comprising of shallow valleys and broad river basins separated by low, rounded hills and ridgelines between 100-150 m AOD. Land-use is predominately agricultural with a strong pattern of arable land and improved pastures laid out as medium sized fields enclosed by post and wire fences and hedgerows. Small woodlands, linear plantations, tree groups and hedgerow trees are important components as are a number of designed landscapes, including Balcarres, Charlton and Lahill. Settlement is relatively dense and ranges from small communities and villages to large towns, including Glenrothes. These are all linked by the major roads that run through the study area.

The Development lies on the very edge of this regional character area at a point where it extends to the northern coastline of the Firth of Forth. Here, the landscape is low-lying and has been substantially built over by the coastal towns of Buckhaven, Leven and Methil, which have effectively coalesced. Heavy industrial uses associated with the offshore oil and gas industry are a particular feature of this part of the coastline and include a large steel fabrication facility with several 80 m high lighting masts immediately adjacent to the Development site.

Within the Midland Valley Lowlands Landscapes RCA, four Landscape Character Types are found within the study area:

- Lowland Hills and Valleys;
- Lowland Dens, which the Development adjoins;
- Lowland River Basins; and
- Lowland Loch Basins.

5.3.4.3 Midland Valley Coastal Landscapes RCA

The Midland Valley Coastal Landscapes RCA comprises of a narrow and discontinuous strip of coastal hills, cliffs, raised beaches and flats where the experience of the landscape is dominated by views of the Firth of Forth and other man-made influences. Landform is gently undulating as far as the coast where it either ends abruptly as cliffs 30-50 m AOD, or slopes gently towards to the sea. Land use is predominantly agricultural and primarily arable production with woodland mostly confined to the coastal edge as linear shelterbelts. Settlement is largely limited to isolated farmsteads lying between coastal settlements, of which Kirkcaldy is the largest.

Within the Midland Valley Coastal Landscapes RCA, four Landscape Character Types are found within the study area:

- Coastal Hills;
- Coastal Terraces (Raised Beaches);
- Coastal Cliffs; and
- Coastal Flats.

5.3.4.4 Intertidal Landscapes RCA

Intertidal Landscapes RCA is a natural landscape that is dominated by the tidal action of the sea. It is found almost continuously around the Fife coastline where it comprises of intertidal mudflats, sands, shingle and rock formations that are exposed as linear features between high and low tides. This is a large-scale, flat, open and exposed coastal landscape of uniform character but also temporary in nature. Views are invariably extensive towards the sea whereas towards the land they are generally curtailed by cliffs, braes and coastal hills. Manmade influences are largely limited to pipelines and groynes exposed at low tide, together with navigational artefacts. In places intertidal areas have been lost to coastal protection works and land reclamation.

Within Intertidal Landscapes RCA, one Seascape Character Type is found within the study area:

- Intertidal Shores.

5.3.4.5 Maritime Landscapes of Fife RCA

Maritime Landscapes RCA essentially applies to the Firths around the Fife coastline and the open sea that extends beyond the coastline of the study area. This is a very large-scale, flat, horizontal seascape dominated by weather conditions and the tidal actions of the sea. It is not, however, a featureless environment. On clear days, expansive views can be obtained across the Firths to the opposite shoreline where distant hills, urban conurbations and industrial structures can be seen. Several small islands in the Firth of Forth also provide point features in views as does the frequent but slow passage of shipping. Although there are no settlements on the maritime Firths, the shores tend to be dominated by towns and industrial development and this includes the shoreline immediately adjacent to the Development.

Within Maritime Landscapes RCA, one Seascape Character Type is found within the study area:

- Firth of Forth.

Where it is relevant to the assessment of effects on landscape character, more information on these Landscape/Seascape Character Types is given in Section 5.4 (Assessment of Potential Effects) of this Chapter.

5.3.5 Landscape Planning Designations

A detailed discussion on the planning context relevant to the Development site and surrounding area, including a review of national, regional and local planning policy, is given in Chapter 4: *Planning Policy* of this ES.

This section considers the significance of any landscape-related planning designations (National Parks, National Scenic Areas, Special Landscape Areas, *etc.*) and other special interests of a landscape nature (Historic Parks and Gardens) that apply to the study area. These are relevant to the assessment of landscape character since they are generally associated with landscapes perceived to be important, or high value, with increased sensitivity to change whether at a national or local level. For this reason they are normally included in the selection of viewpoints and are considered as separate landscape receptors so that the effects of the Development can be specifically assessed and, if necessary, avoided or reduced.

For the purposes of the landscape and visual assessment, the following local plan information and emerging planning policy has been reviewed to identify any landscape-related planning designations and other special interests within the study area:

- Mid Fife Local Plan as modified/intent to adopt (December 2011) and referred to as the Adopted Mid Fife Local Plan (2012); and
- Fife Local Landscape Designation Review (November 2008), prepared for Fife Council by Land Use Consultants.

Consultations with Fife Council planning department has confirmed that whilst Fife is presently covered by ten local plans, they are in the process of being incorporated into three new local plans covering East Fife, Mid Fife and West Fife. The Adopted Mid Fife Local Plan covers the Development site and is the most advanced of the three local plans with detailed policies covering landscape-related planning designations and other special interests. Additionally, Fife Council has commissioned a review of local landscape designations as part of the new local plan process. This is set out in the Land Use Consultants report and whilst this report has not been adopted as supplementary planning guidance, its recommendations are expected to be incorporated into each of the new local plans.

For the purposes of this assessment, the Adopted Mid Fife Local Plan together with the Land Use Consultants report have been used for current landscape-related planning designations in Fife. Additionally, Historic Scotland has been consulted for records of any Gardens and Designed Landscapes. Other special interests within the study area of national or local importance relate to natural heritage (Nature Reserves, Sites of Special Scientific Interest, *etc.*) and cultural heritage (Scheduled Ancient Monuments, Listed Buildings, Conservation Areas, *etc.*). These are in covered separately in Chapter 6: *Ecology* and Chapter 9: *Archaeology and Cultural Heritage* of this ES.

5.3.5.1 Landscape Planning Designations

A review of the above information has identified that the Development site and wider study area is not covered by any national or international landscape-related planning designations. The closest designations are the Cairngorms National Park and Loch Lomond and the Trossachs National Park, both of which are located approximately 70 km from the Development, to the north and west respectively.

At a local level, landscapes in Fife where the scenery is highly valued were originally designated as Areas of Great Landscape Value (AGLVs) in the 1960's and covered extensive tracts of countryside. These designations have been reviewed as part of the new local plan process and replaced by Local Landscape Areas (LLAs) in the Adopted Mid Fife Local Plan. These new designations are based on the 2008 Land Use Consultants study, except they are no longer referred to as Special Landscape Areas. Policy E19 of the Adopted Mid Fife Local Plan covers LLAs and states:

"Development proposed within a Local Landscape Area or outwith the boundary but which may impact on upon the designated area, will only be permitted where it has no significant adverse affect on the identified landscape qualities of the area and/or its overall landscape integrity and setting."

Within the study area, six LLAs have been identified and are included in the assessment. These are listed below and are shown on Figure 5.9:

- Cullaloe Hills and Coast LLA, which covers a sizeable area west of Kirkcaldy and continues beyond the study area;
- East Neuk LLA, which encompasses a narrow coastal strip on the eastern end of Largo Bay and continues east beyond the study area;
- Largo Law LLA, which covers a small area north of Lower Largo encompassing Largo Law and Flagstaff Hill;
- Lomond Hills LLA, which covers a sizeable area north west of Glenrothes encompassing the Lomond Hills and extends into neighbouring Perth & Kinross;
- Tarvit and Ceres LLA, which covers a small area directly south of Cupar extending as far as the minor road linking the A916 with the B941; and
- Wemyss Coast LLA, which covers the coastal edge between Dysart and East Wemyss and is the smallest of the local designations.

It should be noted that the boundaries drawn around the various LLAs have been interpreted from figures contained within the Land Use Consultants study rather than the three new local plans for Fife, which are still progressing through the planning process and are incomplete.

5.3.5.2 Historic Gardens and Designed Landscapes

The 'Inventory of Gardens and Designed Landscapes' as prepared by Historic Scotland, records details of some of the finest parks and gardens in Scotland. These are considered to be of national importance and although inclusion in the Inventory brings no additional statutory protection, local authorities are required to make provision for the protection of the historic environment when preparing development plans and determining planning applications. To ensure this is given due consideration, local authorities are required, under the Town and Country Planning General Development Procedure Order 1992, to consult Historic Scotland and SNH on all applications that affect the character or setting of any Inventory site. Policy E11 of the Adopted Mid Fife Local Plan covers Historic Gardens and Designed Landscapes and states:

"Development affecting Historic Gardens and Designed Landscapes shall protect, preserve, and enhance such places and shall not impact adversely upon their character, upon important views to, from or within them, or upon the site or setting of component features which contribute to their value."

Within the study area, ten Inventory sites have been identified and are included in the assessment. These are listed below and are also shown on Figure 5.9:

- Balbirnie House (adjoins the eastern built-up edge of Glenrothes);
- Balcarres House (lies approximately 5 km north of Earlsferry);
- Charleton House (lies approximately 4.5 km east of Lower Largo);
- Dysart House and Ravenscraig Park (on the coast between Kirkcaldy and Dysart);
- Hill of Tarvit (lies approximately 2.5 km south of Cupar);
- Lahill House (lies approximately 5 km east of Lower Largo);
- Leslie House (within the built-up confines of Glenrothes);
- Lentham Glen (adjoins the northern built-up edge of Leven);

- Raith Park & Beveridge Park (adjoins the western built-up edge of Kirkcaldy); and
- Wemyss Castle (on the coast at West Wemyss).

Three Inventory sites lie on, or just beyond, the study area boundary with little or no visibility indicated by the ZTV, so have been excluded from the assessment. These are Balcaskie House, Falkland Palace and Melville House.

5.3.6 Summary of Principal Landscape and Visual Receptors within the Study Area

There are no valued landscape resources within the boundaries of Fife Energy Park where the Development is to be located. The Development site generally comprises of semi-derelict industrial land that adjoins an operational steel fabrication plant and includes several 80 m high lighting towers.

Five Regional Character Areas (RCAs) are found within the study area and, within these, fourteen Landscape/Seascape Character Types (LCTs) have been identified. The Development lies on the edge of the 'Lowland Dens' LCT at a point where urban and industrial uses have substantially altered the landscape character and have become the prevailing influence.

No national or international landscape-related planning designations exist within the study area. At a local level, six Local Landscape Areas (LLAs) fall within the study area in whole or in part. Additionally, ten Inventory Gardens and Designed Landscapes are found within the study area.

Principal visual receptors identified within the study area include some twenty settlements, nine A-class roads, one long distance footpath and three national/regional cycle routes. In addition, one regional park and three main beaches have been identified as major visitor attractions.

5.4 Assessment of Potential Effects

5.4.1 Introduction

Having identified the baseline landscape and visual resources of the Development site and surrounding area in section 5.3, this section describes and evaluates the changes in the character and quality of the landscape and views that are expected to result from the Development during its operational phase. This section of the assessment aims to:

Identify those potential effects that would result directly or indirectly from the Development on a range of sensitive landscape and visual receptors;

- Estimate the likely scale or magnitude of effect; and
- Assess their significance.

As stated in section 5.2.2, the assessment of landscape and visual effects is divided into four key categories. Each of these categories is assessed separately and therefore this section of the assessment comprises of four main parts:

- Assessment of effects on landscape fabric (section 5.4.2);
- Assessment of effects on landscape character (section 5.4.3);
- Assessment of effects on designated areas/special interests (section 5.4.4); and
- Assessment of effects on views (section 5.4.5).

5.4.2 Effects on Landscape Fabric

This section considers the physical changes to the baseline landscape fabric of FEP that will arise from the addition of the Development. Landscape fabric is the physical pattern of elements such as vegetation, landform, land use and other features that combine to create landscape character. The effects of the Development on landscape fabric are those that alter the physical pattern of elements. These effects are restricted to the landscape within which

the Development is located as it is within this area that the physical pattern of elements will alter, for instance, through loss of vegetation, re-contouring or changes to land-use.

Although the Development will be positioned approximately 20 m offshore, other infrastructure elements will be sited within the FEP site, such as the construction compound, and these require to be assessed. Within the FEP site there is just one landscape element that will undergo physical change as a result of infrastructure works associated with the Development, namely the semi-derelict industrial land that covers the majority of the FEP site.

For this landscape element, or receptor, an assessment is made below of its sensitivity to the Development. This is followed by a description of the changes to the landscape element arising from the Development and an assessment of the magnitude of effect. Both the sensitivity and magnitude of effect are assessed against criteria given in Table 5.2, in section 5.2.3. From this, an assessment of the level of significance has been determined with reference to Table 5.5, also in section 5.2.3.

Indirect effects arising from the visible presence of the Development in the wider landscape are considered in the following section with respect to landscape/seascape character.

5.4.2.1 Semi-Derelict Industrial Land

Much of the FEP site comprises of semi-derelict industrial land associated with its past use as a deep coal mine. Parts of the site are currently devoted to heavy industrial uses associated with the offshore oil and gas industry, whilst other parts are vacant and have been remodelled as part of infrastructure works associated with the FEP development.

Sensitivity

Semi-derelict industrial land has very few, if any, redeeming characteristics or qualities. Certainly no valued landscape elements exist within the FEP site that are worthy of retention and considerable scope exists for substitution or enhancement as part of the FEP development. In addition, a number of large-scale vertical elements exist on the site (lighting towers and cranes) to which the Development can relate to. This combination of factors results in a *very low* sensitivity.

Magnitude of Effect

The introduction of the Development will have no physical effect on the FEP site due its offshore location. Furthermore, it is not anticipated that any additional access roads will have to be constructed within the FEP site as the turbine location can be accessed from existing roads to the quayside. Similarly, all cabling requirements will make use of existing utilities or those provided as part of the FEP development. Whilst a new construction compound will be required, it will occupy a very small part of the FEP site and will be compatible with other commercial buildings on the site and nearby Methil Docks. The magnitude of effect is therefore assessed as *very small*.

Significance of Effect

The physical effect of the Development on the FEP site is assessed as being *negligible* and will be *not significant*. This is due to the semi-derelict nature of the site with high potential for restoration or enhancement, the provision of existing site infrastructure for access and grid connections, the small footprint occupied by the construction compound and the offshore location of the Development itself.

5.4.2.2 Summary of Effects on Landscape Fabric

The principal effect that the Development will have on the physical fabric of the FEP site will be the localised loss of semi-derelict industrial land to accommodate the construction compound. This will be not significant due to the inherently low value of the land, the limited proportion of land that will be lost and the high potential for restoration or enhancement as part of the overall FEP development.

5.4.3 Effects on Landscape Character

Through the landscape characterisation process, areas of landscape can be identified that exhibit distinct and recognisable patterns of elements, which are perceived in a particular way. Although the character of these areas is largely defined by what occurs within them, the perception of them is also influenced by the context of their setting. Hence the perception of a landscape can alter by the visible presence of an uncharacteristic feature in the wider view, even though the affected landscape may not be physically altered. The influence that views of the Development will have on the perception of a particular area will be dependent on those factors listed in section 5.2.3, notably the inherent characteristics of the area, the nature of the Development, the extent that it will be visible and the intervening distance.

This section considers the mainly indirect effects of the Development on the perception of those landscape character types identified in the baseline conditions section of this chapter. Only those character types that will gain visibility of some, or all, of the Development have been assessed and, of these, those where the effect on perception is judged likely to be significant have been assessed in more detail here. Character types with no available views of the Development and whose perception will remain unaltered have been excluded from the assessment process.

This has been determined by an initial sieving exercise with reference to Figure 5.10, which shows the landscape character types in conjunction with the ZTV. Taking into account limitations associated with the ZTV, as described in section 5.2.6, an analysis of the visibility indicated has identified a short-list of landscape character types with potential for significant effects for which further assessment is required. Analysis of the representative viewpoints and computer generated wirelines in conjunction with site visits has then been carried out for the short-listed receptors to identify the presence of screening features that might limit visibility and so determine likely levels of impact and significance.

The findings of the initial assessment from which landscape character types have been short-listed are recorded in Table 5.8 below. Where relevant, the representative viewpoint that best illustrates the potential effect on a character type is referred to. A detailed analysis of the viewpoints is provided in Technical Appendix A5.1 of this ES.

Many of the landscape character types included in the assessment are extensive and the effects of the Development can vary widely across a single character type. The distinction between areas where effects may be significant and where effects will not be significant within the same character type is of particular importance in the assessment. Where this is likely to be the case, the initial assessment has sub-divided the character type into separate areas, or units, which express the differing effects of the Development. The extent and naming of these units generally reflects those local units identified in the Fife Landscape Character Assessment. Where information is lacking, units have been determined by reference to physical features and/or administrative boundaries.

Table 5.8 Predicted Effects on Landscape Character Types

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
Landscape Character Types		
UP - Uplands Uplands' is found in one small area at the north-western limit of the study area, corresponding with the Lomond Hills. This character type also falls wholly within the Lomond Hills Regional Park and LLA, both of which encroach into the study area and imply increased sensitivity. It has low potential for significant effects and is appraised below as a single unit that corresponds with the local unit identified in the Fife LCA (UP2).		
UP2: Lomond Hills Unit	The ZTV shows patchy theoretical visibility from east facing slopes at distances of 12-15 km. In reality, the Development will have limited influence due to the large-scale nature of the receiving landscape, the panoramic nature of views obtained and the small and distant part of the wider outlook affected. Additionally, extensive urban development visible in views towards the Development further reduces its influence. Vp 19 represents this unit.	No, there may be some effect, but this will not be significant due to: Patchy visibility as shown on the ZTV; Large-scale nature of the receiving landscape and the panoramic nature of views obtained; Small part of available views occupied by the Development; Other built influences on the landscape; Distance to Development (min. 12 km).
US - Upland Slopes 'Upland Slopes' wraps around the northern and eastern edge of the 'Uplands' character type at the north western extent of the study area. It also falls within the Lomond Hills Regional Park and LLA. The ZTV shows variable visibility across this character type, which has been divided into two units and appraised separately. These units correspond with local units identified in the Fife LCA (US5 and US6).		
US5: Lomond Hills Slopes - North Unit	The ZTV shows no visibility.	No, due to lack of visibility.
US6: Lomond Hills Slopes - East Unit	The ZTV shows theoretical visibility from more elevated areas at distances of 10-12 km. In reality, visibility is largely curtailed by the network of coniferous woodland and shelter belts that cover the slopes. The landform also faces to the north-east so that available views are mostly orientated away from the Development. The built-up edge of Glenrothes adjoins this unit and provides a strong influence in views towards the Development.	No, there may be some effect, but this will not be significant due to: Screening provided by the network of woodland and shelter belts that cover the slopes; Orientation of landform away from the Development; Other built influences on the landscape; Distance to Development (min. 10 km).
UF – Upland Foothills 'Upland Foothills' occurs as one small area adjoining the southern edge of the 'Uplands' character type at the north western limit of the study area. It also falls within the Lomond Hills Regional Park and LLA. It has low potential for significant effects and is appraised as a single unit that corresponds with the local unit identified in the Fife LCA (UF20).		
UF20: Lomond Foothills Unit	The ZTV shows theoretical visibility at distances of 12-15 km. In reality, the Development will have limited influence due to the relatively large-scale nature of the receiving landscape, the expansive nature of views obtained and the small and	No, there may be some effect, but this will not be significant due to: Large-scale nature of the receiving landscape and the expansive nature of views obtained;

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
	distant part of the wider outlook affected. Additionally, the built-up edge of Glenrothes adjoins this unit and provides a strong influence in views towards the Development.	Small part of available views occupied by the Development; Other built influences on the landscape; Distance to Development (min. 12 km).
UV – Pronounced Volcanic Hills and Craigs 'Pronounced Volcanic Hills and Craigs covers a sizeable area north of the Development with some theoretical visibility indicated. This area corresponds with three local units identified in the Fife LCA (UV23, UV24 and UV25) and also falls within Tarvit and Ceres LLA. Additionally, four smaller areas occur across the study area with varying visibility (UV26, UV27, UV29 and UV30) and some of these also fall within LLAs. These units are all assessed separately in order that the varying effects of the Development on the landscape type are properly considered.		
UV23: Ceres Unit	The ZTV shows no visibility.	No, due to lack of visibility.
UV24: Kettlebridge to Peat Inn Unit	The ZTV shows limited theoretical visibility along the southern edge of this unit at distances of 5-12 km. Visibility from here is variable with screening by landform, woodland and shelter belts. Where views are available from higher ground, the outlook is relatively open, expansive and includes urban influences. Methil Docks Turbine also has an influence on views. Vp 14 represents this unit.	No, there is likely to be some effect, but this will not be significant due to: Limited visibility as shown on the ZTV; Intervening woodland and shelter belts, which further limits views; Open and expansive nature of available views; Other built influences on the landscape; Distance (min. 5 km but in most views the Development is much further away).
UV25: Largoward Unit	The ZTV shows patchy theoretical visibility in one area from a distance of about 13.5 km. In reality, the Development will have very little influence due to intervening vegetation and distance, which combine to limit long views. The landform also faces south so that available views are generally orientated towards the coast.	No, there may be some effect, but this will not be significant due to: Patchy visibility as shown on the ZTV; Intervening woodland and shelter belts, which further limit visibility; Orientation of landform away from the Development; and Distance to Development (min. 13.5 km).
UV26: Largo Law Unit	The ZTV shows a small area of theoretical visibility from south-west facing slopes of this outlying hill at a distance of about 8.5 km. In reality, the Development will have limited influence due to the large-scale nature of the receiving landscape, the panoramic nature of views obtained and the small part of the wider outlook affected. In addition, extensive urban areas are visible in views towards the Development and this further reduces its influence. This includes visibility of Methil Docks Turbine. Vp 12 represents this unit.	No, there is likely to be some effect, but this will not be significant due to: Large-scale nature of the receiving landscape and the panoramic nature of views obtained; Small part of available views occupied by the Development; Other built influences on the landscape in views towards the Development, including influences of a vertical nature; Distance to Development (min. 8.5 km).

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
UV27: Redwell Hill Unit	The ZTV shows patchy theoretical visibility from a distance of about 12 km. In reality, the Development will have very little influence due to the relatively large-scale nature of the receiving landscape, the expansive nature of views obtained and the small and distant part of the outlook affected. The built-up edge of Glenrothes also adjoins this unit and provides a strong influence in views. Vp 17 represents this unit.	No, there may be some effect, but this will not be significant due to: Patchy visibility as shown on the ZTV; Large-scale nature of the receiving landscape and the expansive nature of views obtained; Small part of available views occupied by the Development; Other built influences on the landscape; Distance to Development (min. 12 km).
UV29: Cullaloe Hills Unit	The ZTV shows patchy theoretical visibility from a distance of about 12 km. In reality, the Development will have very little influence due to the large-scale nature of the receiving landscape, the expansive nature of views obtained and the small and distant part of the wider outlook affected. The built-up edge of Kirkcaldy also adjoins this unit and provides a strong influence in views towards the Development. Vp 20 represents this unit.	No, there may be some effect, but this will not be significant due to: Patchy visibility as shown on the ZTV; Large-scale nature of the receiving landscape and the expansive nature of views obtained; Small part of available views occupied by the Development; Other built influences on the landscape; Distance to Development (min. 12 km).
UV30: Kingcraig Unit	The ZTV shows theoretical visibility from a distance of about 10 km, although a combination of rising landform and coniferous woodland within this discrete unit curtails many views. Communications masts are also a detracting influence on higher ground within this unit. Where views are available towards the Development, they are expansive and include urban development on the opposite shoreline. Methil Docks Turbine is also visible in views and further reduces the influence of the Development. Vp 13 represents this unit.	No, there is likely to be some effect, but this will not be significant due to: Open and expansive nature of available views; Small part of available views occupied by the Development; Other built influences on the coastal landscape in views towards the Development, including influences of a vertical nature; and Distance to Development (min. 10 km).
LH – Lowland Hills and Valleys 'Lowland Hills and Valleys' is found in two small areas at the northern limit of the study area and more generally in the west. The ZTV shows variable theoretical visibility across this landscape type, so it has been divided into four units that correspond with local units identified in the Fife LCA (LH31, LH33, LH35 and LH45).		
LH31: NW Cupar Unit	The ZTV shows no visibility.	No, due to lack of visibility.
LH33: Tarvit Mill Unit	The ZTV shows no visibility.	No, due to lack of visibility.
LH35: NE Dunfermline Unit	The ZTV shows near continuous theoretical visibility from around 7	No, there may be some effect, but this will not be significant

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
	km extending west to the limit of the study area. In reality, the low-lying landform in combination with intervening woodland and shelter belts within and adjoining this unit limits views. Additionally, major road and rail routes cross this unit as do overhead pylons and these will have an influence on views.	due to: Low-lying landform which limits long views; Intervening woodland and shelter belts which further limits visibility; Other built influences on the landscape, including influences of a vertical nature; Distance to Development (min. 7 km).
LH45: Falkland Unit	The ZTV shows no visibility.	No, due to lack of visibility.
LD – Lowland Dens 'Lowland Dens' occurs in one location immediately north of Leven, extending east to the coast and north to the boundary with the Volcanic Hills and Craigs type. This extensive area is defined as a single unit (LD51) within the Fife LCA and part of it falls within Largo Law LLA, which implies increased sensitivity. The ZTV shows widespread but patchy theoretical visibility across this character type, although the potential for significant effects will occur in close proximity to the Development. The landscape type has therefore been divided into two units, as a sub-division of Unit LD51, and appraised separately. Unit LD51a covers the area closest to the Development and Unit LD51b covers the remainder of the landscape type. The boundary between the two units coincides with the LLA boundary west of Largo Law.		
LD51a: Largo Unit	This unit lies 3.0-9.0 km from the Development with near continuous theoretical visibility shown. Vps 6, 9 and 11 represent this unit.	Yes, due to close proximity to the Development and near continuous visibility.
LU51b: Largo Unit	This unit covers the remainder of this landscape type wrapping around Largo Law (UV26) and extending further east. The ZTV shows theoretical visibility from mainly south facing slopes with the remainder of the unit having no visibility. In reality views are largely curtailed by the network of woodland and shelter belts that cover these slopes. The landform also faces to the south so that available views are mostly orientated away from the Development. Methil Docks Turbine also provides an influence in some views west of the A915.	No, there is likely to be some effect, but this will not be significant due to: Limited visibility as shown on the ZTV; Network of woodland and shelter belts that further limits views; Orientation of landform away from the Development; Other built influences of a vertical nature on the landscape; and Distance to Development (min. 7 km).
LR – Lowland River Basins 'Lowland River Basins' occurs in two locations coinciding with the 'Howe of Fife' at the northern limit of the study area and the Mid Leven Valley to the west of the Development. These areas correspond with three local units identified in the Fife LCA (LR55, LR56 and LR57). Visibility across these units is variable, although any potential for significant effects will occur in close proximity to the Development. The units are therefore assessed separately below, with unit LR57 further sub-divided into two sub-units to in order that the varying effects of the Development on the landscape are properly considered.		
LR55-LR56: Howe of Fife Unit	The ZTV shows no visibility.	No, due to lack of visibility.

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
LR57a: Mid Leven Valley Unit	This unit lies 2.5-8.0 km from the Development with near continuous visibility shown. Vps 8 and 10 represent this unit.	Yes, due to close proximity to the Development and near continuous visibility.
LR57b: Mid Leven Valley Unit	This unit covers the remainder of this landscape type, extending north-west from the edge of unit LR57a away from the Development. The ZTV shows more limited visibility.	No, there may be some effect, but this will not be significant due to: Limited visibility as shown on the ZTV; Low-lying landform combined with intervening woodland and shelter belts, which further limits views; and Distance to Development (min. 5 km).
LB – Lowland Loch Basins 'Lowland Loch Basins' is found in one very small area at Kilconquhar, which lies to the east of the Development. Fife LCA identifies this landscape type as a single unit (LB62). The unit also lies within East Neuk LLA, which implies an increased sensitivity.		
LB62: Kilconquhar Unit	The ZTV shows theoretical visibility, but in reality all views towards the Development are curtailed by tree belts that enclose the loch.	No, due to lack of visibility.
CH – Coastal Hills 'Coastal Hills' covers one linear area to the west of the Development where it separates Kirkcaldy from the merged built-up areas of Buckhaven, Leven and Methil. Fife LCA identifies this small landscape type as a single unit (CH75). The unit also lies partly within Wemyss LLA, which implies increased sensitivity. The ZTV shows continuous theoretical visibility across most of this landscape.		
CH75: Wemyss Unit	This unit lies 1.5-7.0 km from the Development with continuous visibility indicated. Vps 3, 4 and 7 represent this unit.	Yes, due to close proximity and continuous visibility indicated.
CT – Coastal Terrace - Raised Beaches 'Coastal Terrace' covers one area close to the eastern limit of the study area, where it encloses the Lowland Loch Basins type. Fife LCA divides this landscape type into two units (CT82 and CT83), which are assessed below.		
CT82: Crail and St. Monance Unit	The ZTV shows theoretical visibility from a distance of about 14 km. In reality, distance together with the almost flat landform and intervening vegetation precludes views from this linear unit towards the Development. Where views are gained, they are mostly orientated south towards the coast.	No, there is unlikely to be any effect due to: Low-lying landform, which limits long views; Intervening vegetation, which further limits visibility; Coastal orientation of available views; Distance to Development (min. 14 km).
CT83: Elie Unit	The ZTV shows theoretical visibility from a distance of about 7.5 km. However, the Development will have limited influence due to the almost flat landform and more wooded character of this small unit, which combine to limit long views. Additionally, Methil Docks Turbine provides an influence in views where they are available. Vp 15 represents this unit.	No, there is likely to be some effect, but this will not be significant due to: Low-lying landform, which limits long views; Presence of plantations and shelter belts, which further limit visibility; Other built influences on the landscape of a vertical nature; and Distance to Development (min.

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
		7.5 km).
CC – Coastal Cliffs 'Coastal Cliffs' occurs in one location as a narrow rocky outcrop at Kincraig Point on the far eastern edge of Largo Bay. Fife LCA identifies this landscape type as a single unit (CC89). The unit also lies within East Neuk LLA, which implies increased sensitivity.		
CC89: Kincraig Unit	The ZTV indicates some theoretical visibility from a distance of approximately 10 km. However, the cliffs are mostly orientated south so that views are directed towards the sea rather than inland. Where views are available towards the Development, they are open and expansive and include urban development on the opposite shoreline. Methil Docks Turbine is also visible and further reduces the influence of the Development. Vp 13 represents this unit.	No, there may be some effect, but this will not be significant due to: Orientation of cliffs towards the sea; Open and expansive nature of views towards the Development; Small part of available views occupied by the Development; Other built influences on the coastal landscape, including those of a vertical nature; and Distance to Development (min. 10 km).
CF – Coastal Flats 'Coastal Flats' represent low-lying, open, coastal landscapes at sea level. Within the study area this landscape type occurs in one very small area on the eastern edge of Largo Bay. Fife LCA identifies this landscape type as a single unit (CF109). The unit also lies within East Neuk LLA, which implies an increased sensitivity.		
CF109: St. Ford Links Unit	The ZTV shows theoretical visibility from a distance of approximately 9 km. Whilst the Development will be seen from here, it will occupy a relatively small component of the wider outlook. Furthermore, built development occupies much of the opposite shoreline, which reduces the influence of the Development. Methil Docks Turbine is also a visible component of views towards the Development. Vp13 represents this unit although it is not located within it.	No, there is likely to be some effect, but this will not be significant due to: Open and expansive nature of views; Small part of available views occupied by the Development; Other built influences on the coastal landscape, including those of a vertical nature; and Distance to Development (min. 9 km).
IS – Intertidal Shores 'Intertidal Shores' represent the interface between the sea and land and essentially follows the Fife coastline except where it has been lost to coastal protection works and land reclamation. It is identified as a single unit in the Fife LCA and within the study area this character type follows the northern shoreline of the Firth of Forth, except between Buckhaven and Methil where the FEP site and docks have physically altered the coastline. It has therefore been assessed as two separate units.		
IS: Kinghorn to Buckhaven Unit	The ZTV indicates near continuous theoretical visibility at distances of 2-15 km. However, the orientation of the shoreline across the Firth of Forth together with the large-scale, open, flat and simple nature of the character type ensures it will not be dominated by the Development. Furthermore, this section of coastline has been substantially modified by urban encroachment which further reduces the influence of the Development. Vps 7, 16	No, there will be some effect, but this will not be significant due to: Orientation of shoreline away from the Development; Large-scale nature of the receiving landscape and expansive nature of views obtained; Small part of available views occupied by the Development; and Other built influences on the

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
	and 18 represent this unit although they are located on Fife Coastal Path.	coastal landscape.
IS: Methil to Elie Unit	The ZTV indicates continuous theoretical visibility at distances of 2.5-15 km. As with the previous unit, the general orientation of the shoreline across the Firth of Forth together with the large-scale, open, flat and simple nature of the character type ensures it will not be dominated by the Development. Where views are available towards the Development across Largo Bay they include urban and large-scale industrial uses, which reduce the influence of the Development. This includes Methil Docks Turbine in the same arc of view. Vps 5, 9 and 13 represent this unit although they are located on Fife Coastal Path.	No, there will be some effect, but this will not be significant due to: Orientation of shoreline away from the Development at close range; Large-scale nature of the receiving landscape and expansive nature of views obtained; Small part of available views occupied by the Development; and Other built influences of a large-scale and industrial nature in close range views of the Development.
FF – Firth of Forth 'Firth of Forth' corresponds with the body of open water between the northern and southern shorelines of the Firth of Forth and covers just under half of the study area. It is identified as a single unit in the Fife LCA and is assessed as such.		
Firth of Forth	The ZTV indicates continuous theoretical visibility across the Firth of Forth, although in reality views will only be obtained from passing shipping. Where views of the Development are obtained they will be open and expansive in nature and include urban and other large-scale industrial influences associated with the off-shore oil and gas industry. Methil Docks Turbine will also be visible in the same arc of view.	No, there will be some effect, but this will not be significant due to: Open, expansive and horizontal nature of the receiving landscape; Small part of available views occupied by the Development; Moving nature of the viewer; and Other built influences of a large-scale and industrial nature in close range views of the Development.

The initial assessment identified three units of three landscape character types to have the potential to undergo a significant effect on landscape character arising from the Development. These are: 'Coastal Hills, Wemyss unit;' 'Lowland River Basins, Mid Leven Valley unit;' and 'Lowland Dens, Largo unit.'

The initial assessment found that the other units of these character types and all of the other landscape character types do not have potential to undergo significant effects on landscape character. This is for a number of reasons, including lack of visibility as indicated by the ZTV; screening by intervening vegetation and buildings; orientation of landform; large-scale nature of certain character types; distance; and presence of other built influences in available views.

For each landscape character type where a significant effect is predicted an assessment is made below of its sensitivity to the Development. This is followed by a description of the changes to the landscape arising from the Development and an assessment of the magnitude of effect. Both the sensitivity of the baseline landscape and the magnitude of effect are assessed against the criteria given in Table 5.3, in section 5.2.3. From this, an assessment of the level of significance has been determined with reference to Table 5.5, also in section 5.2.3.

The location of each receptor is shown on Figure 5.8 and is shown in relation to the ZTV on Figure 5.10.

5.4.3.1 Coastal Hills: Wemyss Unit (CH75)

'Coastal Hills' landscape type is a relatively narrow and disjointed landscape that occurs in a number of locations around the Fife coast. This assessment focuses on the 'Wemyss' unit of the Fife LCA, a relatively small, linear area, which adjoins the coast and separates Kirkcaldy from the merged settlements of Buckhaven, Leven and Methil. The unit lies 1.5 km west of the Development at its closest point and has potential for significant effects. Viewpoints 3, 4 and 7 are located within this unit.

This is a low-lying and gently undulating agricultural landscape, divided into medium sized arable fields that are mostly enclosed by post and wire fences or low hedgerows. Tree cover by way of small wooded areas and shelter belts is a characteristic feature of more central and south-western parts of the unit and has a limiting effect on views. Pylons encroach into the north-eastern part where they introduce an unfamiliar, large-scale influence. The built-up edge of Buckhaven and lighting masts on the FEP site are also visible components in views towards the Development from northern parts of this unit. A golf driving range also exists at Wellsgreen Farm and extends the urban influence beyond the immediate built-up edge.

Sensitivity

This unit of landscape has a higher local value due to the south western part being included within a LLA, as this implies a higher sensitivity. However, although the remaining area is predominantly of a rural nature its quality has been diminished by pressures associated with proximity to urban development and encroachment that has occurred. The presence of pylons and lighting towers on the FEP site has further eroded some of the innate rural character. Whilst these factors in themselves result in a lower sensitivity, the existing character nevertheless remains predominantly agricultural and those features that do remain are generally intact and well maintained, which increases sensitivity. As such, the sensitivity of the unit to the Development is judged to be *medium-high.*

Magnitude of Effect

Although the ZTV indicates continuous theoretical visibility across this unit, the magnitude of effect will vary from negligible to large. The most important variable in this is visibility, and the low-lying and vegetated nature of parts of the landscape ensures that certain areas will gain little or no views of the Development. These areas will undergo a negligible to small change in character. Conversely, other areas will gain open and direct views of the Development and the magnitude of effect here will be large, with the Development having an immediately apparent influence on landscape character. Other areas will gain some visibility, but not sufficient to undergo a readily apparent alteration to landscape character.

Where the Development is visible, the magnitude of effect will depend on a number of other considerations, of which distance is perhaps the most quantifiable and site visits have indicated that where there is a clear, open and unobstructed view from up to around 5.0 km from the Development, the magnitude of effect on landscape character is likely to be large. This is because where the Development is visible, its scale, vertical form and movement will constitute a notable contrast to the character of the landscape and its influence will be immediately apparent.

Beyond this distance, the magnitude of effect will begin to diminish as distance from the Development increases and it becomes an increasingly small component in the characterisation of the landscape.

It is important to note that the 5.0 km radius mentioned here is not a boundary that strictly divides the levels of magnitude of effect, but rather the approximate distance around which the influence of the Development on the landscape will begin to diminish due to distance. As the Development becomes a smaller component in the outlook, so its influence will become less. There are of course other considerations involved and this is an approximate guideline assuming a clear, open and direct view towards the Development. There are some areas

within the approximate 5.0 km radius where the magnitude of effect will not be large due to local conditions, for instance where woodland and shelter belts preclude views. Similarly, there may be areas outside of this radius where very specific local conditions result in a large magnitude of effect, such as along the coastal edge.

This variety in the visibility, distance from the Development and viewing conditions of the Development makes it impossible to assign the unit with any single level of magnitude of effect. Some assumptions may, however, be made:

- Where clear, direct and open views are available from up to around 5.0 km way, the magnitude of effect is likely to be *large*, with the Development providing an immediately apparent effect on landscape character;
- Where clear, open and direct views are not available within this radius the magnitude of effect will vary between *medium* and *negligible*, dependent on other factors such as distance, direction of view and extent of the Development visible; and
- Beyond the approximate 5.0 km distance, the magnitude of effect will diminish and will vary from *medium*, again where clear, open and direct views are available, to *negligible* where visibility is very limited.

Significance of Effect

The variation in magnitude of effect ensures that the significance of the effect will also vary across the landscape character unit. Where the magnitude of effect is large, under the conditions described above, the effect on 'Coastal Hills: Weymss unit' will be *moderate* to *moderate-major* and will be significant. The Development will have a material effect on the landscape character of this unit, with the turbine resulting in a material change to the way that the landscape character is perceived. This is due to a combination of variables that contribute to a large magnitude of effect on a receptor of medium-high sensitivity.

Outside of these areas of large magnitude of effect, however, the effect will generally be not significant, as the Development will not have a material or definitive effect on landscape character. Some effect on landscape character may be apparent, depending on local conditions, but is unlikely to be definitive.

5.4.3.2 Lowland River Basins: Mid Leven Valley Unit (LR57a)

'Lowland River Basins' landscape type occurs in two distinct areas, which the Fife LCA has divided into three units. This assessment focuses on the 'Mid Leven Valley unit', which has been divided into two sub-units (LR57a and LR57b) to more accurately reflect the influence of the Development. Unit LR57a lies 2.5 km west of the Development at its closest point and has potential for significant effects. The boundaries to this unit are defined by the built-up edge of Kennoway to the east, the boundary with Coastal Hills landscape type to the south, the boundary with Lowland Hills and Valleys landscape type to the west and by the local road from Markinch to Kennoway to the north, which coincides with a local ridgeline. Viewpoints 8 and 10 are located within this unit. The other sub-unit (LR57b) lies further to the north-west away from the Development with no potential for significant effects.

This is a relatively low-lying agricultural landscape, divided into medium to large sized arable fields that are mostly enclosed by post and wire fences and occasionally by low hedges or stone walls. Tree cover by way of mixed plantations and linear shelter belts is quite prevalent and, together with local landform, has some limiting effect on views. The built-up edges of Kennoway and Buckhaven are visible components of views in the direction of the Development, as are pylons which cut across this unit and introduce unfamiliar large-scale features. Lighting towers on the FEP site are also noticeable in some views.

Sensitivity

This unit of landscape has some value due to its predominantly rural nature, however, it is not covered by any relevant landscape-related planning designations that would imply a higher sensitivity. Furthermore its innate rural character has been eroded by the proximity of built development and in particular by the presence of pylons that cross this unit. Whilst these

factors in themselves result in a lower sensitivity, the existing character nevertheless remains predominantly agricultural and those features that do remain are generally intact and well maintained right up to the urban edge, which increases sensitivity. As such, the sensitivity of the unit to the Development is judged to be *medium.*

Magnitude of Effect

The magnitude of effect on this unit of landscape character will be similar to the previous receptor with a wide variation due to the great range of visibility of the Development. There are parts of the landscape from where the Development will have little or no visibility due to screening vegetation and therefore no influence on the landscape character. Elsewhere, rising ground will allow longer views across the landscape to be gained and it is from these locations where the magnitude of effect will be higher.

Where the Development is visible, the magnitude of effect will depend on a number of other considerations, of which distance is perhaps the most quantifiable as with the previous receptor. Site visits have indicated that where there are clear, open and unobstructed views from around 5.0 km from the Development, the magnitude of effect on landscape character is likely to be large. This is because where the Development is visible, its scale, vertical form and movement will constitute a notable contrast to the character of the landscape and its influence will be immediately apparent.

Beyond this radius, the magnitude of effect will begin to diminish as the distance from the Development increases and it becomes an increasingly small component in the characterisation of the landscape.

As with the previous receptor, it is important to note that the 5.0 km radius is not a boundary that strictly divides the levels of magnitude of effect, but rather the approximate distance around which the influence of the Development on the landscape will begin to diminish due to distance. As the Development becomes a smaller component in the outlook, so its influence will become less. There are of course other considerations involved and this is an approximate guideline assuming a clear, open and direct view towards the Development. There are some areas within the approximate 5.0 km radius where the magnitude of effect will not be large due to local conditions and similarly there will be areas outside of this radius where very specific local conditions my result in a large magnitude of effect.

This variety in the visibility, distance and viewing conditions of the Development makes it impossible to assign the unit with any single level of magnitude of effect. Some assumptions may, however, be made:

- Where clear, direct and open views are available from up to around 5.0 km way, the magnitude of effect is likely to be *large*, with the Development providing an immediately apparent effect on landscape character;
- Where clear, open and direct views are not available within this radius the magnitude of effect will vary between *medium* and *negligible*, dependent on other factors such as distance, direction of view and extent of the Development visible; and
- Beyond the approximate 5.0 km distance, the magnitude of effect will diminish and will vary from *medium*, again where clear, open and direct views are available, to *negligible*, where visibility is very limited.

Significance of Effect

The variation in magnitude of effect ensures that the significance of the effect will also vary across the landscape character unit. Where the magnitude of effect is large, under the conditions described above, the effect on 'Lowland River Basins: Mid Leven Valley unit' will be *moderate* and will be significant. The Development will have a material effect on the landscape character of this unit, with the turbine resulting in a material change to the way that the landscape character is perceived. This is due to a combination of variables that contribute to a large magnitude of effect on a receptor of medium sensitivity.

Outside of these areas of high magnitude of effect, however, the effect will generally be not significant, as the Development will not have a material or definitive effect on landscape character. Some effect on landscape character may be apparent, depending on local conditions, but is unlikely to be definitive.

5.4.3.3 Lowland Dens: Largo Law Unit (LD51a)

'Lowland Dens' landscape type occupies a sizeable area stretching north and east of Leven almost to the limit of the study area. Fife LCA identifies this area as a single unit, but for the purposes of this assessment the unit has been divided into two sub-units to more accurately reflect the influence of the Development. This assessment focuses on unit LD51a, which covers an area that lies 3.0 km north of the Development at its closest point. The boundaries to this unit are defined by the coast and built-up edges of Leven and Kennoway to the south and west, the boundary with the Volcanic Hills and Craigs landscape type to the north and the boundary with Largo Law LLA to the east. Viewpoints 6, 9 and 11 are located within this unit. The other sub-unit (LD51b) lies further to the east with more limited visibility and the initial assessment considered it not to have potential for significant effects.

This is a gently sloping agricultural landscape, not dissimilar to the previous receptor, divided into medium sized arable fields that are mostly enclosed by post and wire fences or low hedgerows. Tree cover by way of small wooded areas and shelter belts is typical of this unit and has a limiting effect on some views. The built-up edge of Leven is a visible component of views in the general direction of the Development, as is Methil Docks Turbine.

Sensitivity

This unit of landscape has some value due to its predominantly rural nature, however, it is not covered by any relevant landscape-related planning designations that would imply a higher sensitivity. Furthermore, its quality has been diminished by the proximity of built development and presence of Methil Docks Turbine in views. Whilst these factors in themselves result in a lower sensitivity, the existing character nevertheless remains predominantly agricultural and those features that do remain are generally intact and well maintained right up to the urban edge, which increases sensitivity. As such, the sensitivity of the unit to the Development is judged to be *medium*.

Magnitude of Effect

The magnitude of effect on this unit of landscape character will be similar to the previous receptors, with a wide variation due to the range of visibility of the Development. Where the Development is visible, the magnitude of effect will depend on a number of other considerations of which distance is the most quantifiable. Site visits have indicated that where there are clear, open and unobstructed views from around 5.0 km from the Development, the magnitude of effect on landscape character is likely to be large. This is because where the Development is visible its scale, vertical form and movement will constitute a notable contrast to the character of the landscape and its influence will be immediately apparent.

Beyond this radius, the magnitude of effect will begin to diminish as the distance from the Development increases and it becomes an increasingly small component in the characterisation of the landscape.

This variety in the visibility, distance and viewing conditions of the Development makes it impossible to assign the unit with any single level of magnitude of effect. Some assumptions may, however, be made:

- Where clear, direct and open views are available from up to around 5.0 km way, the magnitude of effect is likely to be *large*, with the Development providing an immediately apparent effect on landscape character;
- Where clear, open and direct views are not available within this radius the magnitude of effect will vary between *medium* and *negligible*, dependent on other factors such as distance, direction of view and extent of the Development visible; and

- Beyond the approximate 5.0 km distance, the magnitude of effect will diminish and will vary from *medium*, again where clear, open and direct views are available, to *negligible*, where visibility is very limited.

Significance of Effect

The variation in magnitude of effect ensures that the significance of the effect will also vary across the landscape character unit. Where the magnitude of effect is large, under the conditions described above, the effect on 'Lowland Dens: Largo Law sub-unit' will be *moderate* and will be significant. The Development will have a material effect on the landscape character of this unit, with the turbine resulting in a material change to the way that the landscape character is perceived. This is due to a combination of variables that contribute to a large magnitude of effect on a receptor of medium sensitivity.

Outside of these areas of high magnitude of effect, however, the effect will generally be not significant, as the Development will not have a material or definitive effect on landscape character. Some effect on landscape character may be apparent, depending on local conditions, but is unlikely to be definitive.

5.4.4 Effects on Designated Areas and Special Interests

This section considers any additional effects of the Development on a specific group of landscape-related planning designations such as National Parks, National Scenic Areas, etc. and other special interests of a landscape nature such as Historic Gardens and Designed Landscapes. These landscape receptors have a particular character or setting that distinguishes them from surrounding areas and has contributed to their designation. They are generally perceived as being of high value with a heightened sensitivity and limited capacity for change. Development within or adjoining these high sensitivity landscape receptors will not normally be permitted where significant adverse effects are identified that compromise the overall integrity of the designation.

As with the landscape character types described in the previous section, any change in this perception will be dependent on available views of the Development from all, or part, of the designated area. This has been determined by an initial sieving exercise with reference to Figure 5.11, which shows those landscape-related designations and special interests in conjunction with the ZTV. Taking into account limitations associated with the ZTV, as described in section 5.2.6, an analysis of the visibility indicated has identified an initial short-list of receptors with potential for significant effects. Analysis of the representative viewpoints and computer generated wirelines in conjunction with site visits has then been carried out to identify the presence of screening features and other modifying factors that might limit visibility and so determine likely levels of impact and significance.

The findings of the initial assessment, from which receptors are short-listed for further consideration, is recorded in Table 5.9 below. Where relevant, the representative viewpoint that best illustrates the potential effect on a receptor is referred to. A detailed analysis of the viewpoints is provided in Technical Appendix 5.1 of this ES.

Table 5.9 Predicted Effects on Landscape Designations and Special Interests

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
Landscape Designations		
Cullaloe Hills and Coast LLA	The ZTV shows very patchy theoretical visibility from around 12 km away. In reality, the Development will have limited influence due to the large-scale nature of the receiving landscape, the expansive nature of views obtained and the small and distant part of the wider outlook affected. Additionally, extensive urban development adjoins the eastern edge of	No, there may be some effect, but this will not be significant due to: • Patchy visibility as shown on the ZTV; • Large-scale nature of the receiving landscape and the expansive nature of views; • Small part of available views occupied by the Development;

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
	the LLA and provides a strong influence in views towards the Development. Vp 20 represents views from the LLA.	• Other built influences on the landscape; • Distance to Development (min. 12 km).
East Neuk LLA	The ZTV shows theoretical visibility from a distance of 9 km. In reality, the Development will have limited influence due to the low-lying landform and screening afforded by woodlands and shelter belts within the LLA. Where views are available towards the Development, they are expansive and include urban development on the opposite shoreline of Largo Bay. Methil Docks Turbine is also visible and further reduces the influence of the Development. Vp 13 represents views from the edge of the LLA where an open outlook is obtained.	No, there is likely to be some effect, but this will not be significant due to: • Low-lying landform, which limits long views; • Woodland and shelter belts within the LLA, which further limits views; • Expansive nature of coastal views in which the Development will be seen; • Small part of available views occupied by the Development; • Other built influences on the coastal landscape, including those of a vertical nature; and • Distance (min. of around 9 km).
Largo Law LLA	The ZTV shows theoretical visibility confined to mainly south facing slopes along the southern edge of the LLA from a distance of 7 km. In reality, visibility is further limited by the network of shelter belts and wooded areas that cover these slopes. The landform also faces to the south so that available views are mostly orientated away from the Development. Urban development and Methil Docks Turbine also provide an influence in views from the south-west edge of the LLA. Vp 12 represents views from the LLA.	No, there is likely to be some effect, but this will not be significant due to: • Limited visibility as shown on the ZTV; • Woodland and shelter belts within the LLA, which further limits views; • Orientation of landform away from the Development; • Other built influences on the landscape, including those of a vertical nature; and • Distance from the Development, which is a minimum of 7 km but in many views is much greater.
Lomond Hills LLA	The ZTV shows patchy theoretical visibility from around 10 km away. In reality, much of this is further screened by coniferous woodland and shelter belts that cover the steeper slopes. Where views are available the Development will have limited influence due to the large-scale nature of the receiving landscape, the panoramic nature of views obtained and the small and distant part of the wider outlook affected. Additionally, extensive urban development adjoins the eastern edge of the LLA and has a strong influence in views. Vp 19 represents views from the LLA.	No, there may be some effect, but this will not be significant due to: • Patchy visibility as shown on the ZTV; • Further screening by forestry plantations within the LLA; • Large-scale nature of the receiving landscape and the panoramic nature of available views; • Small part of available views occupied by the Development; • Other built influences on the landscape; • Distance to Development (min. 10 km).
Tarvit and Ceres LLA	The ZTV shows very limited theoretical visibility along the southern edge of the LLA at a distance of approximately 8.5	No, there may be some limited effect, but this will not be significant due to:

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
	km. In reality, views are further screened by shelter belts and small wooded areas that cover this area. Vp 14 represents views from the edge of the LLA.	• Limited visibility as shown on the ZTV; • Woodland and shelter belts within the LLA, which further limits visibility; and • Distance to Development (min. 8.5 km)
Wemyss LLA	The ZTV shows continuous theoretical visibility across the smallest of the LLAs from around 3.0 km. In reality, views are mostly curtailed by a combination of the low-lying landform and network of wooded areas and shelter belts that cover the LLA. Vp 7 represents views from the coastal edge of the LLA where an open outlook is obtained.	No, there is likely to be some effect, but this will not be significant due to: • Low-lying landform, which limits long views; and • Woodland and shelter belts within the LLA, which further limits visibility.
Historic Parks and Gardens		
Balbirnie House	Balbirnie lies around 8.5 km north-west of the Development at its closest point, where it adjoins the north eastern edge of Glenrothes. It comprises of a 168 ha country park that includes an 18-hole golf course, caravan park and craft centre. The focal point remains the 18th Century house and gardens, now converted into a hotel. The ZTV shows theoretical visibility over most of the parkland, but in reality views are curtailed by tree groups, tree belts and wooded areas within and adjoining the park. Built development adjacent to the southern edge of the park further limits views in the direction of the Development.	No, there is unlikely to be any effect due to: • Low-lying landform, which limits long views; • Tree groups, tree belts and wooded areas within the park and built development beyond which provides further screening; • Parkland mostly converted to a golf course and caravan park, which is less important in landscape terms; and • Distance to Development (min. 8.5 km)
Balcarres House	Balcarres lies around 11.5 km north-east of the Development and comprises of a 1900 ha landscaped parkland and formal terraced gardens laid out on south facing slopes. The 16th century house sits centrally within the parkland and is orientated towards the coast. The ZTV shows patchy theoretical visibility across the house, parkland and lower slopes, which are mostly in agricultural use. In reality there are no views due to the orientation of the landform and screening by mature trees, tree belts and wooded areas within the estate and beyond.	No, there is unlikely to be any effect due to: • Patchy visibility as shown on the ZTV; • Tree groups, tree belts and wooded areas within and beyond the estate, which provide further screening; • Orientation of landform, which directs available views away from the Development; • Estate partly in agricultural use and less important in landscape terms; and • Distance to Development (min. 11.5 km).
Charleton House	Charleton lies some 10.0 km north-east of the Development, adjacent to Balcarres. It comprises of a 400 ha estate, incorporating informal parkland with 18-hole golf course and over 2 ha of formal, terraced gardens laid out on south facing slopes adjoining the main house with	No, there is unlikely to be any effect due to: • Screening by tree groups, tree belts and wooded areas within and beyond the estate; • Orientation of landform, which directs available views away from

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
	views towards the coast. The ZTV shows theoretical visibility across the house, formal gardens and golf course, but in reality there are no views due to orientation of the landform and screening by mature trees, tree belts and wooded areas within the estate and beyond.	the Development; • Estate partly converted to a golf course, which is less important in landscape terms; and • Distance to Development (min. 10 km).
Hill of Tarvit	Hill of Tarvit lies around 13.0 km due north of the Development and comprises of an early 20th century mansion house with formal gardens and parkland leading to a local high point from where panoramic views can be obtained. The ZTV indicates no visibility.	No, due to lack of visibility.
Lahill House	Lahill lies around 9.0 km north-east of the Development, adjacent to both Balcarres and Charleton. It comprises of 30 ha of informal parkland on south facing slopes with views towards the coast from the 19th century manor house. The ZTV shows theoretical visibility across most of the parkland, but in reality there are no views due to orientation of the landform and screening by mature trees, tree belts and wooded areas within the parkland and beyond.	No, there is unlikely to be any effect due to: • Screening by tree groups, tree belts and wooded areas within and beyond the estate; • Orientation of landform, which directs available views away from the Development; and • Distance to Development (min. 9 km).
Leslie House	Leslie lies around 10.0 km north-west of the Development in the centre of Glenrothes. It comprises of a 17th century manor house set within 10 ha of private grounds through which the River Leven flows. The ZTV shows theoretical visibility, but a combination of mature trees within the grounds and buildings which completely enclose the site ensures there are no views beyond the boundary.	No, there is unlikely to be any effect due to: • Low-lying landform, which limits long views; • Vegetation within the grounds and built development beyond, which provides further screening; and • Distance to Development (min. 10 km).
Lentham Glen	Lentham Glen lies around 4.0 km north of the Development as a small, linear municipal park on the northern built-up edge of Leven. The ZTV shows theoretical visibility, but a combination of mature trees within the park and buildings which adjoin it ensures there are no views beyond the park boundary.	No, there is unlikely to be any effect due to: • Low-lying landform, which limits long views; and • Vegetation within the park and built development beyond, which provides further screening.
Raith Park & Beveridge Park	Raith Park and Beveridge Park lie around 12.5 km south-west of the Development where they adjoin the western built-up edge of Kirkcaldy. Raith Park incorporates an informal 19th century parkland setting with house, formal lakes and extensive wooded areas. Beveridge Park represents a later and smaller municipal park. The ZTV shows theoretical visibility from Beveridge Park but more limited visibility across Raith Park.	No, there is unlikely to be any effect due to: • Limited visibility as indicated on the ZTV; • Tree groups, tree belts and wooded areas within both parks and built development beyond which provides further screening; and • Distance to Development (min. 12.5 km).
Dysart House and Ravenscraig Park	Ravenscraig Park lies around 8.5 km south-west of the Development as a	No, there is unlikely to be any effect due to:

Landscape Receptor	Description of Predicted Effect	Further Assessment Required?
	relatively small municipal park overlooking the coast on the eastern built-up edge of Kirkcaldy. The ZTV shows theoretical visibility, but in reality the Development cannot be seen from here due to screening vegetation within the park.	• Screening by trees, tree groups and tree belts within the park; • Coastal orientation of available views; • Distance to Development (min. 8.5 km)
Wemyss Castle	Wemyss Castle lies around 4.5 km south-west of the Development at its closest point, as an 18th-19th century landscaped park with earlier 15th century features surviving, including the castle and chapel. The ZTV shows theoretical visibility across most of the parkland, which is now in agricultural use. In reality, the Development will have very limited influence due to the low-lying landform and screening by tree belts and wooded areas within and adjoining the parkland. The main house is also orientated towards the coast and away from the Development.	No, there may be some effect, but this will not be significant due to: • Low-lying landform, which limits long views; • Tree groups, tree belts and wooded areas within and beyond the parkland, which provide further screening; • Coastal orientation of available views; • Parkland mostly in agricultural use and less important in landscape terms.

The initial assessment found that none of the local landscape designations have potential to undergo a significant effect arising from the presence of the Development, for which further assessment is required. This is due to a number of reasons including lack of visibility; screening by intervening vegetation; large-scale nature of the receiving landscape; small part of available views occupied by the Development; orientation of landform; other built influences on the landscape; and distance from the Development. Similarly, none of the special interests have potential to undergo significant effects arising from the presence of the Development. This is due to a number of reasons including lack of visibility; screening by intervening vegetation and buildings; orientation of landform; changes in land-use; and distance from the Development.

5.4.4.1 Summary of Effects on Landscape Character and Landscape Related Planning Designations

Of the fourteen landscape character types initially assessed in Table 5.8, three units of landscape character were judged likely to undergo significant effects as a result of the Development. These are: 'Coastal Hills, Wemyss unit;' 'Lowland River Basins, Mid Leven Valley sub-unit;' and 'Lowland Dens, Largo Law sub-unit.'

These three units were then assessed in greater detail and more specific conclusions were drawn regarding the extent of significant effects. As a general rule, it was found that significant effects were most likely to occur within a radius of approximately 5.0 km from the Development, with the scale, vertical form and movement having an immediately apparent influence on the character of the landscape. However, the landform and vegetation cover of the study area does mean that some areas within this radius will gain limited or no turbine visibility and, as such, will not undergo any influence. The extent of significant effects on landscape character will therefore be sporadic and will certainly not affect all of the landscape within this area.

Beyond the 5.0 km radius, effects will generally not be significant due to the nature of the landscape, extent of the landscape affected, orientation of the landscape, increasing distance and the extent of the Development that will be seen.

The other landscape character types were found in the initial assessment to have no potential for significant effects. This is due to a variety of reasons including lack of visibility; the large-scale and working nature of the environment in which the Development will be seen; the

expansive nature of views and the small part of available views that will be occupied by the Development; orientation of landform; screening by vegetation; distance; and other built influences in available views.

The initial assessment also found that none of the landscape-related planning designations assessed in Table 5.9 has the potential to undergo significant effects on landscape character arising from the presence of the Development. This is for a number of reasons including lack of visibility; the large-scale nature of the environment in which the Development will be seen; the expansive nature of views and the small part of available views that will be occupied by the Development; screening by vegetation; distance, which is mostly beyond 5.0 km; and presence of other built influences in views. Similarly, none of the special interests have potential for a significant effect. This is for a number of reasons including lack of visibility, screening by vegetation and buildings, orientation of landform, changes in land-use and distance.

The distribution of significant effects on landscape character and designations is shown on Figure 5.14a**.**

5.4.5 Effects on Views

The assessment of visual effects considers changes that will arise to the composition and character of views within the study area arising from the Development, and the effect this has on people. This includes residents, those experiencing the landscape (for example, walkers and hikers) and those simply passing through it as part of a journey.

The assessment of effects on views is divided into two parts. The first of these identifies the effects that the Development will have on the principal visual receptors within the study area. These are the main settlements, major roads, important rights of way and visitor attractions identified in the baseline conditions section of this Chapter. Each of the principal receptors has been included in the assessment as a specific receptor.

The second part of the assessment broadly identifies effects on local views. The settlement pattern of the study area has resulted in a low-density but fairly continuous development of villages, hamlets, individual houses, farms and local roads in the general vicinity of the Development. These visual receptors are too numerous to be included as specific receptors, but are nonetheless important to the overall assessment. Effects on these local views are drawn from the assessment of the principal receptors.

5.4.5.1 Effects on Principal Visual Receptors

The assessment of effects on the principal visual receptors has been determined by initial reference to Figures 5.12 and 5.13. These show the principal receptors identified in the baseline conditions section in relation to the ZTV for the study area. Taking account of limitations associated with the ZTV, as described in section 5.2.6, an analysis of the visibility indicated has identified a short-list of settlements, routes and attractions with potential for significant effects for which further assessment is required. Analysis of the representative viewpoints and computer generated wirelines in conjunction with site visits has then been carried out for the short-listed receptors to identify the presence of screening features that might limit visibility and so determine likely levels of impact and significance.

The initial impression gained from the ZTV is one of quite limited visibility, particularly to the north where higher ground contains most views to within 10 km of the Development. To the east and west, theoretical visibility extends across more low lying areas to the limit of the 15 km radius study area, whilst to the south theoretical visibility extends beyond the study area boundary to the southern shoreline of the Firth of Forth. A more detailed assessment generally supports this impression except that actual visibility across lower lying areas in the east and west is more limited than that indicated on the ZTV. This is due to a number of factors, of which screening by vegetation is the most important. Shelter belts and wooded areas are characteristic features of more low-lying areas within the study area and these combine to filter and screen views of the Development along with screening by buildings and local landform. Additionally, whilst theoretical visibility exists from along the southern shoreline of the Firth of Forth, the distances involved (20-25 km) are such that in reality the

Development will have very limited influence from here. This can be seen in viewpoint 21, which represents the closest available views of the Development south of the Forth, and viewpoints 22, 23 and 24 which are more distant.

The full list of receptors considered and findings of the initial assessment are recorded in Table 5.10 below. Where relevant, the representative viewpoint that best illustrates the potential effect on a receptor is referred to. A detailed analysis of the viewpoints is provided in Technical Appendix 5.1 of this ES.

Table 5.10 Predicted Effects on Principal Visual Receptors

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
Main Settlements (Figure 5.12)		
Buckhaven	Buckhaven is the closest settlement to the Development, with residential properties facing directly towards it from around 500 m with an unobstructed outlook. Vps 1, 2 and 3 represent views from here.	Yes, due to proximity and orientation of views.
Ceres	Ceres lies around 13 km north of the Development. The ZTV shows no visibility from the settlement.	No, due to lack of visibility.
Coaltown of Balgonie	Coaltown of Balgonie lies around 7 km west of the Development. The ZTV indicates theoretical visibility, but the low-lying landform ensures there are no views from within the settlement as surrounding buildings obstruct them. The north-south orientation of the settlement also ensures that most views towards the Development from houses on the edge are oblique and are unlikely to be obtained. Where views are available the influence of the Development will be limited by distance, low-lying landform and screening by intervening vegetation. Additionally, pylons are visible and have an influence in views. Vp 10 represents views from here.	No, there may be some effect, but this will not be significant due to: • Low-lying landform on which the settlement lies, which prevents visibility from within it; • Orientation of houses on the edge of the village away from the Development; • Intervening vegetation, which further limits views; • Other built influences in views; and • Distance to Development (min. 7 km).
Coaltown of Wemyss	Coaltown of Wemyss lies around 4.5 km south-west of the Development. The ZTV indicates theoretical visibility, but the low-lying landform ensures there are no views from within the settlement as surrounding buildings obstruct them. The north-west to south-east orientation of the settlement also ensures that houses on the edge are unlikely to gain views.	No, there is unlikely to be any effect due to: • Low-lying landform on which the village lies, which prevents visibility from within it; • Orientation of houses on the edge of the village away from the Development; • Intervening vegetation, which further limits visibility.
Colinsburgh	Colinsburgh lies around 11.5 km to the east of the Development. The ZTV indicates theoretical visibility, but the low-lying landform ensures there are no views from within the village as surrounding buildings obstruct them. The north-south orientation of the village also ensures that views towards the Development from houses on the edge are oblique and are unlikely to be obtained. A small number	No, there may be some effect, but this will not be significant due to: • Low-lying landform on which the village lies, which prevents visibility from within it; • Orientation of most houses on the edge of the village away from the Development; • Intervening vegetation, which further limits visibility; and

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
	of houses on the southern edge are orientated towards the Development and may gain some visibility.	• Distance to Development (min. 11.5 km)
Earlsferry/ Elie	Earlsferry and Elie adjoin each other on the coast some 11-13 km due east of the Development. The ZTV shows some theoretical visibility on the southern edge of both settlements where there are a small number of houses that are orientated towards the Development.	No, there may be some effect, but this will not be significant due to: • Limited visibility as shown on the ZTV; • Low-lying landform on which these settlement lie, which prevents visibility from within them; • Orientation of most houses on the edge of both settlements away from the Development; • Distance to Development (min. 11 km)
East Wemyss	East Wemyss lies on the coast around 2.5 km south-west of the Development with some houses on the eastern edge orientated towards it. The ZTV shows continuous theoretical visibility.	Yes, due to proximity and orientation of some views
Falkland	Falkland lies around 14 km north-west of the Development towards the limit of the study area. The ZTV shows no visibility from here.	No, due to lack of visibility.
Freuchie	Freuchie lies around 11.5 km north-west of the Development. The ZTV shows no visibility from here.	No, due to lack of visibility.
Glenrothes	Glenrothes lies around 7.5 km due west of the Development at its closest point. The ZTV shows theoretical visibility across most of the town, but the low-lying landform ensures any views will be limited to the eastern built-up edge where buildings are mostly of a commercial nature. Visibility will be further reduced by intervening vegetation and distance.	No, there may be some effect, but this will not be significant due to: • Low-lying landform on which the settlement lies, which prevents visibility from within it; • Commercial nature of properties on the eastern edge of the town where views are available; • Intervening vegetation which further limits visibility; and • Distance to Development (min. 7.5 km).
Kennoway	Kennoway lies around 4 km north of the Development at its closest point. Houses on the southern edge are orientated towards the Development on rising ground and gain an open outlook. Houses within the settlement that are not screened by intervening buildings may also gain views, particularly from upper floors. Vp 6 represents views from here.	Yes, the southern edge of this settlement and some houses within it may be significantly affected due to proximity and orientation of views.
Kilconquhar	Kilconquhar lies around 12 km east of the Development. The ZTV shows theoretical visibility, but the low-lying landform ensures there are no views from within the settlement as surrounding buildings obstruct them. The north-south	No, there is unlikely to be any effect due to: • Low-lying landform on which the settlement lies, which prevents visibility from within it; • Orientation of houses on the edge

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
	orientation of the settlement also ensures that houses on the edge are unlikely to gain views.	of the village away from the Development; • Intervening vegetation and local landform, which further limits visibility; • Distance to Development (min. 12 km).
Kinghorn	Kinghorn lies around 14.5 km south-west of the Development on the limit of the study area, where the ZTV shows patchy theoretical visibility. The relatively level landform ensures that houses within the settlement gain no views as surrounding buildings screen them. The east facing orientation of houses on the edge of the settlement also ensures that views towards the Development are oblique and therefore unlikely to be gained.	No, there may be some effect, but this will not be significant due to: • Patchy visibility as shown on the ZTV; • Orientation of houses on the edge of the settlement away from the Development; and • Distance to Development (min. 14.5 km)
Kinglassie	Kinglassie lies around 13.5 km due west of the Development and is shown on the ZTV to have theoretical visibility. The relatively low-lying landform ensures there are no views from within the settlement as surrounding buildings obstruct them. The north-south orientation of the settlement also ensures that houses on the edge are unlikely to gain views.	No, there is unlikely to be any effect due to: • Low-lying landform on which the village lies, which prevents visibility from within it; • Orientation of houses on the edge of the village away from the Development; • Intervening vegetation and local landform, which further limits visibility; • Distance to Development (min. 13.5 km)
Kirkcaldy	Kirkcaldy lies around 7.5 km south-west of the Development at its closest point. The ZTV shows quite patchy visibility and in reality this will be limited to the built-up edges of the town. The coastal orientation of houses on the edge of the town ensures that views towards the Development are oblique and are unlikely to be obtained. Vp 16 represents views from here.	No, there may be some effect, but this will not be significant due to: • Patchy visibility as shown on the ZTV; • Low-lying landform on which the town lies, which prevents visibility from within it; • Orientation of houses on the edge of the settlement away from the Development; • Distance to Development (min. 7.5 km).
Ladybank	Ladybank lies around 13 km north-west of the Development. The ZTV shows no visibility from here.	No, due to lack of visibility.
Leven	Leven lies around 2.5 km north-east of the Development at its closest point. The ZTV shows continuous theoretical visibility, but in reality the low-lying landform ensures that views are limited to the built-up edges of the town. Visibility will be further reduced by intervening built development at Methil, which adjoins Leven on slightly higher ground. Additionally, the coastal orientation of	No, there may be some effect, but this will not be significant due to: • Low-lying landform on which the town lies, which prevents visibility from within it; • Intervening urban development, which further limits visibility; • Orientation of houses on the edge of the settlement away from the

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
	houses on the edge of the town ensures that any views towards the Development are oblique and are unlikely to be gained. Methil Docks Turbine also provides a strong influence in views in the direction of the Development. Vp 5 represents views from here.	Development; • Other built influences of a large-scale and industrial nature in close range views of the Development.
Lower Largo	Lower Largo lies around 5.5 km north-east of the Development. The ZTV shows continuous visibility and for a small number of properties on the coastal edge that are orientated towards the Development, an open outlook is obtained. Vp 9 represents views from here.	Yes, some houses on the western edge of this settlement may be significantly affected due to proximity and orientation of some views.
Markinch	Markinch lies around 7.5 km north-west of the Development. The ZTV shows patchy theoretical visibility and in reality this will be restricted to the built-up edge. Low lying landform and intervening vegetation will further limit views.	No, there may be some effect, but this will not be significant due to: • Patchy visibility as shown on the ZTV; • Low-lying landform on which the settlement lies, which prevents visibility from within it; • Intervening vegetation; and • Distance to Development (min. 7.5 km).
Methil	Methil adjoins Buckhaven with some houses on the coastal edge gaining a similar outlook.	Yes, due to proximity and orientation of views.
Thornton	Thornton lies around 8 km due west of the Development and is oriented towards it. The ZTV show theoretical visibility, but in reality all views are obstructed by the A92, which passes immediately east of the settlement on embankment	No, due to lack of visibility.
Windygates	Windygates lies around 3 km north-west of the Development. The ZTV shows continuous theoretical visibility, but the relatively low-lying landform ensures there are no views from within the settlement as surrounding buildings obstruct them. The east and south-west orientation of houses on the edge of the settlement also ensures that views towards the Development are oblique and unlikely to be obtained. Intervening vegetation and extensive urban development on slightly elevated ground at Buckhaven and Methil further limits visibility.	No, there may be some effect, but this will not be significant due to: • Low-lying landform on which the settlement lies, which prevents visibility from within it; • Orientation of most houses on the edge of the settlement away from the Development; and • Intervening vegetation and urban development, which further limits visibility.
Upper Largo	Upper Largo lies around 7.5 km north-east of the Development. The ZTV shows theoretical visibility, but the relatively low lying landform ensures there are no views from within the settlement as surrounding buildings obstruct them. The south facing orientation of houses on the edge of the settlement also ensures that views	No, there may be some effect, but this will not be significant due to: • Low-lying landform on which the settlement lies, which prevents visibility from within it; • Orientation of most houses on the edge of the settlement away from the Development;

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
	towards the Development are oblique and unlikely to be obtained. Intervening vegetation further limits views.	• Intervening vegetation, which further limits visibility; and • Distance to Development (min. 7.5 km).
Routes: Major Roads (Figure 5.12)		
A92 24 km section in study area	The A92 runs north-south across the western part of the study area, passing through Glenrothes. The ZTV shows theoretical visibility from approximately half the length of the route, from the northern edge of Glenrothes south to the limit of the study area. In reality, visibility is further reduced by buildings where the route passes through Glenrothes for a distance of 5 km. South of the town to the roundabout junction with the A921, the road is mostly on embankment with well established coniferous vegetation and views tend to be glimpsed and fleeting in either direction of travel . Beyond the roundabout, the Development passes behind southbound travellers and has no further effect. Northbound travellers gain some limited views from 8-15 km away where the direction of travel is more orientated towards the Development.	No, there may be some limited effect, but this will not be significant due to: • Low-lying landform crossed by the route, which limits visibility; • Further screening by roadside vegetation and buildings (especially through Glenrothes); • Acute angle of most available views; • Moving nature of the viewer; and • Distance to the Development, which is a minimum of 7.5 km and in most views is further away.
A911 13 km section within study area	The A911 runs east-west across the western part of the study area, passing through Glenrothes and on to Buckhaven where it joins the A915. The ZTV shows mostly continuous theoretical visibility along the route, but in reality visibility is limited to a 5 km section between Glenrothes and Buckhaven, and only for eastbound travellers. From this short section of road, views are further screened and filtered by roadside vegetation and local landform.	No, there will be some effect for eastbound travellers, but this will not be significant due to: • Low-lying landform crossed by the route, which limits visibility; • Further screening by roadside vegetation and buildings (especially through Glenrothes); • Short section with visibility; • Angled nature of most views; • Other built influences in views; and • Moving nature of the viewer.
A912 5 km section within study area	The A912 just encroaches in to the north west of the study area where it passes through Falkland. The ZTV indicates almost no visibility.	No, due to lack of visibility.
A914 14 km section within study area	The A914 crosses the northern part of the study area between Glenrothes and Cupar. The ZTV indicates no visibility.	No, due to lack of visibility

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
A915 25 km section within study area	The A915 runs parallel with the coast between Kirkcaldy and Lower Largo, passing to within 2.5 km of the Development as the route skirts around the northern built-up edges of Buckhaven and Methil. At Lower Largo the route deviates from the coast and heads in a north-easterly direction over higher ground towards the edge of the study area. The ZTV shows continuous theoretical visibility from Kirkcaldy to just east of Largo Law where high ground precludes any further views. In reality, for travellers heading north from Kirkcaldy, views are largely screened or filtered by tree belts and wooded areas that adjoin the route as far as the golf driving range at Wellsgreen Farm. For a 2km section between the driving range and roundabout junction with the B932, the Development can be seen, but views are at an acute angle to the viewer and it will be seen in context with the built-up edge of Buckhaven with pylons and lighting towers on the FEP as visible elements in views. Beyond the roundabout, travellers have passed the Development and it no longer has an effect. For southbound travellers, visibility commences just east of Largo Law as the route descends towards Lower Largo from where direct views of the Development will be gained from 10 km away. Between Lower Largo and Leven, buildings and vegetation restrict visibility to fleeting glimpses at an angle to the viewer where Methil Docks Turbine has an influence in views. As the route passes through Leven visibility is mostly curtailed by buildings and once beyond the built-up edge, travellers have passed the Development and there is no longer any effect.	No, there will be some effect, but this will not be significant due to: • Low-lying landform crossed by much of the route where visibility is indicated; • Screening by roadside vegetation and buildings (especially between Buckhaven and Leven); • Short sections with visibility; • Angled nature of most views; • Other built influences in views; • Moving nature of the viewer.
A916 17 km section within study area	The A916 runs in a north-south direction from its junction with the A911 at Kennoway to beyond the study area. Travellers heading north will gain no visibility of the Development as it always lies behind them. For southbound travellers, the ZTV shows theoretical visibility from an 8 km section between Montrave and the A911 junction (see Vp 11). In reality, roadside vegetation and buildings restricts views from this section to brief glimpses and mostly of an angled nature.	No, there will be some effect for southbound travellers, but this will not be significant due to: • Screening and filtering of views by roadside vegetation and buildings (especially through Kennoway); • Short sections with visibility; • Angled nature of most views; • Moving nature of the viewer; • Other built influences in views; and • Distance to Development, which is generally beyond 5.0 km.

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
A917 11 km section within study area	The A917 runs in a broadly east-west direction from its junction with the A915 at Lower Largo, passing through Elie and beyond the study area. Travellers heading east will gain no visibility of the Development as it always lies behind them. For westbound travellers, the ZTV shows mostly continuous theoretical visibility. In reality, the low-lying landform combined with roadside vegetation and intervening wooded areas restricts views to brief glimpses at an angle of about 90 degrees (see Vp 15).	No, there will be some limited effect for westbound travellers, but this will not be significant due to: • Low-lying landform crossed by the route, which limits visibility; • Further screening and filtering of views by roadside vegetation and intervening wooded areas; • Short sections with visibility; • Acute angle of visibility; • Moving nature of the viewer; and • Distance to Development, which is a minimum of 8 km.
A921 9 km section within study area	The A921 closely follows the coast from Kinghorn, at the southern limit of the study area, to Kirkcaldy where it joins the A92. Travellers heading south will gain no views of the Development as it always lies behind them. For northbound travellers, the ZTV indicates mostly continuous theoretical visibility. In reality, the built-up nature of much of the route ensures any views are limited to a 2 km section immediately north of Kinghorn and a 1-2 km section along the sea front at Kirkcaldy, with the closest views gained from over 11 km away. Vp 16 represents views from here.	No, there may be some limited effect for northbound travellers, but this will not be significant due to: • Low-lying landform crossed by the route, which limits visibility; • Further screening by roadside vegetation and buildings (especially through Kirkcaldy); • Very short sections with visibility; • Angled nature of visibility; • Moving nature of the viewer; and • Distance to Development, which is a minimum of 11 km.
A955 13 km section within study area	As with the A921, the A955 closely follows a coastal route from Kirkcaldy to Leven, where it then joins the A915. The route passes to within 1.5 km of the Development as it travels through Buckhaven and the ZTV shows continuous theoretical visibility along its length. However, for travellers heading south, views are mostly obstructed by buildings where the route passes through Leven, Methil and Buckhaven for a distance of about 5 km. Beyond Buckhaven, travellers have passed the Development and it no longer has any effect. For travellers heading north, views are mostly screened or filtered by tree belts and buildings that adjoin the route. It is only from a 1-2 km section north of East Wemyss that views open up and it will be possible to see the Development at an angle to the viewer from around 2.5 km away. Pylons, lighting towers on the FEP site and the built-up edge of Buckhaven will all be visible elements in these views.	No, there will be some effect for northbound travellers, but this will not be significant due to: • Low-lying landform crossed by the route, which limits visibility; • Further screening by roadside vegetation and buildings (especially between Buckhaven and Leven); • Very short sections with visibility; • Angled nature of visibility; • Other built influences in views; and • Moving nature of the viewer.
Routes: Walking Routes (Figure 5.13)		
Fife Coastal Path 35 km section	Fife Coastal Path closely follows the coast between Kinghorn and Elie and passes within 500 m of the Development. Vps 1,	Yes, due to proximity and orientation of views

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
within study area	4, 5, 7, 9, 13, 16 and 18 represent views from this route.	
Routes: Cycle Routes (Figure 5.13)		
National Cycle Route 1 21 km section within study area	National Cycle Route 1 follows a series of minor roads between Ceres and Falkland in the northern part of the study area and passes within 8 km of the Development at its closest point. The ZTV shows almost no visibility.	No, due to lack of visibility.
National Cycle Route 76 5 km section within study area	National Cycle Route 76 just encroaches into the far south-west of the study area and passes within 12 km of the Development where it follows the A921 through Kirkcaldy. The ZTV indicates some theoretical visibility, but in reality the Development will have limited influence due mainly to screening by buildings adjoining the route. Where views are obtained along the seafront at Kirkcaldy, they are open and expansive with the Development occupying a small and distant part. Vp 20 represents views gained from the seafront at Kirkcaldy.	No, there may be some limited effect, but this will not be significant due to: • Screening by vegetation and buildings along the route (especially through Kirkcaldy); • Short sections with visibility; • Open and expansive nature of available views with the Development occupying a small part; and • Distance to Development, which is a minimum of 12 km.
Regional Cycle Route 63 20 km section within study area	Regional Cycle Route 63 crosses the western part of the study area, passing through Glenrothes and linking National Cycle Routes 1 and 76 together. The ZTV shows theoretical visibility from much of the route, but in reality views are quite limited due to screening and filtering by vegetation, landform and buildings particularly where it passes through Glenrothes. Additionally, where the route passes to the west of the A92, at its closest point to the Development, views are largely obstructed by embankments which support the road.	No, there may be some effect, but this will not be significant due to: • Low-lying landform through which the route passes, which limits long views; • Further screening by vegetation, landform and buildings (especially through Glenrothes and adjoining the A92); • Short sections with visibility; • Angled nature of most visibility; and • Distance to Development, which is a minimum of 7 km.
Visitor Attractions (Figure 5.13)		
Lomond Hills Regional Park	The ZTV shows patchy theoretical visibility from around 10 km away. In reality, much of this is further screened by coniferous plantations and shelter belts that cover the steeper slopes. Where views are available, the Development will have a limited influence due to the large-scale nature of the receiving landscape, the panoramic nature of views obtained and the small and distant part of the wider outlook affected. Additionally, the built up edge of Glenrothes adjoins the park boundary and has a strong influence in views towards the Development. Vp 19 represents views from the park.	No, there may be some effect, but this will not be significant due to: • Patchy visibility as shown on the ZTV; • Further screening by forestry plantations and shelter belts within the park; • Large-scale nature of the receiving landscape and expansive nature of views where obtained; • Small part of available views occupied by the Development; • Other built influences in views; and • Distance to Development, which is a minimum of 10 km.

Visual Receptor	Description of Predicted Effect	Further Assessment Required?
Beaches: Elie to Earlsferry	The ZTV indicates theoretical visibility at distances of 10-13 km. However, these small and somewhat secluded beaches are orientated south so that the main focus of views is across the Firth of Forth where an expansive outlook is obtained. Where views are available inland across Largo Bay the Development occupies a small and relatively distant part of the outlook where it is seen against a backdrop of urban and industrial development along the opposite shoreline with more distant hills behind. Methil Docks Turbine is also visible in the same arc of view and reduces the influence of the Development.	No, there may be some effect, but this will not be significant due to: • Orientation of beaches away from the Development; • Open and expansive nature of views; • Small part of available views occupied by the Development; • Presence of urban and industrial influences in views towards the Development, including those of a vertical nature; and • Distance to Development, which is a minimum of 10 km.
Beaches: Largo Bay	The ZTV shows theoretical visibility at distances of 2.5-10 km. The closest beaches, between Leven and Lower Largo, are orientated in a south easterly direction with an expansive outlook directed across the Firth of Forth. Views inland from these beaches towards the Development include Methil Docks Turbine at close range and other large-scale industrial uses on the docks, which both screen and moderate the influence of the Development. Between Lower Largo and King Craig Point, the beaches are more orientated towards the Development at distances of 8-10 km. This ensures the Development will occupy a relatively small part of the wider outlook and will also be seen in conjunction with Methil Docks Turbine and other large-scale industrial uses in the same arc of view. Vps 5, 9 and 13 represent views from around the bay.	No, there will be some effect, but this will not be significant due to: • Orientation of beaches away from the Development at close range; • Open and expansive nature of views; • Small part of available views occupied by the Development; • Presence of urban and large-scale industrial influences in close range views towards the Development; and • Increasing distance from the Development, with direct views gained from a minimum of 8 km.
Beaches: Kirkcaldy	The ZTV shows theoretical visibility at distances of 10-13 km. However, the beach and adjacent promenade is orientated in a south easterly direction so that the main focus of views is across the Firth of Forth. Where views are available along the coastline towards the Development they include the built-up edge of Kirkcaldy in the foreground and other more distant coastal settlements. The Development itself occupies a small and distant part of the outlook below Largo Law. Vp 16 represents views from the promenade and adjacent beach.	No, there may be some effect, but this will not be significant due to: • Orientation of beaches away from the Development; • Open and expansive nature of views; • Small part of available views occupied by the Development; • Presence of urban influences in views towards the Development; and • Distance to Development, which is a minimum of 10 km.

Over 20 settlements are included as principal receptors in the initial assessment, ranging from extensive urban areas of Glenrothes and Kirkcaldy to smaller towns and villages. Of these, five settlements are predicted to undergo significant effects on views, namely Buckhaven, East Wemyss, Kennoway, Methil and Lower Largo. The initial assessment found that none of the other settlements have potential to undergo significant effects. This is for a number of reasons including limited theoretical visibility as indicated by the ZTV; screening by

vegetation, buildings and local landform; orientation of landform and settlements; and distance. It is of particular relevance that many of the settlements are historically located in low-lying areas from where outward views towards the Development are restricted.

Nine roads are included as principal receptors: the A92, A911, A912, A914, A915, A916, A917, A921 and A955. Effects are predicted for most of these roads, in particular the A915 and A955, but these are not judged to be significant due to a combination of factors including the low-lying landform crossed by these routes, which limits long views; filtering and screening of views by roadside vegetation and buildings; short sections with visibility; angle of view; moving nature of the viewer; distance; and presence of other built influences in available views.

One long distance footpath and three cycle routes are also included as principal receptors: Fife Coastal Path; National Cycle Routes 1 and 76; and Regional Cycle Route 63. Of these, a section of the Fife Coastal Path has the potential to undergo significant effects where it passes in close proximity to the Development in the vicinity of Buckhaven. Effects on the other routes are not predicted to be significant due to lack of visibility; screening by vegetation, buildings and local landform; and distance.

One Country Park and three main beaches are included as principal receptors: Lomond Hills Regional Park and beaches at Elie/Earlsferry, Largo Bay and Kirkcaldy. However, effects on these visitor attractions are predicted to be not significant due to the large-scale nature of the receiving landscape and expansive nature of views obtained; small part of views occupied by the Development; orientation of landform; distance; and presence of other built influences in views.

For each receptor where a potentially significant effect is predicted an assessment is made below of its sensitivity to the Development. This is followed by a description of the changes to the views arising from the Development and an assessment of the magnitude of effect. Both the sensitivity of the baseline view and the magnitude of effect are assessed against the criteria given in Table 5.4**,** in section 5.2.3. From this, an assessment of the level of significance has been determined with reference to Table 5.5**,** in section 5.2.3**.**

The location of each receptor is shown on Figures 5.6 and 5.7 and is shown in relation to the ZTV on Figures 5.12 and 5.13.

5.4.5.2 Buckhaven and Methil

Buckhaven lies about 500 m west of the Development at its closest point. It is considered jointly with Methil as both settlements sit directly alongside each other and share a similar outlook towards the coast. The view gained from here is represented in viewpoints 1, 2 and 3.

Sensitivity

Settlements are normally considered to have a high sensitivity to change due to their residential nature. In this instance, the outlook obtained from residential properties that face the coast at Buckhaven and Methil, and from some properties within these settlements, is a mixture of derelict land and heavy industrial uses associated with the off-shore oil and gas industry. Views include a large operational steel fabrication facility adjoining the FEP site and several 80 m high lighting columns on the FEP site itself. Methil Docks Turbine (81 m tip height) is also visible in a number of views. These large-scale influences combine with the current derelict nature of the FEP site to lower sensitivity. As such, the sensitivity of these two settlements to the Development is judged to be *medium-high.*

Magnitude of Effect

The magnitude of effect on Buckhaven and Methil will vary throughout both settlements depending on visibility gained of the Development. The majority of properties will have very limited or no visibility of the Development due to the screening effects of low-lying landform in combination with vegetation and buildings within and around the built-up edge. Properties north of the A955 in particular, where it passes through both settlements, are unlikely to gain any visibility as they occupy a north facing slope that falls gently away from the Development

towards the River Leven. Thus for these properties, there will either be a *negligible* or *very small* magnitude of effect.

Other properties will gain some visibility of the Development where they are orientated towards it and where gaps between buildings occur. This generally applies to built-up areas that occupy slightly elevated ground between the A955 and the coast. For these properties, the magnitude of effect is likely to be between *small* and *medium* depending on the view obtained.

Residential properties on the coastal edge will, however, gain direct visibility of the Development as there is no intervening development to screen views. In particular houses along the B931 Wellesley Road, which adjoins the FEP site from a slightly elevated position, will gain open views where they are orientated towards the Development without the benefit of screening vegetation. The magnitude of effect on these houses (30-40 no) will be *large* or *very large*, with the Development providing the dominating influence in the view despite the presence of other large-scale elements that are familiar features in views and have some moderating effect.

Other houses further along the coastal edge will gain more oblique views of the Development and from a less elevated position. These include houses along Rising Sun Road and Shore Street to the south-west of the Development. For these houses the magnitude of effect is likely to be between *medium* and *very large* depending on the view available.

The turbine will be the principal visible element in views from houses along the coastal edge of Buckhaven and Methil. The construction compound may also be visible in views from houses along Wellesley Road, but in the context of the existing view this will not be significant. Cranes will also be visible as a short-term effect during the construction and decommissioning periods. There will be no permanent, irreversible effects on the view.

Significance of Effect

The significance of effect will vary according to the magnitude of effect. Many properties within Buckhaven and Methil will undergo no effect due to a lack of visibility. Some properties may undergo some change but the effect will generally be not significant due to limited visibility of the Development. For those properties on the coastal edge of these towns that do gain clear and unobstructed views of the Development the effect will between *moderate* and *major,* and thus significant. This is due to a combination of factors that results in a large or very large magnitude of effect and the medium-high sensitivity of the receptor.

5.4.5.3 East Wemyss

East Wemyss lies on the coast between 2.5 and 4.0 km south-west of the Development at its closest point. The view gained from here is represented in viewpoint 4.

Sensitivity

East Wemyss has a *high* sensitivity due to its residential nature. There are also scenic qualities in the coastal landscape seen in the view towards the Development from here, despite the built-up edge of Buckhaven being present.

Magnitude of Effect

The magnitude of effect on East Wemyss will vary throughout the settlement depending on the nature of visibility gained of the Development. The majority of the settlement will gain very limited or no visibility of the Development due to the low lying nature of the landform on which the settlement is built, in conjunction with the south-east orientation of the settlement towards the coast and screening by houses and vegetation within and around the edge of the settlement. There will therefore be a *negligible* to *very small* magnitude of effect for much of the settlement.

It is likely however, that visibility will be gained from some houses on the eastern edge of the settlement (10-15 no) where they are orientated due east towards the Development with a relatively open outlook, particularly from upper windows. The view shown in viewpoint 4 is similar to that available from these houses, albeit the view is from slightly further south on

Fife Coastal Path. For these houses, the magnitude of effect is likely to be *large* with the Development being immediately apparent and providing one of the prevailing influences in the view along with the baseline characteristics.

The large magnitude of change is due to a combination of factors discussed in relation to viewpoint 4 assessment. In summary, factors that reduce the effect from 'very large' are mainly increased distance (around 2.5 km), together with the relatively open nature of the view, the limited part of the Development that will be visible and the presence of vertical elements in the baseline view, which reduces the eye catching impact of the Development.

The turbine will be the only visible element in views from East Wemyss, with intervening vegetation and built development screening all other site infrastructure. Cranes will also be visible as a short-term effect during the construction and decommissioning periods. There will be no permanent, irreversible effects on the view.

Significance of Effect

The significance of effect here will vary according to the magnitude of effect. Much of the settlement will undergo no effect due to a lack of visibility. For a small number of properties on the eastern edge that do gain clear and unobstructed views of the Development, the effect will be *moderate-major,* and thus significant. This is due to a combination of factors that results in a large magnitude of effect on a receptor of high sensitivity.

5.4.5.4 Kennoway

Kennoway lies between 3.8 and 5.5 km north of the Development. The view gained from here is represented in viewpoint 6.

Sensitivity

Kennoway has a *high* sensitivity due to its residential nature, despite some detracting influences seen in the view towards the Development from here.

Magnitude of Effect

As at East Wemyss, the magnitude of effect on Kennoway will vary throughout the settlement, depending on the nature of visibility gained of the Development. The landform on which Kennoway is built slopes southwards towards the Development and whilst many houses within the settlement will gain little or no visibility, many others will gain an outlook where they are orientated towards the Development with views between buildings. For these houses the magnitude of effect is likely to be between *small* and *medium,* depending on the nature of the view obtained and distance. For houses on the southern edge of the settlement that lie closest to the Development, a direct and open outlook will be gained as there is no intervening development to screen views. The magnitude of effect on these houses (20-30 no) will be between *medium* and *large,* with the Development being immediately apparent and providing one of the prevailing influences in the view along with the baseline characteristics. This is due to a combination of factors discussed in relation to viewpoint 6 assessment. In summary, factors which increase the magnitude of effect are proximity of the edge of the settlement to the Development (just over 3.5 km), the direct and open outlook obtained and orientation of the view towards the Development. Factors that reduce the magnitude of effect from a large level are the relatively open and expansive nature of the view, the limited proportion of the view occupied by the Development, the limited part of the Development that will be visible and the presence of vertical elements in the baseline view, which reduce the eye catching impact of the Development.

The turbine will be the only visible element in views from Kennoway, with intervening vegetation and built development screening all other site infrastructure. Cranes will also be visible as a short-term effect during the construction and decommissioning periods. There will be no permanent, irreversible effects on the view.

Significance of Effect

The significance of effect here will vary according to the magnitude of effect. Parts of the settlement will undergo no effect due to a lack of visibility. For properties on the southern

edge that do gain clear and unobstructed views of the Development, the effect will be *moderate* to *moderate-major,* and thus significant. This is due to a combination of factors that results in a medium to large magnitude of effect on a receptor of high sensitivity.

5.4.5.5 Lower Largo

Lower Largo lies on the coast between 5.5 and 7.0 km north-east of the Development. The view gained from here is represented in viewpoint 9.

Sensitivity

Lower Largo has a *high* sensitivity due to its residential nature. There are also some scenic qualities in the coastal landscape seen in the view towards the Development from here, although built-development and Methil Docks Turbine in particular are detracting influences.

Magnitude of Effect

The magnitude of effect on Lower Largo will vary throughout the settlement depending on the nature of the visibility gained of the Development. The majority of the settlement will gain very limited or no visibility of the Development due to the low lying nature of the landform on which the settlement is built, the orientation of the settlement south towards the coast and screening by houses and vegetation within and around the edge of the settlement. There will therefore be a *negligible* to *very small* magnitude of effect for much of the settlement.

It is likely however, that visibility will be gained from a very small number of houses (3-5 no) on the western edge of the settlement overlooking the golf course where they are orientated due west towards the Development with an open outlook. The view shown in viewpoint 9 is from Fife Coastal Path where it passes directly in front of these houses and is virtually identical to the view obtained from them. For these houses, the magnitude of effect is likely to be *medium* with the Development being readily apparent and providing one of the prevailing influences in the view along with the baseline characteristics.

The medium magnitude of change is due to a combination of factors discussed in relation to viewpoint 9 assessment. In summary, factors that reduce the effect from 'large' are increased distance (minimum of 5.5 km), the open, uniform and expansive nature of the coastal view, the small proportion of the full available view occupied by the Development and the presence of vertical elements in the baseline view, which reduces the eye catching impact of the Development.

The turbine will be the only visible element in views from Lower Largo, with intervening built development screening all other site infrastructure. Cranes will also be visible as a short-term effect during the construction and decommissioning periods. There will be no permanent, irreversible effects on the view.

Significance of Effect

The significance of effect here will vary according to the magnitude of effect. Much of the settlement will undergo no effect due to a lack of visibility. For a very small number of properties on the western edge that do gain clear and unobstructed views of the Development, the effect will be *moderate* and thus significant. This is due to a combination of factors that results in a medium magnitude of effect on a receptor of high sensitivity.

5.4.5.6 Fife Coastal Path

Fife Coastal Path closely follows the Fife coastline for a distance of 150 km, of which approximately 35 km falls within the study area between Kinghorn in the south-west and Elie in the east. At its closest point, at Buckhaven, the route passes to within 500 m of the Development. Viewpoints 1, 4, 5, 7, 9, 13, 16 and 18 represent views from this long distance footpath.

Sensitivity

Fife Coastal Path has a high importance due to its recognition as a long distance and sign posted walking route. People using this route will have an awareness of their surroundings and will be focussed on the landscape through which they are passing. It also has a high

value due to the various designated areas through which it passes. These factors give it a *high* sensitivity as a visual receptor, although this will be reduced locally where the route passes through built-up areas that adjoin the coast and limit views.

Magnitude of Effect

The magnitude of effect will vary along the route depending on visibility gained of the Development. The magnitude of effect will also vary depending on the direction of travel, so the two principal directions of travel (northbound and southbound) are assessed separately.

Northbound

For northbound travellers, visibility starts at the edge of the study area where the ZTV shows theoretical visibility from a short section between Kinghorn and Kirkcaldy, around 11-15 km from the Development. The view from here is shown in viewpoint 18, which represents the first available views of the Development, and viewpoint 16, which is from the seafront at Kirkcaldy. Both viewpoints are assessed to have a *small* magitude of effect due to the limited effect that the Development will have.

From the seafront, the route continues in a north-easterly direction passing through built-up parts of Kirkcaldy, including Ravenscraig Park, and on the West Wemyss. The ZTV shows quite limited visibility from along this section and in reality the influence of the Development will be even further reduced due to screening by buildings, vegetation and landform. The magnitude of effect on any views from this predominantly built-up section of the route will at most be *small* to *medium.*

From West Wemyss, a higher magnitude of effect will become apparent as the route continues in a north-easterly direction from a distance of 5 km with an open outlook obtained, which is orientated directly towards the Development. The view from here is shown in viewpoint 7 where the effect is judged to be between *medium* and *large,* with the Development providing one of the defining influences in the view. This magnitude of effect will increase as the route draws closer to the Development. Viewpoint 4 shows a *large* magnitude of effect on the view from the path at around 2.5 km from the Development, whilst viewpoint 1 illustrates the view from the edge of the FEP site, 500 m from the Development, where the magnitude of effect will be *very large.* Beyond the FEP site, the Development is behind the walker and the effect ceases.

It should be noted, however, that viewpoint 1 is from within the built-up edge of Buckhaven and, as such, views are largely limited to gaps between buildings that adjoin the FEP site. Furthermore, the built-up nature of this section of the route and in particular the industrial character of the coastal edge has a lowering effect on sensitivity for users of the footpath. Nevertheless, the magnitude of effect from here is such that it will be significant irrespective of sensitivity.

Southbound

For walkers heading south, the ZTV shows some patchy theoretical visibility between Elie and Earlsferry, 10-13 km from the Development. In reality the influence of the Development will be very limited due to distance, the general orientation of views away from the Development and screening by buildings and local landform. The magnitude of effect on any views from this section of the route will at most be *very small* .

Beyond Earlesferry, in the vicinity of Kingcraig Point, the route turns north to follow the edge of Largo Bay. From this point, a higher magnitude of effect will become apparent where an open outlook is obtained across the bay. This can be seen in viewpoint 13 where the effect is judged to be between *small* and *medium*, with the Development forming a noticeable feature in the view along with the built-up edges of Buckhaven, Leven and Methil where they have coalesced. Methil Docks Turbine is also a visible feature of the outlook towards the Development. From Kingcraig Point around to Lower Largo, the ZTV shows continuous theoretical visibility although views across the bay are of an acute angle to the direction of travel. This, together with the presence of Methil Docks Turbine in views, limits the

magnitude of effect over this stretch to *medium*, as can be seen in viewpoint 9 at Lower largo, around 5.5 km away.

West of Lower Largo, the route continues to follow the edge of Largo Bay with views progressively becoming orientated towards the Development. The magnitude of effect will, however, remain largely unchanged due to the moderating influence of Methil Docks Turbine and other large-scale industrial uses, which are seen directly in front of the Development and are closer to the viewer. This can be seen in viewpoint 5, where the footpath follows the seafront at Leven. Although the view from the footpath is orientated directly towards the Development from a distance of about 3 km, the magnitude of effect is assessed as *medium* due to the presence of Methil Docks Turbine and other large-scale industrial uses in the foreground. Beyond the Methil Docks Turbine, the magnitude of effect will increase to *large* or *very large* at a distance of around 2 km away and will continue to the FEP site where upon the southbound walker will pass beyond the Development and the effect will cease.

The turbine will be the only visible element in views from the long distance footpath, with intervening built development screening all other site infrastructure. Cranes will also be visible as a short-term effect during the construction and decommissioning periods. There will be no permanent, irreversible effects on the view.

Significance of Effect

The effect on Fife Coastal Path will vary according to the magnitude of effect, which varies along the route. The sensitivity of the route is also considered, particularly as sections of it pass through built-up areas, some of which are of an industrial nature. This has a lowering effect on the otherwise high sensitivity of the footpath, although the large magnitude of effect experienced along some of these built-up sections is such that the level of sensitivity is largely irrelevant.

Much of the route will undergo a not significant effect due to limited visibility and the resultant limited magnitude of effect. For sections of the route that lie closer to the Development, and pass adjacent to it, the effect will be *moderate* to *major* and thus significant. This is due to the medium to very large magnitude of effect that will occur and the generally high sensitivity of the route.

For northbound walkers, the significant effect will start as the path emerges from West Wemyss, about 5 km south-west of the Development, and finish as it passes the FEP site, a distance of about 6 km. For southbound walkers, the significant effect will generally start where the route emerges from Lower Largo, about 5.5 km north-east of the Development, and finish where it passes the FEP site, a distance of about 6.5 km.

5.4.5.7 Effects on Local Views

As well as identifying any significant effects on principal visual receptors, the assessment of visual effects also considers effects on local views. This part of the assessment focuses on the area in close proximity to the Development where significant visual effects are most likely to occur. The assessment of effects on local views does not assess effects on specific properties, which would require access to private land and property, but draws conclusions as to the likely effects that the Development will have on views from within this area.

Effects on local views have therefore been identified through an analysis of the ZTV and representative viewpoints (Appendix A5.1), together with a site survey of the area where significant effects are most likely to occur. The ZTV, viewpoint assessment and site survey indicate this area to be contained within a radius of approximately 5 km from the Development. Within this radius, the proximity of the Development to the viewer and the contrast that its scale, form, colour and movement will have with the visual setting means it will generally have a material effect on views where clear, open and direct visibility is obtained. This can be seen in relation to viewpoints 1 to 7 where a combination of viewpoint sensitivity and magnitude of effect on the view has mostly resulted in a significant effect. Elsewhere within the 5 km radius similar views are likely to be obtained from other sensitive receptors and will result in a significant effect.

There will, however, be instances within the 5 km radius where effects will be not significant. In particular the sensitivity of the receptor will be a determining factor. In terms of visual amenity, occupiers of residential properties and users of public rights of way are considered to be high sensitivity receptors, whilst road users are judged to be low sensitivity as the nature of views obtained is a transient one. So whilst a view from a road may be similar to that obtained from a nearby house, the effect on the road user may be not significant due to its lower sensitivity, whereas for the residential occupier the effect may be significant due to its higher sensitivity. It is worth noting here that of those major roads assessed that pass within a 5 km radius of the Development, none were judged to undergo a significant effect.

Other factors that determine sensitivity include the nature and value of the view. For instance, man-made influences present in a view can have a lowering effect on sensitivity, particularly those of a vertical nature to which turbines can relate (pylons, masts, chimneys, *etc*.). In this instance, large-scale industrial buildings and other vertical structures characterise close range views towards the Development and have a certain familiarity with the scale and appearance of the Development. These existing influences increase the ability of the visual receptor to accommodate the Development as viewers are already familiar with the type and scale of development proposed. This can be seen in relation to viewpoints 1 and 5 in particular.

In addition to the sensitivity of the receptor, the limited magnitude of effect that it undergoes can also result in effects within the 5 km radius being judged as not significant. Within the study area, the most frequent factor that limits magnitude of effect is screening by vegetation, buildings and local landform, none of which register on the ZTV. Shelter belts and wooded areas are characteristic features of the study area both within and beyond the 5 km radius and these help to filter and screen potential views towards the Development, particularly when in combination with low-lying landform. Similarly, built development is a feature of the study area in the immediate proximity of the Development and this has had a further limiting effect on close range views. Overall, the presence of screening vegetation and buildings in combination with low-lying landform within the study area has resulted in a reduced number of individual receptors that will be significantly affected by the Development.

Magnitude of effect within the 5 km radius may also be reduced by the degree of contrast or integration with the existing view. For instance, the magnitude of effect will generally be less where a development fits with the overall scale and complexity of a view. In this instance, the presence of large-scale industrial buildings and other vertical structures in close range views towards the Development not only limits visibility, but also helps to reduce the degree of contrast in the baseline view that would otherwise occur if the Development were the only or predominant vertical influence in views.

Magnitude of effect may also be reduced by the orientation of the receptor relative to the Development. If the principal outlook from a house is orientated away from the Development then the magnitude of effect will usually be less than if the outlook is directly towards the Development. Similarly, the orientation of landform is also important. If a house or footpath is located on ground that sits below the Development and faces away from it then the magnitude of effect is likely to be less than if the ground slopes down from the house or footpath towards the Development and draws the eye towards it.

Beyond 5 km radius, the effects of the Development are generally reduced and are unlikely to be significant. The most important and predictable factor in this reduction in effect is the increased distance of the Development from the viewer, which ensures that the turbine is seen as a progressively smaller component that occupies a smaller proportion of available views. This is particularly well illustrated in viewpoints 7 and 16, which are located on Fife Coastal Path between 5.0 and 12 km south-west of the Development with very similar views.

It is important to note that the distance at which effects tend to become not significant is site specific and will be dependent on the characteristics of views available and the nature of the development. At some sites where lack of screening or a more elevated location affords greater visibility than is the case here, or where there is an absence of detracting influences in views, or turbines are present in greater numbers than the single turbine proposed, then

significant effects may extend over a wider radius as a larger proportion of the view may be affected from a greater distance.

5.4.5.8 Distribution of Significant Effects on Local Views

Of the area contained within an approximate 5 km radius of the Development, around half falls within the Firth of Forth from where the only views available are from passing shipping. Of the remaining land area, a further half is occupied by the low-lying coastal towns of Buckhaven, Leven and Methil, which have effectively coalesced on either side of the River Leven and joined with Kennoway and Windygates slightly further inland. Together with East Wemyss, these settlements have been assessed separately as principal receptors. Beyond these settlements, the remaining area contained within an approximate radius of 5 km is not heavily populated. In fact, outside of these principal settlements, built development is limited to the occasional farm or isolated house to the west of Buckhaven and north of Leven, linked by minor roads. Vegetation cover is relatively widespread and includes Wemyess Wood together with other wooded areas and shelter belts in the west and more generally to the north.

Immediately beyond the western built-up edge of Buckhaven, a small handful of isolated houses and farms exist including Cameron, Little Lun, Granstfield, Percival and Woodbank. The landform here is relatively level and, although areas west of Buckhaven are well vegetated, the area adjoining the built-up edge is generally devoid of wooded areas or shelter belts. Consequently, some of these houses or farms are likely to undergo significant effects where they are orientated towards the Development with a clear and open outlook.

North of Leven, a small handful of houses occupy south facing slopes that fall towards the Development including Balgrummo, Durie House and Wester Dune. As with isolated properties west of Buckhaven, these are likely to undergo significant effects where they gain a clear outlook. Viewpoint 6 is located in this part of the study area and illustrates the type of effect the Development will have when clearly seen in views.

5.4.5.9 Summary of Effects on Visual Receptors

The initial assessment (Table 5.10) identified six principal visual receptors, five settlements and one walking route, to have the potential to undergo significant effects as a result of the Development. These are the settlements of Buckhaven, East Wemyss, Kennoway, Methil and Lower Largo together with Fife Coastal Path.

Further assessment of these receptors concluded that for those parts of Buckhaven, East Wemyess, Kennoway, Methil and Lower Largo that gain direct views of the Development, the effects were likely to be significant even allowing for the presence of other built influences of a large-scale and industrial nature. For other parts of these settlements where there is no visibility, or limited visibility, the effects will not be significant. There will be a significant effect on Fife Coastal Path where it passes the Development and for up to 6 km on each side. For the rest of this long distance footpath the effects are assessed to be not significant due to a combination of limited visibility, distance and screening by landform, vegetation and buildings.

The other principal visual receptors included in the initial assessment were found to have no potential to undergo significant effects. This is due to a variety of reasons including lack of visibility as indicated by the ZTV; screening by vegetation and buildings; orientation of landform; distance; and presence of other built influences in views.

There are likely to be some significant effects on local views within approximately 5 km radius of the Development. However, these will be limited to a small handful of isolated houses and farms that lie to the west and north of the built-up edges of the principal settlements that fall within the 5 km radius and occupy the majority of the area local to the Development.

The distribution of significant effects on views is shown on Figure 5.14b.

5.5 Mitigation Measures and Residual Effects

The restriction of the Development to a single turbine, its size and near-shore location offers no scope to incorporate landscape mitigation measures that might otherwise be considered where several turbines are proposed and are located on dry land. Consequently, the effects as assessed in Section 5.4 above represent the residual effects arising from the Development that will remain for the duration of its operational life.

5.6 Cumulative effects

The previous section considered the predicted effects on the landscape and visual resource of the study area arising from the Development as a standalone scheme. This section considers any additional cumulative effects that might arise from the addition of the Development to other wind energy developments in the surrounding area. Cumulative effects arise when the ZTVs of two or more wind energy developments overlap so that both wind energy developments are experienced at a proximity where they might have an incremental effect.

As described in section 5.2.8, the search area for cumulative effects is increased to 30 km radius in order that any potential cumulative effects towards the edge of the 15 km radius study area for the Development can be identified. Within this enlarged area, it has been agreed with Fife Council to assess the Development against those wind energy developments that were identified in relation to the Consented Development, plus the 2-B Energy Proposed Development. These developments are shown on Figure 5.4 and are listed in Table 5.7, in section 5.2.8.

The potential for additional cumulative effects has been determined by reference to Figures 5.5a to 5.5g. These show the ZTV for the Development in conjunction with the ZTVs for each of these wind energy developments as a series of paired ZTVs (Figures 5.5a-5.5e) and with the Development ZTV added to ZTVs of all of these developments together (Figures 5.5f-5.5g). Taking into account limitations associated with the ZTV, as described in section 5.2.6, an analysis of the visibility indicated has identified areas of overlapping ZTV with potential for additional cumulative effects for which further assessment is required. Analysis of cumulative viewpoints and computer generated wirelines in conjunction with site visits has then been carried out to identify the presence of screening features that might limit visibility and so determine likely levels of cumulative effects.

The ZTVs and wirelines have been analysed, firstly with the Development added to those operational and consented wind energy developments as the future of these is certain, and, secondly, with the Development added to those undetermined sites. The undetermined sites are considered separately in view of uncertainties surrounding their progress through the planning process, which may result in changes to a layout, a refusal or even the withdrawal of an application.

5.6.1 Development with Operational and Consented Wind Energy Developments

This section considers the potential effects that the addition of the Development will have on those operational wind energy developments identified within the extended search area. Wind energy developments with the benefit of a planning consent, but not yet constructed, are also included here in view of their likely imminent construction. These developments are:

- Methil Docks (operational) – 1 x 81 m turbine, approximately 1.7 km north-east of the Development;
- Little Raith (consented) – 9 x 100 m turbines, approximately 18.5 km south-west of the Development; and
- Lochelbank (consented) – 12 x 91 m turbines, approximately 29.0 km north-west of the Development.

Analysis of the Development ZTV added to the Methil Docks ZTV (Figure 5.5a) shows remarkable similarity across the 15 km radius study area, as would be expected given their proximity to each other. Although the Development has greater visibility due to its increased

height, very few areas exist within the study area where both turbines cannot be seen together.

Analysis of the Development ZTV added to Little Raith ZTV (Figure 5.5b) shows widespread overlapping visibility across central and southern parts of the 15 km radius study area. This mostly coincides with low-lying areas where screening by vegetation and built-development will restrict actual visibility. However, some overlapping visibility is indicated across higher ground including the Cullaloe Hills, Lomond Hills and Largo Law. Widespread overlapping visibility is also indicated across the Firth of Forth, although views will only be obtained from passing shipping and are less important.

Analysis of the Development ZTV added to Lochelbank ZTV (Figure 5.5c) shows much more limited overlapping visibility. This partly reflects the distance separating these two sites (almost 30 km), but also the limited extent of theoretical visibility indicated on the Development ZTV across northern parts of the study area. Potential for cumulative effects between these two sites is essentially limited to two discrete areas lying to the west and north-east of the Development, where a combination of distance, low-lying landform and screening by vegetation and built development will further restrict visibility.

5.6.1.1 Additional Cumulative Effects on Landscape Character

One operational site and two consented sites are located in the extended study area with overlapping visibility giving rise to potential cumulative effects. However, the status of these sites indicates that cumulative effects have not been judged unacceptable. The addition of the Development to these operational and consented sites has the potential to produce an additional cumulative effect on the landscape, as the degree of overlapping visibility indicated on the ZTVs is widespread. In reality, the proximity of the Development to Methil Docks turbine ensures that it will tend to read as part of a slightly larger development in most views from within the 15 km radius study area. This is important as it reduces the potential for cumulative effects that might otherwise be the case if these turbines were widely spaced apart. The proximity of these turbines to each other is particularly evident in cumulative viewpoints 7, 9, 12, 17, 19, 20 and 21. Thus, cumulative effects within the study area will continue to be influenced by Methil Docks turbine in combination with Little Raith and, to a lesser extent Lochelbank, with the addition of the Development judged to have no more than a *small* effect that will be not significant. Issues of compatibility between the Development and Methil Docks turbine due to differences in turbine size and rotor speeds will, however, be noticeable in close range views from around the study area.

5.6.1.2 Additional Cumulative Effects on Landscape Designations and Special Interests

Additional cumulative effects on Tarvit and Ceres LLA will be non-existent or *negligible*, due to the lack of visibility of the Development, as identified in the main assessment. Of the other five LLAs within the study area, overlapping visibility between Little Raith, Methil Docks and, to a lesser extent, Lochelbank already exists across each of these local designations with potential for cumulative effects. The addition of the Development does not result in any appreciable overlapping visibility over and above that which already exists between Methil Docks and at least one other of the consented sites. Thus, additional cumulative effects arising from the addition of the Development to Little Raith, Lochelbank and Methil Docks is likely to be similar to landscape character, amounting to no more than a *small* cumulative magnitude of effect, which will be not significant.

Additional cumulative effects on identified Inventory sites will be non-existent or *negligible,* due largely to the lack of visibility of the Development, as identified in the main assessment.

5.6.1.3 Additional Cumulative Effects on Fixed Views (Settlements)

All three operational and consented sites plus the Development are located in an area that has a fairly dense pattern of settlement ranging from isolated houses to extensive urban areas, all of which generally have a high sensitivity. Methil Docks, Little Raith and Lochelbank exist as operational and consented sites and whilst cumulative effects on residential receptors may arise because of these, they have not been judged to be unacceptable by the determining authorities.

The ZTVs suggest that the addition of the Development to Little Raith and Methil Docks in particular has potential for additional cumulative effects on visual receptors, as the degree of overlapping visibility between these three sites is widespread. However, within the wider study area, many residential properties gain little or no views of the Development, as identified in the main assessment. For these receptors, the potential for cumulative effects arising from the addition of the Development is non-existent, or *negligible*.

Where properties and settlements do gain visibility of the Development, its location relative to the Methil Docks turbine ensures that both turbines are seen together and appear as part of a slightly larger development in views rather than entirely separate developments. This can be seen in cumulative viewpoints 7, 9, 12, 17, 19, 20 and 21 in particular and is important in reducing the potential for cumulative effects. Thus, cumulative visibility within the study area will continue to be defined primarily by Methil Docks turbine in combination with Little Raith, with the addition of the Development judged to have no more than a *small* effect that will be not significant. Issues of incompatibility between the Development and Methil Docks turbine arising from differences in turbine size and rotor speeds, will be noticeable in close range views from around the study area.

5.6.1.4 Additional Cumulative Effects on Sequential Views (Routes)

Potential for sequential effects on views exists for users of the A92 in particular and some of the coastal routes, including the A915, A955 and Fife Coastal Path, where Little Raith and Methil Docks turbine are seen in succession, separated by a distance of around 20 km. The addition of the Development will have a *very small* influence on this particular effect, since its location relative to Methil Docks ensures that both turbines will generally be seen together in views from these routes and other major routes around the study area and will tend to read as a slightly larger development rather than distinctly separate sites.

5.6.2 Development with Operational, Consented and Undetermined Wind Energy Developments

This section considers the potential effects that the addition of the Development will have on those operational and consented wind energy developments, as described in the previous section, in association with those submitted but, as yet, undetermined wind energy developments. The undetermined developments are:

- Westfield – 5 x 110 m turbines, approximately 15.0 km west of the Development; and
- 2-B Energy Proposed Development – 2 x 168.5 and 172.5 m turbines, approximately 1.5 to 1.7 km south of the Development.

Analysis of the Development ZTV added to the Westfield ZTV (Figure 5.5d) shows overlapping visibility limited, in the main, to two areas west and east of the Development coinciding with the Leven Valley and east of Largo Bay. In reality, the low-lying landform together with screening vegetation will have a significant limiting on views.

Analysis of the Development ZTV added to the 2-B Energy Proposed Development (Figure 5.5e) shows remarkable similarity across the 15 km radius study area, as would be expected given their proximity to each other. Very few areas exist within the study area where both schemes cannot be seen together.

Analysis of the Development added to all operational, consented and undetermined sites (Figure 5.5g) shows much similarity between all six sites across southern, eastern and, to a lesser extent, western parts of the 15 km radius study area. The northern part of the study area is, however, mostly free of overlapping visibility due to intervening landform which largely curtails views of the Development, Methil Docks and the 2-B Energy Proposed Development.

5.6.2.1 Additional Cumulative Effects on Landscape Character

The ZTVs suggest that the addition of the Development to Methil Docks, Little Raith, Lochelbank, Westfield and the 2-B Energy Proposed Development has the capacity to produce a cumulative effect on the landscape, as the degree of overlapping is widespread. However,

for reasons described in 5.6.1.1, the proximity of the Development to Methil Docks turbine ensures that it appears as part of a slightly larger scheme in most views from around the study area and will have no more than a *small cumulative* effect that will be not significant. Should the 2-B Energy Proposed Development be consented, then the Development will appear as part of a small cluster of turbines in most views from around the study area and will be indistinguishable as a separate development. As such, the Development would have only a very minor role in extending windfarm influence.

5.6.2.2 Additional Cumulative Effects on Landscape Designations and Special Interests

Additional cumulative effects on Tarvit and Ceres candidate LLA will be non-existent or *negligible*, due to the lack of visibility of the Development, as identified in the main assessment. Additional cumulative effects on the other five LLAs arising from the addition of the Development to Methil Docks, Little Raith, Lochelbank, Westfield and the 2-B Energy Proposed Development are likely to be similar to those on landscape character described above, with the Development having no more than a *small* effect due to its proximity to both Methil Docks turbine and the 2-B Energy Proposed Development.

Additional cumulative effects on identified Inventory sites will be non-existent or *negligible* due to lack of visibility of the Development, as identified in the main assessment.

5.6.2.3 Additional Cumulative Effects on Fixed Views (Settlements)

As described in 5.6.1.3, many houses and settlements in the study gain little or no visibility of the Development. Thus, for these visual receptors the potential for cumulative effects is non-existent, or *negligible*. Where views of the Development do exist its location relative to the Methil Docks turbine and the 2-B Energy Proposed Development ensures that itappears as part of a slightly larger development in views rather than an entirely separate development. Thus, cumulative visibility within the study area will be defined primarily by Methil Docks turbine in combination with Little Raith, Westfield and the 2-B Energy Proposed Development, with the addition of the Development judged to have no more than a *small* effect that will be not significant.

5.6.2.4 Additional Cumulative Effects on Sequential Views (Routes)

Potential for sequential effects on views exists for users of the A92 and for some of the coastal routes, including the A915, A955 and Fife Coastal Path, where Methil Docks, Little Raith, Westfield and the 2-B Energy Proposed Development will be seen in succession, with all three sites separated by a distance of around 20 km. The addition of the Development will have no more than a *small* influence on this particular effect, since its location relative to Methil Docks and the 2-B Energy Proposed Development ensures that it will appear as part of a small cluster of turbines in most views from these and other major routes around the study area.

5.6.3 Summary of Additional Cumulative Effects

The assessment has shown that the addition of the Development to the operational and consented sites of Methil Docks, Little Raith and Lochelbank will not result in any significant cumulative effects. This is due to the proximity of the Development to the Methil Docks turbine, which ensures that it cannot be easily discerned as a separate site in most views from around the study area. In this context, the Development will have limited capacity for additional cumulative effects as the addition of the Development will not result in the impression of a landscape or view that is defined by the presence of more than one wind energy development and is characterised primarily by wind energy developments to the extent that other patterns or components are no longer definitive. This is because Methil Docks, Little Raith and Lochelbank already affect the landscape and views of the study area, and the addition of a single turbine will not significantly increase the windfarm influence.

The assessment has also found that there is no potential for significant cumulative effects arising from the addition of the Development to Methil Docks, Little Raith, Lochelbank and the undetermined sites at Westfield and the 2-B Energy Proposed development. This is again due to the location of the Development in relation to Methil Docks turbine and the 2-B Energy

Proposed Development. In this context, the Development will have limited capacity for additional cumulative effects as the addition of the turbine will not result in the impression of a landscape or view that is defined by the presence of more than one wind energy development and is characterised primarily by wind energy developments to the extent that other patterns or components are no longer definitive. This is because Methil Docks, Little Raith, Lochelbank, Westfield and the 2-B Energy Proposed Development will primarily affect the landscape and views of the study area, and the addition of a single turbine will not significantly increase the windfarm influence.

Issues of incompatibility between the Development and Methil Docks Turbine will be apparent in close range views from around the study area due to differences that exist in terms of turbine size and blade movement.

5.7 Summary of Effects

The landscape and visual assessment has considered the potential effects that the Development may have on the physical pattern of landscape elements within the FEP site, on the landscape character of the wider study area, on landscape-related planning designations within the study area and on key visual receptors within the study area. The assessment has also considered the additional cumulative effects of the Development when added to other existing and proposed wind energy developments within an extended study area. Significant effects have been identified in respect of the following:

- 'Wemyss unit' of the 'Coastal Hills' landscape character type, extending from the built-up edge of Buckhaven for a distance of about 5 km south-west of the Development;
- 'Mid-Leven Valley unit' of the 'Lowland River Basins' landscape character type, extending from the built-up edge of Kennoway for a distance of about 5 km west of the Development;
- 'Largo Law unit' of the 'Lowland Dens' landscape character type, extending from the built-up edge of Leven for a distance of about 5 km north of the Development;
- Houses on the coastal edge of Buckhaven and Methil (30-40 no) and from some houses within these settlements that gain an open view;
- Small number of houses on the eastern edge of East Wemyss (10-15 no);
- Houses on the southern edge of Kennoway (20-30 no) and from some houses within the settlement that gain an open view;
- Small number of houses on the western edge of Lower Largo (3-5 no);
- Section of Fife Coastal Path, between West Wemyss and Lower Largo, covering a total distance of about 12 km; and
- Local views from a small number of individual houses and farms to the west and north of the Development, extending for a distance of about 5 km.

These effects arise from the addition of the turbine rather than other infrastructure works associated with the Development and are considered to be 'negative' since they will not result in specific benefits to the affected landscape or views. However, the effects will be 'short term' and 'reversible' and are limited to a period of no more than 5 years.

Beyond those significant 'negative' effects identified above, the Development is likely to have an effect on some of the other landscape character types or views but these are not judged to be significant. Furthermore, the nature and extent of significant effects identified above are identical to those effects identified for the Consented Development and so represent 'no change'.

5.8 Statement of Significance

The assessment of effects on the landscape and visual resources of the study area has demonstrated that the Development will have localised significant effects on landscape

character and views within close proximity to it. Whilst these local effects are considered to be significant, in the wider context the Development is judged capable of being accommodated without bringing about an unacceptable change to the landscape and visual resources of the study area. This acceptability is due in part to the design of the Development and the landscape and visual context in which it will be seen.

There are two design aspects relating to wind energy developments that are of particular importance, firstly, the number and layout of turbines proposed and, secondly, the way in which they will be seen in views from around the study area. In terms of turbine numbers, the proposal is for a single turbine and, in very general terms, the fewer the turbines the lower the landscape and visual impact. This is because a single turbine will be seen from fewer locations and will only occupy a very small proportion of views, leaving more of the baseline view unaffected. The layout and appearance of wind energy developments is equally important, since well designed layouts that avoid gaps, clusters, over lapping and notable scale differences are generally less prominent and more acceptable that those that do not. As this proposal is for a single turbine, issues of layout and appearance of turbines do not arise.

The context in which the Development will be seen is fundamental to its acceptability for several reasons. Landscapes that are medium to large-scale, open and with relatively uniform landform or land cover generally have a greater capacity to accommodate wind energy developments since they avoid awkward scale comparisons that can arise with landscapes that are small-scale, intimate or enclosed. This is generally the case in views towards the Development where it is seen against the backdrop of a medium to large-scale coastal landscape where it appears as a relatively small feature. The presence of screening features, particularly vegetation, can also play an important role in reducing visibility. The level of vegetation found across the study area is relatively high and this does afford greater screening and filtering of views that might otherwise be significant. The largely built-up nature of the area in close proximity to the Development is also important at limiting views, whilst the presence of other large-scale vertical elements in views reduces the eye catching impact that the Development might otherwise have if it were the only or predominant vertical element. For residents in close proximity to the Development there is also a certain familiarity between the Development and the sight of large-scale structures associated with the off-shore oil and gas industry that are manufactured and repaired at Methil.

In planning designation terms, the Development is considered acceptable as it will not have significant effects on any national or locally designated areas or on those Inventory sites identified within the study area.

The absence of significant cumulative effects is another important consideration in the acceptability of the Development since it increases the ability of the landscape and visual resource to accommodate the Development. In this respect, the proximity of the Development to the operational turbine at Methil Docks and the two undetermined turbines associated with the 2-B Energy Proposed Development ensures that it plays only a minor role in extending the windfarm influence within the study area. Issues of compatibility between turbine sizes arising from the Development when seen in conjunction with the Methil Docks turbine will, however, remain.

The above aspects of the Development in combination with the landscape and visual attributes of the study area combine to make the proposed Development acceptable in landscape and visual terms. This is despite the presence of localised significant effects that will occur in close proximity to the Development. These effects are also identical to those significant effects identified for the Consented Development and therefore represent ‘no change’, as summarised in Table 5.11 below.

Table 5.11 Variances of Consented Scheme and Revised Scheme

	Consented Scheme		**Revised Scheme**		
EIA Element	**Significant Yes/No**	**Mitigation Required**	**Significant Yes/No**	**Mitigation Required**	**Difference between Schemes**
Landscape Fabric					
FEP Site	No	Not Applicable	No	Not Applicable	No change
Landscape Character					
Coastal Hills LCT	Yes	Not Applicable	Yes	Not Applicable	No change
Lowland River Basins LCT	Yes	Not Applicable	Yes	Not Applicable	No change
Lowland Dens LCT	Yes	Not Applicable	Yes	Not Applicable	No change
Designated Areas					
Local Landscape Areas (LLAs)	No	Not Applicable	No	Not Applicable	No change
Inventory Sites	No	Not Applicable	No	Not Applicable	No change
Views (Settlements)					
Buckhaven	Yes	Not Applicable	Yes	Not Applicable	No change
East Wemyss	Yes	Not Applicable	Yes	Not Applicable	No change
Kennoway	Yes	Not Applicable	Yes	Not Applicable	No change
Lower Largo	Yes	Not Applicable	Yes	Not Applicable	No change
Methil	Yes	Not Applicable	Yes	Not Applicable	No change
Views (Routes)					
Main Roads	No	Not Applicable	No	Not Applicable	No change
Footpaths: Fife Coastal Path	Yes	Not Applicable	Yes	Not Applicable	No change
Cycle Routes	No	Not Applicable	No	Not Applicable	No change
Views (Attractions)					
Country Parks	No	Not Applicable	No	Not Applicable	No change
Beaches	No	Not Applicable	No	Not Applicable	No change
Local Views					
Properties	Yes	Not Applicable	Yes	Not Applicable	No change
Minor Roads	No	Not Applicable	No	Not Applicable	No change
Cumulative Effects					
Landscape Character	No	Not Applicable	No	Not Applicable	No change
Designated Areas	No	Not Applicable	No	Not Applicable	No change
Views	No	Not Applicable	No	Not Applicable	No change

6 NOISE

6.1 Introduction

This chapter of the ES evaluates the effects of the Development on nearby noise-sensitive receptors during construction, operation and decommissioning of the Development.

The aim of the assessment is to predict the potential levels of noise that would arise from the Development at the nearest noise sensitive receptors and assess these against relevant standards and guidelines. Note that only the effects of onshore noise on human receptors are assessed in this chapter. The effects of offshore noise on ecological receptors are addressed in Chapter 7: *Ecology* of this ES.

The chapter is structured as below:

- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Turbine Noise Emissions;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment; and
- Statement of Significance.

A glossary of acoustic terminology and a definition of terms are contained at the end of this chapter.

6.2 Assessment Methodology and Significance Criteria

6.2.1 Relevant Guidance and Legislation

The following guidance and information sources have been considered in carrying out the operational noise assessment:

- The Scottish Government's web-based planning information on onshore wind turbines (revised January 27 2012)[1];
- Planning Advice Note 1/2011 (PAN 1/2011): Planning and Noise[2];
- 'ETSU-R-97: The Assessment and Rating of Noise from Wind Farms[3]' (ETSU-R-97); and
- 'Bowdler et al. (2009): Prediction and Assessment of Wind Turbine Noise[4]'.

Relevant Development Plan and other planning policies are set out in Chapter 4: *Planning Policy* of this ES.

6.2.1.1 Scottish Government Planning Information on Onshore Wind

The former Planning Advice Note 45 (PAN 45): Renewable Energy Technologies has been replaced with web-based information which provides advice to local authorities on the planning issues associated with wind farm development. With regard to noise from wind farms, it states that ETSU-R-97: The Assessment and Rating of Noise from Wind Farms:

"...describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to asses and rate noise from wind energy developments, until such time as an update is available. This gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable burdens on wind farm developers, and suggests appropriate noise conditions."

[1] http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/themes/renewables/Onshore.
[2] Planning Advice Note 1/2011: Planning and Noise, The Scottish Government, March 2011.
[3] ETSU for the DTI (1996) ETSU-R-97: The Assessment and Rating of Noise from Wind Farms.
[4] IOA Bulletin Article (Bowdler *et al.*). (2009) Prediction and Assessment of Wind Turbine Noise: Agreement about relevant factors for noise assessment from wind energy projects. Acoustic Bulletin, Vol 34 No2 March/April 2009, Institute of Acoustics.

The information goes on to refer to Circular 10/1999 (now superseded) as setting out Government policy on the role of the planning system in controlling noise, and states that the PAN on Planning and Noise provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise.

It also states that:

"The most conclusive summary of the implications of low frequency wind farm noise for planning policy is given by the UK Government's statement regarding the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise. The report concludes that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines."

6.2.1.2 PAN 1/2011: Planning and Noise

PAN 1/2011 supersedes Circular 10/1999 Planning and Noise and PAN 56: Planning and Noise and provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. It promotes the principles of good acoustic design and the appropriate location of new potentially noisy development. An associated Technical Advice Note offers advice on the assessment of noise impact and includes details of the legislation, technical standards and codes of practice appropriate to specific noise issues.

Appendix 1 of the Technical Advice Note: Assessment of Noise describes the use of ETSU-R-97 in the assessment of wind turbine noise. It also makes reference to the advice contained in Bowdler *et al*. (2009).

6.2.1.3 ETSU-R-97

ETSU-R-97 provides a framework for the assessment and rating of noise from wind turbine installations. It has become the accepted standard for wind farm developments in the UK, and the methodology has therefore been adopted for the present assessment.

Both background noise and noise from wind turbines typically vary with wind speed. According to ETSU-R-97, wind farm noise assessments should therefore consider the site-specific relationship between wind speed and background noise, along with the particular noise emission characteristics of the proposed wind turbines.

ETSU-R-97 specifies the use of the $L_{A90,10min}$ descriptor for both background and wind turbine noise. Therefore, unless otherwise specified, all references to noise levels within this chapter relate to this descriptor. Similarly, all wind speeds referred to relate to a height of 10 m above ground level (AGL) standardised in accordance with Bowdler *et al*. (2009) or BS EN 61400-11:2003[5] as appropriate, unless otherwise stated.

The document recommends the application of external noise limits at the nearest noise-sensitive properties, to protect outside amenity and prevent sleep disturbance inside dwellings. These limits take the form of a 5 dB margin above the prevailing wind speed-related background noise level, except where background noise levels are lower than certain thresholds, where fixed lower limits apply. Separate limits apply for quiet day-time and night time periods, as outlined below.

During daytime, the guidance prioritises the protection of outdoor amenity for residents, by applying noise limits that would not significantly affect the enjoyment of areas such as gardens, with the limits based on the prevailing, wind speed-related background noise level for 'quiet daytime' periods. Quiet daytime is defined in ESTU-R-97 as:

- 18:00 – 23:00 every day;
- 13:00 – 18:00 on Saturday; and
- 07:00 – 18:00 on Sundays.

ETSU-R-97 recommends that the fixed lower noise limit for daytime should be set within the range 35 to 40 dB, LA90,10min, with choice of value dependent on the following factors:

[5] BS EN (IEC) 61400-11:2003 Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques.

- The number of dwellings in the neighbourhood of the wind farm;
- The effect of the noise limits on the number of kWh (kilo Watt hours) generated; and
- The duration and level of exposure.

Different standards apply at night, where potential sleep disturbance is the primary concern rather than the requirement to protect outdoor amenity. Night time is considered to be all periods between 23:00 and 07:00. A limit of 43 dB(A) is recommended for night time at wind speeds or locations where the prevailing wind speed-related night-time background noise level is lower than 38 dB(A). At other times, the limit of 5 dB above the prevailing wind speed-related background noise level applies. The value of night-time fixed lower limit was selected in order to ensure that internal noise levels remained below those considered to have the potential to cause sleep disturbance, taking account of the attenuation of noise when passing from outdoors to indoors, and making allowance for the presence of open windows.

There is also provision for an increase in the fixed lower limit value where the occupier of the property has a financial interest in the Development. ETSU-R-97 recommends:

"that both day and night-time lower fixed limits can be increased to 45 dB(A) and that consideration should be given to increasing the permissible margin above background where the occupier of the property has some financial involvement in the wind farm".

The noise limits specified in ETSU-R-97 relate to the cumulative effect of noise from all turbines that affect a particular location. Any existing wind turbines should not be considered as a part of the prevailing background noise level.

6.2.1.4 Prediction and Assessment of Wind Turbine Noise

Bowdler *et al*. (2009) sets out a number of preferred procedures for the prediction and assessment of wind farm noise and the form in which certain information should be presented to support an environmental noise assessment for a proposed windfarm development. The authors included members of the Noise Working Group responsible for the preparation of ETSU R 97, and include those who represent developers, local authorities and third party interests. The recommendations are intended to enhance the quality of wind farm noise assessments and usefully limit areas of disagreement between parties acting for developers and those acting for objectors, and supplement the recommendations of ETSU-R-97.

Whilst this guidance does not have the status of official government guidance or policy, it is generally agreed to represent a statement of best practice on the specific aspects of wind farm noise assessments which it addresses.

The following issues were addressed:

- The acquisition of baseline data;
- The prediction of wind turbine noise immission[6] levels at receptors locations; and
- The significance of low-frequency noise, infrasound and ground-borne vibration.

Acquisition and Analysis of Baseline Noise Data

The recommendations of Bowdler *et al*. (2009) relate principally to the measurement and use of wind speed data, against which background noise measurements are correlated. It recommends measuring wind speeds at two heights; H1 and H2, H1 being not less than 60% of the proposed turbine hub height and H2 being between 40% and 50% of the proposed hub height. For each 10-minute interval the mean wind speed measured at height H1 should be corrected to hub height using a specified procedure, which takes account of the wind shear conditions occurring during that 10-minute interval. A standardised 10 m height wind speed is then calculated from this hub height wind speed using the procedure specified in BS EN 61400-11:2003 Section 8.1, which applies a standardised wind shear profile. This allows for the elimination of the effects of variations in the wind shear characteristics of the site of the proposed turbines and the site on which noise emissions were measured.

[6] Literally means incoming noise, i.e., the noise levels at receptor locations.

Prediction of Wind Turbine Noise Immission Levels

Bowdler *et al*. (2009) recommend the use of the ISO 9613-2[7] method in calculating the levels of wind turbine noise at receptor locations ('immission levels'), with the following specific measures:

- The turbine sound power levels should be stated, along with whether these are measured levels, measured levels with an allowance for measurement uncertainty, warranted levels or generic levels;
- The atmospheric conditions assumed should be stated, with 10°C and 70% relative humidity preferred;
- The ground factor assumed should be either:
  (i) G=0 (hard ground), together with measured sound power levels; or
  (ii) G=0.5 (mixed ground); together with a receiver height of 4.0 m; and manufacturer's warranted sound power levels, or measured sound power levels plus an allowance for measurement uncertainty;
- Barrier attenuation should not be included; and
- The predicted noise levels (LAeq,t) may be converted to the required LA90,10min by subtracting 2 dB.

The above advice has been applied in this assessment. Section 6.4 details the turbine sound power levels used in the assessment and the assumptions made in the calculation of predicted noise immission levels.

ISO 9613-2 provides a prediction of noise levels likely to occur under worst-case conditions; those favourable to the propagation of sound, i.e., down-wind or under a moderate, ground-based temperature inversion as often occurs at night (often referred to as stable atmospheric conditions). The specific measures recommended in Bowdler *et al*. (2009) have been shown to provide good correlation with levels of wind turbine noise measured at operational windfarms[8].

Low-frequency Noise, Infrasound and Ground-borne Vibration

Bowdler *et al*. (2009) conclude that:

"...there is no robust evidence that low frequency noise (including 'infrasound') or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours".

There is therefore considered to be no need to specifically address these issues in this ES.

6.2.1.5 *Low Frequency Noise*

A study[9], published in 2006 by Hayes McKenzie on the behalf of the DTI, investigated low frequency noise from wind farms. This study concluded that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines, but that complaints attributed to low frequency noise were in fact due to a phenomenon known as Amplitude Modulation (AM).

6.2.1.6 *Research into Amplitude Modulation (AM)*

A further study[10] was carried out on behalf of the Department for Business, Enterprise and Regulatory Reform (BERR) by the University of Salford, which investigated the incidence of noise complaints associated with wind farms and whether these were associated with AM. This report defined AM as aerodynamic noise from wind turbines with a greater degree of

[7] ISO (1996).ISO 9613-2:1996 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation.
[8] Bullmore *et al*.(2009). Wind Farm Noise Predictions and Comparison with Measurements, Third International Meeting on Wind Turbine Noise, Aalborg, Denmark 17 – 19 June 2009.
[9] The measurement of low frequency noise at three UK wind farms', Hayes Mckenzie, The Department for Trade and Industry, URN 06/1412, 2006.
[10] The measurement of low frequency noise at three UK wind farms', Hayes Mckenzie, The Department for Trade and Industry, URN 06/1412, 2006.

fluctuation than normal at blade passing frequency. Its aims were to ascertain the prevalence of AM on UK wind farm sites, to try to gain a better understanding of the likely causes, and to establish whether further research into AM is required.

The study concluded that AM has occurred at only a small number (4 of 133) of wind farms in the UK, and only for between 7% and 15% of the time. It also states that, at present, the causes of AM are not well understood and that prediction of the effect is not currently possible. BERR has decided against conducting further research into the phenomenon, and as such no revision to the current guidelines (ETSU-R-97) on wind farm noise assessment has been recommended.

Renewable UK is currently conducting research into AM, with the objectives of identifying its causes, establishing a dose-response relationship, developing measurement and assessment techniques and drafting sample planning conditions. The study is expected to report in Summer 2012.

6.2.1.7 Vibration

Research undertaken by Snow in 1996[11] found that the level of ground-borne vibration at a distance of 100 m from an operational wind turbine was significantly below criteria for 'critical working areas' given by British Standard BS6472:1992 Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz), and was lower than limits specified for residential premises by an even greater margin.

Ground-borne vibration from wind turbines can be detected using sophisticated instruments several kilometres from the wind farm site as reported by Keele University[12]. This report clearly shows that, although detectable using highly sensitive instruments, the magnitude of the vibration is orders of magnitude below the human level of perception and does not pose any risk to human health or the integrity of built structures at any distance from the turbines.

6.2.1.8 Application of ETSU-R-97

A recent study[13] by Hayes McKenzie Partnership of behalf of the Department for Energy and Climate Change (DECC) investigated the ways in which ETSU-R-97 has been applied in wind farm noise assessments in England in recent years. It identified several areas in which additional guidance on best practice would be helpful, but made no specific recommendations regarding assessment methods.

6.2.1.9 Wind Farm Noise and Nuisance

A report[14] was recently published by the Department for Environment, Food and Rural Affairs (DEFRA) concerning methods of assessing nuisance resulting from noise from wind farms or wind turbines. Nuisance is dealt with under a separate regime to the planning system and so this report is not of direct relevance. However, a well-designed wind farm that operates within the recommendations of ETSU-R-97 should not result in a noise nuisance.

6.2.1.10 Significance Criteria

ETSU-R-97 does not define criteria for whether effects should be considered significant or not, but rather what levels of wind farm noise should be considered to be acceptable, whilst acknowledging the need to strike a balance between the need to protect amenity of surrounding residences and the wider benefits associated with the generation of renewable energy. In drawing conclusions from this assessment for the purposes of EIA, predicted noise

[11] ETSU (1997), Low Frequency Noise and Vibrations Measurement at a Modern Wind Farm, prepared by D J Snow.
[12] Microseismic and infrasound monitoring of low frequency noise and vibrations from wind farms: recommendations on the siting of wind farms in the vicinity of Eskdalemuir, Scotland". Keele University, 2005.
[13] Hayes McKenzie Partnership on behalf of DECC, Research Contract 01.08.09.01/492A, Analysis of How Noise Impacts are Considered in the Determination of Wind Farm Planning Applications, HM: 2293/R1, 6th of April 2011.
[14] AECOM, Wind Farm Noise Statutory Nuisance Complaint Methodology, Report Preapred for Defra: Contract No. NANR 277, 6th of April 2011.

levels deemed acceptable under ETSU-R-97 are regarded as not significant in terms of the EIA Regulations[15].

6.2.2 Consultation

A Scoping Report was issued to Marine Scotland in February 2012 of which Marine Scotland and Fife Council provided responses in relation to noise. These responses are summarised below in Table 6.1.

Table 6.1: Scoping Responses

Consultee	Comments	Response
Marine Scotland	Suggests construction noise will need to be restricted by carrying out work between the hours of 8am – 7pm. Operational noise from the turbine will have no detrimental effect on local residents.	Section 6.5.2 details measures to be employed to minimise noise during construction including the willingness to accept a condition relating to working hours. Section 6.4 details the ability of the site to operate in accordance with the applicable noise levels as detailed in Table 6.3.
Fife Council	The approach detailed within the Scoping Report is acceptable.	The approach has been applied throughout this assessment. Further specific consultation with Fife Council's Environmental Services Department has been undertaken in preparing the application as outline below.

Consultation was carried out with Fife Council's Environmental Services Department to establish and agree upon appropriate noise limits to be applied to the Development through planning conditions. Noise data obtained for the previously Consented Development (detailed in Table 6.2) was agreed to be suitable for use in this assessment and was used from publically available sources. The associated noise limits have therefore been adopted for the purpose of this assessment.

6.2.3 Operational Noise Assessment Methodology

In summary, the assessment process for operational noise comprises:

- Identification of potential receptors, i.e. houses and other potentially noise-sensitive locations;
- Measurement of existing (baseline) background noise levels at a representative selection of the potential receptors;
- Establishment of limits for acceptable levels of wind turbine noise at residential receptors, based on the measured background noise and as specified in ETSU-R-97;
- Prediction of the likely levels of wind turbine noise received at the most sensitive receptors; and
- Comparison of the predicted levels with the noise limits.

6.2.4 Construction Noise

6.2.4.1 Relevant Guidance

The following legislation, guidance and standards are of particular relevance to construction noise:

- The Control of Pollution Act 1974 (CoPA 1974);
- The Environmental Protection Act 1990 (as amended); and
- BS 5228:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites.

[15]The Town and Country Planning (Environmental Impact Assessment) Regulations 2011.

6.2.4.2 The Control of Pollution Act (CoPA) 1974

CoPA 1974 provides Local Authorities in England, Scotland and Wales with powers to control noise and vibration from construction sites.

Section 60 of the Act enables a Local Authority to serve a notice to persons carrying out construction work of its requirements for the control of site noise. This may specify plant or machinery that is or is not to be used, the hours during which construction work may be carried out, the level of noise or vibration that may be emitted, and provide for changes in circumstances. Appeal procedures are available.

Section 61 of the Act allows for those carrying out construction work to apply to the Local Authority in advance for consent to carry out the works. This is not mandatory, but is often to the advantage of the developer, as once consent is issued, the Local Authority is no longer able to take action under Section 60 of CoPA 1974 or Section 80 of the Environmental Protection Act (EPA) 1990. It does not, however, prevent nuisance action under Section 82 of the EPA 1990. The application is expected to give as much detail as possible about the works to be carried out, the methods to be used and the measures that will be taken to minimise noise and vibration.

6.2.4.3 The Environmental Protection Act 1990 (as amended)

The Environmental Protection Act 1990 (as amended) specifies the duties of and powers available to Local Authorities in respect of any noise that either constitutes or is likely to cause a statutory nuisance, which is also defined in the Act. A duty is imposed on Local Authorities to carry out inspections to identify statutory nuisances, and to serve abatement notices against these. Procedures are also specified with regards to complaints from persons affected by a statutory nuisance.

BS 5228:2009 Code of Practice for Noise and Vibration Control on Construction and Open sites

BS 5228:2009 supersedes the previous version of the Standard, issued in 1997, and is published in two parts: Part 1- Noise and Part 2- Vibration. The discussion below relates mainly to Part 1- Noise, however, the recommendations of Part 2 in terms of vibration are broadly very similar.

It refers to the need for the protection against noise and vibration of persons living and working in the vicinity of and those working on construction and open sites. It recommends procedures for noise and vibration control in respect of construction operations.

The Standard stresses the importance of community relations, and states that early establishment and maintenance of these relations throughout the carrying out of site operations will go some way towards allaying people's concerns. In terms of neighbourhood nuisance, the following factors are likely to affect the acceptability of construction noise:

- Site location, relative to the noise sensitive premises;
- Existing ambient noise levels;
- Duration of site operations;
- Hours of work;
- The attitude of local residents to the site operator; and
- The characteristics of the noise produced.

Recommendations are made regarding the supervision, planning, preparation and execution of works, emphasising the need to consider noise at every stage of the operation.

Measures to control noise are described, including:

- Control of noise at source by, for example:
    - Substitution of plant or activities by less noisy ones;
    - Modification of plant or equipment to reduce noise emissions;
    - The use of noise control enclosures;
    - The siting of equipment and its method of use;
    - Equipment maintenance; and

- Controlling the spread of noise, e.g., by increasing the distance between plant and noise-sensitive premises or by the provision of acoustic screening.

Another key revision to the standard is the inclusion of a discussion of noise control targets, and example criteria for the assessment of the significance of noise effects. These are not mandatory.

Methods of calculating the levels of noise resulting from construction activities are provided, as are updated source levels for various types of plant, equipment and construction activities.

6.2.4.4 Construction Noise Assessment Methodology

Due to the nature of the Development site (i.e. an industrial site subject to 24-hour heavy industrial activity), surrounding area (a built-up area with relatively high background noise levels) and the limited duration of construction, it is not considered necessary to carry out a detailed assessment of construction noise. Rather, it is proposed that construction noise is managed through planning conditions restricting hours of working, and the implementation of good practice measures as recommended by BS 5228-1:2009, examples of which are included in Section 6.5.2 Construction Noise Mitigation.

6.3 Baseline Conditions

6.3.1 Existing Background Noise Data

Publically available background noise measurements undertaken for the Consented Development (Arcus, 2010) at the closest noise sensitive properties have been used to inform this assessment. This approach was agreed with the Environmental Services Department at Fife Council in February 2012.

Background noise levels were therefore established from measurements undertaken in 2010 at three properties, in accordance with ETSU-R-97 and current best practice guidelines detailed in Bowdler e*t al.* (2009), the locations of which are detailed in Figure 6.1.

During the previous noise survey conducted in 2010, hub height (108.5 m AGL) wind speeds were calculated from 51 m[16] and 70 m wind speeds, and these were used to derive 10 m wind speeds, using the procedure specified in Section 6.4. Noise measurements from each monitoring location were correlated with these derived 10 m wind speeds. Whilst it is acknowledged that the proposed hub height of 110 m for the Development is slightly greater than that for the previous application, it is considered that the effect upon the relationship between background noise and wind speed would be negligible and the data is therefore suitable for use in this assessment.

Table 6.2 details the background noise levels for each for the assessment locations.

Table 6.2: Prevailing Background Noise Levels and Noise Limits

Location	Period	Standardised 10 m Wind Speed, ms^{-1}											
		1	2	3	4	5	6	7	8	9	10	11	12
		Prevailing Background Noise Level, dB, $L_{A90,10min}$											
1	Day	39.0	39.0	39.0	39.0	39.1	39.8	41.3	43.8	43.8	43.8	43.8	43.8
	Night	36.4	36.4	36.4	36.4	36.4	37.4	39.5	42.2	44.9	46.6	46.2	46.2
2	Day	35.5	36.4	36.5	36.3	36.5	37.7	40.1	42.9	42.9	42.9	42.9	42.9
	Night	30.7	30.7	30.7	30.7	30.7	32.2	34.9	38.4	41.7	44.1	44.9	44.9
3[17]	Day	33.9	33.9	33.9	33.9	33.9	33.9	36.2	39.1	39.1	39.1	39.1	39.1

[16] Although this is slightly less than the 50% of hub height recommended in the IOA Bulletin article, the difference would not significantly affect the results.

[17] Background noise data measured at Position 3 represent those used in the previous application and excludes measurements taken close to a hedge which resulted in higher noise levels.

	Night	31.1	31.1	31.1	31.1	31.0	32.0	34.0	36.6	39.2	41.0	41.0	41.0

6.3.2 Noise Limits

As the use of the existing background noise data for this assessment has been agreed by the Environmental Services Department of Fife Council, the derived noise limits are equal to those presented in the Consented Development, based upon a lower fixed daytime limit of 35 dB(A). Table 6.3 details the limits derived from the prevailing background noise levels.

Table 6.3: Derived Noise Limits

Location	Period	Standardised 10 m Wind Speed, ms^{-1}											
		1	2	3	4	5	6	7	8	9	10	11	12
		Noise Limit, dB, $L_{A90,10min}$											
1	Day	44.0	44.0	44.0	44.0	44.1	44.8	46.3	48.8	48.8	48.8	48.8	48.8
	Night	43.0	43.0	43.0	43.0	43.0	43.0	44.5	47.2	49.9	51.6	51.2	51.2
2	Day	40.5	41.4	41.5	41.3	41.5	42.7	45.1	47.9	47.9	47.9	47.9	47.9
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.4	46.7	49.1	49.9	49.9
3	Day	38.9	38.9	38.9	38.9	38.9	38.9	41.2	44.1	44.1	44.1	44.1	44.1
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	46.0	46.0	46.0

6.4 Turbine Noise Emissions

As described in Chapter 3: *Project Description* of this ES, the Development will consist of a single wind turbine with a maximum hub height of 110 m, and a maximum blade tip height of 196 m. The proposed location of the turbine is shown in Figure 6.1. Due to the nature of the Development, as a test facility for a new turbine design, the noise emission characteristics of the turbine cannot be confirmed at the time of writing.

However, based upon the noise limits derived for the most noise sensitive properties, the maximum permissible turbine noise emissions which would result in compliance have been calculated for operational wind speeds between 4 and 12 ms^{-1}.

ISO9613 calculations require the use of a noise spectrum, detailing the distribution of sound at different frequencies, as air absorption varies with frequency. Such spectra are expressed in octave bands (each octave change represents a doubling or halving of frequency). Expected octave band frequency data provided by a candidate turbine manufacturer for noise emissions at a wind speed of 12 ms^{-1} have been used to calculate a reference predicted noise level at receptors. Table 6.4 details this reference octave band spectrum.

Table 6.4: Calculated Octave Band Spectrum for Proposed Turbine

Octave Band Frequency, Hz	63	125	250	500	1k	2k	4k	8k
Sound Power Level, dB, L_{WA}	91.8	99.0	103.4	107.4	107.5	105.5	101.7	94.7

The reference octave band spectrum has been used to derive the maximum permissible noise emission levels at 10 m height integer wind speeds between 4 and 12ms^{-1}, as detailed in Table 6.5.

The maximum permissible sound power levels have been derived using a hard ground (G=0.0) factor as a conservative measure, and represent those which would be measured on site, in accordance with Bowdler *et al.* (2009).

Table 6.5: Maximum Permissible Sound Power Levels as a function of 10m Wind Speeds

Integer 10 m Wind Speed, ms^{-1}	3	4	5	6	7	8	9	10	11	12
Sound Power Level, dB, L_{WA},	108.9	108.9	108.9	108.9	110.5	111.8	114.1	114.1	114.1	114.1

Based upon typical noise emissions for a turbine of the scale proposed, it is considered that the maximum noise emissions detailed in Table 6.5 would be met by a range of commercially available large-scale offshore turbine models with similar dimensions to those proposed, without the requirement for restricted operation. The testing and certification process that will be undertaken as a part of the project will include measurement of noise emissions in accordance with IEC 61400-11. This will allow for the actual noise emission from the turbine to be quantified at an early stage of the Development and for compliance with the requirements of ETSU-R-97 to be verified. In the event that sound power levels are higher than those detailed in Table 6.5, adjustments to turbine operational parameters (such as rotational speed and blade pitch settings) may be made to ensure compliance with the limits detailed in Table 6.3 and will result in effects which are considered to be not significant in terms of EIA regulations. Further details of such control measures are given in Section 6.5.1 Operational Noise Mitigation.

6.5 Mitigation Measures and Residual Effects

6.5.1 Operational Noise

During the testing and certification process to be carried out as a part of the Development, measurements of noise emissions from the turbine will be undertaken, in accordance with BS EN (IEC) 61400-11:2003. This will confirm the actual levels of noise emitted by the turbine in operation. Adjustments to the noise emission levels of a wind turbine are possible by manipulating operational parameters such as the rotational speed and blade pitch settings. In the event that incidences of higher than permitted noise were to occur, then such measures could be implemented during sensitive times (i.e. ETSU-R-97 quiet daytime and night-time periods) to ensure that compliance is achieved and the turbine noise emission levels do not exceed those detailed in Table 6.5.

It is anticipated that a more flexible approach may be appropriate during normal working hours, given that the purpose of the installation is to test and certify a new turbine design, that the chosen site is designated for the development of renewable energy industries, the existing industrial nature of the area and consequently elevated ambient noise levels. For example, there may be times when it is necessary for operational or testing reasons to operate the turbine in such a way as causes higher noise levels, or unexpected noise levels may occur due to unforeseen circumstances. Such circumstances would be limited as much as is reasonably practicable within the requirements to fully test the turbine, particularly in easterly winds when the turbine would be upwind of the nearest noise sensitive receptors.

6.5.1.1 Residual Operational Noise Effects

Implementation of the operational noise mitigation measures detailed above, if necessary, would ensure that noise immission levels comply with the requirements of ETSU-R-97 or do not constitute a statutory nuisance, as appropriate, and therefore the effects of noise as a result of operation are considered to be not significant.

6.5.2 Construction Noise

It is anticipated that planning conditions specifying restrictions to the hours of working i.e. 8am to 7pm, would provide sufficient management of construction noise. The best practice measures detailed below represent examples of additional good practice that would be employed to minimise the effects of construction noise on nearby receptors:

- The site contractors shall publicise the construction programme (e.g. in local newspapers, through mailings to local residents, through an on-site information board

at the site access, and on the developer's website) for the commencement and duration of operations, and named contacts for daytime and out of hours;
- The contractors shall be required to select the quietest item of suitable plant available for all site operations where practicable;
- Phasing of the work programme to reduce the combined effects arising from several noisy operations;
- Where necessary and practicable, containing noise from fixed plant and equipment within suitable acoustic enclosures or behind acoustic screens;
- Requiring all sub-contractors appointed by the main contractor to be formally and legally obliged, through contract, to comply with all environmental noise conditions; and
- Where practicable, night time working will not be carried out. However, any plant and equipment required for operation at night (23:00 - 07:00) shall be mains electric powered where practicable. Any night-time lighting rigs, pumps or other equipment shall be powered using mains electricity or silenced and suitably shielded to ensure compliance with World Health Organisation (WHO) night-time noise criteria at the nearest residential properties, assuming open windows.

Notwithstanding the above, the Control of Pollution Act 1974 provides additional mechanisms for controlling noise from construction activities, including pre-application by the developer under Section 61 for consent to carry out the works, or action by the Local Authority under Section 60 to halt work or to specify noise-control measures that should be employed.

Similar measures would be employed during the decommissioning of the Development at the end of the 5 year operational lifespan.

6.5.2.1 Residual Construction Noise Effects

Application of the above measures to manage construction noise will ensure that effects are minimised as far as is reasonably practicable and that the construction and relocation process is operated in compliance with the relevant legislation. The effects of noise from construction activities are therefore considered to be not significant.

6.6 Cumulative Effects Assessment

The closest turbine to the Development is that which is located at Methil Docks. Due to the distance between this turbine and the Development (1.7 km), and taking into consideration the effect of wind direction on noise propagation, the likelihood of noise from both turbines simultaneously affecting a particular location to such a degree that ETSU-R-97 limits would be exceeded is considered to be low. Operation of the development's cumulatively within the required noise limits is considered acceptable and therefore not significant.

6.7 Statement of Significance

An assessment of noise from the operation of the proposed Development has been carried out.

Baseline background noise levels at the nearest noise-sensitive receptors have been established. Based upon the noise limits derived in accordance with ETSU-R-97, maximum permissible turbine noise emission levels which would ensure compliance with the requirements of ETSU-R-97 have been established. Whilst the turbine noise emissions cannot be confirmed at the time of writing, compliance with the maximum permissible noise emission levels could be achieved with a range of commercially available offshore wind turbines of a scale similar to that proposed.

Mitigation measures have been identified that would ensure compliance in the event that noise immission levels at the closest noise sensitive receptors are greater than the limits detailed in Table 6.3. In the event that noise emissions from the turbine results in a breach of noise limits or constitutes a statutory nuisance, the Applicant is committed to complying with any noise requirements imposed on the Development. Therefore, based upon the noise limits derived in accordance with ETSU-R-97 and the control measures identified in order to

ensure compliance, the effects of noise from operation of the turbine are considered to be not significant.

Noise during construction and relocation of the turbine will be addressed through the application of planning conditions restricting hours of working and the use of good practice measures. Effects of noise from activities associated with construction are therefore considered to be not significant.

6.8 Glossary of Acoustic Terminology

The following items of acoustic terminology may have been referred to in the preceding chapter. Terms in italics are defined elsewhere in the glossary.

AGL: Above Ground Level

Background Noise: The background noise level is the under lying level of noise present at a particular location for the majority (usually 90%) of a period of time. As such it excludes any short-duration noises, such as individual passing cars (but not continuous traffic), dogs barking or passers-by. Sources of background noise typically include such things as wind noise, traffic and continuously operating machinery (e.g. air conditioning or generators).

Decibel (dB): The decibel is the basic unit of noise measurement. It relates to the pressure created by the sound (Sound Pressure) and operates on a logarithmic scale, ranging upwards from 0dB. 0dB is equivalent to the normal threshold of hearing at a *frequency* of 1000Hz (20 micro Pascals). Each increase of 3dB on the scale represents a doubling in the Sound Pressure, and is typically the minimum noticeable change in environmental sound level under normal listening conditions. For example, while an increase in noise level from 32dB to 35dB represents a doubling in sound pressure, this change would only just be noticeable to the majority of listeners.

dB(A): Environmental noise levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible *frequencies*. The ear is most sensitive in the middle range of frequencies (around 1000-3000 Hertz (Hz)), and less sensitive at lower and higher frequencies. The A-weighted noise level is derived by analysing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out automatically within noise measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

Emission: The sound given (emitted) out by a source.

Frequency: The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are Hertz (Hz), which represents the number of cycles (vibrations) per second.

Immission: The sound arriving at a particular location, e.g. a *noise sensitive receptor.*

$LA_{90,t}$: This term is used to represent the *A-weighted* sound pressure level that is exceeded for 90% of a period of time, t. This is used as a measure of the *background noise* level.

$LA_{eq,t}$: This term is known as the *A-weighted* equivalent, continuous sound pressure level for a period of time, t. It is similar to an average, and represents the sound pressure level of a sound of continuous intensity that would result in an equal quantity of sound energy as a sound which varies in intensity.

Low frequency noise: Noise at the lower end of the range of audible frequencies (20Hz – 20kHz). Usually refers to noise below 250Hz. Should not be confused with infrasound, which is sound below the lowest audible frequency, 20Hz.

Noise: Unwanted sound. May refer to both natural (e.g. wind, birdsong etc) and artificial sounds (e.g. traffic, noise from wind turbines, etc)

Noise sensitive receptors: Locations that may potentially be adversely affected by the addition of a new source of noise. Can include residential properties, outdoor areas and sensitive species.

Sound power (W): The sound energy radiated per unit time by a sound source, measured in watts (W).

Sound power level (L_w): Sound power measured on the decibel scale, relative to a reference value (W_o) of 10^{-12}W.

Sound pressure (P): The fluctuations in atmospheric pressure relative to atmospheric pressure, measured in Pascals (Pa).

Sound pressure level (L_p): Sound pressure measured on the decibel scale, relative to a sound pressure of 2×10^{-5} Pa (20 micro Pascals).

Vibration: In this context, refers to vibration carried in structures such as the ground or buildings, rather than airborne noise.

Wind Shear: The variation in wind speed with height above ground.

7 ECOLOGY

7.1 Introduction

This chapter of the ES identifies and evaluates the effects of the Development on habitats and species arising from construction, operation and decommissioning phases. An assessment of effects on birds is addressed separately in Chapter 8: *Ornithology*.

The chapter is structured as below:

- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Valued Ecological Receptors;
- Embedded Mitigation;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Summary of Effects;
- Cumulative Effect Assessment; and
- Statement of Significance.

This chapter is supported by Technical Appendix 7.1 Ecology Survey Results.

Where applicable the application documents for the Consented Development[1] are referred to throughout this chapter.

7.2 Scoping and Consultation

A Scoping Report was issued to Marine Scotland in February 2012 of which Scottish Natural Heritage (SNH), Marine Scotland, and the Scottish Environmental Protection Agency (SEPA) provided responses in relation to ecology. These responses are summarised below in Table 7.1.

Table 7.1: Consultation Responses

Consultee	Comments	Response
SNH	Stated that the location of natural and manmade habitats should be clearly mapped. Details of construction methods should be provided and baseline data for marine mammals should also be presented. SNH also stated that best practice methods should be followed throughout construction works and a Marine Mammal Observer (MMO) should be present during works.	The distribution of man-made and natural habitats are provided within Figure 7.2. Details of construction methods are provided within Chapter 3 Project Description. The results of a detailed desk study for marine mammals, including cetacean sightings and seal haul-out sites, are presented in Technical Appendix 7.1. Section 7.1.8.3 specifies that best practice methods will be implemented and a MMO will be present throughout works.
Marine Scotland	Generally in agreement with the ecological content of the scoping report, but also recommend that pre-installation and possibly post-installation surveys for habitats and protected species are completed.	Pre- and post-installation benthic surveys will be undertaken. Surveys for other habitats (including onshore, intertidal and subtidal) are not considered to be necessary given the very low ecological value of such habitats comprising disturbed bare ground and artificial shore. It is proposed to undertake pre-installation protected species surveys as detailed within section 7.8.
SEPA	Request clarification on the size of turbine foundations and state that effects on habitats should be fully	Full details of the size of the turbine and all associated infrastructure is provided within Chapter 3 Project Description.

[1] Arcus, Methil Offshore Demonstration Wind Turbine, April 2010

Consultee	Comments	Response
	considered. SEPA also request that a condition requiring the developer to draw up a method statement to remove the risk of introducing marine non-native species.	Effects on habitats are fully assessed within this chapter section 7.1.7. It can be confirmed that best practice working methods and guidance will be adhered to throughout construction works to minimise the risk of introducing marine non-native species.
Inshore Fisheries Group (South East)	Commented that laying of cables from the proposed offshore developments to the onshore infrastructure will cause disruption to fishing activities. Notes the lack of data on the effects of offshore developments on fish, shellfish, cephalopods, crustaceans and bivalves. Suggested a study pre-development, during construction and during operation to advise further.	The cables for the turbines will be attached to the connecting bridge above the water and will not be laid on the sea bed. Given the close proximity of the turbine location to the shore, and its location in the intertidal area this is not anticipated to disrupt fishing activities. Due to the near shore, inter tidal location of the turbine this development would not present representative data which is applicable to development in the further offshore environment.

7.3 Assessment Methodology and Significance Criteria

7.3.1 Legislative Background

The following guidance, legislation and policies have been considered during the assessment:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna ("Habitats Directive");
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- The Conservation of Habitats and Species Regulations 2010, relating to reserved matters in Scotland;
- The Wildlife and Countryside Act 1981 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2004;
- Nature Conservation (Scotland) Act 2004 (as amended);
- The Protection of Badgers Act 1992;
- Marine (Scotland) Act 2010;
- The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2011 (where applicable) relating to projects being developed in the marine environment
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended by The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008 (where applicable) relating to the development of energy generating projects;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011) relating to projects falling under the Town and Country Planning regime (landward of the MLWS);
- Scottish Planning Policy; and
- Planning Advice Note (PAN) 60 Planning for Natural Heritage 2000.

7.3.2 Survey Area

The ecology survey area is shown in Figure 7.2. This area was designed to allow an assessment of the status and distribution of species and habitats potentially affected by the Development. For the purposes of the assessment of effects on habitats and species, this study area is also considered to be the potential zone of influence of the Development. A

desk study was undertaken to collate available ecological information within the local area and covered a maximum radius of 10 km from the Development site.

The 'Development site' refers to the footprint of the Development, including all associated infrastructure and turbines.

7.3.3 Baseline Methods: Desk Study

A detailed desk study was undertaken for the Consented Development. Publically available supporting information from this application (Arcus, 2010) has been used to inform this desk study including records of otter and marine mammals within a search radius of 2 km and 10 km, respectively, from Fife Records Centre.

Additionally, an updated data search of the following sources was undertaken, including a 2 km search radius for otter and a 10 km search radius for marine mammals and notable migratory/marine fish species:

- Scottish Natural Heritage[2]; and
- National Biodiversity Network Gateway[3].

The Scottish Government Consultation on Seal Haul-out Sites Document[4] was also consulted for any potential seal haul-out sites located within 10 km of the Development site.

7.3.4 Baseline Methods: Field Survey

7.3.4.1 Habitats

An initial Phase 1 habitat survey was undertaken to inform the Consented Development on 12 February 2010. This survey was updated with specific regard to this Development on 14 March 2012.

The survey was conducted in accordance with standard methods[5]. The survey assessed and classified the semi-natural habitats within the survey area and recorded the vascular plants of each habitat type following recognised nomenclature[6]. All habitats, with their dominant plant species codes, were mapped in the field on to large-scale maps. The survey also sought to determine the presence/absence of non-native, invasive marine species and controlled botanical species (e.g. Japanese knotweed) listed in Schedule 9 Part II of the Wildlife and Countryside Act 1981, as amended. The survey took place outside of the optimum survey period (April–September) but, given the types of habitats recorded on the site, the classification and assessment of the habitats and their constituent species is considered robust.

Given the scale and location of the Development, detailed surveys of the local littoral and benthic habitats and communities were not considered necessary. A benthic survey will be undertaken pre and post construction (Section 7.1.8.1).

7.3.4.2 Fauna

An otter survey was undertaken on 12 February 2010 to inform the Consented Development. This survey methodology was repeated on 14 March 2012 including a detailed search of the Development site and a 250 m buffer for field signs of otter following standard methods[7]. The potential for habitats and features within the survey area to support other protected or notable fauna was assessed during the survey.

[2] www.snh.org.uk/snhi [accessed on 22 January 2012]
[3] NBNGateway 2008 National Biodiversity Network Gateway website online search facility, www.searchnbn.net [accessed on 22 January 2012]
[4] Scottish Government, Consultation on Seal Haul-out Sites, March 2011
[5] Joint Nature Conservation Committee (2003) Handbook for Phase 1 habitat survey – a technique for environmental audit. Peterborough: JNCC.
[6] Botanical Society of Great Britain (BSBI) principally following Kent (1991) and Stace (1997). For simplicity, only the common names of plant species, where available, have been used in this report.
[7] Chanin, P. (2003) Monitoring the Otter (Lutra lutra). Conserving Natura 2000 Rivers Monitoring Series No. 10, Peterborough: English Nature.

Given the scale and location of the Development surveys for marine mammals or fisheries were not considered necessary.

7.3.5 Assessment Methodology and Significance Criteria

The approach taken to assess ecological effects follows the guidance document produced by the Institute of Ecology and Environmental Management (IEEM)[8]. These guidelines set out the process for assessment through the following stages:

- Describing the ecological baseline in the zone of influence through survey and desk study;
- Assigning a value to "Valued Ecological Receptors" (VERs) – these are the designated sites, habitats and species of highest ecological value present;
- Identifying and characterising the potential effects on these VERs based on the nature of construction, operation and decommissioning activities associated with the Development;
- Describing any mitigation, compensation and/or enhancement measures associated with the Development and assessing residual significance; and
- Identification of any monitoring requirements.

7.3.5.1 Evaluating Features of Ecological Interest

Value is defined on the basis of the geographic scale given in Table 7.2. Attributing a value to a receptor is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of a value level. For example, a Special Area of Conservation (SAC) designated under the Habitats Directive is explicitly of European (International) importance. For non-designated receptors, the use of guidelines such as the national guidelines for the selection of Sites of Special Scientific Interest (SSSI)[9] can be helpful in attributing a value to a receptor.

Note that some receptors, such as legally protected species, may be of insufficient ecological value to warrant consideration within the ecological impact assessment, but are instead considered in the context of legal and policy implications.

Table 7.2: Approach to Valuing Ecological Receptors

Level of Value	Examples
International	An internationally designated site (e.g. SAC), or site meeting criteria for international designations.
	Species present in internationally important numbers (>1% of biogeographic populations).
National	A nationally designated site (SSSI, or a National Nature Reserve (NNR)), or sites meeting the criteria for national designation.
	Species present in nationally important numbers (>1% UK population).
	Large areas of priority habitat listed on Annex I of the EC Habitats Directive and smaller areas of such habitat that are essential to maintain the viability of that ecological resource.
Regional	Species present in regionally important numbers (>1% of the Natural Heritage Zone population).
	Sites falling short of criteria for selection as a SSSI, but of greater than the local criteria below.
Local	Scottish Wildlife Trust Reserves, Local Nature Reserves that do not include features as described above.
	Areas of semi-natural ancient woodland smaller than 0.25 ha.
	Areas of habitat or species considered to appreciably enrich the ecological resource within the local context, e.g. species-rich flushes or hedgerows.

[8] IEEM (2006) Guidelines for Ecological Impact Assessment in the United Kingdom (version 7 July 2006)
[9] JNCC (1994) Guidelines for selection of biological SSSIs: bogs JNCC Peterborough

Level of Value	Examples
Negligible	Usually widespread and common habitats and species of limited ecological value.

Part of the process of attributing value to species involves defining the population to be valued and requires professional judgment in order to identify an ecologically coherent population against which effects on integrity can be assessed. For example, for wide-ranging species such as otter, it may be more appropriate to value the otter population in a whole catchment, whereas for more localised species, such as water vole, value may be attributed to groups of related colonies which function as a meta-population.

Socio-economic, cultural, and secondary/supporting values may be considered, where appropriate, but do not otherwise form a key part of this assessment.

7.3.5.2 Characterising Potential Ecological Effects

The magnitude of effects is predicted quantitatively where possible. Where this is not possible, a more qualitative approach is taken. Magnitude can be negative (very high, high, moderate, low or negligible) or positive. High magnitude effects could include large-scale permanent and/or high probability changes that affect the receptor's population or extent. Low magnitude effects would typically be small in scale or possibly temporary in their effect. The criteria used in this assessment for describing the overall magnitude of a potential effect are summarised in Table 7.3.

Table 7.3: Effect Magnitude

Effect Magnitude	Description
Very high negative	Total or almost complete loss of a receptor resulting in a permanent adverse effect on the integrity of the receptor. The conservation status of the receptor would be affected.
High negative	High effects may include those that result in large-scale, permanent changes in a receptor likely to change its ecological integrity. These effects are therefore likely to result in overall changes in the conservation status of the receptor.
Moderate negative	Moderate-scale permanent changes in a receptor, or larger-scale temporary changes, but the integrity of the receptor is not likely to be affected. This may mean that there are temporary changes in the conservation status of the receptor, but these are reversible and unlikely to be long-term.
Low negative	Effects that are small in magnitude, have small-scale temporary changes, and where integrity is not affected. These effects are unlikely to result in overall changes in the conservation status of the receptor.
Negligible	No perceptible change in the receptor.
Positive	Changes to the receptor are considered to be beneficial.

The assessment also takes into account whether the effect is positive or negative, short term (for example only during construction) or long term (throughout the lifetime of the Development), reversible or permanent.

It is also important to consider the degree of confidence in the assessment and to quantify the certainty of the impacts on the ecological resource. The following categories are used in this assessment:

- Certain/near certain: probability estimated at 95% or higher;
- Probable: probability estimated above 50% but below 95%;
- Unlikely: probability estimated at above 5% but less than 50%; and
- Extremely unlikely: probability estimated at less than 5%.

7.3.5.3 Determining Significance of Potential Ecological Effects

Having followed this process, the significance of an effect is then determined. The IEEM Guidelines use only two categories: "significant" or "not significant". A significant effect is

defined in ecological terms as an effect on the integrity or conservation status of a defined site, habitat or species. The significance of an effect is determined by considering the value of the receptor and the magnitude of the effect and applying professional judgement as to whether the integrity of the receptor will be affected. This concept can be applied to both designated sites (for example, a SSSI) and to defined populations (for example a great crested newt breeding population).

The term integrity is used here in accordance with the definition adopted by the ODPM Circular 06/2005 on Biodiversity and Geological Conservation[10] whereby designated site integrity refers to *"…coherence of ecological structure and function…that enables it to sustain the habitat, complex of habitats and/or levels of populations of species for which it was classified*". Integrity therefore refers to the maintenance of the conservation status of a habitat or species population at a specific location or geographical scale.

Effects are more likely to be considered significant where they affect receptors of higher conservation value or where the magnitude of the effect is high. Effects not considered to be significant would be those where the integrity of the receptor is not threatened, effects on receptors of lower conservation value, or where the magnitude of the effect is low.

In this assessment, an effect that threatens the integrity of a receptor is considered to be significant in terms of the EIA Regulations. Effects assessed as not significant should be considered as not significant in terms of the EIA Regulations. It should be noted that, alongside the criteria provided, professional judgement is applied in determining the significance of potential effect. Mitigation measures and detailed design work avoid and reduce potentially significant effects, but it is also best practice to propose mitigation measures to reduce negative effects that are not significant.

7.3.5.4 Mitigation, Compensation and Enhancement

Mitigation, compensation and enhancement measures should be presented in terms of the integrity/conservation status of the ecological resource to which they apply.

Mitigation measures should be developed during the design process where possible and aim to:

- Avoid negative ecological effects – especially those that could be significant; and
- Reduce negative effects that cannot be avoided.

Compensation seeks to minimise any remaining significant negative ecological effects that cannot be avoided by a mitigation strategy. Compensation measures often carry a degree of uncertainty and there may also be a time lag between damage and compensation. Ideally, enhancement measures should also be implemented, where possible, to achieve net ecological gain.

7.4 Baseline Conditions

7.4.1 Desk Study

7.4.1.1 Designated Sites

A desk study has identified the following statutory designated sites within 5 km of the Development site (as illustrated on Figure 7.1):

- The Firth of Forth Site of Special Scientific Interest (SSSI) comprises an extensive mosaic of intertidal and coastal habitats including saltmarsh, sand dune, fen, coastal sluiced saline lagoons, calcareous grassland, neutral grassland, dune grassland and maritime grassland. Extensive mudflats make up much of the intertidal area with areas of sand, shingle, rock and boulders as well as numerous valuable geological features. The mudflats are invertebrate rich and form important feeding grounds for

[10] ODPM Circular 06/2005 provides administrative guidance on the application of the law relating to planning and nature conservation as it applies in England. However, this definition of integrity is equally applicable in Scotland for the purposes of ecological impact assessment.

the abundant waders and wildfowl in the Forth. The Development site is located within this designated site;

- The Firth of Forth Special Protection Area (SPA) comprises an area in excess of 6,000 ha. It qualifies as an SPA by regularly supporting wintering populations and post-breeding populations of European importance of numerous Annex 1 bird species. It further qualifies by supporting wintering populations of both European and international importance of five migratory bird species. In addition, the Firth of Forth also qualifies by supporting wintering wildfowl assemblages of European importance. The Development site is located within this designated site; and
- The Firth of Forth Ramsar qualifies as a site under Criterion 3a by regularly supporting over 20,000 waterfowl in winter. The site supported a 1993/94–97/98 winter peak mean of 95,000 waterfowl, comprising 45,000 wildfowl and 50,000 waders. The Development site is located within this designated site.

No non-statutory sites are situated within 2 km. Sites designated wholly for their ornithological value (i.e. the Firth of Forth SPA and Ramsar) are not considered further in this assessment, please refer to Chapter 8: *Ornithology*

7.4.1.2 Data Search

Full details of data search results are presented in Technical Appendix 7.1 and are summarised below.

Fife Records Centre

Fife records centre provided a record of a common porpoise stranding dating from 1997 located approximately 1.1 km to the west of the Development site.

Scottish Natural Heritage

SNHi provided a record of grey seal dating from 1970 within the 10 km square N040 (the Development site is located within the 10 km square NT39) and a single otter record dating from 1900 within the 10 km square NO30.

National Biodiversity Network (NBN)

NBN provided records of marine mammals within 10 km including Atlantic white sided dolphin, harbour porpoise, Sowerby's beaked whale, grey seal, minke whale and common seal. Protected migratory/marine fish records include European eel and Atlantic salmon. The records provided by NBN are presented in Table 7.1.1 of Appendix 7.1.

7.4.1.3 Scottish Government Consultation on Seal Haul-out Sites

The Scottish Government's consultation on seal haul-out sites document contains details of potential seal haul-out sites within Scotland, taken from data supplied by the Sea Mammal Reserch Unit (SMRU). This document does not contain details of any potential seal haul-out sites within 10 km of the Development site. The closest potential haul-out site is Kinghorn Rocks, which is a site for common seals, located approximately 13 km to the south of the Development site.

7.4.2 Field Survey

7.4.2.1 Habitats

The 2012 Phase 1 survey confirmed that habitats within the survey area had not changed considerably since the initial Phase 1 survey was completed in 2010. Small areas of previously bare ground subsequently appear to have been colonised by gorse scrub and ephemeral/short-perennial vegetation, but other habitats including the littoral and subtidal zones remain unchanged. The results of the updated Phase 1 survey are presented in Figure 7.2.

Onshore

Onshore habitats are dominated by bare ground formed by reclaimed colliery spoil which is subject to high levels of repeated disturbance from reshaping and industrial activities. Small

areas of colliery spoil have been colonised by common and widespread pioneer and opportunistic plants forming areas of ephemeral/short-perennial vegetation. Dominant species include ribwort plantain, broadleaf dock, common nettle, creeping thistle, rosebay willowherb, dandelion and cocks foot. Small areas of dense and scattered scrub are also present including buddleia, bramble and gorse.

Intertidal

The shoreline has eroded considerably and the intertidal zone and upper shoreline has been reinforced with rock revetment to prevent further erosion. The rock revetment is constantly rebuilt and redistributed to combat erosion and extends throughout the littoral zone and is therefore subject to regular wave action. Consequently, the coastline offers a very limited habitat in which only a very sparse covering of wracks (channelled wrack and twisted wrack) and Irish moss was recorded, as well as sparse patches of periwinkles and occasional limpets, along the middle to lower shore. Further northwards, the coastline enters the dock yards and is entirely man-made from sheet-piling and concrete, backed by reclaimed spoil and hardstanding.

Subtidal

The subtidal environment in the area of the proposed turbine location was not surveyed but there is evidence to suggest that it comprises mainly sand overlying a soft clay substrate with high levels of contaminants arising from the onshore spoil. There are no plant communities within the footprint of the turbine location or within adjacent and nearby subtidal areas.

7.4.2.2 Fauna

Otter

The 2012 otter survey did not record any evidence of the presence of otter and habitats are considered to be sub-optimal for the species owing to the high level of disturbance from anthropogenic and wave/tidal activity. However, otters may occasionally use or pass through sub-optimal habitats, for example when dispersing or foraging, but such movements are likely to be very limited in duration and frequency.

Other Species

A single common seal was recorded during the 2012 survey approximately 100 m offshore. However, habitats surrounding the Development site are considered unlikely to be of value for marine mammals (i.e. as key foraging and breeding grounds) owing to high levels of anthropogenic disturbance.

The desk study indicated that notable fish species, including European eel and Atlantic salmon, are present within the Firth of Forth. The distributions and populations of such species are likely to fluctuate annually owing to spatial and temporal variations in the utilisation of habitats by different species at various stages in their life cycle. Given the location of the turbine, which is situated on the mean low water springs mark, habitats are considered highly unlikely to be of value for fish species.

The presence of bare ground and short vegetation across much of the onshore area offers potential basking and hunting habitat for some reptile species, most likely common lizard and slow worm. However, the high level of disturbance, as well as a lack of historical records, suggest that reptiles are unlikely to occur on site.

Taking into consideration the location of the proposed turbine within an exposed coastland environment, habitats are considered to be highly sub-optimal for bats. No potential roosting sites were recorded during the survey.

Taking into consideration the poor quality of the habitats present, no other protected or notable species are considered likely to be present within the survey area.

7.5 Valued Ecological Receptors

On the basis of the description of the ecological baseline as presented in section 7.3 and the definitions presented in Table 7.1, the values attributed to ecological receptors within the zone of influence are shown in Table 7.4.

Table 7.4: Valued Ecological Receptors

Receptor	Value	Comments
Firth of Forth SSSI	National	This site is designated as a SSSI and is therefore of national value.
Onshore habitats	Negligible	Habitats are dominated by reclaimed colliery spoil with small areas of ephemeral/short-perennial vegetation and dense/scattered scrub considered to be of negligible value.
Littoral and subtidal habitats	Negligible	Habitats are heavily modified with limited plant or algae species present and are considered to be of negligible value.
Otter	Negligible	Habitats are sub-optimal for otter because they are heavily disturbed and are consequently of negligible value for the species. Otter are a European Protected Species and are listed as a priority species on the UK BAP.
Marine mammals	Negligible	Populations of cetaceans and pinnipeds are present within the Firth of Forth. However, given the high levels of disturbance within relatively close proximity to the Development site, habitats considered to be of local value for such species. All cetaceans are European Protected Species.
Fish	Negligible	The Firth of Forth is an important corridor for several migratory fish species. However, the Development site is not considered important for any part of the species' lifecycles and therefore is considered to be of negligible value. Atlantic salmon are listed on Annex II and V of the EC Habitats & Species Directive and the UK BAP. European eel are listed as a priority species on the UK BAP.
Common lizard and slow worm	Negligible	Habitats are suitable for reptiles, however their potential to support these species is likely to be limited by high levels of disturbance and the Development site is therefore of negligible value for reptiles. Common lizard and slow worm are protected under the Wildlife and Countryside Act 1981 (as amended) and are listed on the UK BAP.
Bats	Negligible	Given the coastal location of the survey area and the high levels of disturbance, the Development site is likely to be of negligible value for bat species. Bats are European Protected Species.

7.6 Embedded Mitigation

The Surface and Coastal Water Management Plan (SCWMP) (provided as Technical Appendix 9.1) describes water management measures to control surface water onshore and drain hardstandings and other structures during the construction and operation of the Development. The SCWMP will form part of a Pollution Prevention Plan (PPP) to be implemented for the Development. The PPP will set out best practice to be followed in all aspects of construction, operation and decommissioning. Further details about these measures and potential effects are provided in Chapter 9: *Water Resources and Coastal Hydrology*.

7.7 Assessment of Potential Effects

7.7.1 Basis of the Assessment

Within this section potential effects are assessed on a 'receptor by receptor' basis which takes into consideration the range of factors described in section 7.1.3.5.

Potential effects are discussed in the context of construction and operational phases of the Development. Effects arising from the process of decommissioning are considered to be of a similar nature to construction effects, but of a smaller scale and shorter duration, and are not discussed separately.

7.7.2 Designated Sites

The Development site is located within the Firth of Forth SSSI, SPA and Ramsar site. As the qualifying interests of the Firth of Forth SPA and Ramsar sites relate to ornithological species, potential effects on these sites are considered in Chapter 8: *Ornithology* of this ES. Potential effects on the non-avian interests of the Firth of Forth SSSI are considered below.

No habitats which are notified features of the Firth of Forth SSSI are located within the Development site, namely maritime cliff, saltmarsh, sand dune, mudflats, saline lagoons, lowland neutral grassland and transition fen grassland. Therefore, no direct effects on the notified features of the SSSI are predicted as a result of construction works. Nonetheless, mitigation will be implemented to ensure that best practice working methods are adhered to throughout construction works to minimise the risk of indirect effects on the notified features of the SSSI.

No effects on the Firth of Forth SSSI are predicted as a result of the operational phase of the Development.

7.7.3 Onshore, Intertidal and Subtidal Habitats

Construction works will cause the temporary loss of 3 ha of bare ground onshore habitat. This loss is considered to be a negative, permanent effect which is certain to occur. However, given the negligible value of the habitats and the negligible magnitude of habitat losses, these effects are assessed as not significant.

Supporting piles will be drilled within the rocky intertidal habitats to support an access bridge. This will be a negative, permanent effect which is certain to occur. However, given the negligible value of the habitats, comprising bare rock, and the negligible magnitude of habitat losses, this effect is assessed as not significant.

The sea bed preparation will effect up to 850 m^2 of subtidal habitat however this material removal will be a one off occurrence and hence the habitat will be able to recover with time. This is a negative, temporary effect which is certain to occur.

Construction of the turbine foundation will cause the loss of approximately 12 m^2 of subtidal habitat. This will be a negative, permanent effect which is certain to occur.

Given the negligible value of the habitats and the negligible magnitude of habitat losses, this effect is assessed as not significant.

No significant effects on habitats are therefore predicted as a result of the operational phase of the Development.

7.7.4 Fauna

7.7.4.1 Otter

Construction works will cause habitat loss and possible disturbance to commuting or foraging otters that may be present within the area. Such effects are considered to be negative, temporary effects which are unlikely to occur. As the value of this receptor is negligible and the impact magnitude of this effect is also negligible, the effects of habitat loss and disturbance are assessed as not significant.

No effects on otter are predicted as a result of the operational phase of the Development.

7.7.4.2 Marine Mammals

During construction it is proposed to drill and grout the supporting piles into position. This method of construction will cause low levels of noise emissions. Taking this into consideration, works are highly unlikely to cause harm to marine mammals. However construction works may cause temporary disturbance to any marine mammals present in the area at the time of works, this would be a negative temporary effect which is unlikely to occur. Mitigation is proposed within section 7.1.8 to minimise the risk of disturbance to marine mammals during construction works in line with best practice working methods.

During the operational phase of the Development, marine mammals may experience disturbance effects from operational noise and vibration associated with the turbine rotation. Such effects would be negative long term effects which are unlikely to occur. The impact magnitude of this effect low and the effects of operational disturbance are assessed as not significant.

7.7.4.3 Other Species

No effects to other protected or notable species are predicted as a result of the construction or operational phases of the Development.

7.8 Mitigation Measures and Residual Effects

7.8.1 Habitats

Pre- and post-installation surveys for benthic habitats will be undertaken within the footprint of the Development, including areas to be subject to sea bed preparation. This will determine the presence/absence of sensitive seabed habitats or species.

It can be confirmed that best practice working methods and guidance will be adhered to throughout construction works to minimise the risk of introducing marine non-native species.

7.8.2 Otter

A pre-construction survey for otter will be undertaken within 250 m of the Development site. Should any holts or resting places be identified, mitigation will be agreed in advance of construction works with SNH and a licence obtained, if necessary.

In order to avoid harm to otter during construction works, deep trenches or excavations will be covered when not in use and escape ramps provided in shallower trenches or excavations in which otters could be entrapped.

7.8.3 Marine Mammals

The proposed Construction Method Statement and Decommissioning Method Statement will include mitigation measures set out in the JNCC good practice guidance for piling, blasting and seismic survey activities[11]. A primary requirement is to employ a marine mammal observer (MMO) who will conduct watches for marine mammals prior to, and during, noisy activities to ensure that no individuals come so close to the source point of the noise as to be at risk of injury.

[11] Joint Nature Conservation Committee (2010) Statutory Nature Conservation Agency Protocol for Minimising the Risk of Injury to Marine Mammals from Piling Noise

7.9 Summary of Effects

Table 7.5: Summary of Potential Effects

Receptor	Predicted Effect in Absence of Mitigation	Impact Magnitude	Mitigation Measures	Significance
Designated Sites	No effects predicted	No effects predicted	No effects predicted	No effects predicted
Onshore habitats	Loss of areas of bare ground	Negligible	None required	Not significant
Littoral and subtidal habitats	Loss of reinforced shoreline habitat and bare sand/clay substrate	Negligible	None required	Not significant
Otter	Disturbance to commuting or foraging otter	Negligible	Pre-construction otter survey and trenches to have means of escape	Not significant
Marine mammals	Construction noise which may cause harm and disturbance. Operational noise which may cause disturbance	Low	MMO to be present during construction works and 'soft start' construction	Not significant

7.10 Assessment of Cumulative Effects

Potential effects of the Development are considered in relation to other developments in the local area to determine any significant cumulative effects on valued ecological receptors. One operational single turbine development is located within 5 km of the Development site, namely Methil Docks located 1.8 km to the northeast. However, no operational effects are predicted as a result of the Development, and so no cumulative effects with the operational Hydrogen Office turbine are anticipated. Other works are anticipated to take place at FEP, including quay side improvements. Should such works take place at the same time as construction of the Demonstration Turbine, there may be a cumulative disturbance effect to any marine mammals present in the area at the time of works. This would be a negative temporary effect which is unlikely to occur. Given the use of the FEP as an active works area, current disturbance levels are already high. Therefore this potential cumulative effect of disturbance is not considered to be significant.

7.11 Statement of Significance

Site survey and a desk study have determined a number of ecological receptors which have the potential to be affected by the Development. However, an ecological impact assessment has subsequently determined potential effects on such receptors to be not significant. Nonetheless, mitigation is proposed to reduce the likelihood of possible disturbance effects to legally protected species.

8 ORNITHOLOGY

8.1 Introduction

This chapter of the ES identifies and evaluates the effects of the Development on birds. An assessment of effects on non-avian ecology is addressed separately in Chapter 7: *Ecology* of this ES.

The Consented Development for a single, smaller turbine (185 m to tip height) approximately 25 m northeast of the Development was granted consent in 2011. This chapter presents a revised assessment for this new application for a single turbine of different dimensions from the Consented Development.

The chapter is structured as below:

- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Potential Effects on European Sites (Natura 2000);
- Summary of Effects; and
- Statement of Significance.

This report is accompanied by Technical Appendix 8.1 (the Ornithology Technical Appendix), which provides details of:

- A desk study;
- The methods and results of baseline surveys carried out by Ove Arup & Partners Ltd (ARUP) between 2006 and 2007; and
- Collision risk modelling.

8.2 Assessment Methodology and Significance Criteria

8.2.1 Consultation

SNH provided a response to the Consented Development application in June 2010, which has fed into the scope and assessment approach for the current application. A Scoping Report for the current application was issued to consultees in February 2012. To date, Marine Scotland, SNH and the Royal Society for the Protection of Birds (RSPB) have provided responses relating to ornithology. These consultations are summarised in Table 8.1.

Table 8.1: Summary of scoping responses relating to ornithology

Consultee	Response	Action
SNH	SNH advised that the baseline information gathered for the Consented Development application can be re-used for the EIA and Habitats Regulations Appraisal for the current application. The scoping advice and Section 36 response previously provided by SNH for the Consented Development application are also relevant to inform the requirements for the current application.	
	SNH objected to the Consented Development application in June 2010. They stated that the objection could be overcome if:	
	• Construction work is carried out in accordance with a Construction Method Statement (CMS) which will incorporate measures to avoid disturbance to birds;	A requirement for a CMS as a planning condition has been written into this chapter. The scope of the CMS will be agreed with SNH.
	• A post-construction monitoring plan is implemented to study the interactions of birds with the wind turbine and to record any collisions; and	A requirement for a post-construction monitoring plan has been considered in this chapter, the scope of which will be agreed with SNH.
	• A Decommissioning Method Statement (DMS) will be implemented to avoid disturbance to birds during decommissioning.	A requirement for a DMS as a planning condition has been written into this chapter. The scope of the DMS will be agreed with SNH.
	SNH's key concerns were that:	
	• There was no provision of raw data relating to timing of surveys and observations, weather conditions and tidal state.	Raw data relating to weather conditions and tidal state is included within Appendix 8.1.
	• There was no assessment regarding the lattice tower potentially being used by birds, resulting in increased collision risk	Potential effects of a lattice tower substructure are discussed in this chapter.
	• In relation to the Habitats Regulations Appraisal, SNH stated that there was no analysis of survey information in relation to tidal state or time of day, but that this could be addressed through conditions relating to the CMS and DMS.	The influence of tidal state and time of day is considered in the current assessment, but as a result of the absence of many birds within the survey area, it is not addressed through detailed analysis.

Consultee	Response	Action
RSPB	The ES should contain sufficient information to inform an Appropriate Assessment (AA) on potential effects on the Firth of Forth and Forth Islands Special Protected Areas (SPAs).	The ES contains sufficient information to inform an AA and includes a separate section on potential effects on the Firth of Forth and Forth Islands SPAs.
	In order to assist this process tabulated raw data showing flock sizes survey dates/times and flights for target species that are at PCH[1] should be included.	Details of at-risk target species flights are presented in full in Appendix 8.1 and are summarised in this chapter.
	Maps showing numbered flight lines for different species, cross-referenced to tables, should also be provided.	All target species flight lines recorded through survey cells B2 and C2 followed the coast line and as such, it is not considered necessary to present individual flight lines.
	Collision Risk Modelling should be updated based on the new turbine specifications.	Collision risk modelling has been updated based on the new turbine.
	RSPB accept that although surveys were originally undertaken during 2006 – 2007, the data is still sufficient to inform a single turbine assessment.	
MS	For the Consented Development application MS previously indicated that a cumulative assessment with other wind farm developments is undertaken and that the projects will require an AA of the implications of the Development on the Firth of Forth and Forth Islands SPAs.	A cumulative assessment of effects is incorporated into this chapter and a sufficient level of detail has been included to allow the competent authority to undertake an AA of the potential effects of the Development on the SPAs.
	They also indicated that other consultees may consider the survey data to be out of date. MS response to the Development included a summary of all previous responses to date. Specifically they highlighted the importance the intertidal habitats associated with the Firth of Forth SPA and stated that the Development must be considered in respect of these habitats.	The RSPB consider that the survey data will be satisfactory for the assessment. There is no natural intertidal habitat remaining at the Development site. This area comprises man-made coastal defence materials and is largely unsuitable for SPA species.
	They reiterate that AA will need to be considered in respect of the Firth of Forth and Forth Islands SPAs. They indicate that timing restrictions on construction works should be considered to minimise any disturbance effects on Firth of Forth/Forth Islands SPA species.	As mentioned above, this chapter has a separate section, providing sufficient detail for the competent authority to undertake an AA. There is no clear pattern of temporal bird use of the survey area, no breeding birds recorded in close vicinity to the Development and very few birds which use the Development and there are very few birds recorded using this area at all. No timing restrictions are considered necessary.

[1] PCH = Potential Collision Height

Consultee	Response	Action
Fife Council	Noted the studies and submissions in the Scoping Report were suitable if updated to reflect the new turbine and position. Noted the previous data was sufficient to inform the assessment and mitigation.	The studies and surveys are reported throughout this chapter.

8.2.2 Legislation and Guidance

The Landscape and Natural Heritage section of the Scottish Planning Policy sets out national planning policy considerations and obligations in relation to the conservation of Scotland's natural heritage. It provides guidance on the role of the planning system in safeguarding areas of nature conservation interest, from local, non-statutory sites to statutory sites of international importance. It also draws attention to the importance of protecting and enhancing natural heritage interests outside those designated areas.

The ornithological baseline surveys and assessment have been designed and carried out with reference to a number of legislative and guidance documents. Key legislative and guidance documents are summarised below:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora ("Habitats Directive");
- Council Directive 2009/147/EC on the Conservation of Wild Birds ("Birds Directive");
- The Convention on Wetlands of International Importance ("Ramsar Convention");
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- The Wildlife and Countryside Act 1981 (as amended);
- The Marine (Scotland) Act 2010;
- Nature Conservation (Scotland) Act 2004;
- Planning for Natural Heritage: Planning Advice Note 60;
- Survey Methods for Use in Assessing the Impacts of Onshore Windfarms on Bird Communities 2005[2];
- Birds of Conservation Concern 3[3];
- Fife Local Biodiversity Action Plan (LBAP) 2nd Edition;
- Scottish Biodiversity Strategy and associated Implementation Plans;
- Birds and Wind Farms: Risk Assessment and Mitigation 2007[4];
- Assessing Significance of Impacts from Onshore Windfarms on Birds Outwith Designated Areas[5]; and
- Institute of Ecology and Environmental Management (IEEM) Guidelines for Ecological Impact Assessment in the United Kingdom 2006[6].

8.2.3 Baseline Methods: Ecological Impact Assessment

The approach taken to the assessment of ornithological effects follows the guidance document produced by the Institute of Ecology and Environmental Management (IEEM)[7]. These guidelines set out the process for assessment through the following stages:

- Describing the ornithological baseline through survey and desk study;

[2] Scottish Natural Heritage (SNH) (2005) Survey methods for use in assessing the impacts of onshore windfarms on bird communities. SNH.
[3] Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R., Aebischer, N.J., Gibbons, D.W., Evans, A. & Gregory, R.D. (2009) Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. *British Birds,* 102: pp296–341.
[4] de Lucas, M., Guyonne, F.E. and Ferrer, M. (eds) (2007) Birds and Wind Farms: Risk Assessment and Mitigation. Quercus, Madrid.
[5] Scottish Natural Heritage (2006) Assessing Significance of Impacts from Onshore Windfarms on Birds Outwith Designated Areas. SNH.
[6] IEEM (2006) Guidelines for Ecological Impact Assessment in the United Kingdom. IEEM, Winchester.
[7] Loc. op.

- Determining the value of receptors – identification of "Valued Ornithological Receptors" (VORs);
- Identifying and characterising the potential effects on VORs based on the nature of construction, operation and decommissioning activities associated with the Development;
- Identifying mitigation, compensation and enhancement measures to avoid, reduce or remedy potential effects;
- Determining the significance of the effects, taking into account the value of the receptor, the nature of the effect and mitigation measures where appropriate; and
- Identification of any monitoring requirements.

8.2.3.1 Determining Value

Value is defined in the context of a geographic frame of reference. Examples are provided in Table 8.2. Attributing a value to a receptor is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of a value level. For example, a Special Protection Area (SPA) is implicitly of European (international) importance.

When assigning value to non-designated bird populations, reference is made to established criteria for defining nationally and internationally important populations of a species[8]. Professional judgement is important in these cases and must take into account factors such as the rarity, distribution and conservation status of a species.

Species Action Plans (SAPs) have been prepared under the UK Biodiversity Action Plan (UKBAP) or local Biodiversity Action Plan (LBAP) for a number of species that are in serious decline within the UK. The purpose of these SAPs is to guide conservation action, rather than imply a specific value for the species. However, as a guide in this assessment, any priority species listed in the UKBAP or relevant LBAP has been considered of at least local value. Similarly, due to their declining status or restricted distribution, species listed in the amber or red lists of Birds of Conservation Concern[9] are also considered to be of at least local value.

IEEM guidelines recommend that social and economic factors are also considered when valuing receptors. The Development site does not comprise any ornithological features of outstanding social or economic value (e.g. a special hide for viewing rare breeding birds, such as osprey). However, there may be some connectivity between seabirds observed at the Development and breeding birds at the Forth Islands, viewed by live-camera at the North Berwick Seabird Centre. This value is inherently incorporated in the overall assessment of potential effects of the Development on the number of birds from the Forth Islands and the social and economic value is not treated as a separate entity in this assessment. The potential effects of the Development on other socio-economic resources are discussed elsewhere in this ES.

Table 8.2: Approach to valuing ecological receptors

Level of Value	**Examples[10]**
International	- An internationally designated site (e.g. SPA, Ramsar). - The qualifying feature of a SPA. - Species present in internationally important numbers (> 1 % of biogeographic/flyway populations).

[8] This is typically 1% of the national or biogeographic/flyway population respectively.
[9] Loc. Cit.
[10] SPA: Special Protection Area; Ramsar: site designated under the 1971 Ramsar Convention on Wetlands; SSSI: Site of Special Scientific Interest; NNR: National Nature Reserve; LNCS: Local Nature Conservation Site; LNR: Local Nature Reserve.

Level of Value	Examples[10]
National	- A nationally designated site (SSSI, NNR). - The notified interest of a SSSI. - Ecologically sensitive species such as rare birds (< 300 breeding pairs in the UK). - Species present in nationally important numbers (> 1 % UK population). - Regularly-occurring relevant migratory species which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering and staging areas in relation to the proposed windfarm.
Regional (NHZ[11] or Natural Area)	- Species that contribute to the integrity of a SPA or SSSI but which are not cited as species for which the SPA or SSSI is designated or notified. - Species present in regionally important numbers (>1% regional Eastern Lowland NHZ population).
Local	- Priority species in the UKBAP or LBAP. - Other species of conservation interest, e.g. red- or amber-listed species in Birds of Conservation Concern 3[12] not covered above. - LNCSs and LNRs designated for bird interests.
Negligible	- All other species, e.g. those on the green list that are not present in regionally or nationally important numbers. Receptors falling below local value are not normally considered in detail in the assessment process.

8.2.3.2 Characterising Potential Effects

Effect Magnitude

In order to characterise the likely change and effect of the Development on a Valued VOR (whether positive or negative), the magnitude of the change is a key consideration. Magnitude refers to the size of an effect, defined in quantitative terms where possible, and may relate to the area of habitat lost to the Development footprint in the case of a habitat receptor, or predicted loss of individuals in the case of a population. Table 8.3 defines five categories of effect magnitude.

Table 8.3: Criteria for describing effect magnitude (from Percival 2007)13

Effect Magnitude	Description
Very high	Total loss or very major alteration to key elements of the baseline (pre-development) conditions such that the post-development character, composition or other attributes would be fundamentally changed and may be lost from the site altogether. Guide: <20% of population/habitat remains
High	Major loss or major alteration to key elements of the baseline conditions such that the post-development character, composition or other attributes would be fundamentally changed. Guide: 20–80% of population/habitat lost

[11] SNH has identified 21 Natural Heritage Zones which cover the Scottish mainland and the islands, with the aim of developing an integrated approach to the management and sustainable use of the natural heritage in each zone, which take into consideration local, social and economic aspirations.
[12] Loc. Cit.
[13] Percival, S.M. (2007) Predicting the effects of wind farms on birds in the UK: the development of an objective assessment method. In de Lucas, M., Janss, G. & Ferrer, M. (eds.) *Birds and Wind Power: Risk Assessment and Mitigation*. Quercus, Madrid.

Effect Magnitude	Description
Medium	Loss or alteration to one or more key elements of the baseline conditions such that post-development character, composition or other attributes would be partially changed. Guide: 5–20% of population/habitat lost
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration would be discernible but the underlying character, composition or other attributes would be similar to pre-development conditions. Guide: 1–5% of population/habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. Guide: < 1% population/habitat lost

SNH guidelines[14] recommend that effects on populations outwith designated sites are assessed within an appropriate biogeographical scale. Effects on breeding bird populations are assessed in a regional context. The appropriate regional biogeographical unit has been identified as the Natural Heritage Zone (NHZ). NHZ classifications represent areas with a high level of biogeographical coherence and are unrelated to administrative boundaries. The Development site is located within the Eastern Lowlands NHZ and regional effects may be assessed in relation to the populations within this area. However, there are few data sources on bird populations for the majority of species in this NHZ and so there are some limitations to the consideration of effects on regional populations in this assessment.

In most cases, the potential effects of the Development are in relation to seabirds and waterbirds associated with the Firth of Forth SPA or Forth Islands SPA. In this context, the magnitude of an effect on a species is assessed in terms of the population for which the relevant SPA is designated.

Effect Characterisation

Factors to be taken into account when characterising effects include:

- Behavioural Sensitivity: some species are more tolerant than others to disturbance effects and the same species may be more tolerant to effects at different times of year. Behavioural sensitivity is determined subjectively based on a species' ecology and behaviour, as well as using documented evidence of responses of birds to wind turbines. As a guide, the following criteria may be applicable:
    - High: Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting (guide: ≥20 minutes) reactions to disturbance events.
    - Moderate: Species or populations that appear to be warily tolerant of human activities, or exhibit short-term reactions (guide: 5–20 minutes) to disturbance events.
    - Low: Species or populations occupying areas subject to frequent human activity and exhibiting mild and brief reactions (including flushing behaviour) to disturbance events.
- Reversibility and Duration: this defines whether or not it is possible for the resource to recover from the effect. An irreversible effect is permanent, or one from which recovery is not possible within a reasonable timescale. A reversible effect is temporary; reversible effects are defined in terms of their duration according to the following timescales:

[14] Loc. Cit.

- Short term: ≤5 years
- Medium term: 5-15 years
- Long term: 15-25 years (*i.e.* up to the lifespan of the development)

- Timing and frequency: an effect may only occur if the change coincides with a certain part of the life-cycle of a receptor – for example, the construction phase might be scheduled such that it does not affect the bird breeding season. The frequency of the effect is also considered – for example, during the operational phase, disturbance due to the presence of vehicles and personnel is likely to be minimal, but during the construction and decommissioning phases, movement of vehicles and personnel will be more frequent.

Confidence in Predictions

It is important to consider the probability that a change will occur as predicted and to determine the degree of confidence in the assessment of the effect on the receptor. Throughout the assessment process, the degree of confidence in the predictions is expressed as follows:

- Certain/near-certain: probability estimated at 95% chance or higher;
- Probable: probability estimated above 50% but below 95%;
- Unlikely: probability estimated above 5% but less than 50%; and
- Extremely unlikely: probability estimated at less than 5%.

8.2.3.3 Mitigation

Based on the nature of potential effects determined through the processes above, an initial assessment is made as to whether or not the change is likely to have an adverse effect on the integrity or favourable conservation status (see below for definitions) of the receptor's population. If there is likely to be an adverse effect, appropriate mitigation measures are proposed to avoid, reduce or remedy the potential effect.

8.2.3.4 Significance of Effects

Legislation and policy guidance, such as the EIA Regulations (section 2.1.4), require that significant effects are distinguished from others. Having followed the processes defined above to characterise the nature of the effect, a judgement is then made as to the significance of the effect, having taken any proposed mitigation measures and their likelihood of success into account. In accordance with the IEEM and SNH guidelines, a significant effect is defined as an (adverse or positive) effect on the integrity or conservation status of the receptor within the appropriate geographical area. Ecological integrity is defined (in relation to designated sites) in the ODPM circular 06/2005[15] as a site's "coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified". This concept can be applied to both designated sites and to defined populations (for example a regional breeding population). Favourable conservation status is defined as follows:

- Population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats;
- The natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future; and
- There is (and will probably continue to be) a sufficiently large habitat to maintain its populations on a long-term basis.

An effect can be judged as of concern and potentially significant where it would adversely affect the favourable conservation status of a species, or stop a recovering species from reaching favourable conservation status.

[15] Although this guidance is directed at the English planning, the definition of integrity is equally applicable in Scotland.

8.2.3.5 Monitoring

Where mitigation measures are proposed to avoid or reduce significant effects, there may be a requirement to implement a monitoring programme to assess the success of the mitigation.

8.2.3.6 Assessment of Cumulative Effects

A cumulative effect is considered to be an additional effect on ornithological receptors arising from the Development in combination with other proposed developments likely to affect the birds or their habitats. For example, the collision risk at different developments affecting a population is added together in order to consider the cumulative collision risk on that population. The method followed to assess the cumulative effects is the same as that used for the Development in isolation, as outlined above.

8.2.4 Baseline Methods: Desk Study

Statutory designated sites within 5 km of the Development site were identified using JNCC/SNH digital datasets in a Geographical Information System. The search area was extended to 20 km for SPAs. Information about non-statutory designated sites and other sites for bird conservation was obtained where available within a radius of 2 km from the Development site.

Wetland Bird Survey data for the Core Count area from East Wemyss to Leven Power Station for the five-year period 2006-2010 were purchased from the British Trust for Ornithology.

Consultation was also undertaken with the Fife Bird Recorder to determine the current status of peregrine at the FEP. It was confirmed that the power station has been removed and consequently the pair of peregrine are no longer present.

Full details of the data requests and results are provided in Section 8.3 below, and in Appendix 8.1.

8.2.5 Baseline Methods: Field Survey

Full details of the surveys carried out and the methods used are presented in Appendix 8.1. Field surveys were carried out between September 2006 and September 2007 following SNH guidelines[16] and taking into account consultations with SNH and RSPB during the survey period. The following surveys were carried out:

- Focal Animal Sampling: flight paths and heights of birds were recorded from a single vantage point. The data collected provide the baseline information to inform the collision risk assessment.
- Activity Summary Survey: prior to commencing each vantage point survey, the numbers of all birds present were recorded. The data collected provide the baseline information to inform the assessment of potential displacement effects.

Survey areas are illustrated on Figure 8.2.

8.2.6 Baseline Methods: Collision Risk Assessment

Full details of the method used to estimate the collision risk to target species recorded at the Development site are presented in Appendix 8.1.

8.3 Baseline Conditions

The following sections combine the results of the baseline methods presented above to describe the ornithological interest of the site and local area. Full details of the desk study results, baseline survey results and collision risk are presented in Appendix 8.1. A summary of the results is presented in this chapter.

[16] Loc. Cit.

8.3.1 Designated Sites

8.3.1.1 Statutory Designated Sites

A full list of statutory designated sites is included in Appendix 8.1 and illustrated on Figure 8.1. Consultation has indicated that potential effects on the Firth of Forth and Forth Islands should be considered as part of this assessment. No other sites designated for ornithology are considered to be close enough to be affected be the Development. There is unlikely to be connectivity between the Development site and the qualifying interests of any other designated site that would result in the Development undermining any of the conservation objectives for the designated sites' qualifying interests. With the exception of the Firth of Forth and Forth Islands, there are therefore no likely significant effects on any other designated sites and they have been scoped out of further detailed assessment.

Firth of Forth

The Firth of Forth is a large coastal area stretching from Alloa Inches in the River Forth to Fife Ness and Dunbar in the east and comprises a complex of estuaries, mudflats, rocky shorelines, beaches and saltmarshes. The mudflats are invertebrate rich and form important feeding grounds for the abundant waders and wildfowl. The Firth of Forth is notified as a Site of Special Scientific Interest (SSSI), designated as a Special Protection Area (SPA) and Ramsar site, and is covered by a Nature Conservation Order (NCO). Further details of the statutory nature conservation status of the Firth of Forth are provided in Chapter 7: *Ecology* and in Appendix 8.1.

The SPA and Ramsar designations are mainly in place due to the internationally and nationally important numbers of wintering waterbirds: red-throated diver, Slavonian grebe, golden plover, bar-tailed godwit, sandwich tern (on passage), pink-footed goose, shelduck, knot, redshank, turnstone, great crested grebe, cormorant, scaup, eider, long-tailed duck, common scoter, velvet scoter, goldeneye, red-breasted merganser, oystercatcher, ringed plover, grey plover, dunlin and curlew, with large numbers of wigeon, mallard and lapwing also adding to the assemblage. The SSSI citation also specifically mentions teal and regionally important populations of wintering pochard, pintail and purple sandpiper in addition to the species detailed in the SPA and Ramsar qualifications, and important breeding populations of eider, shelduck, ringed plover, fulmar and kittiwake.

Forth Islands

The Forth Islands are located in the Firth of Forth and are designated as a SSSI and SPA. The SPA comprises a number of separate islands or island groups, principally Inchmickery (together with the nearby Cow and Calves) off Edinburgh, Long Craig, Fidra, Lamb and Craigleith together with the Bass Rock off North Berwick, and the much larger Isle of May in the outer part of the estuary. The site also includes additional other small islands. The islands support important numbers of a range of breeding seabirds, in particular terns, auks and gulls. The colony of gannets is the largest on the east coast of the UK. The seabirds feed outside the SPA in nearby waters, as well as more distantly in the North Sea.

The SPA designation is mainly in place due to the presence of internationally and nationally important breeding populations of waterbirds: Arctic tern, roseate tern, common tern, sandwich tern, gannet, shag, lesser black-backed gull, razorbill, common guillemot, puffin, black-legged kittiwake, herring gull, fulmar and cormorant. The SSSI is also notified for holding nationally important numbers of breeding seabirds and together form the largest breeding seabird colony in the Lothians. Craigleith supports the largest puffin colony in the Lothians and Lamb has the only breeding cormorant colony in the region.

8.3.1.2 Non-statutory Designated Sites

There are no non-statutory designated sites within 2 km of the Development site.

8.3.2 Species

Wetland Bird Survey Core Count data provided by the BTO for the five-year period 2006-2010 are provided in Appendix 8.1. The data show that the area covered by the Core Count sector

East Wemyss to Leven Power Station is important for the following species, which have over 1% of the Firth of Forth SPA qualifying population present: eider, long-tailed duck, common scoter, red-breasted merganser, red-throated diver, cormorant, oystercatcher, turnstone and sandwich tern.

Table 8.4 provides a summary of the presence of each of the species recorded. Full details of the survey results are provided in Appendix 8.1.

Table 8.4: Summary of baseline results for each species

Species	Baseline summary
Teal	A single record of two females flying below PCH parallel to the shoreline. Otherwise, not recorded within the survey area and no records in the WeBS Core Count sector between 2006-2010. Collision risk is negligible.
Mallard	Three records: two singles flying at PCH in October and one bird flying at PCH in March. Otherwise, not recorded within the survey area and no records in the WeBS Core Count sector between 2006-2010. Collision risk estimated at one bird every 20 years (0.05 birds per year).
Scaup	A single record of one male flying below PCH parallel to the shoreline in November. Otherwise, not recorded within the survey area and no records in the WeBS Core Count sector between 2006-2010. Collision risk is negligible.
Eider	Recorded in small numbers during almost all surveys on near-shore waters within 100 m of the shoreline around the site. Mean number of 13.6 birds within the survey area, with a maximum of 67 in May. A total of 189 bird-flights were recorded, mainly parallel to the shoreline, three flights (11 birds) occurred at PCH. Collision risk predicted to be one bird every 5 years (0.19) birds per year). Winter mean peak count of 525 birds in the WeBS Core Count Sector between 2006-2010, representing 5.6 % of the Firth of Forth SPA cited population.
Long-tailed duck	Recorded in small numbers, infrequently, during the winter and early spring on near-shore waters within 100 m of the shoreline around the site. A maximum of 13 birds observed. A total of 15 bird-flights were recorded, mainly parallel to the shoreline, but none were at PCH, therefore collision risk is negligible. Winter mean peak count of 35 birds in the WeBS Core Count Sector between 2006-2010, representing 3.3% of the Firth of Forth SPA cited population.
Common scoter	Recorded in small numbers, infrequently, during the winter and early spring on near-shore waters within 100m of the shoreline around the site. A maximum of 12 birds observed in March, although none were observed during the majority of surveys. Just two birds were recorded in flight, but neither were at PCH, therefore collision risk is negligible. Winter mean peak count of 206 birds in the WeBS Core Count Sector, representing 7.1% of the Firth of Forth SPA cited population.
Velvet scoter	Recorded twice during the winter and early spring on near-shore waters within 100m of the shoreline around the site, with a maximum of three birds in March. Five bird-flights were recorded; two of those were at PCH. Collision risk estimated at one bird every 39 years (0.03 birds per year). Not recorded in the WeBS Core Count Sector between 2006-2010.
Goldeneye	Recorded three times during the winter on near-shore waters within 100m of the shoreline around the site, with a maximum of two birds in January. Two birds were recorded in flight, both below PCH, therefore collision risk is negligible. Winter mean peak count of 2 birds in the WeBS Core Count Sector between 2006-2010, representing 0.1 % of the Firth of Forth SPA cited population.
Red-breasted merganser	Recorded in small numbers during the winter on near-shore waters within 100 m of the shoreline around the site. A maximum of four birds observed. A total of 20 bird-flights were recorded, mainly parallel to the shoreline. One flight (two birds) occurred at PCH. Collision risk predicted to be one bird every 39 years (0.03 birds per year). Winter mean peak count of 16 birds in the WeBS Core Count Sector between 2006-2010, representing 2.4% of the Firth of Forth SPA cited population.

Species	Baseline summary
Red-throated diver	Recorded in small numbers between September and May on near-shore waters within 100m of the shoreline around the site. A maximum of three birds observed. Just three bird-flights were recorded, but none were at PCH, therefore collision risk is negligible. Winter mean peak count of one bird in the WeBS Core Count Sector between 2006-2010, representing 1.1 % of the Firth of Forth SPA cited population.
Black-throated diver	A single record of a bird flying below PCH parallel to the shoreline, therefore collision risk is negligible. Otherwise, not recorded within the survey area and no records in the WeBS Core Count sector.
Fulmar	Recorded infrequently during flight activity surveys between March and July. A total of ten bird-flights were recorded, mainly parallel to the shoreline, of which seven were at PCH. Collision risk was estimated to be approximately one bird every five years (0.19 birds per year).
Manx shearwater	One record of a bird in October flying off-shore below PCH, therefore collision risk is negligible. No other records.
Gannet	Recorded occasionally during flight activity surveys in spring, summer and autumn. A total of 259 bird-flights recorded offshore within the survey area, with the majority of the records (238) on one day in October. 65 birds were recorded at PCH. Collision risk was estimated to be between one and two birds per year (1.69 birds per year).
Cormorant	Recorded in small numbers during almost all surveys on near-shore waters often within 10m of the shoreline around the site and also roosting or resting on the sea wall and other coastal structures. Maximum count of ten birds in January. A total of 400 bird-flights were recorded, mainly parallel to the shoreline. 38 birds were at PCH. Collision risk was estimated to be nearly one bird every year (0.83 birds per year). Winter mean peak count of 66 birds in the WeBS Core Count Sector, representing 9.7 % of the Firth of Forth SPA cited population.
Shag	Recorded in small numbers during almost all surveys on near-shore waters within 100 m of the shoreline around the site and also roosting or resting on the sea wall and other coastal structures. Maximum count of seven birds in August. A total of 269 bird-flights were recorded, mainly parallel to the shoreline, 32 birds were at PCH. Collision risk was estimated to be approximately one bird every one to two years (0.64 birds per year).
Grey heron	A single record of a bird in the survey area in May. No flights recorded, therefore collision risk is negligible.
Peregrine	A pair prospected nesting on a structure near the Development site and some associated flight activity was observed. There were five bird-flights recorded within the survey area, all of which were at PCH. Methil Power Station has been removed and, as such, peregrine no longer make use of the Development site. Collision modelling has therefore not been undertaken for this species, as collision risk is no longer applicable as an effect of the Development.
Oystercatcher	Just one record of a bird using habitat within the survey area in November. There were 405 records of birds in flight moving through the survey area along the coastline between feeding areas. 69 birds were at PCH, resulting in an estimated collision risk of one bird approximately every year (1.16 birds per year). Winter mean peak count of 76 birds in the WeBS Core Count Sector between 2006-2010, representing 1.0% of the Firth of Forth SPA cited population.
Ringed plover	One record of two birds using habitat within the survey area in May. There were just two birds recorded in flight along the coastline, neither of which were at PCH, therefore collision risk is negligible. Not recorded in the Count Sector during the WeBS counts between 2006-2010.
Grey plover	A single record of a bird flying below PCH along the coastline, therefore collision risk is negligible. Otherwise, not recorded within the survey area. Winter peak mean of four birds in the WeBS Core Count Sector between 2006-2010, representing 0.6 % of the SPA cited population.

Species	Baseline summary
Dunlin	A total of nine birds recorded flying below PCH along the coastline, therefore collision risk is negligible. Otherwise, not recorded within the survey area and no records in the WeBS Core Count sector between 2006-2010.
Curlew	A total of nine birds recorded flying along the coastline, two were at PCH. Collision risk estimated at one bird every 27 years (0.04 birds per year). Otherwise, not recorded within the survey area. Winter mean peak count of nine birds in the WeBS Core Count Sector between 2006-2010, representing 0.5 % of the Firth of Forth SPA cited population.
Common sandpiper	13 recorded in the survey area in March and one in June. Otherwise, no other records of this species. These were possibly recorded incorrectly on the field recording sheet – the single bird is a possible occurrence of this species, but the flock of 13 common sandpipers (CS) are likely to have been incorrectly recorded using the wrong two-letter species code for common scoter (CX).
Redshank	One record of eight birds using habitat within the survey area in February. There were just three birds recorded in flight along the coastline, none of which were at PCH, therefore collision risk is negligible. Winter mean peak count of 22 birds in the WeBS Core Count Sector, representing 0.5 % of the Firth of Forth SPA cited population.
Turnstone	One record of four birds using habitat within the survey area in February. There were no flight records, therefore collision risk is negligible. Winter mean peak count of 19 birds in the WeBS Core Count Sector, representing 2.2 % of the Firth of Forth SPA cited population.
Kittiwake	Recorded in small numbers in the survey area between June and August, with a maximum of four birds. There were 91 records of birds in flight moving through the survey area along the coastline. 69 were recorded at PCH, resulting in an estimated collision risk of between one to two birds every year (1.34 birds per year).
Black-headed gull	Birds were recorded resting on the sea wall on most surveys, with a maximum of ten birds recorded within the survey area. Just one bird was recorded flying at PCH, resulting in a negligible collision risk.
Common gull	Birds were recorded resting on the sea wall or within the survey area infrequently, with a maximum of seven birds recorded. Two birds were recorded in flight through the survey area at PCH, resulting in a negligible collision risk.
Herring gull	Moderate numbers observed frequently on the water and resting on the sea wall, with a maximum of 410 recorded in September. Herring gull was not recorded as a target species, as significant numbers were not observed in flight through the survey area at PCH. Most flights would be likely to be below PCH, although there is likely to be some low level of collision risk.
Lesser black-backed gull	Moderate numbers observed frequently on the water and resting on the sea wall, with a maximum of 96 recorded in August. Lesser black-backed gull was not recorded as a target species, as significant numbers were not observed in flight through the survey area at PCH. Most flights would be likely to be below PCH, although there is likely to be some low level of collision risk.
Great black-backed gull	Small numbers observed frequently on the water and resting on the sea wall, with a maximum of seven recorded in August. Great black-backed gull was not recorded as a target species, as significant numbers were not observed in flight through the survey area at PCH. Most flights would be likely to be below PCH, although there is likely to be some low level of collision risk.
Sandwich tern	Just one record of a two birds using habitat within the survey area in August. There were 242 records of birds in flight moving through the survey area along the coastline. 158 were recorded at PCH, resulting in an estimated collision risk of approximately four birds per year (3.89 birds per year). Post-breeding mean peak of 20 birds in the WeBS Core Count Sector between 2006-2010, representing 1.2 % of the Firth of Forth SPA cited population.

Species	Baseline summary
Common tern	Just one record of two birds using habitat within the survey area in May. There were 58 records of birds in flight moving through the survey area along the coastline during the summer months. 51 were recorded at PCH, resulting in an estimated collision risk of between one and two birds every year (1.43 birds per year).
Common guillemot	Frequently recorded in small numbers within the survey area, typically between one and eight birds on the water, although a maximum of 27 recorded in May. Five bird-flights recorded below PCH along the coastline, therefore collision risk is negligible.
Razorbill	Infrequently recorded in small numbers within the survey area, typically between one and eight birds on the water. One bird recorded flying below PCH along the coastline in September, therefore collision risk is negligible.
Puffin	A single record of a bird on the water within the survey area in June. No other records.
Woodpigeon	A single record of one bird in the survey area.
Swallow	Four and five birds recorded within the survey area in June. Swallow was not a target species for flight activity surveys.
Rock pipit	Occasional records of single birds on the shoreline within the survey area.
[Yellow wagtail] / grey wagtail	One record of a bird "flitting about" in the survey area in November. As yellow wagtails are summer migrants, it is suspected that this was a mis-recorded grey wagtail.
Pied wagtail	Infrequent records of up to four birds within the survey area.
Robin	A single record in January.
Wheatear	A single record of a passage bird in April.
[Chiffchaff]	Several records of one or two birds, mainly in the winter. This species is unlikely to winter at this location; it is suspected that the species code recorded on the field recording sheets (CC) refers to carrion crow (C.).
Carrion crow	Occasional records of small numbers within the survey area.
Linnet	A small flock recorded infrequently within the survey area.

8.3.3 Valued Ornithological Receptors

Receptors requiring further detailed assessment are shown in Table 8.5, and the remainder of this chapter focuses on assessment of the potential effects on these receptors.

Table 8.5: Valued Ornithological Receptors

Receptor	Value	Reasons and Comments
Firth of Forth SPA/SSSI	International	As there are no direct effects of the Development on the habitats within the SPA/SSSI, the potential effects on the SPA/SSSI are considered in terms of the populations of the species for which it is designated (see below). A summary of the potential for likely significant effects on the SPA is also provided. The species notified in the SSSI citation are mostly coincident with the species for which the SPA qualifies. Those additional species in the SSSI citation that are not part of the SPA qualification (either individually or as part of the assemblage) are highly unlikely to be affected by the development, or are considered as species for which the Forth Islands SPA qualifies (see below).
Forth Islands SPA/SSSI	International	The potential effects on the SPA/SSSI are considered in terms of the populations of the species for which it is designated (see below). A summary of the potential for likely significant effects on the SPA is also provided. The species notified in the SSSI citation are coincident with the species for which the SPA qualifies.
Eider	National	Species listed in the Firth of Forth assemblage qualification under Article 4.2 by supporting nationally important wintering populations. Present in small numbers within the survey area and frequently observed flying offshore through the survey area.
Long-tailed duck	National	Species listed in the Firth of Forth assemblage qualification under Article 4.2 by supporting nationally important wintering populations. Present in small numbers within the survey area and infrequently observed flying offshore through the survey area.
Red-throated diver	International	Firth of Forth qualifies under Article 4.1 by regularly supporting wintering populations of European importance. Present in small numbers within the survey area.
Fulmar	National	Species listed in the Forth Islands assemblage qualification under Article 4.2 by supporting nationally important populations. Infrequently observed flying offshore through the survey area.
Gannet	International	Forth Islands qualifies under Article 4.2 by regularly supporting populations of European importance. Frequently observed flying offshore through the survey area.
Cormorant	National	Species listed in both the Firth of Forth and Forth Islands assemblage qualifications under Article 4.2 by supporting nationally important wintering and breeding populations respectively. Present in small numbers within the survey area and frequently observed flying offshore through the survey area.
Shag	International	Forth Islands qualifies under Article 4.2 by regularly supporting populations of European importance. Present in small numbers within the survey area and frequently observed flying offshore through the survey area.
Oystercatcher	National	Species listed in the Firth of Forth assemblage qualification under Article 4.2 by supporting nationally important wintering populations. Present very infrequently within the survey area, but frequently observed flying through the survey area.
Kittiwake	National	Species listed in the Forth Islands assemblage qualification under Article 4.2 by supporting nationally important populations. Frequently observed flying offshore through the survey area.

Receptor	Value	Reasons and Comments
Herring gull	National	Species listed in the Forth Islands assemblage qualification under Article 4.2 by supporting nationally important populations. Present in moderate numbers within the survey area.
Lesser black-backed gull	International	Forth Islands qualifies under Article 4.2 by regularly supporting populations of European importance. Present in small numbers within the survey area.
Sandwich tern	International	Firth of Forth qualifies under Article 4.1 by regularly supporting passage populations of European importance. Forth Islands also qualifies under Article 4.1 by regularly supporting populations of European importance. Frequently observed flying offshore through the survey area.
Common tern	International	Forth Islands qualifies under Article 4.1 by regularly supporting populations of European importance. Frequently observed flying offshore through the survey area.

The following species that were recorded during the baseline surveys are not considered in further detail in this assessment, because the data collected have demonstrated that their presence at or near the site is very infrequent or they are species of low conservation value and it is considered that potential effects of the Development on their populations are highly likely to be negligible:

- Teal
- Mallard
- Scaup
- Common Scoter
- Velvet scoter
- Goldeneye
- Red-breasted merganser
- Black-throated diver
- Manx shearwater
- Grey heron
- Peregrine
- Ringed plover
- Grey plover
- Dunlin
- Curlew
- Common sandpiper
- Redshank
- Turnstone
- Black-headed gull
- Common gull
- Great Black-backed gull
- Common guillemot
- Razorbill
- Puffin
- Swallow
- Rock pipit
- Pied wagtail
- Robin
- [Yellow/grey wagtail]
- Wheatear
- [Chiffchaff]
- Carrion crow
- Linnet

8.4 Assessment of Potential Effects

This section provides an assessment of the potential effects of the Development on the species identified as VORs in the absence of mitigation during each phase of development i.e. construction, operation and decommissioning. Mitigation measures required to reduce the magnitude and significance of potential effects are presented separately in section 8.55. As required under the Habitats Regulations, an assessment of the potential for any likely significant effect on the Firth of Forth SPA and Forth Islands SPA is provided in order to determine whether Appropriate Assessment should be undertaken to ascertain whether or not the proposal would adversely affect the integrity of these European sites.

8.4.1 Embedded mitigation

The Surface and Coastal Water Management Plan (SCWMP) (provided as Technical Appendix 9.1) describes water management measures to control surface water onshore and drain hardstandings and other structures during the construction and operation of the Development. The SCWMP is therefore considered to be of relevance to ornithological

receptors and will form part of a Pollution Prevention Plan (PPP) to be implemented for the Development. The PPP will set out best practice to be followed in all aspects of construction, operation and decommissioning. Therefore, potential effects to ornithological receptors arising from pollution, both particulate and chemical, are considered extremely unlikely and are not considered further. Further details about these measures and potential effects are provided in Chapter 9: *Water Resources and Coastal Hydrology*.

Detailed construction and decommissioning method statements will be developed and implemented to minimise potential disturbance to birds.

8.4.2 Potential Construction Effects

Construction activities are described in Chapter 3: *Project Description* of this ES and considered likely to cause two broad types of direct and indirect effect: habitat loss and disturbance.

Effects on habitats as a result of land-take will occur only during construction and include both temporary and permanent loss/damage. The habitat loss as a result of the construction of the Development would be in the foundation pile locations and at the top of the foreshore section where the bridge link will rest on a concrete pad. There will be no significant loss of feeding or roosting habitat and no effects resulting from this minimal habitat loss are predicted on birds.

Disturbance-related effects during construction are likely from activities such as piling of the steel jacket, ground and water pollution, and increased pedestrian and plant machinery activity. This has the potential to result in the displacement of birds from using habitats within the zone of influence of the Development, or to result in altered flight behaviour as birds flying past the source of the disturbance. Birds affected in this way may be directly associated with the Firth of Forth SPA (i.e. the birds affected may be within the SPA boundary) or may be indirectly associated with the Firth of Forth SPA or the Forth Islands SPA (i.e. birds that have connectivity with either SPA may be subject to disturbance effects that result in effects on their ability to survive). However, it should be noted that any disturbance effects during construction will be very short-term in nature, lasting only for as long as the construction phase takes place – this is likely to be approximately four months.

8.4.2.1 Eider

Eiders were one of the most consistently recorded birds within the survey area, although the numbers present were relatively small. There was a mean count of 13.6 birds and a maximum of 67 birds, representing 0.14% and 0.7% of the Firth of Forth SPA population respectively. It is therefore considered that the area close to the Development site is not critical for this species and there is a considerable amount of more suitable foraging area within the Firth of Forth. Any displacement from the Development site is near-certain to have a negligible effect on the population within the Firth of Forth. Eiders were frequently recorded flying through the survey area and it is probable that birds would slightly adjust their flight route to fly further away from the Development area during construction. However, due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

8.4.2.2 Long-tailed Duck

Long-tailed ducks were infrequently recorded in small numbers within the survey area and were also infrequently recorded flying through the survey area. There was a mean count of 2.9 birds during the non-breeding season (September to April) and a maximum of 13 birds, representing 0.28% and 1.24% of the Firth of Forth SPA population respectively. It is therefore considered that the area close to the Development site is not critical for this species and there is a considerable amount of more suitable foraging area within the Firth of Forth. Any displacement from the Development site is near-certain to have a negligible effect on the population within the Firth of Forth. As the movement of birds through the survey area was very infrequent, there is no evidence that birds would be subject to adverse energetic consequences as a result of a slightly changing their flight lines.

8.4.2.3 Red-throated Diver

The presence of red-throated diver was only occasionally recorded within the survey area, in very small numbers, therefore it is considered that the area close to the Development site is not important for this species. Just three birds were recorded flying through the survey area, therefore there is no evidence that birds would be subject to adverse energetic consequences as a result of a barrier effect to movement. Any displacement from this area is near-certain to have a negligible effect on the population within the Firth of Forth.

8.4.2.4 Fulmar

Fulmars were infrequently recorded flying through the survey area. There was no evidence that the area around the Development site formed an important feeding area for this species, as fulmars feed mainly in the off-shore marine environment. It is probable that birds would slightly adjust their flight line to fly further away from the Development area during construction, but the Development site is not located in a regularly used flight route. Due to the small scale of the Development and the low level of flight activity near the turbine, the energetic consequences to individual birds are near-certain to be negligible. The fulmars observed within the survey area could potentially be associated with the Forth Islands SPA population. The available foraging grounds for pelagic species in the Firth of Forth and around the Forth Islands are vast, therefore the potential temporary displacement from a relatively small coastal zone around the proposed Development site is near-certain to have a negligible effect on the Forth Islands SPA population.

8.4.2.5 Gannet

Gannets were frequently recorded flying through the survey area, but there was no evidence that the area around the Development site formed an important feeding area for this species, as gannets feed mainly in the off-shore marine environment. It is probable that birds would slightly adjust their flight line to fly further away from the Development area during construction, but the Development site is not located in a regularly used flight route. Due to the small scale of the Development and low level of flight activity near the turbine, the energetic consequences to individual birds are near-certain to be negligible. The gannets observed within the survey area could potentially be associated with the Forth Islands SPA population. The available foraging grounds for pelagic species in the Firth of Forth and around the Forth Islands are vast, therefore the potential temporary displacement from a relatively small coastal zone around the proposed Development is near-certain to have a negligible effect on the Forth Islands SPA population.

8.4.2.6 Cormorant

Cormorants used habitats within the survey area and were also frequently recorded flying offshore through the survey area. Their main use of the area was for resting on the sea-wall and other coastal structures and foraging near-shore within approximately 10 m of the sea-wall. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and taking into consideration the very small numbers present, it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during construction is near-certain to have a negligible effect on the population within the Firth of Forth. Displaced birds would have a substantial amount of alternative available area to use. Cormorants are known to forage up to 35 km away from their breeding sites during the breeding season (Grémillet 1997)[17], therefore birds recorded within the survey area could potentially be associated with the Forth Islands SPA. The available foraging grounds for cormorants in the Firth of Forth are vast, therefore the potential temporary displacement from a relatively small zone around the proposed Development site is near-certain to have a negligible effect on the Forth Islands SPA population.

[17] Grémillet, D. (1997) Catch per unit effort, foraging efficiency, and parental investment in breeding great cormorants (*Phalacrocorax carbo carbo*). *ICES Journal of Marine Science* 54: 635–644

8.4.2.7 Shag

Shags used habitats within the survey area and were also frequently recorded flying offshore through the survey area. Their main use of the survey area was for resting on the sea-wall and other coastal structures. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and taking into consideration the very small numbers present, it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during construction is near-certain to have a negligible effect on the local population. Shags are known to forage up to 17 km away from their breeding sites during the breeding season (Wanless *et al.* 2008)[18], therefore birds recorded within the survey area could potentially be associated with the Forth Islands SPA. The available foraging grounds for shags in the Firth of Forth and around the Forth Islands are vast, therefore the potential temporary displacement from a relatively small zone around the proposed Development site is near-certain to have a negligible effect on the Forth Islands SPA population.

8.4.2.8 Oystercatcher

Oystercatchers were frequently recorded flying through the survey area, probably moving between roosts and feeding areas in response to tidal changes. There was only one record of a bird using habitat within the survey area, therefore the area within the zone of influence of the Development is not important as a foraging area for oystercatchers. It is probable that birds would slightly adjust their flight route to fly further away from the Development area during construction. However, due to the small scale of the Development and the relatively small number of birds moving through the survey area, the energetic consequences to individual birds are near-certain to be negligible.

8.4.2.9 Kittiwake

Kittiwakes were fairly frequently recorded flying through the survey area, but there was no evidence that the area around the Development site formed an important feeding area for this species, as kittiwakes feed mainly in the off-shore marine environment. It is probable that birds would slightly adjust their flight line to fly further away from the Development area during construction, but the Development site is not located in a regularly used flight route. Due to the small scale of the Development and low flight activity near the turbine, the energetic consequences to individual birds are near-certain to be negligible. The kittiwakes observed within the survey area could potentially be associated with the Forth Islands SPA population. The available foraging grounds for pelagic species in the Firth of Forth and around the Forth Islands are vast, therefore the potential temporary displacement from a relatively small coastal zone around the proposed Development site is near-certain to have a negligible effect on the Forth Islands SPA population.

8.4.2.10 Herring Gull

Herring gulls used habitats within the survey area, but flight activity in the area at PCH was not considered sufficient to warrant including them as a target species. Their main use of the survey area was for resting on the sea-wall and other coastal structures, where small numbers were infrequently recorded for most of the year, with highest numbers present during the late summer/autumn period. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during construction is near-certain to have a negligible effect on the local population. Herring gulls may forage considerable distances from their nest sites, therefore birds recorded within the survey area could potentially be associated with the Forth Islands SPA population. The

[18] Wanless, S., Harris, M. P. & Morris, J.A. (2008) Foraging range and feeding locations of Shags *Phalacrocorax aristotelis* during chick rearing. *Ibis* 133:30-36

available foraging grounds for gulls in the Firth of Forth and around the Forth Islands are vast, therefore the potential temporary displacement from a relatively small zone around the proposed Development site is near-certain to have a negligible effect on the Forth Islands SPA population.

8.4.2.11 Lesser Black-backed Gull

Lesser black-backed gulls used habitats within the survey area, but flight activity in the area at PCH was not considered sufficient to warrant including them as a target species. Their main use of the survey area was for resting on the sea-wall and other coastal structures, where very small numbers were infrequently recorded for most of the year, with larger numbers present only during the late summer/autumn period. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and taking into consideration the small numbers present, it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during construction is near-certain to have a negligible effect on the local population. Lesser black-backed gulls may forage considerable distances from their nest sites, therefore birds recorded within the survey area could potentially be associated with the Forth Islands SPA population. The available foraging grounds for gulls in the Firth of Forth and around the Forth Islands are vast, therefore the potential temporary displacement from a relatively small zone around the proposed Development site is near-certain to have a negligible effect on the Forth Islands SPA population.

8.4.2.12 Sandwich Tern

Sandwich terns were frequently recorded flying through the survey area, but there was no evidence that the area around the Development site formed an important feeding area for this species. It is probable that birds would slightly adjust their flight route to fly further away from the Development area during construction. However, due to the small scale of the Development the energetic consequences to individual birds are near-certain to be negligible.

8.4.2.13 Common Tern

Common terns were frequently recorded flying through the survey area, but there was no evidence that the area around the Development site formed an important feeding area for this species. It is probable that birds would slightly adjust their flight route to fly further away from the Development area during construction. However, due to the small scale of the Development the energetic consequences to individual birds are near-certain to be negligible.

8.4.3 Potential Operational Effects

Operational activities are described in Chapter 3: *Project Description* of this ES and are considered likely to cause three broad types of direct and indirect effect: disturbance, barrier effect to movements and collision.

Disturbance many arise from increased movements of personnel, vehicles and machinery servicing the operational turbine, as well as from visual and noise disturbance created by the moving parts of the turbine. Species with low tolerance for such disturbance may be displaced from the area.

The presence of the turbine may cause an obstruction to bird flight, forcing birds to fly above or around the structure. This has a potential for population disturbance by increasing energy expenditure of individuals, particularly where regularly used flight paths between important sites for feeding, roosting, etc are affected. On a small scale barrier effects on bird populations has been found to be not significant. However the cumulative effect of numerous windfarms, or extensive sites could have a negative effect on populations.

Collision would occur when a bird flying through the rotor swept area is struck by a moving rotor. Collision of a bird with operational turbine rotors is almost certain to result in the death of the bird. The loss of individuals from a species with a low population density and low reproductive rate, such as raptors, may cause a greater negative effect on the population

than the loss of individuals from species occurring at typically higher population densities and higher reproductive rates (e.g. oystercatcher). The frequency and likelihood of collisions depends on a number of factors relating to the biology of birds (often species-specific), the local landscape, and the structure of the turbine. The base of the turbine tower is of a steel lattice construction, which may offer opportunities for birds to perch on. However, the lattice part of the structure is entirely below the rotor sweep. Collision risk may be increased for birds that are attracted to perch on the base, although those birds flying below 24.5 m above mean sea level would be below the sweep of the rotors and would be unlikely to be at risk when flying onto or off the tower. Most species would be unlikely to perch on the jacket, although those species currently resting on terrestrial habitats within the FEP site may do so: cormorant, shag and gulls.

For this assessment, an arbitrary threshold of 1% increase in species baseline mortality (derived from Birds of the Western Palearctic)[19] for the population assessed has been set as a trigger for further, more detailed consideration of the effects of collision mortality. An increase of less than 1% in baseline mortality has been judged as likely to be a negligible effect on the population and is not assessed in more detail. Baseline mortality percentages for VORs at risk of collision from the Development are presented in Table 8.6 below.

Table 8.6: Baseline Mortality Rates

Species	**Mortality Rate**
Eider	20 %
Fulmar	5.52 %
Gannet	6.1 %
Cormorant	21.125 %
Shag	16 %
Oystercatcher	15.9 %
Kittiwake	16.5 %
Sandwich tern	8 %
Common tern	8 %

The effects of operational disturbance and the risk of collision may be considered mutually exclusive i.e., a bird that avoids the turbine due to disturbance will not be at risk of collision with the turbine rotors at that time. However, a bird may initially avoid the turbine (due to disturbance) but habituate to it over time, and would then be at risk of collision.

Where sufficient flight activity at PCH has been recorded for individual species, collision risk modelling has been conducted, the results of which are presented in Appendix 8.1.

8.4.3.1 Eider

Eiders were consistently present within the survey area, although the numbers recorded were less than 1% of the Firth of Forth population. The area close to the Development site is not critical for this species and there is a considerable amount of more suitable foraging area within the Firth of Forth. Any displacement from this area as a result of the presence of the operational turbine is near-certain to have a negligible effect on the population within the Firth of Forth.

Eiders were frequently recorded flying through the survey area and it is probable that birds would slightly adjust their flight route to fly further away from the operational turbine. However, due to the small scale of the Development the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to eiders was estimated to be one bird approximately every 5 years (0.19 birds per year), therefore one collision might occur during the five-year operational phase of the Development. This represents an increase in baseline mortality of approximately 0.002 %

[19] Cramp, S. and Simmons, K.E.L. (1983). Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palearctic Volume III. Oxford University Press.

for the Firth of Forth SPA cited population of 9,400 birds (an increase in the rate of mortality of 0.01 %) and is therefore considered to be negligible.

8.4.3.2 Long-tailed Duck

Long-tailed ducks were infrequently present within the survey area in small numbers. The area close to the Development site is not important for this species and there is a considerable amount of more suitable foraging area within the Firth of Forth. Any displacement from this area as a result of the presence of the operational turbine is near-certain to have a negligible effect on the population within the Firth of Forth.

Long-tailed ducks were infrequently recorded flying through the survey area. It is probable that birds would slightly adjust their flight route to fly further away from the operational turbine. However, long-tailed ducks tend to forage more distantly off-shore, therefore there is unlikely to be a regular flight route through the Development area. Due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to long-tailed ducks was estimated to be negligible, as all records during surveys were of birds flying below PCH.

8.4.3.3 Red-throated Diver

Red-throated divers were only occasionally recorded within the survey area, in very small numbers, therefore it is considered that the area close to the Development site is not important for this species. Any displacement from this area is near-certain to have a negligible effect on the population within the Firth of Forth.

Just three birds were recorded flying through the survey area, therefore there is no evidence that birds would be subject to adverse energetic consequences as a result of a barrier effect to movement.

The collision risk to red-throated divers was estimated to be negligible.

8.4.3.4 Fulmar

Fulmars were infrequently recorded flying through the survey area. There was no evidence that the area around the Development site formed an important feeding area for this species, therefore the effects of operational disturbance are negligible.

It is probable that birds would slightly adjust their flight route to fly further away from the operational turbine, but the Development site is not located in a regularly used flight route – the fulmar is mainly a pelagic species foraging in off-shore, rather than near-shore areas. Due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to fulmars was estimated to be one bird approximately every five years (0.19 birds per year), therefore there might be one collision during the five-year operational phase of the Development. This represents an increase in baseline mortality of 0.012 % for the Forth Islands SPA cited population of 798 pairs (an increase in the rate of mortality of 0.22 %) and is therefore considered to be negligible.

8.4.3.5 Gannet

Gannets were frequently recorded flying through the survey area, but there was no evidence that the area around the Development site formed an important feeding area for this species, therefore the effects of disturbance are negligible.

It is probable that birds would slightly adjust their flight route to fly further away from the operational turbine, but the Development site is not located in a regularly used flight route – the gannet is mainly a pelagic species foraging in off-shore, rather than near-shore areas. Due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to gannets was estimated to be one or two birds per year (1.69 birds per year). This represents an increase in baseline mortality rate of 0.008 % for the Forth Islands SPA cited population of 21,600 pairs (an increase in the rate of mortality of 0.13 %) and is therefore considered to be negligible.

8.4.3.6 Cormorant

Cormorants used habitats within the survey area and were also frequently recorded flying offshore through the survey area. Their main use of the area was for resting on the sea-wall and other coastal structures and foraging near-shore within approximately 10 m of the sea-wall. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and taking into consideration the small numbers present, it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during the operational phase is near-certain to have a negligible effect on the population within the Firth of Forth. Displaced birds would have a substantial amount of alternative available areas to use. Birds recorded within the survey area could potentially be associated with the Forth Islands SPA. The available foraging grounds for cormorants in the Firth of Forth are vast, therefore the potential displacement from a relatively small zone around the proposed Development site during the operational phase of up to five years is near-certain to have a negligible effect on the Forth Islands SPA population.

It is probable that birds would slightly adjust their flight lines to fly further away from the operational turbine. However, due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to cormorants was estimated to be nearly one bird per year (0.83 birds per year). Birds may perch at the base of the turbine tower on the jacket, but this is below the rotor sweep, therefore it is extremely unlikely that birds landing on or taking off from that part of the tower would be at increased risk of collision with the moving rotors. The potential effect of collision risk on the nationally important Firth of Forth SPA or Forth Islands SPA populations of cormorants is therefore considered to be negligible – increase of 0.12 % in baseline mortality of Firth of Forth SPA cited population of 682 birds (increase in rate of mortality of 0.58 %); and increase of 0.21 % in baseline mortality of Forth Islands SPA cited population of 200 pairs (increase in rate of mortality of 0.98%).

8.4.3.7 Shag

Shags used habitats within the survey area and were also frequently recorded flying offshore through the survey area. Their main use of the survey area was for resting on the sea-wall and other coastal structures. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and taking into consideration the very small numbers present, it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during the operational phase is near-certain to have a negligible effect on the local population. The birds recorded within the survey area could potentially be associated with the Forth Islands SPA. The available foraging grounds for shags in the Firth of Forth and around the Forth Islands are vast, therefore the potential displacement from a relatively small zone around the proposed Development site during the operational phase of the Development is near-certain to have a negligible effect on the Forth Islands SPA population.

It is probable that birds would slightly adjust their flight lines to fly further away from the operational turbine. Due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to shags was estimated to be one bird approximately every one or two years (0.64 birds per year). Birds may perch at the base of the turbine tower on the jacket, but this is below the rotor sweep, therefore it is extremely unlikely that birds landing on or taking off

from that part of the tower would be at increased risk of collision with the moving rotors. The potential effect of collision risk on the Forth Islands SPA population of shags is therefore considered to be negligible – increase of 0.01 % in baseline mortality of the Forth Islands SPA cited population of 2,400 pairs (increase in rate of mortality of 0.08 %).

8.4.3.8 Oystercatcher

Oystercatchers were frequently recorded flying through the survey area, probably moving between roosts and feeding areas in response to tidal changes. There was only one record of a bird using habitat within the survey area, therefore the area within the zone of influence of the Development is not important as a foraging area for oystercatchers. The potential effect of operational disturbance is therefore negligible.

It is probable that birds would slightly adjust their flight route to fly further away from the Development area during the operational phase. Although there were frequent records of oystercatchers flying through the survey area, the maximum number recorded was 50 birds and there was no evidence of regular movement of large numbers of birds between feeding and roosting sites. In terms of the Firth of Forth population, the numbers involved were relatively small. Due to the small scale of the Development and the relatively small number of birds moving through the survey area, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to oystercatchers was estimated to be approximately one bird every year (1.16 birds per year). This represents an increase in baseline mortality of 0.01 % for the Firth of Forth SPA cited population of 7,846 birds (an increase in the rate of mortality of 0.09%) and is therefore considered to be negligible.

8.4.3.9 Kittiwake

Kittiwakes were fairly frequently recorded flying through the survey area. There was no evidence that the area around the Development site formed an important feeding area for this species, therefore the effects of operational disturbance are negligible.

It is probable that birds would slightly adjust their flight route to fly further away from the operational turbine, but the Development site is not located in a regularly used flight route – the kittiwake is mainly a pelagic species foraging in off-shore, rather than near-shore areas. Due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to kittiwakes was estimated to be approximately one to two birds every year (1.34 birds per year). This represents an increase in baseline mortality of 0.008 % in the baseline mortality for the Forth Islands SPA cited population of 8,400 pairs (an increase in the rate of mortality of 0.05 %) and is therefore considered to be negligible.

8.4.3.10 Herring Gull

Herring gulls used habitats within the survey area, but flight activity in the area at PCH was not considered sufficient to warrant including them as a target species. Their main use of the survey area was for resting on the sea-wall and other coastal structures, where small numbers were infrequently recorded for most of the year, with highest numbers present during the late summer/autumn period. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during the operational phase is near-certain to have a negligible effect on the local population. The birds recorded within the survey area could potentially be associated with the Forth Islands SPA. The available foraging grounds for herring gulls in the Firth of Forth and around the Forth Islands are substantial, therefore the potential displacement from a relatively small zone around the proposed Development site during the operational phase of the Development is near-certain to have a negligible effect on the Forth Islands SPA population.

No regular flight route of herring gulls was detected, therefore there are not likely to be any effects on the population as a result of barrier to movements. Birds may perch at the base of the turbine tower on the jacket, but this is below the rotor sweep, therefore it is extremely unlikely that birds landing on or taking off from that part of the tower would be at increased risk of collision with the moving rotors. It is probable that the magnitude of the effect of collision risk would be negligible or low in the context of the regional population.

8.4.3.11 Lesser Black-backed Gull

Lesser black-backed gulls used habitats within the survey area, but flight activity in the area at PCH was not considered sufficient to warrant including them as a target species. Their main use of the survey area was for resting on the sea-wall and other coastal structures, where very small numbers were infrequently recorded for most of the year, with larger numbers present only during the late summer/autumn period. This species will be habituated to a certain degree to human and vehicular disturbance within the FEP site and taking into consideration the small numbers present, it is probable that birds would either continue to rest on structures close to the Development site, or would be able to use areas elsewhere for resting. The area around the Development site is not used by large numbers of foraging birds, therefore it is concluded that any displacement from this area during the operational phase is near-certain to have a negligible effect on the local population. The birds recorded within the survey area could potentially be associated with the Forth Islands SPA. The available foraging grounds for lesser black-backed gulls in the Firth of Forth and around the Forth Islands are vast, therefore the potential displacement from a relatively small zone around the proposed Development site during the operational phase of the Development is near-certain to have a negligible effect on the Forth Islands SPA population.

No regular flight route of lesser black-backed gulls was detected, therefore there are not likely to be any effects on the population as a result of barrier to movements. Birds may perch at the base of the turbine tower on the jacket, but this is below the rotor sweep, therefore it is extremely unlikely that birds landing on or taking off from that part of the tower would be at increased risk of collision with the moving rotors. It is probable that the magnitude of the effect of collision risk would be negligible or low in the context of the regional population.

8.4.3.12 Sandwich Tern

Sandwich terns were frequently recorded flying through the survey area, but there was no evidence that the area around the Development site formed an important feeding area for this species, therefore the effects of disturbance are negligible.

It is probable that birds would slightly adjust their flight route to fly further away from the operational turbine. However, due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to Sandwich terns was estimated to be nearly four birds per year (3.89 birds per year). This is an increase in baseline mortality of 0.24 % for the Firth of Forth SPA cited population of 1,617 birds (an increase in the rate of mortality of 3.01 %) and 0.44 % for the Forth Islands SPA cited population of 440 pairs (an increase in the rate of mortality of 5.53 %). The increase in baseline mortality is less than 1 % of the cited populations of the Firth of Forth and the Forth Island SPA cited populations, but due to their low mortality rate, the increase in the mortality rate itself is more than 1 %. Over the short life-span of the Development (five years of operation), it is considered that the effect is of negligible magnitude (the scale of possible loss to collisions is well within the annual variation in numbers) and is therefore not significant. It is also considered that collision risk would not adversely affect the integrity of either the Firth of Forth or the Forth Islands SPAs.

8.4.3.13 Common Tern

Common terns were frequently recorded flying through the survey area, but there was no evidence that the area around the Development site formed an important feeding area for this species, therefore the effects of disturbance are negligible.

It is probable that birds would slightly adjust their flight route to fly further away from the operational turbine. However, due to the small scale of the Development, the energetic consequences to individual birds are near-certain to be negligible.

The collision risk to common terns was estimated to be between one to two birds every year (1.43 birds per year). This represents an increase in baseline mortality of 0.21 % for the Forth Islands SPA cited population of 334 pairs (an increase in the rate of mortality of 2.68 %). The increase in baseline mortality is less than 1 % of the cited populations of the Firth of Forth and the Forth Island SPA cited populations, but due to their low mortality rate, the increase in the mortality rate itself is more than 1 %. Over the short life-span of the Development (five years of operation), it is considered that the effect is of negligible magnitude (the scale of possible loss to collisions is well within the annual variation in numbers) and is therefore not significant. It is also considered that collision risk would not adversely affect the integrity of the Forth Islands SPA.

8.4.4 Potential Decommissioning Effects

Potential effects of decommissioning the Development are considered likely to be similar in nature to those identified during construction, except that the magnitude of these effects will be reduced due to the shorter timescale of operations.

8.5 Mitigation Measures and Residual Effects

It is not considered that the construction and decommissioning method statements require implementation of any restriction on the timing of the works, as there does not appear to be any clear temporal pattern of occurrence of birds within the survey area. There are no breeding birds in close vicinity to the Development and there are very few birds at any time of year making any use of the habitats on land, in the intertidal area, or off-shore within the zone of influence of the Development. No additional mitigation measures, other than those embedded in the design of the Development, are proposed, as all identified potential effects have been assessed as negligible and not significant. There are no significant residual effects on any of the VORs.

The estimated collision risk to each species is considered to be negligible. The total estimate collision risk for all species is approximately 12 birds per year. This estimate makes use of an avoidance rate of 98 %, which is considered to be precautionary for use in assessments of collision risk. The collision rate is therefore likely to be less than 12 birds per year and any monitoring effort required to detect collisions would not be commensurate with the scale of the predicted effect. However, as the Development is for a demonstration turbine of a scale not currently in use in the industry, post-construction monitoring may be helpful to understand the interaction of birds with this type of turbine. A monitoring plan will be considered, the details of which will be agreed through consultation with SNH and Marine Scotland.

8.6 Cumulative Effect Assessment

The cumulative assessment considers the potential for effects of the Development on birds in combination with other similar developments in the wider area. As presented in the Landscape and Visual Assessment of this ES, four other developments are considered here. It should be noted that as there is no survey data available for the two additional proposed 2-B turbines listed in the Landscape and Visual Assessment, any assessment would be purely hypothetical and as such they are not included in this cumulative assessment:

- Little Raith Windfarm – a development of 9 wind turbines near Lochgelly approximately 18.5 km south west of the Development;
- The Hydrogen Office turbine at Methil Docks – a single wind turbine located approximately 1.7 km northeast of the Development adjacent to part of the Firth of Forth SPA;
- Lochelbank Windfarm – a development of 12 wind turbines located near Glenfarg in Perth and Kinross approximately 28.8 km north west of the Development; and

- Westfield Windfarm – a development of 5 wind turbines located near Kinglassie approximately 15 km west of the Development.

Of these consented and/or constructed developments, only the consented Hydrogen Office turbine at Methil Docks is likely to have potential effects on the ornithological interests of the Firth of Forth SPA in combination with this Development of a single demonstrator turbine at the FEP. The other three developments are located in areas sufficiently distant from the Firth of Forth that they would not contribute to any cumulative effect on birds in combination with this Development.

In their response to Scoping, the RSPB highlighted the need to consider the Round 3 and Scottish Territorial Waters offshore wind energy developments in the outer Forth. However, it is not possible to take such proposed developments fully into account in this assessment, as no baseline information is available regarding the potential effects. It should be noted that this Development is scheduled for an operational phase of a maximum of five years. Considering the likely timescales involved in the planning application and construction phase of offshore developments in the Firth of Forth, it is likely that this Development would have completed its operational phase before any offshore developments in the Forth are operational.

The potential for cumulative collision risk effects are considered in Table 8.7. The collision risk figures for the Hydrogen Office turbine are taken as the values presented in the revised ornithological assessment for that development, specifically for the location of a EWT DW750 turbine in Cell B3. Only those species assessed as having some collision risk at the Hydrogen Office and/or some collision risk at this Development are included in the cumulative assessment below. Any other VORs considered in this ornithology chapter can be assumed to have no cumulative effect additional to that described above in the assessment for each species.

Table 8.7: Cumulative Collision Risk Assessment

Receptor **(baseline % mortality)**	**Collision Risk at Hydrogen Office turbine (birds/year)**	**Collision Risk at this Development (birds/year)**	**Cumulative Collision Risk (birds/year)** **SPA population (FoF/FI)*** **% increase in baseline mortality for SPA population (FoF/FI)*** **% increase in rate of mortality for SPA population (FoF/FI)***	**Cumulative Assessment**
Cormorant (21.125 %)	0.97	0.83	1.80 682/400 0.26/0.45 1.25/2.13	Magnitude: Negligible Not Significant
Shag (16 %)	0.23	0.64	0.87 NA/4800 NA/0.02 NA/0.11	Magnitude: Negligible Not Significant
Oystercatcher (15.9 %)	2.94	1.16	4.10 7846/NA 0.05/NA 0.33/NA	Magnitude: Negligible Not Significant
Kittiwake (16.5 %)	11.09	1.34	12.43 NA/16800 NA/0.07 NA/0.45	Magnitude: Negligible Not Significant

Receptor (baseline % mortality)	Collision Risk at Hydrogen Office turbine (birds/year)	Collision Risk at this Development (birds/year)	Cumulative Collision Risk (birds/year) SPA population (FoF/FI)* % increase in baseline mortality for SPA population (FoF/FI)* % increase in rate of mortality for SPA population (FoF/FI)*	Cumulative Assessment
Sandwich tern (8 %)	0.56	3.89	4.45 1617/880 0.28/ 3.44/6.32	Magnitude: Negligible Not Significant
Common tern (8 %)	0.04	1.43	1.47 NA/668 NA/0.22 NA/2.75	Magnitude: Negligible Not Significant

*FoF = Firth of Forth; FI = Forth Islands; NA = not applicable

The increase in baseline mortality caused by cumulative collision risk is less than 1 % of the cited populations of the Firth of Forth and the Forth Island SPA cited populations of all species and is therefore considered to be of negligible magnitude and not significant. However, for cormorant, Sandwich tern and common tern, the increase in the mortality rate itself is more than 1 %. Over the short life-span of the Development (five years of operation), it is considered that the effect on each of these species' populations is of negligible magnitude, because the scale of possible loss to collisions is well within the annual variation in numbers, and is therefore not significant. It is also considered that the cumulative collision risk would not adversely affect the integrity of either the Firth of Forth or the Forth Islands SPA populations of any species considered in this assessment.

During post-application discussions with SNH regarding the Consented Development application, SNH highlighted that there was considerable difference between the collision risk estimates for kittiwake at the Hydrogen Office turbine and the Consented Development turbine. The estimated collision risk for kittiwake at the Hydrogen Office turbine is ten times higher than that estimated for this Development. It is unclear why such a difference exists between the two developments which are in relatively close proximity to each other. However, it may be due to the difference in height of the rotor swept areas, or may simply be due to a difference in observed flight activity as a result of different proximity to the nearest nest sites. It is not considered that a detailed examination of this difference is necessary for the assessment, because the collision risk estimates are small and no likely significant effects would be identified for kittiwake, either based on the observed flight activity, or under a theoretical scenario that the risk posed by the Development were similar to that at the Hydrogen Office turbine.

8.7 Potential Effects on European Sites (Natura 2000)

Under the Habitats Regulations (Regulation 48), where an authority concludes that a development proposal unconnected with the nature conservation management of a Natura 2000 site is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the conservation interests for which the area has been designated. The need for appropriate assessment extends to projects outwith the boundary of the site in order to determine their implications for the interest protected within the site.

8.7.1 Firth of Forth SPA

The assessment provided above considers the potential effects of the construction, operation and decommissioning of the Development on each of the species for which the Firth of Forth qualifies as a SPA. For Sandwich tern, there is the potential for a likely significant effect resulting from collision mortality, both alone and in combination with the Hydrogen Office

turbine. However, as mentioned above, it is considered that the loss of up to four Sandwich terns per year is highly unlikely to threaten the integrity of the SPA, which is designated in part for its passage population. For all remaining species, the assessment concludes that the magnitude of the potential effects on the species' populations is negligible. In this regard, it is concluded with reasonable certainty that the integrity of the Firth of Forth SPA would not be adversely affected.

Although located within the Firth of Forth SPA (Figure 8.1), the Development will not directly affect the intertidal habitats within the SPA that support the important bird populations. Natural intertidal habitats no longer exist at the location of the Development (survey cell C2), which is evident in the results of the activity surveys: there was just one record of an oystercatcher, one record of eight redshank and one record of four turnstone on the sea wall within the survey area. As a result of the lack of any intertidal area and paucity of any records of wading birds using the survey area, it is not considered that any detailed analysis of tidal state and bird presence is necessary to inform the assessment. The Development would not result in any likely significant effects as a result of disturbance to qualifying SPA species.

8.7.2 Forth Islands SPA

The assessment provided above considers the potential effects of the construction, operation and decommissioning of the Development on each of the species for which the Forth Islands qualifies as a SPA. For Sandwich tern and common tern there is the potential for a likely significant effect resulting from collision mortality, both alone and in combination with the Hydrogen office turbine. However, as mentioned above, it is considered that the loss of up to four sandwich terns and two common terns per year is highly unlikely to threaten the integrity of the SPA. For all remaining species, the assessment concludes that the magnitude of the potential effects on the species' populations is negligible. In this regard, it is concluded with reasonable certainty that the integrity of the Forth Islands SPA would not be adversely affected.

8.8 Summary of Effects

Potential effects on ornithology arising from the Development are summarised in Table 8.8.

Table 8.8: Summary of Effects

Development phase	Receptor	Effect	Mitigation & Design measures	Effect magnitude and/or likelihood	Significance & confidence
Construction/ Decommissioning	Eider Long-tailed duck Red-throated diver Cormorant Shag Herring gull Lesser black-backed gull	Temporary (approximately four months), reversible, small-scale displacement of small numbers of individuals from sub-optimal foraging and resting areas	None required	Negligible/Extremely unlikely	Not significant; certain/near certain
Construction/ Decommissioning	Eider Long-tailed duck Red-throated diver Cormorant Shag Oystercatcher Sandwich tern Common tern	Temporary (approximately one month), reversible, small-scale disruption to flight movements of small numbers of birds along the coastline, resulting in reduced survival or breeding productivity due to adverse energetic consequences	None required	Negligible/Extremely unlikely	Not significant; certain/near certain
Operation	Eider Long-tailed duck Red-throated diver Cormorant Shag Herring gull Lesser black-backed gull	Temporary (≤5 years), reversible small-scale displacement of small numbers of individuals from sub-optimal foraging and resting areas	None required	Negligible/Extremely unlikely	Not significant; certain/near certain
Operation	Eider Long-tailed duck Red-throated diver Cormorant Shag Oystercatcher Sandwich tern Common tern	Temporary (≤5 years), reversible small-scale barrier to flight movements of small numbers of birds along the coastline resulting in reduced survival or breeding productivity due to adverse energetic consequences	None required	Negligible/Extremely unlikely	Not significant; certain/near certain

Development phase	Receptor	Effect	Mitigation & Design measures	Effect magnitude and/or likelihood	Significance & confidence
Operation	Fulmar Gannet Cormorant Shag Oystercatcher Kittiwake Sandwich tern Common tern	Temporary (≤5 years), reversible collision risk to birds moving along the coastline	None required	Negligible/Extremely unlikely	Not significant; certain/near certain
Construction/ Operation/ Decommissioning	Firth of Forth SPA	Potential effects as described above for qualifying species	None required	Negligible and extremely unlikely	Not significant; certain/near certain No adverse effect on integrity
Construction/ Operation/ Decommissioning	Forth Islands SPA	Potential effects as described above for qualifying species	None required	Negligible and extremely unlikely	Not significant; certain/near certain No adverse effect on integrity

8.9 Statement of Significance

This chapter has assessed the significance of the potential effects of the Development on ornithological receptors and, on the basis of currently available information, has determined them all to be not significant. No mitigation is considered necessary to avoid or reduce the any potential effects.

It is considered that there would be no adverse effects on the integrity of the Firth of Forth SPA and the Forth Islands SPA as a result of the construction, operation and decommissioning of the Development, alone or in combination with other similar developments.

9 WATER RESOURCES AND COASTAL HYDROLOGY

9.1 Introduction

This chapter of the ES identifies and evaluates the effects of the Development arising from the construction, operation and decommissioning phases on the water resources and coastal hydrology.

This assessment has involved the following elements, further details of which are provided in the sections below:

- Legislation, Guidance and Consultation;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

This chapter is supported by Technical Appendix 9.1 Surface and Coastal Water Management Plan.

Where applicable the application documents for the Consented Development[1] are referred to throughout this chapter.

9.2 Legislative, Guidance and Consultation

The following guidance and policy has been considered during the assessment:

- Water Framework Directive (2000/60/EC)[2]. The Water Framework Directive (WFD) establishes a framework for the protection, improvement and sustainable use of all water environments;
- Sections 196 – 211 Flooding and Drainage of Scottish Planning Policy (SPP). This Policy states that new developments should not materially increase the probability of flooding elsewhere, add to the area of land which requires protection by flood prevention measures or affect the ability of the functional flood plain to attenuate the effects of flooding by storing flood water;
- Coast Protection Act 1949[3]: the construction, alteration or improvement of any works on, under or over any part of the seashore lying below the level of mean high water springs (MHWS) require authorisation from the Secretary of State (including the deposit or removal of any object or materials from the seashore below the level of mean low water springs (MLWS);
- The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2011 (where applicable) relating to projects being developed in the marine environment
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended by The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008 (where applicable) relating to the development of energy generating projects;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011) relating to projects falling under the Town and Country Planning regime (landward of the MLWS).

[1] Arcus, Methil Offshore Demonstration Wind Turbine, April 2010
[2] European Parliament (2000). "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" ("The Water Framework Directive") [online] Available at: http://ec.europa.eu/environment/water/water-framework/index_en.html. [Accessed 09/03/2012].
[3] Coast Protection Act (1949) [online] Available at: http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1949/cukpga_19490074_en_1 [Accessed 24/02/2012].

9.2.1 Pollution Prevention Guidance Notes (PPGs)

- Produced by the Scottish Environmental Protection Agency (SEPA), Pollution Prevention Guidance Notes (PPGs) give advice on statutory responsibilities and good environmental practice. Each PPG addresses a specific industrial sector or activity. The following guidelines are of relevance:
- PPG2: Above ground oil storage tanks[4];
- PPG4: Disposal of sewage where no mains drainage is available[5];
- PPG6: Working at construction and demolition sites[6];
- PPG14: Marinas and Craft[7];
- PPG18: Managing fire water and major spillages[8]; and
- PPG21: Pollution incident response planning[9].

Other relevant guidance comprises the following:

- PAN 51: Planning, Environmental Protection and Regulation[10];
- PAN 61: Planning and Sustainable Urban Drainage Systems;
- PAN 69: Planning and Building Standards Advice on Flooding;
- PAN 79: Water and Drainage;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR)[11];
- SEPA 'CAR Practical Guide'[12];
- The Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C692) (2010). C650 provides guidance on how to avoid causing environmental damage when on a construction site; and
- CIRIA Control of Water Pollution from Construction Sites (C532) (2001). C532 provides guidance on how to plan and manage construction projects to control water pollution.

9.2.2 Consultation

- Information and advice in response to consultation has been provided by a range of organisations during the assessment, and this is summarised in Table 9.1 which includes responses received to the Scoping report issued in February 2012.

[4] SEPA (no date provided). PPG2: "Above ground oil storage tanks" [online] Available at: http://publications.environment-agency.gov.uk/pdf/PMHO0204BHTN-e-e.pdf?lang=_e. [Accessed 03/03/2012].
[5] SEPA (no date provided). PPG4: "Treatment and disposal of sewage where no foul sewer is available" [online] Available at: http://publications.environment-agency.gov.uk/pdf/PMHO0706BJGL-E-E.pdf. [Accessed 09/03/2012].
[6] SEPA (no date provided). PPG6: "Working at construction and demolition sites" [online] Available at: http://publications.environment-agency.gov.uk/pdf/PMHO0203AUDJ-e-e.pdf [Accessed 08/03/2012].
[7] SEPA (no date provided). PPG14: "Marinas and Craft" [online] Available at: http://www.ni-environment.gov.uk/ppg14.pdf [Accessed 11/02/2012].
[8] SEPA (no date provided). PPG18: "Managing fire water and major spillages" [online] Available at: http://publications.environment-agency.gov.uk/pdf/PMHO600BBUD-e-e.pdf. [Accessed 22/02/2012].
[9] SEPA (no date provided). PPG21: "General Pollution Incident Response Planning" [online] Available at: http://publications.environment-agency.gov.uk/pdf/PMHO0309BPNA-e-e.pdf. [Accessed 22/02/2012].
[10] PAN 51 – 79 [online] Available at: http://www.scotland.gov.uk/Topics/Built-Environment/planning/publications/pans [Accessed 07/03/2012].
[11] OPSI (2005). The Water Environment (Controlled Activities) (Scotland) Regulations 2011. [online] Available at: http://www.legislation.gov.uk/ssi/2011/209/made [Accessed 18/02/2012].
[12] SEPA (2008). Controlled Activities Regulations - A Practical Guide.

Table 9.1: Consultation Responses

Consultee	Comments	Response
Marine Scotland	Advised to consult with SEPA regarding Water Environment (Controlled Activities) (Scotland) Regulations 2005.	Noted. Consultation with SEPA has been undertaken and will be ongoing.
	Notes SEPA Pollution Prevention Guidelines which should be given consideration. Be aware of the CIRIA guidance on control of water pollution.	The relevant guidelines including PPG's and CIRIA guidance are referenced in Section 9.2.1 above and have been incorporated into this assessment.
	Prevention and clean up measures should be considered during construction, operation and decommissioning.	Pollution prevention measures, and measures to protecting the water environment are presented throughout this chapter.
	Consultation with local fisheries board at an early stage.	The Inshore Fisheries Group (South East) were consulted as part of the scoping exercise. Comments regarding protection of fisheries stocks are presented in Chapter 7 of this ES.
	Identify location of and protective measures relating to private water supplies.	Private water supplies are included in Section 9.3.1.2.
	Marine Scotland commented on the Physical Environment and coastal processes such as sediment processes and noted consideration should be given to the SNH reports on coastal cells.	Coastal processes are considered in Section 9.3.6 and 9.6.1.2 of this chapter including consideration of the relevant SNH report of coastal cells.
Fife Council	Studies and reports as per the Scoping report to be undertaken. Considered the scope of the reports should not need to exceed those from the Consented Development.	The studies and reports have been undertaken and are presented throughout this chapter.
SNH	SNH recommended Arcus seek updated comments from SEPA regarding Water Environment (Controlled Activities) (Scotland) Regulations 2005.	Arcus have consulted with SEPA regarding CAR and will continue to liaise with SEPA throughout the consenting and development process.
	SNH also recommend that the Development site is an actively eroding stretch of coastline and that further thought is given to the possibility of effects on coastal processes – including any impacts to existing coastal defences.	Consideration is given to coastal processes in Section 9.3.6 and 9.6.1.2 of this chapter.

Consultee	Comments	Response
SEPA	Scoping response noted SEPA were content the scope of the ES can remain as per the Consented Development with the exception of river basin management planning and marine non-native species. SEPA note that all transitional (estuarine) and coastal waters out to three nautical miles seaward from the Scottish territorial baseline falls under the Water Framework Directive (WFD) which requires them to be considered in terms of their chemical, ecological and hydromorphological status. The Elie to Buckhaven water body (WB ID 200050) should be included in the ES.	Marine non-native species are addressed in Chapter 7: *Ecology* of this ES. The Elie to Buckhaven water body (WB ID 200050) is identified in the baseline in Section 9.3.9 and is assessed in Section 9.6.1 of this chapter.
Fife Council (Environmental Health)	Information provided on private water supplies.	Information provided on private water supplies.
The Meteorological Office		Data was obtained from the Meteorological Office on regional climatic averages.
National River Flow Archive		Data was obtained from the National River Flow Archive on precipitation levels at a gauging station on the River Leven.

9.2.3 Assessment Methodology

The significance of the potential effects of the Development have been classified by taking into account sensitivity of receptor and magnitude of potential effect, combined with the likelihood of an event occurring. The Development, for the purposes of this assessment, has been taken to be as described in Chapter 3: *Project Description* of this ES, including the Surface and Coastal Water Management Plan, which is provided as Technical Appendix 9.1.

The sensitivity of the receiving environment is defined as its ability to absorb an effect without perceptible change and can be classified as either low, moderate or high. The sensitivity is dependent on factors such as the quality of local receiving waters, their purpose (e.g. whether used for drinking, fisheries, etc.) and existing influences, such as land use and are outlined in the following paragraphs.

9.2.3.1 High Sensitivity

A 'high sensitivity' receptor is classified as either:

- A large, medium or small waterbody with a SEPA water quality classification of "High" or "Good";
- The hydrological receptor and downstream environment will struggle to attenuate natural fluctuations in hydrochemistry and cannot absorb further changes without fundamentally altering its baseline characteristics / natural processes;
- The hydrological receptor is of high environmental importance or is designated as national or international importance, such as SAC's and SSSI's;
- The hydrological receptor is designated for supporting ecological interest;
- The hydrological receptor acts as an active floodplain or other flood defence;
- The hydrological receptor is protected under the Bathing Waters (Scotland) Regulations 2008[13];

[13] The Bathing Waters (Scotland) Regulations 2008 [online] Available at: http://www.legislation.gov.uk/ssi/2008/170/contents/made [Accessed 08/03/2012].

- The hydrological receptor will support abstractions for public water supply or private water abstractions for more than 25 people;
- Areas containing geological or geomorphological features considered to be of national importance (e.g. SSSI's); and/or
- Local groundwater constitutes a valuable resource because of its high quality and yield. Aquifer(s) of local or regional value. Statutorily designated nature conservation sites (e.g. SAC's and SSSI's) dependent on groundwater.

9.2.3.2 Moderate Sensitivity

A 'moderate sensitivity' receptor is classified as either:

- A large, medium or small waterbody with a SEPA water quality classification of "Moderate";
- The hydrological receptor and downstream environment will have some capacity to attenuate natural fluctuations in hydrochemistry but cannot absorb some changes without fundamentally altering its baseline characteristics / natural processes;
- The hydrological receptor is of regional environmental importance;
- The hydrological receptor does not act as an active floodplain or other flood defence;
- The hydrological receptor is not used for recreational use;
- The hydrological receptor does support abstractions for public water supply or private water abstractions for less than 25 people;
- Areas containing geological features of designated regional importance including Regionally Important Geological Sites (RIGS), considered worthy of protection for their historic or aesthetic importance; and/or
- Aquifer(s) of limited value (less than local) as water quality does not allow potable or other quality sensitive uses. Exploitation of local groundwater is not far-reaching. Local areas of nature conservation known to be sensitive to groundwater impacts.

9.2.3.3 Low Sensitivity

A 'low sensitivity' receptor is classified as either:

- A large, medium or small waterbody with a SEPA water quality classification of "Poor" or "Bad";
- The hydrological receptor and downstream environment will have capacity to attenuate natural fluctuations in hydrochemistry but can absorb some changes without fundamentally altering its baseline characteristics / natural processes;
- The hydrological receptor is not of regional, national or international environmental importance;
- The hydrological receptor is not designated for supporting freshwater ecological interest;
- The hydrological receptor does not act as an active floodplain or other flood defence;
- The hydrological receptor is not used for recreational use;
- The hydrological receptor does not support abstractions for public water supply or private water abstractions.
- Geological features or geology not protected and not considered worthy of specific protection; and/or
- Poor groundwater quality and / or very low permeability make exploitation of groundwater unfeasible. Changes to groundwater not expected to affect local ecology.

The **magnitude** of the predicted effects is determined by the timing, scale, size and duration of the potential effect resulting from the Development. The magnitude of potential effects can be classified as negligible, minor, moderate or major and are outlined in the following paragraphs.

9.2.3.4 Major Magnitude

- Short or long term major shift in hydrochemistry or hydrological conditions sufficient to negatively change the ecology of the receptor. This change would equate to a downgrading of a SEPA water quality classification by two classes e.g. from "High" to "Moderate";
- A sufficient material increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affect the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with SPP);
- Major (greater than 50 %) or total loss of a geological receptor or coastal habitat site, or where there would be complete severance of a site such as to fundamentally affect the integrity of the site (e.g. blocking hydrological connectivity);
- Major permanent or long term negative change to groundwater quality or available yield;
- Major permanent or long term negative change to geological receptor; and/or
- Changes to quality or water table level will negatively alter local ecology or will lead to flooding issue.

9.2.3.5 Moderate Magnitude

- Short or long term non-fundamental changes to the hydrochemistry or hydrological environment, resulting in a change in ecological status. This change would equate to a downgrading of a SEPA water quality classification by one class e.g. from "High" to "Good";
- A moderate increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affect the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with SPP);
- Loss of part (approximately 15 % to 50 %) of a geological receptor or peat habitat site, major severance, major effects to its integrity as a feature, or disturbance such that the value of the site would be affected, but could still function;
- Changes to the local groundwater regime may slightly affect the use of the receptor;
- Yield of existing supplies may be reduced or quality slightly deteriorated; and/or
- Fundamental negative changes to local coastal habitats may occur, resulting in impaired functionality.

9.2.3.6 Minor Magnitude

- Detectable non-detrimental change to the baseline hydrochemistry or hydrological environment. This change would not negatively change the SEPA water quality classification;
- A marginal increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affect the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with SPP);
- Detectable but non-material effect on the receptor (up to 15 %) or a moderate effect on its integrity as a feature or where there would be a minor severance or disturbance such that the functionality of the receptor would not be affected; and/or
- Changes to groundwater quality, levels or yields do not represent a risk to existing baseline conditions or ecology.

9.2.3.7 Negligible Magnitude

- No perceptible changes to the baseline hydrochemistry or hydrological environment;
- No change to the SEPA water quality classification;
- No increase in the probability of flooding onsite and offsite;
- Slight or negligible change from baseline condition of geological resources; and

- Change hardly discernible, approximating to a 'no change' in geological condition.

9.2.4 Significance

The predicted significance of the effect is determined through a standard method of assessment based on professional judgement, considering both the sensitivity of receptor and the magnitude of the potential effect as defined in Table 9.2.

Table 9.2: Significance Criteria

Magnitude	**Sensitivity**		
	Low	**Moderate**	**High**
Negligible	Negligible	Negligible	Negligible
Minor	Negligible	Minor	Moderate
Moderate	Minor	Moderate	Major
Major	Minor	Major	Major

Measures are set out within the Surface and Coastal Water Management Plan (SCWMP) which can be found in Technical Appendix 9.1. They comprise methods and works that are established and effective measures to which the Applicant will be committed through the development consent. There is sufficient confidence in the measures set out in the SCWMP for them to be treated as part of the Development for the purposes of this assessment. Accordingly, the assessment of significance of effects of the Development is considered with the inclusion of the SCWMP.

Effects assessed as major or moderate are considered to be significant for the purposes of The Environmental Impact Assessment (Scotland) Regulations 2011 (as amended)[14] (the EIA Regulations). Effects assessed as minor or less are considered to be not significant for the purposes of the EIA Regulations.

9.2.5 Assessment of Cumulative Effects

A cumulative effect is considered to be an additional effect on hydrological resources arising from the Development in combination with other proposed developments likely to affect the hydrological environment. At distances greater than 10 kilometres (km), it is considered that schemes are unlikely to contribute to a cumulative hydrological effect due to attenuation and dilution over distance of potentially polluting chemicals. Therefore, for the purposes of the assessment of potential cumulative effects on the immediate catchment and hydrological regime, only proposed developments within approximately 10 km of the Development have been considered. These developments have been identified through consultation with the relevant local authorities and statutory consultees, as outlined in Table 9.1, and are discussed in more detail in Section 9.7. The methodology followed to assess the cumulative effects is the same as that used for the Development in isolation.

9.3 Baseline Conditions

9.3.1 Desk Study

The desk study included:

- Identification of catchments, watercourses, springs and water features;
- Collation of data provided through consultations;
- Collation of tidal range data; and

[14] The Environmental Impact Assessment (Scotland) Regulations 2011 [online] Available at: http://www.legislation.gov.uk/ssi/2011/139/contents/made [Accessed 30/01/2012].

- Collation of flood plain information and water quality data.

Reference was made to the following sources of information:

- The Ordnance Survey (OS) 1:50,000 Landranger Map (Sheet 59);
- British Geological Service (BGS) Hydrogeological Map of Scotland;
- SEPA River Basin Management Plans (Interactive Map)[15]; and
- SEPA Indicative River and Coastal Flood Map (Scotland)[16].

9.3.2 Topography and Land Use

The turbine is to be located in an area of seabed to the south west of Quay 2. The Development is located approximately 35 m from the MHWS and 48.3 m from the FEP boundary, as shown in Figure 1.2 of this ES. The sea revetment in this area has not been repaired or re-instated but it is understood that proposals by Scottish Enterprise to re-construct formal coastal defences to protect the site will be implemented in due course.

The elevation of the onshore site is approximately 8 m AOD and it is assumed that ground level at the turbine location will be 3 m below Ordnance Datum.

9.3.3 Climate

The BGS Hydrogeological Map of Scotland 1:625,000, shows the Average Annual Rainfall (AAR) to be between 1,200 mm and 1,600 mm per annum. The National River Flow Archive (NRFA)[17] report AAR at the Leven gauging station (on the Leven), approximately 2.2 km north of the Development, as 948 mm.

9.3.4 Tides

The strong flood and ebb currents, with maximum velocities of 0.9 m/s and 0.5 m/s on spring and neap tides respectively (Hydrographic Office, 1975), within the Firth of Forth tend to be deflected by the rocky headlands and are considered to have minimal influence on beach development. Typical tidal flow direction within the Firth of Forth is presented in Figure 9.1. Typical tidal flows adjacent to the FEP are between 0.25 m/s and 0.5 m/s during mean neap and spring tides respectively.

The east coast of Scotland has been classified as a macrotidal area which experiences semi-diurnal tides with high water occurring approximately once every 12.4 hours. A summary of tide levels for Methil docks has been provided in Table 9.3[18].

Table 9.3: Typical Tide Levels at Methil

	Level (m/Chart Datum)	**Level (m/Ordanance Datum**
Highest Astronomic Tide (HAT) level	+6.1	+3.3
Mean High Water Spring (MHWS) tide level	+5.5	+2.6
Mean High Water Neap (MHWN) tide level	+4.3	+1.4
Mean Sea Level (MSL)	+3.1	+0.2
Mean Low Water Neap (MLWN) tide level	+1.9	-1.0
Mean Low Water Spring (MLWS) tide level	+0.7	-2.2
Lowest Astronomic Tide (LAT) level	-0.2	-3.1

[15] SEPA River Basin Management Plans [online] Available at: http://www.sepa.org.uk/water/river_basin_planning.aspx [Accessed 22/02/2012].
[16] SEPA: The Indicative River and Coastal Flood Map [online] Available at: http://go.mappoint.net/sepa/ [Accessed 02/02/2012].
[17] The National River Flow Archive [online] Available at: http://www.ceh.ac.uk/data/nrfa/data/spatial.html?17002 [Accessed 08/03/2012].
[18] UK Hydrographic Office Admiralty Tide Tables 2008.

9.3.5 Waves

The Firth of Forth is characterised by two types of waves, those originating from outside the area (swell waves) and those generated within the region by active wind processes (locally generated wind waves). Swell waves tend to be generated in the North Sea and travel into the Firth of Forth from a northerly or easterly direction.

Within the Firth of Forth significant wave heights greater than 4 m are most common from between 000° and 120° as more extreme wind conditions prevail from the northeast and east. Approximately 60 % of swell conditions are experienced from between 020° and 060°. FEP is sheltered from waves approaching from between 045° and 090° by the headland at Elie Ness. The northern end of FEP is protected from waves approaching from between 045° and 090° by Methil Harbour breakwater[19] see Figure 12.2 the Admiralty Chart.

9.3.6 Erosion Processes

SNH report that coastal evolution and erosion for the coastal stretch at Methil to Kirkcaldy (cell 1-c) is dominated by the supply of heavy colliery waste which [20]was tipped onto the beaches. This input of material has now stopped and rapid landward erosion is occurring along this coastline. Around Buckhaven and Methil much of the coastal edge has been reclaimed and protected by coastal defences. There is little beach material along this frontage as any material from further east along the Leven frontage will tend to move quickly along this frontage with little to hinder its progress.

9.3.7 Solid Geology

The solid geology map shows that the underlying solid strata in the vicinity of the near shore turbine position belong to the Upper Coal Measures. This sequence typically comprises red cross-bedded sandstones above; red, purple, yellow and green siltstones, mudstones, seatclays and thin sandstones below. There are no coal seams recorded within this sequence. The strata are generally indicated to dip 10° in a south easterly direction. The Buckhaven Fault, with an indicated downthrow to the south of 70 m, is shown to run under the area 400 m to the north.

9.3.8 Superficial Geology

BGS Digital Mapping shows that artificially made ground is present across the majority of the Development and underlies the onshore ancillary structures. Previous borehole investigations, undertaken by Posford Haskoning[21] and Ironside Farrar[22], indicate that made ground can reach depths of up to 35 m in proximity to the colliery spoil heap, approximately 120 m south west of onshore ancillary structures. Borehole records in proximity to the quay indicate between 0.9 m and 3.85 m of superficial deposits, mainly comprising colliery spoil material, likely to have been transported into the sea in surface water runoff from the adjacent spoil heap. There is some evidence of colliery spoil amongst the silty sand in the 2 m of superficial marine deposits.

9.3.9 Surface Water Hydrology

No onshore surface water features, such as burns or drainage channels. However, the Elie to Buckhaven water body (WB ID 200050) lies adjacent to the site. This is water body has been classified by SEPA under the Water Framework Directive as possessing a 'Good' Ecological Status and a chemical status of 'Pass'.

9.3.10 Hydrogeology

The BGS Hydrogeological Map of Scotland (Digital Edition) shows the site to be underlain by rocks described as locally important aquifers. The aquifers underlying the site are described as

[19] Scottish Enterprise, September 2009, Fife Energy Park Coastal Erosion and Flood Risk Management Plan,
[20] SNH Coastal Cells in Scotland: Cell 1 - St Abb's Head to Fife Ness [online] Available at: http://www.snh.org.uk/pdfs/publications/research/143.pdf [Accessed 30/04/2012].
[21] Posford Haskoning. August 2004. *Kvaerner Fabrication Yard Coastal Assessment*.
[22] Ironside Farrar. January 2007. *Fife Energy Park, Phase 3 Geo-environmental Report*.

"aquifers in which flow is dominantly in fissures and other discontinuities".

The SEPA Groundwater Vulnerability Map shows the majority of the Development to be underlain by rocks that fall within Scenario 4 (class 4b), and is vulnerable to those pollutants not readily absorbed or transformed and vulnerable to individual pollution events.

During the previous site investigation by Posford Haskoning, groundwater was only encountered at one borehole at depths greater than 2 m.

9.3.11 Designations

One hydrological designation exists within a 2 km radius of the Development site (this is shown on Figure 9.2):

The Firth of Forth is an area of Site of Special Scientific Interest (SSSI) and lies directly adjacent to the Development. The Firth of Forth SSSI is designated for Westphalian rock layer sequences on the coast at Buckhaven, illustrating the palaeogeography and palaeoenvironment of the area during Upper Carboniferous.

9.3.12 Private and Public Water Supplies

Consultation highlighted no active private water supplies within 1 km of the Development site.

9.3.13 Fisheries

The distributions and populations of fish species, including migratory salmon, sea trout, lamprey, and eel, are known to fluctuate annually in the Firth of Forth owing to spatial and temporal variations in the utilisation of the estuary by different species and their different life stages. There is significant trawling activity in the outer Firth of Forth, principally for Norway lobster, and crab, lobster, whelk and clams are also landed commercially within the Firth of Forth. Other estuarine benthic fauna is likely to include polychaete and oligochaete worms, and bivalves such as the common mussel.

9.3.14 Flooding

The Indicative River and Coastal Flood Map (Scotland)[23] shows that sections the Development are located adjacent to areas which have a 0.5 % or greater annual risk of coastal inundation. No onshore ancillary structures, such as construction compounds, are located in areas at risk of coastal inundation.

9.3.15 Information Gaps

The information available for this assessment is considered to be sufficient to assess the potentially significant effects on water resources.

9.4 Potential Sensitive Receptors

The effect on the receptors highlighted in Table 9.4 has been considered for the construction, operation and decommissioning phases of the Development.

Table 9.4: Receptors Sensitivity to Possible Effects

Receptor	Possible Effects	Sensitivity	Comment
Coastal Water Environment	Increased run-off, erosion and sedimentation, and pollution as a result of construction groundworks and chemical handling/storage.	Moderate	Considered moderate sensitivity due to the moderate attenuation capacity of the receptors with regard to hydrocarbon-based construction materials and chemicals. The receptor (Elie to Buckhaven water body) does, however, have a SEPA water quality class of 'Good'. The receptor has previously held a SEPA water quality classification of Class C

[23] SEPA: The Indicative River and Coastal Flood Map [online] Available at: http://go.mappoint.net/sepa/ [Accessed 02/02/2012].

Receptor	Possible Effects	Sensitivity	Comment
			"unsatisfactory" for the 5 km coastal stretch of Methil Docks.
Groundwater	Pollution as a result of construction groundworks and chemical handling/storage.	Low	Considered low sensitivity as no potable groundwater abstractions are supported within 1.5 km of the Development. The Aquifer is of limited value (less than local) and has poor groundwater quality.
Geology	Increased run-off, erosion and sedimentation, and pollution as a result of construction groundworks and chemical handling/storage.	Moderate	Considered moderate sensitivity as the receptor has been subjected to various sources of chemical pollution as a result of heavy industry at Methil Docks.

9.5 Embedded Mitigation

The SCWMP (provided as Technical Appendix 9.1) describes water management measures to control surface water onshore and drain hardstandings and other structures during the construction and operation of the Development. This will form part of a Pollution Prevention Plan (PPP) to be implemented for the Development.

9.5.1 Good Practice

Good practice will be followed in all aspects of construction, operation and relocation, specifically through a PPP.

The PPP will set out measures to be employed to avoid or mitigate potential effects for all phases of the Development, and will also include an Incident Plan to be followed should a pollution event occur. This plan will be produced following consultation and agreement with SEPA and all appropriate personnel working on the site will be trained in its use. The construction project manager will have specific responsibility for implementation of the PPP.

Method statements will also be applied, which will follow the principles laid out in relevant SEPA Pollution Prevention Guidelines.

9.6 Assessment of Potential Effects

9.6.1 Potential Construction Effects

The nature and magnitude of effects that could result from construction activities, as described in Chapter 3: *Project Description* of this ES, are assessed below.

9.6.1.1 Chemical Pollution

Potential risks include the spillage or leakage of chemicals, fresh concrete, fuel or oil, during use or storage on site. These pollutants have the potential to adversely affect the surrounding geology and coastal hydrology, and hence effects on the biodiversity of receptors.

Measures such as absorbent spill pads, impermeable geosynthetic membranes and other measures highlighted within the SCWMP will effectively limit the uncontained release of chemicals from onshore elements of the Development to minor fugitive releases. All onshore machinery will be equipped with drip pans to contain minor fuel spillage or equipment leakages.

The machinery and vessels used to install the turbine foundations are a potential chemical pollution source. While all machinery and vessels are considered potential spill sources, the likelihood of a spill is remote as a spill could only occur if there is a breach in the area of the fuel tank. Bunding will be placed between the crane hardstanding area and the shoreline to prevent fuel and oil transfer into the Firth of Forth in the event of a fuel or oil tank breach in any machinery used in the installation of the turbine.

Therefore, chemical pollution effects on all hydrological receptors (including the Firth of Forth SSSI and Elie to Buckhaven waterbody) have the potential to be of negligible magnitude and therefore (in accordance with Table 9.2) of negligible significance. This is not considered significant in terms of the EIA Regulations.

9.6.1.2 Sedimentation and Erosion

Erosion and sedimentation can occur from excavations, de-watering, ground disturbance, overburden stockpiling and piling of foundations. Sediment generated during the excavation of the turbine foundation, in preparation of the piles, has the potential to impact on water quality and reduce oxygen concentrations (if sediments are organically enriched) and, hence, impact upon aquatic ecology in the Firth of Forth.

The sea bed preparation will be undertaken utilising best practice in accordance with a method statement to be submitted to Marine Scotland for approval as part of the Marine Licence application. The material removed from the site during the preparation of the sea bed will be removed and transported to an existing off site disposal location.

During drilling for the piles sediment also has the potential to disperse into the Firth of Forth. Before the excavation of the turbine foundation an insulating metal jacket will be sunk into the seabed (48.3 m from the FEP boundary) to enclose the working area. This process is outlined within Technical Appendix 9.1: SCWMP. This enclosure will be dewatered and any sediment removed for disposal off site before the piled foundations are installed. Chemical analysis for the material removed during sea bed preparation and drilling will be undertaken to ensure the material is suitable for disposal at the off site location.

Measures described in the SCWMP will effectively prevent sediment entering the Firth of Forth during the installation of the ancillary onshore components. Works will be conducted during periods of low tide, therefore limiting the potential of sediment dispersing into the Firth of Forth and Elie to Buckhaven water body.

As noted by SNH there is little beach material along the frontage at Methil as any material from further east along the Leven frontage tend to move quickly with little to hinder its progress. The open lattice structure of the turbine jacket will allow currents to pass through the supporting frame and will effectively limit the potential for sediment to drop out of suspension and be deposited around the turbine.

For these reasons, the magnitude of this effect will be negligible. Given the moderate sensitivity and negligible magnitude of effect, the significance of effects associated with erosion and sedimentation is considered to be negligible, in accordance with Table 9.2.

Erosion and sedimentation from the onshore elements of the Development has limited potential to impact upon groundwater as excavation depths for hardstanding are less than 1 m depth into made ground. As such, there will negligible magnitude of effect, the significance of effects associated with erosion and sedimentation on groundwater is considered to be negligible. This is not considered significant in terms of the EIA Regulations.

9.6.1.3 Migration of Pollutants from Contaminated Land

Previous studies by Posford Haskoning and Ironside Farrar have identified areas of potentially contaminated land within the made ground surrounding the Development. A trial pit (TP12) dug by Ironside Farrar at the approximate location of the onshore ancillary structures indicated elevated concentrations of zinc.

In 2007, Arup[24] excavated trial trenches and boreholes, approximately 75 m north east of the proposed onshore elements of the Development, were undertaken. Laboratory analysis concluded that no elevated concentrations of metals or inorganic contaminants within the soils. Contaminant levels were not considered to pose a significant detrimental risk to the water environment, including groundwater.

Should potentially contaminated land be encountered during excavations, it will be tested and appropriate action taken in accordance with The Environmental Protection Act 1990 (Amendment) (Scotland) Regulations 2001. A nominated construction engineer will ensure that brownfield sites standard health and safety precautions are adopted and followed.

Effects associated with contaminated land are, therefore, considered to be of minor magnitude and significance, in accordance with Table 9.2. This is not considered significant in terms of the EIA Regulations.

9.6.1.4 Flooding

A feasibility report was completed for Buckhaven in 2007 by Halcrow Group Limited[25], which recommended that remediation works should be undertaken for the existing flood defences, adjacent to the Development. The re-profiled revetment will be stable under storm events with a 2 % annual probability of occurrence (1 in 50 year return period), reducing the associated flood risks to the Development.

The access route and a small area of hardstanding are the only onshore elements of the Development which are located within areas described as having a 0.5 % or greater annual risk of coastal inundation, according to The SEPA Indicative River and Coastal Flood Map (Scotland)[26]. As a precautionary measure, all onshore elements of the Development will be constructed with an element of flood protection in the event of coastal ingress.

The impermeable nature of the made ground on-site and the underlying geology means that, in the baseline scenario, there will be relatively low infiltration and relatively high run-off rates, and hence the addition of the Development would have a minimal impact upon infiltration and run-off rates.

The magnitude of the effects identified above is negligible, and hence the significance of effects associated with run-off and flood risk is negligible. This is not considered significant in terms of the EIA Regulations.

9.6.1.5 Alteration of Current Flow Pathways

The installation of the turbine foundations has the possibility to impact upon the natural flow of water currents in the Firth of Forth, possibly leading to sediment scouring and ultimately impacts upon aquatic ecology. Typical tidal flows adjacent to the Development are between 0.25 m/s and 0.5 m/s during mean neap and spring tides respectively. Sediment transport around the coast at Development is strongly to the south west, with sediment having a tendency not to be retained on the coast[27,28]. Sediment is driven towards the southwest by waves from the North Sea.

The turbine is to be located in an intertidal area, meaning the area is not submerged under water during low tide. During low tide there will be no effect on coastal currents. Considering the relatively small volume of the permanently installed turbine foundation (approximately 13 m^2) and the wide spacing of each metal support beam, it is considered that

[24] Arup & Partners Scotland Ltd. 2007. Fife Energy Park, Methil. Proposed Slipway Development. Geotechnical and Geoenvironmental Interpretive Report.
[25] Halcrow Group Limited. 2007. *Fife Energy Park Coastal Erosion and Flood Risk Management Plan*
[26] SEPA: The Indicative River and Coastal Flood Map [online] Available at: http://go.mappoint.net/sepa/ [Accessed 02/02/2012].
[27] Fife Council, 1998, *Shoreline Management Plan of Fife, Volume I – Core Report*. Fife Council, 1998, *Shoreline Management Plan of Fife*, Volume II – Atlas. Fife Council, 1998, *Shoreline Management Plan of Fife*, Volume III – Supporting Document
[28] HR Wallingford, 1997, Coastal Cells in Scotland, Scottish Natural Heritage Research Survey and Monitoring Report No.56

the Development will have a negligible effect on the natural coastal currents during high tide and will not lead to sediment scouring to the southwest of the turbine foundations. Given the moderate sensitivity and negligible magnitude of effect, the significance of effects associated with the alteration of current flow pathways is considered to be negligible, in accordance with Table 9.2. This is not considered significant in terms of the EIA Regulations.

9.6.2 Potential Operational Effects

Potential medium and long term effects associated with Development infrastructure such as the jacket and hardstandings could potentially include:

- Further erosion and sedimentation;
- Alterations to natural flow pathways; and
- Risk of a pollution event.

These effects have been discussed in relation to the construction phase, and as there would be substantially less activity during operation, and as there is unlikely to be any ground disturbance during operation, the magnitude of these effects is similarly reduced. Any changes during construction would continue through operation, as the majority of infrastructure would remain in place. This will be further reduced through adopting best practice design and construction, as set out in the SCWMP, such as retaining silt traps, and adherence to a PPP, as discussed above. As a result, the magnitude and significance of all effects associated with operation of the Development are assessed as being negligible. This is not considered significant in terms of the EIA Regulations.

9.6.3 Potential Decommissioning Effects

Potential effects of the decommissioning of the turbine are similar in nature to those during construction, as some ground-work may be required to remove turbine foundation. These effects would be substantially lesser in magnitude than during construction, however, and would be controlled by a PPP, as discussed above. Where infrastructure would be left in place, silt traps and bunding features would also be left in place, where this is compatible with the PPP. As a result, the magnitude and significance of all effects associated with the relocation are assessed as being negligible. This is not considered significant in terms if the EIA Regulations.

9.7 Cumulative Effect Assessment

The greatest potential for cumulative effects arises when the construction phase of a cumulative development overlaps with the construction phase of the Development. Cumulative effects are considered to have the potential to be significant only where such an overlap may exist. As a result, the potential for cumulative effects on surface water resources from the Development in combination with the construction of new industrial developments at FEP. To assess a worst case scenario, it is considered that the construction phase of any new industrial development may coincide with the construction phase of the Fife Energy Park Offshore Demonstration Wind Turbine. The primary cumulative hydrological effect is likely to be an increase in flow rates during the construction phase associated with increased run-off from new hardstanding area of the developments. As noted above, these are considered to be of negligible magnitude for the Development. If water management measures are implemented at those sites similar to those described in the SCWMP (in line with normal practice and as would be required by SEPA), the magnitude of cumulative effects will be negligible and, therefore, of negligible significance.

Consequently, cumulative effects on estuarine water resources would be negligible. This is not considered significant in terms of the EIA Regulations.

9.8 Mitigation Measures and Residual Effects

No additional mitigation measures above embedded design and construction good practice measures identified in Chapter 3: *Project Description* and the SCWMP are proposed as all identified potential effects have been assessed as being of negligible significance. There are no significant residual hydrological effects.

9.9 Proposed Monitoring

The following monitoring will be carried out:

- Monitoring requirements will be detailed in the PPP and overseen by the construction project manager;
- During construction, regular inspections of the site drainage and flood retention walls will be carried out to ensure that sediment and debris do not accumulate to present a flood risk or damage the ecology of the hydrological environment (further detail of likely monitoring is provided in Technical Appendix 9.1: SCWMP); and
- Continual liaison with SEPA will be carried out during the construction and decommissioning stages.

9.10 Statement of Significance

This chapter has assessed the likely significance of effects of the Development, including its Surface and Coastal Water Management Plan, on coastal hydrology. All potential effects have been assessed as being of minor or negligible significance and are therefore not significant in terms of the EIA Regulations.

10 CULTURAL HERITAGE

10.1 Introduction

The purpose of this chapter is to assess the Development in terms of potential effects upon the cultural heritage resource of the site and surrounding area. Cultural heritage resources include Scheduled Ancient Monuments, other archaeological sites, Listed Buildings and other buildings of historic or architectural importance (and recorded in the Sites and Monuments Record), Conservation Areas, and Inventoried Designed Landscapes and Historic Gardens.

The assessment is intended to identify cultural heritage sites which may be affected, either directly (e.g. through physical disturbance during construction) or indirectly (e.g. through changes to visual and archaeological setting) during construction, throughout operation, or from de-commissioning of the Development.

This chapter contains the following sections:

- Assessment Methodology and Significance Criteria;
- Baseline Description;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effects;
- Summary of Effects; and
- Statement of Significance.

10.2 Assessment Methodology and Significance Criteria

10.2.1 Assessment Methodology

This assessment has involved:

- Review of the relevant cultural heritage legislation, policy and guidance;
- Consultation with the statutory and non-statutory authorities to gain data establishing the baseline conditions for the site and its surrounding area;
- Desk-based studies and site visits to contribute to and validate data relevant to establishing the baseline conditions;
- Assessment of the potential effects expected from the development upon the existing conditions;
- Assessment of the significance of the effects taking into account the sensitivity of the site (and selected features beyond the site), the magnitude of potential effects (both direct and indirect) and the likelihood of such effects occurring; and
- Identification of means to mitigate and avoid, where possible, any potential effects, as well as the assessment of the residual effects which may exist after mitigation.

10.2.1.1 Legislation, Policy and Guidance

Legislation

This assessment has taken into account the following legislation:

- Statutory protection for archaeology is principally outlined in the Ancient Monuments and Archaeological Areas Act (1979) as amended by the Historic Environment (Amendment) (Scotland) Act (2011) and nationally important sites are listed in a Schedule of Monuments. Scheduled Monument Consent (SMC) is required before any work affecting the fabric of a Scheduled Monument can be carried out; and
- The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended by the Historic Environment (Amendment) (Scotland) Act (2011) details the duties of National and Local Authorities regarding the desirability of preserving and enhancing settings.

Policy

This assessment has taken into account the following policies:

- Scottish Planning Policy, paragraphs 110 onwards, sets out how all types of historic environment assets are to be dealt with within the planning framework;
- Scottish Historic Environment Policy (SHEP, July 2009) prepared by Historic Scotland provides more detailed consideration of the Ministers policy in historic assets, and provides for the replacement of sections of the Memorandum of Guidance on Listed Buildings and Conservation Areas (1998) by a series of guidance notes. This document is regarded as a "living" document, to be updated as required;

The appraisal has taken into consideration relevant regional and local policies dealing with cultural heritage in the East Fife and St. Andrews Local Plan, and the Kirkcaldy and West Fife Local Plan. These are further discussed in Chapter 4: *Planning Policy* of this ES.

Guidance

The following guidance and advice was also considered:

- Planning Advice Note (PAN) 2/2011: Archaeology - Planning Process and Scheduled Monument Procedures provides advice on the handling of archaeological matters within the planning process and on the separate control over Scheduled Monuments under the Ancient Monuments and Archaeological Areas Act 1979; and
- The revised online replacement to Planning Advice Note (PAN) 45: Renewable Energy Technologies (provides useful advice and information for on-shore wind power, and contains guidance on the visual effects from wind turbines.
- Standards and Guidance for Archaeological Desk Based Assessments (Institute for Archaeologists, rev. 2008). This advises that the aim of a desk-based assessment is to gain information about the known and potential archaeological resource within the Development boundary and that from this an appraisal can be made on the presence or absence of archaeology;
- Assessment of impact on the setting of the historic environment resource: some general considerations (Historic Scotland, 2009);
- Memorandum of Guidance on Listed Buildings and Conservation Areas; now replaced in part by a series of advice notes in line with the advice in SHEP (2009); and
- Managing Change in the Historic Environment- Setting, Historic Scotland (2011) provides some guidance on assessment of settings.

10.2.1.2 Consultation

Consultation was undertaken with both statutory and non-statutory consultees as part of the Appraisal process. The responses are summarised below;

Table 10.1 Consultation Responses

Consultee	Comment	Response
Fife Council	Provided data from Sites and Monuments Record,	Information has been used to inform the assessment of the potential for unknown archaeological remains to existing within the site.
Historic Scotland	Historic Scotland were consulted regarding the Development and confirmed their previous advice on the Consented Development was still appropriate for this application. In their response to the scoping report for the Consented Development, Historic Scotland acknowledged there are no nationally designated features within or adjacent to the site which will receive any direct effects, and this includes the offshore element. However they identified four Scheduled Ancient Monuments (Index Numbers 797 Standing Stone of Lundin, 817 Wemyss Caves,	The receptors identified are assessed in Section 10.4 of this Chapter.

Consultee	Comment	Response
	860 Macduff's Castle and 861 Maiden Castle Motte), 2 Category A Listed Buildings (Durie House HB Number 16699 and Wemyss Castle HB Number 16709 and one Garden and Designed Landscapes (Wemyss Castle) which they requested be assessed for potential indirect effects. Historic Scotland expressed themselves to be broadly content that there would be no significant effect on these identified assets, but reserved judgement until the full EIA is available. They also made more general comments on the need to assessment of effects on settings of other features within the wider area.	

10.2.1.3 Desk-based Assessment and Walkover Survey

A desk-based assessment was undertaken by Headland Archaeology, which used readily available documentary, cartographic and photographic evidence, to inform the baseline condition of the site. A site visit and walkover by an experienced archaeologist was undertaken in February 2010 to validate the data gained as part of the desk-based assessment, and to identify (and if appropriate record) any previously unrecorded cultural heritage features within the boundary. The desk-based assessment Report was completed in March 2012 and is presented as Technical Appendix 10.1 in Volume III of this ES.

10.2.1.4 Assessment of Potential Effects

The assessment of effects on the cultural heritage is concerned with direct (physical) and indirect (largely visual) impacts.

Direct (Physical)

Assessment of physical effects considers direct effects upon features of cultural heritage interest, whether known sites or unknown buried archaeology, which are in danger of being disturbed or destroyed. Physical impacts are likely to occur during construction and decommissioning/relocation, and are permanent and irreversible. They are discussed in section 10.4.1, Potential Construction Effects. For purposes of identifying known archaeological and historic features, a study area equal to the Consented Development area plus a 1 km buffer around it was used.

Indirect (Visual, noise etc.)

This assessment will take account of the potential visual effects on the settings of Scheduled Monuments, monuments registered as nationally important and Listed Buildings that exist within the Development and a 15 km Zone of Theoretical Visibility (ZTV) around it. The setting of a national monument or Listed Building can be loosely interpreted as features, spaces and views that are historically and functionally related, and which can be considered to be vital to their intrinsic interest. Setting can be tangible, such as a defined boundary, or intangible, such as atmosphere or ambience. The main concern for visual effects on a cultural heritage setting is the potential for the Development to fragment the historic landscape, separate connectivity between historic sites and impinge on views to and from sites with important landscape settings. Wind Energy and the Historic Environment (English Heritage, 2005) lists visual dominance, scale, intervisibility, vistas and sight-lines as well as noise, movement and light as potential effects upon features of cultural heritage interest that might be derived from wind farm projects. Indirect effects can occur during construction, operation and decommissioning. Standard wind farm developments can have a lifespan of up to 25 years, but the visual and any other indirect effects from this form of development are still considered temporary and easily reversible. Unlike the standard wind farms detailed above the test site would be operational for a maximum of 5 years before being removed.

10.2.1.5 Study Area

A study area including all the land within the site boundary used at the scoping stage and a 1 km area around it was used to identify known cultural heritage features that might receive a direct impact. In addition, records from this within this area were used that might inform on the potential for unknown buried archaeological remains to survive within the development area which themselves might be subject to a direct impact from construction related activities.

In order to identify cultural heritage features with the potential for their settings to be affected by the Development, an initial search area of 15 km was defined based on distance from the Development boundary. Distance was used as the principal criterion in determining the likelihood of a significant visual effect on setting for the purposes of this preliminary assessment. In later stage information from the landscape and visual assessment was available.

Detailed assessment was given to nationally important features within approximately 5 km of the turbine location, as based on previous experience and using professional judgement, these were judged to have the potential to receive a likely significant effect upon their settings.

The final assessment is based on the site layout shown in Figure 1.2 and distances to cultural heritage features are taken from the nearest proposed infrastructure or turbine rather than the Development application boundary.

In summary, the most significant effects on the settings of cultural heritage features have the potential to occur within a 5 km radius of the turbines, and that is what has been defined as the study area. This was born out by the results of the site specific assessments.

10.2.1.6 Zone of Theoretical Visibility (ZTV)

The ZTV used in this assessment has been calculated from tip height to mean sea level and intervening ground contours, it also does not allow for any vegetation (such as mature blocks of trees) or settlement. The ZTV is calculated to reflect visibility at approximately 2 m above ground level. The ZTV is further explained in Chapter 5: *Landscape and Visual Assessment* of this ES.

In considering effects using this methodology, the following points need to be borne in mind. Firstly, the ZTV is a theoretical construct, based upon a fairly crude base terrain modelling only with no modelling of settlement and vegetation cover. No distinction is made in how much of the turbine is visible. The ZTV therefore represents a “worst case scenario” and in reality visual effects may be substantially less than suggested.

Secondly, mechanical application of the methodology will generate major and medium effects (simply based on distance and designated status) for which, in case of visual effects upon settings, no mitigation is proposed. Where this is the case predicted medium or major effects are discussed in detail within the assessment text (in section 10.6.2 Potential Operational Effects) and any ameliorating conditions highlighted.

10.2.2 Significance Criteria

The assessment of effects is based on the final form of the Development and is discussed in section 10.6.2 Potential Operational Effects. This appraisal proceeds from a consideration of the sensitivity of a cultural heritage feature against the magnitude of any potential impact, to arrive at the significance of the effect.

Sensitivity for the purposes of this appraisal has been equated with designation status, as shown on the table below:

Table 10.2 Sensitivity

Level of Sensitivity	Designation Status
Very High	World Heritage Sites which are internationally important
High	Scheduled Monuments, Non-Scheduled Category C/V monuments, Grade A Listed Buildings, Registered Battlefields, Inventoried Designed Landscapes and Historic Gardens, which are considered to be nationally important.
Medium	Grade B Listed Buildings, regionally important archaeological features and areas (as defined in the Sites and Monuments Record) and Conservation Areas, which are considered regionally important.
Low	Grade C (S) Listed Buildings, sites and features noted as Locally important in the Sites and Monuments Record.
Negligible	Badly preserved/damaged or very common archaeological features/buildings of little or no value at local or other scale.

Listed Buildings are nationally designated and are placed on Lists maintained by Historic Scotland. Whilst they are regarded as a nationally important resource, they are subject to a grading process (Grade A, B, C(s)) and we have taken this categorisation as indicative of a presumed level of sensitivity, based on rarity, period, architectural style, completeness, degree of subsequent alterations and so on. This appraisal has assigned the Grades to different levels of sensitivity as shown above on Table 10.2.

Magnitude is a measure of the nature of the expected effect. It has been broken down for direct and indirect impacts as shown in Table 10.3 below. For the purposes of visual assessment proximity to the Development (within the ZTV) has been taken as one of the determining attributes. Within the assessment distances are given to either the nearest turbine or the nearest point on the Development boundary.

Table 10.3 Magnitude

Level of Magnitude	Definition
Very High	Total loss of or major alteration to a site, building or other feature (e.g. destruction of archaeological feature, or blocking or severance of key visual or other relationship).
High	Major damage to or significant alteration to a site, building or other feature. Extensive change to the setting of a Scheduled Monument, monuments registered as nationally important or Category A/B Listed Building or other feature (e.g. loss of dominance, intrusion on key view or sightline).
Medium	Damage or alteration to a site, building or other feature. Encroachment on an Area considered to have a high archaeological potential for buried remains. Change in setting to Monuments/buildings and other features e.g. intrusion on designed sight-lines and vistas.
Low	Minor damage or alteration to a site, building or other feature. Encroachment on an area where it is considered that low archaeological potential exists. Minor change in setting of Monuments, site and other features (e.g. above historic skylines or in designed vistas).
Negligible	No physical impact. Slight or no change in setting.

The significance of any potential effect can be arrived at by matching sensitivity against magnitude in the following table, with the application of professional judgement;

Table 10.4 Significance

Sensitivity / Magnitude	Very High	High	Medium	Low	Negligible
Very High	Major	Major	Moderate	Minor	Minor
High	Major	Major	Moderate	Minor	None
Medium	Moderate	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible	Negligible

Where potential scores of moderate or major significance have been predicted for features using the matrix-based approach shown in Table 10.4, such features have been selected for a more detailed consideration in section 10.5. This includes a definition of the setting of each feature, considering its designation status, essential attributes etc. An assessment is made using professional judgement of the extent to which that setting is affected by the Development and an assessment of significance is given. Potential effects that are scored as major or moderate are considered to be significant for purposes of the EIA Regulations. Potential effects scored as minor or negligible are both considered to be not significant for purposes of the EIA Regulations, and are not discussed in further detail.

Systematic application of the methodology (simply based on distance and designated status) may indicate major and moderate effects where this is not the case. In these instances, the predicted effects are discussed in detail within the assessment text (in section 10.5) and any ameliorating conditions highlighted.

As noted above, the assessment has taken an approach in which the sensitivity of a feature is set against the degree of intervisibility with the Development, based primarily on distance, assuming that this will be a determinant in the degree of magnitude of any change that might be caused. Simple intervisibility with turbines is not necessarily considered to be adverse, unless there is a material effect on an outward setting, as defined in accordance with the terms used above.

It is also important to consider existing screening of cultural heritage features by topography. Forest and woodlands, as well as buildings, can provide visual screening to cultural heritage features. However, it is noted that in managed forests the level of screening will alter and views may be opened up over time, which previously did not exist.

No detailed consideration of potential effects from noise or shadow flicker (see Chapters 6: *Noise* and 14: *Shadow Flicker* of this ES) has been undertaken for cultural heritage features, since no substantial above-ground or built heritage features exist within or immediately adjacent to the site to receive any such effects.

10.3 Baseline Conditions

10.3.1 Baseline Assessment

A desk-based assessment was undertaken by Headland Archaeology to establish the baseline condition for the Development based on a study area (the initial Development area) and a 1 km buffer around it. This is presented within Technical Appendix 10.1. It is not proposed to repeat the information with the Headland Archaeology report here but the following sections have drawn upon that work, supplemented by a separate consideration of cultural heritage features at a greater distance from the Development (which may be subject to indirect effects upon their settings).

10.3.2 Site Description

The Development site and proposed layout are described fully in Chapter 3: *Project Description*. It consists of a single wind turbine location, situated approximately 48.3 m from the FEP boundary with associated infrastructure located onshore. The onshore elements of the site are located on currently disused, former industrial land south of Methil port, within the FEP, on the northern side of the Firth of Forth in Fife.

The FEP site was formerly used by Denbeath and Wellesley collieries, and locally for brickworks and a creosote factory (now under the site of the Fabrication yard). More recently, in part, it is used as a large steel fabrication yard in support of the North Sea oil and offshore renewable industries.

The onshore infrastructure is located in land known to be reclaimed from the sea by the tipping of spoil from the former Wellesley colliery. This is clearly demonstrated by comparison on the modern coast line to that shown for example on the 1948 Ordnance Survey mapping (see Illustration 4 of the desk-based assessment presented at Appendix 10.1). This spoil forms a made-ground consisting of clayey sands with gravel of mudstone, sandstone and shale with cobbles and large boulders. This thickens to the south and south-west. Geotechnical investigations indicate that there is approximately 4 m to 10 m of made ground at the location of the onshore elements of the development. Further detail on ground conditions can be found in *Kvaerner Fabrication Yard, Methil Geo-Environmental Report,* Scottish Enterprise Fife 2005 and *Fife Energy Park Phase 3 Geo-Environmental Report,* Scottish Enterprise Fife 2007.

10.3.3 Features within the Site

There are no known archaeological features within the Development boundary.

10.3.4 Features beyond the site boundary

10.3.4.1 Scheduled Ancient Monuments

There are 59 Scheduled Ancient Monuments of all periods within 15 km of the Development. Of these, 3 lie within 5 km (and within the predicted ZTV) and were identified as having the potential to receive a significant effect on their settings within the preliminary assessment. These are listed on the table below and identified by their Index number.

Table 10.5 Scheduled Ancient Monuments within 5km ZTV

Index No.	Name
817	Wemyss Caves
860	Macduff's Castle and Dovecote
861	Maiden Castle Motte, Windygate

Potential impacts upon the settings of these Scheduled Monuments are considered below (Section 10.4.2), based on the operational form of the wind turbines. The Standing Stones at Lundin Links (Index no. 797) lie approximately 5.7 km from the proposed turbine location; Historic Scotland raised these as a potential concern in their original scoping response to the Consented Development (this advice being subsequently confirmed on reconsultation in respect of the present application). The stones are also assessed in section 10.5.2 of this ES.

10.3.4.2 Listed Buildings

There are 1898 Listed Buildings of all grades within 15 km of the proposed turbine location, the majority lying within Kirkcaldy, Glenrothes, Leven, Methil, Largo and other smaller settlements such as Kennoway, Windygates, Ceres, Falkland, Earlsferry and Elie. Of these, 188 of all Categories lie within 5 km of the Development boundary, 186 of which are predicted lie within the ZTV. Of these, only Durie House is listed at Grade A and is considered to be nationally important. Wemyss Castle lies just outside of the 5 km study area, but was specifically mentioned within the response from Historic Scotland. It has been included in the

assessment presented in section 10.5.2. Both of these are listed on the table below and assessed in section 10.5.2 below.

Table 10.6 Listed Buildings within 5km ZTV

HBNUM	Name	Category
16699	Durie House (with courtyard, sundial and walled garden)	A
16709	Wemyss Castle	A

10.3.4.3 Conservation Areas

Three conservation areas have been identified within 5 km of the proposed development boundary. These are at Coaltown of Wemyss, Leven and Kennoway. They are considered to be of local importance (and are locally designated), and are considered below is section 10.5.2.

10.3.4.4 Historic Gardens and Designed Landscapes

Although there are 13 Gardens and Designed Landscapes within 15 km of the Development boundary, only two of these lie within 5 km, and may potentially receive a significant effect on their settings. The nearest is at Letham Glen, the southern edge of the designated area being approximately 3.5 km from the proposed turbine location. The eastern-most edge of the Designed Landscape at Wemyss Castle lies approximately 3.8 km west of the proposed turbine location. For purposes of this assessment they are regarded as nationally important. They are listed below, considered in detail in section 10.5.2, and a final assessment of significance given.

Table 10.7 Gardens and Designed Landscapes within 5km

Index No.	Name
2127	Lethem Glen
2132	Wemyss Castle

10.3.4.5 Archaeological Potential

The site is effectively industrial in origin, being the product of spoil tipping from the adjacent former colliery, and has subsequently been used for creosote manufacturing and as a laydown area for large offshore steel structures. The area in which the onshore element of the Development will be located is entirely composed of made ground (spoil), and represents an extension from the former coastline.

On the basis of the above it is considered that there no potential for unknown archaeological remains to survive within the site that may be disturbed during construction of the onshore elements of the Development.

No known features of cultural heritage interest are known to exist offshore at the proposed turbine location, nor within its vicinity. It is considered that there is very limited potential for significant archaeological remains to exist. The foundation for the turbine tower will consist of a maximum of four bored pile of 2 m in diameter, with sea bed preparation consequently only a limited area of the seabed will be directly affected.

10.3.5 Information Gaps

There are no known information gaps.

10.4 Assessment of Potential Effects

10.4.1 Construction Effects

No effects are anticipated from construction upon any nationally important designated or non-designated cultural heritage features.

There is a no potential for unknown archaeological remains, to be encountered during groundwork in connection with the onshore elements of the Development. This is due to the onshore site being composed entirely of made ground comprising colliery spoil. Geotechnical records suggest that the original shoreline is to the north of the current shore line, which has been extended into the sea here by the tipping of the spoil. It is concluded that there is a negligible potential for archaeological remains associated with the exploitation of the coastline to survive at the current shoreline.

The foundation for the turbine tower will consist of a maximum of four bored pile of 2 m in diameter. The sea bed will be prepared prior to the installation of the turbine base to ensure a level surface is provided. This is limited to a defined area around the turbine, only a limited area of the seabed will be directly affected. As such there is unlikely to be any effect on unknown archaeological remains offshore. No wrecks (protected or otherwise) or other features of cultural heritage interest are known to exist at the location of the turbine itself, nor in its immediate vicinity.

The construction of the Development is considered to have no potential to cause damage to any remains and this potential effect is considered to be of negligible significance for which no mitigation is proposed or considered necessary. The effects during construction are therefore considered to be not significant in terms of the EIA Regulations.

Indirect, visual effects upon the settings of feature beyond the site boundary are considered below.

10.4.2 Operational Effects

10.4.2.1 Direct Effects

No direct effects upon archaeological remains or other cultural heritage assets are anticipated from the operation of the test facility.

Consideration has been given below to the potential for scouring to occur on the sea bed or along the coast due to changes in tidal and current flows resulting from the turbine foundations.

This is considered to be of negligible magnitude, due in part to the fact that the turbine will be founded on a four-legged steel tower, each leg of which is approximately 2 m in diameter and will be drilled into the underlying rock. There is limited sedimentation above the rockhead at the turbine location, and the coast immediately adjacent is formed from the spoil of the former colliery. As noted in the baseline description, the modern coastline represents a seaward extension caused by tipping, so that the original coastline is assumed to be buried at some distance to the north and as a result no coastal archaeological remains will be affected. It is noted that the coastline to the north and east is heavily altered by the presence of the structures associated with Methil Port, and to the south-west includes more of the made ground formed by the colliery spoil, which has been subject to amendment and reinforcement in the recent past.

The limited nature of the turbine foundation is considered to have a negligible effect on the local tidal and current conditions, and the potential for effects to occur from scouring resulting from the Development is assessed as negligible and therefore not significant in terms of the EIA Regulations.

10.4.2.2 Indirect Effects

There are potential indirect, visual effects upon the settings of some cultural heritage features within 5 km of the Development. These are discussed below. The locations of features falling within 5 km of the Development, and lying within the ZTV are shown on Figure 10.1. The assessment below is based solely on the turbine and tower itself, the supporting infrastructure not being visible from beyond the FEP boundary.

Scheduled Ancient Monuments

There are no Scheduled Monuments within 2 km of any Development infrastructure. There are three Scheduled Monuments within 2-5 km of the Development boundary and within the

ZTV. All are considered to be nationally important and of high sensitivity. According to the matrix on Table 10.3 these would have the potential to receive an impact upon their settings of medium magnitude, resulting in an effect of high significance. However, they are further assessed below in relation to their settings and associations and a final statement of the significance of any impact upon setting is provided below.

- Wemyss Caves (Index number 817)

The scheduling includes 5 caves set in the coastal cliffs on the northern side of the Forth, the nearest of which is approximately 2.5 km south-west of the turbine location. The caves have openings facing towards the North Sea, i.e. in a south-east direction; therefore the Development is unlikely to be visible. As there are no long views towards the caves, their settings are considered to be limited to the coastal cliff and shorelines. This setting, the historic associations of the caves to each other, to the coast and to the remains of the Scheduled Macduff's Castle (see below) are not considered to be affected. The effect is considered to be negligible upon these features of high sensitivity (by virtue of their designation) and the potential effect upon their setting is therefore assessed as negligible and therefore not significant in terms of the EIA Regulations.

- Macduff's Castle and Dovecot (Index number 860)

The monuments consists of the ruined remains of a castle (with an associated dovecot carved into a cave) set above the coastal cliffs overlooking the Forth, approximately 2.6 km south-west of the turbine location. The castle and dovecot are also listed at Category B (HB Numbers 16707 and 16708 respectively).

The castle lies within scrubland adjacent to the coast, and can be approached from the north (along a track adjacent to a large municipal cemetery) and from the south east along a path climbing from the coast (in which the turbine will not be prominent). There is some degree of cover provided by vegetation in views toward the north-east from around the castle's base and this will limit the presence of the turbine in views in that direction. Current views in include the urban fringes of Buckhaven and Methil, with the structures associated with the steel fabrication yard, port and former power station beyond (a representative viewpoint and photomontage from the Coastal Path north of the monument is presented at Figure 5.15d). The turbine will be visible in this view, but will not be out of place against this urban and industrial background.

The ruined nature of the remains prevents there being access for views from the upper levels of the castle. The purpose of the scheduling in ensuring the physical preservation of the castle's fabric and associated archaeological evidence will not be affected by the proposed development. The remains are of high sensitivity by virtue of their designation. Despite the large scale and proximity of the new design turbines, the effect is considered to be of low magnitude, due to the distance and industrial background against which the turbines will be seen and the limited views towards the castle in which the turbine would be visible. The potential effect upon the setting of the monument is therefore assessed as minor and this is not considered to be significant for purposes of the EIA Regulations. It should be noted that the turbine will only have a consented presence of 5 years, so any effect it has upon the setting of this feature must be regarded as medium term and temporary, and fully reversible upon decommissioning.

- Maiden Castle, Motte, Windygates (Inventory 861)

The monument consists of the remains (the mound and associated earthworks) of a former Motte fortification, now covered partially with scrub and surrounded by a mature hedge. It is situated on higher ground above a tributary of the River Leven, on the southern outskirts of Kennoway. The A916 (as well as the course of a former railway) lies close to west, along with adjacent houses, with farmland to the east. The remains of the monuments have a relatively limited presence within the landscape, and its setting is considered to be related to the small valley and road corridor to Kennoway.

There are only limited views towards the monument, due to the surrounding terrain and local vegetation cover. Although intended originally as a defensible site and one in which visibility

is considered to be important to its function, views from the site have been much altered since its original construction.

The Development is not considered to affect the understanding of the monument's relationship to the approaches to Kennoway, nor will it affect the preservation of archaeological evidence for the previous use and development of the site. The turbine will constitute a significant new structure in views to the south from the monument (at a distance of approximately 3.6 km), but these views already include the urban areas of Methilhill, Methil and Buckhaven along with the larger structures of the steel fabrication yard, port and former power station.

The magnitude of the effect of the turbine is therefore considered to be low (as an additional feature in an already changed view to the south), despite its size, upon a feature of high sensitivity by virtue of its designation. The potential effect of the Development upon the Motte's setting is therefore assessed as being of minor significance. This is not considered to be significant for the purposes of the EIA Regulations.

- Standing Stones of Lundin, Lundin Links

Although outside of the 5 km study area, the Standing Stones of Lundin have been identified as a potential cause of concern by Historic Scotland (in their response to the originally Consented Development, which was confirmed on subsequent re-consultation) and so have been included within this assessment.

This monument lies approximately 5.7 km to the north-east of the proposed turbine location and consists of three upright stones within the fairway of a golf course. The stones are in excess of 4 metres in height, and may have originally been four in number (another stone is said to have still been evident in the late 18th century). The scheduling preserves the stones and associated buried archaeological evidence.

There are open views towards the stones from within the golf course itself, and from the minor road to the west, as well as in intermittent views from the main Leven-Largo road to south, however in most of these views the turbine will not be visible. The turbine will be visible in long views from the vicinity of the stones, (behind and above the existing structures in Leven and Methil), and in views including the stones in approaches across the golf course from the east and north-east.

From the stones the turbine will be visible at distance in views from the stones to the south-west, above the intervening structures at Leven (including the chimney of the former power station and the operational Methil turbine – see a representative Viewpoint taken from the golf course presented in Figure 5.15i), but would not be present in the open views to the north and east.

Given limited arc of view from the stones in which the turbine would be visible, as well as the distance and the presence of other industrial elements (including a wind turbine) in views to the south-west, the Development is considered to form a slight change in the setting of the stones, of negligible magnitude. The Stones are considered to be of high sensitivity. The potential effect upon the setting of the stones is therefore assessed as being of negligible significance and this is not significant for purposes of the EIA Regulations.

Listed Buildings

There are 186 Listed Buildings of all categories within 5 km of the Development which lie within the ZTV. Of these, Durie House is listed at Category A and is considered to be nationally important and of high sensitivity. It is assessed individually below. Although just beyond 5 km from the test site, Wemyss Castle has also been assessed below, as it has been raised as a specific concern by Historic Scotland (in their response to the scoping report for the originally Consented Development, which was reaffirmed during subsequent re-consultation).

<u>Category A Listed Buildings within 5 km</u>

- Durie House, with Court of Offices and Sundial and walled garden HB Number 16699

This Listing covers three separate entities, namely the House, with a courtyard and offices (now converted to accommodation) to its north, along with sundial within a walled garden to its east. The property is located within landscaped grounds, approximately 4.2 km to the north-north-west of the demonstration turbine, north of Leven and is approached from the east via a tree lined track.

There is extensive plantation to the north and east of the property and landscaped planting to its west and south-west. The principal aspect of the house is its south facing elevation, from which there will be extensive views over Leven and Methil and over the Forth of Firth, and approximately centred on the chimney of the former power station. Although the turbine will be visible in these views, it will not affect their character in that the views already take in the urban and industrial character of Leven and Methil. These views have changed extensively since 1769 when the house was built.

The turbine will occupy only a small arc of the view to the south-south-west, and this is considered to be a potential effect of low magnitude, upon a feature of high sensitivity. The potential effect of the development upon the setting of the House (and associated courtyard and garden) is therefore assessed as of minor significance only, and this is not significant for purposes of the EIA Regulations.

- Wemyss Castle HB Number 16709 (and associated structures)

The castle is located approximately 5.1 km to the south-west of the proposed turbine location and lies on the coastal cliffs between East and West Wemyss, within an Inventoried Historic Park and Designed Landscape, which is assessed separately below. The House is grouped with a number of other Category B listed buildings within the Garden, namely the Pink House (part of the Home Farm, HB Number 49183) and the Category A Home Farm Courtyard and Stables (HB Number 46952) located to the north of the Castle. The group is considered as a whole, in relation to the Castle, for purposes of this assessment.

The castle is irregular in plan and dates back to the 15th century, with later additions. Primary approaches are from the south-east towards the entrance. The castle entrance is on the north-western elevation, with the main south-eastern elevation facing over the cliffs and across the Firth. The north-eastern elevation provides views along the coast towards Methil.

To the north and west of the castle are formal lawns and gardens, with plantations which screen the stables and associated buildings (including the Pink House) from sight from the castle itself. Close to the north of the Castle lies the Red House, listed at Category B (HB number 46053). Further north are three other associated listed cottages within the estate (HB Number 46051, three entities), as well as the ruined Orangery and walled garden (HB Number 46054) all listed at Category C(S). To the south of the castle, lies the category B listed dovecot.

The interrelationship of the castle to the associated structures and spaces within the Garden is not affected by the Development. The turbines will not be visible from the principal elevations of the castle, but will be visible in the distance and above intervening settlement from the upper stories on north-eastern elevation. Vegetation within the Gardens and surrounding the castle close to its north will prevent views towards the turbine at ground level, and also limits the potential for long views towards the castle in which the turbine will also be visible.

The potential effect of the Development upon the setting of the castle is considered to be of low magnitude, in that the turbine will only be visible from upper floors of the castle or glimpsed above tree lines in occasional views from within the grounds and in the vicinity of associated structures within the estate.

Further, the development will not affect the interrelationship of the Castle to the Historic Garden, which is considered to form its setting, nor to elements within that setting, namely the associated listed buildings and gardens. Although the Castle (and grouped structures) is of high sensitivity, the potential for significant effects to occur upon its setting is assessed as minor in significance. This is not significant for purposes of the EIA Regulations.

Category B Listed Buildings

Category B are considered regionally important and of medium sensitivity. There are 67 within 5 km, the majority of which lie within the settlements of Windygates (primarily associated with the Cameron Hospital), Leven and Kennoway. Those within 2 km are assessed separately and in detail below. The buildings between 2-5 km are considered in groups (as related structures or by settlement) where appropriate.

Category B listed buildings within 2km

- Randolph Wemyss Memorial Hospital HB Number 22716

The hospital was built in 1908 and has an extension built in 1965. It lies approximately 600m to the north-west of the proposed turbine. It setting is determined by it urban location with a residential street to either side (including between it and the FEP).

The main entrance and elevation are on the south-eastern facing side of the building (towards the turbine), so that views towards this elevation will not include the turbine. The turbine will be visible above intervening structures in views to the south-east from the grounds and upper floors, but although substantially larger in scale, is not out of keeping with other industrial elements visible from the hospital. Long views towards the hospital are limited by its urban location, and the extension is the most prominent features in those limited views that are available (mainly from south-west to the north-east, along the streets on either side). There are no views of the main elevations in which the turbine will intrude into the foreground.

The hospital is of medium sensitivity by virtue of it level of designation, and despite the proximity and scale of the turbine, the Development is considered to have an effect of only low magnitude upon its setting. This is due to the limited views to and from the hospital, and takes into account its current urban setting. The potential effect upon the setting of the hospital is therefore assessed as being of minor significance, and this is not significant for purposes of the EIA Regulations.

- St Andrews Theatre, Buckhaven HB Number 22711

The theatre is a conversion of a former church dating back to the 1820's, with an extension built in the 1980s. It lies approximately 1 km to the south-west of the turbine. It principal entrance and elevation are on its eastern side, so that views towards it will not include the development. Its setting is considered to be street side and urban in character, fronting onto the B944.

Although the turbine may be visible above intervening structures in views from the front (eastern side) of the building, this is considered to constitute an effect of low magnitude only (in that the skyline will receive a substantial change) upon a building of medium sensitivity. The Development will not fundamentally change the immediate setting of the building, nor affect its current function, nor jeopardise the ability to appreciate the building's special architectural and historic interest. The potential effect upon its setting is therefore assessed to be minor significance, and this is not significant for purposes of the EIA Regulations.

- Methil Parish Church HB Number 22712

The listing includes the boundary walls and gate piers. The church is located within a churchyard within Methil, approximately 1.1 km to the north-east of the proposed turbine location. Although there is open greenspace to the southwest of the church, its setting is considered to be essentially urban, with residential housing to its north and south.

Long views towards the church are only available from the south-west, and these will not include the turbine. The turbine may be visible in glimpsed views between and above intervening structures from the churchyard. It is noted that these views will already include residential housing blocks and the structures belonging to the steel fabrication yard that occupies the north-eastern part of the FEP site. The additional of the turbine to the skyline in views to the south-west from the church is considered to be an effect of only low magnitude upon the setting of a feature of medium sensitivity, the significance of which is assessed as being minor. This is not considered to be significant for purposes of the EIA Regulations.

- Aberhill Primary School, Methil HB Number 46076

The school is located approximately 1.6 km north-east of the Development. It is single storey and has an unusual cruciform plan, and sits within its own schoolyard, enclosed by a boundary wall. The building's setting is considered to be urban and limited by the boundary wall (which forms part of the listing). It is surrounded by residential development to south, east and west, with industrial units and warehousing across rough ground to its north.

The school's setting is not considered to be affected by the Development even where the turbine maybe visible from within the schoolyard, or its immediate proximity, and the architectural interest in the building is not considered to be jeopardised. The Development is considered to have an effect of negligible magnitude upon the setting of a feature of medium sensitivity, which is assessed as negligible and therefore not significant in terms of the EIA Regulations.

- Miner's cottages, Wilson Square, Methil HB Number 19129 (9 entities)

These single storey buildings (in three terraces) lie on the north, western and eastern sides of a square fronting on to the B932, at a distance of approximately 1.7 km north-north-west of the Development. The setting of the buildings is considered to be defined by their relationship to the square itself, to the B932 to the south and to the surrounding residential developments, including the residential properties present on the southern side of the road.

The buildings themselves are not visible from long distance, being surrounded by neighbouring properties, and views from the south into the square (and towards the principal elevations of the properties) will not include the development. The turbine will be visible above intervening structures in views to the south-south-east from the square, but this is considered to be an effect of "low" magnitude in that there is a change in the current skyline only.

The integrity of the design around the square is not affected, nor is the ability to appreciate the architectural and socio-historic interest in the buildings, which are considered to be of medium sensitivity by virtue of their level of designation. The potential effect upon the sitting of the buildings is therefore assessed as being minor and this applies only to the change to the existing views to the south from the square (and within the south facing range). This is not considered significant for purposes of the EIA Regulations.

- Methilhill House, Methilhill HB Number 46080

This 19th century house lies within a large garden, with its principal elevation facing to the south-east (towards the development, which lies approximately 1.8 km from it). The front elevation of the house is screened by vegetation within the garden.

Views towards the house are limited by adjacent properties and the boundary wall (which forms part of the listing). The setting of the house is considered to be defined by the garden to its south, the neighbouring buildings to its west, along with the minor access road and Leisure Centre to its east and north east.

The setting as described above is not considered to be changed by the proposed development, nor is architectural interest in the house jeopardised, even where the turbine may be visible in views to the south-east. The effect is considered to be negligible in magnitude, upon a feature of medium sensitivity, and therefore the potential effect of the development upon the setting of Methilhill House is assessed to be negligible and therefore not significant in terms of the EIA Regulations.

<u>Category B listed buildings from 2-5 km</u>

- Ashgove House, Methilhill HB Number 22715

This building is located on the outskirts of Methil, approximately 2.1 km north-west of the Development, on the south side of the B932. The building's setting defined by its roadside location and by the residential properties in close proximity to its north and open fields to the south. The turbine will be visible in views to the south-east, above the school and other

intervening structures. The presence of the turbine will not affect the immediately setting as described above, but will constitute a new vertical element in the views to south-east.

Given the intervening urban structures, and other tall structures along the coast in Methil, the Development is considered o form an effect of only low magnitude (upon a feature of medium sensitivity), which is assessed as having an effect of minor significance upon the building's setting. This is not significant for purposes of the EIA Regulations.

- Macduff's Castle HB Number 16707 and Dovecote cave HB Number 16708

These structures have been assessed above under their Scheduled designation (Index number 860) which takes precedence.

- St Mary's (Former Parish Church), East Wemyss, HB Number 16704;
- St Mary's, Graveyard, wall and memorial Stones, HB Number 46041; and
- Former Manse, East Wemyss HB Number 16705

These related structures are situated within East Wemyss, approximately 3.2 km to the south-west of the Development. The former church lies within the graveyard, immediately adjacent to the coast, with the manse lying across the street immediately to the north of the former church. The setting for the church is in part defined by its place within the graveyard, its relationship to neighbouring structures within the village, including the manse and its proximity to the shore line. The manse's setting is similarly defined, but considered to be entirely enclosed by surrounding buildings. The setting of the graveyard, and memorial stones are considered to be defined by the surrounding boundary wall which forms part of the listing.

The ZTV indicate that the proposed turbine would be visible from the environs of the listed structures (in part, above intervening structures and the shoulder of the cliffs to the north-east of East Wemyss). However, the settings of the buildings, as described above, are not affected by any intervisibility. The interrelationship of former church to its graveyard, and to the former manse will not be affected, and the architectural and historic interest in these structures will similarly not be jeopardised. The Development is therefore considered to constitute an effect of negligible magnitude upon features of medium sensitivity and the potential effect upon their settings is therefore assessed as negligible and therefore not significant in terms of the EIA Regulations.

- East Lodge, Wemyss Castle HB Number 19128; and
- The Red House, Wemyss Castle HB Number 46053

These Buildings are both associated with the Historic Garden surrounding Wemyss Castle (Inventory Number 2132), and are 4.1 km and 4.9 km respectively south-west of the proposed turbine. East Lodge faces north on to the A955 and is essentially surrounded by plantation to south, east and west. This defines its setting and is not considered to be affected, nor is its historic relationship to the parkland as a whole. The Red House lies within the centre of the park, and has been considered in relation to the Castle (above). In both cases the Development is considered to constitute an effect of negligible magnitude upon features of medium sensitivity, and therefore the potential effect upon their settings is assessed as negligible and not significant in terms of the EIA Regulations.

- Newton Farmhouse, East Wemyss HB Number 46046

This traditional nineteenth century farmhouse is located approximately 4 km south-west of the Development. The principal elevation is south-east facing and the property is approached form the north-east. Its boundary to south and west is marked by matures trees in close proximity to the house, with more open garden to the north-east, and views in this direction include the barns and outbuildings of this working farm (within 100 m of the house). The surrounding garden and boundary planting is considered to define the setting of the house.

There are no long views towards the house in which the turbine will be visible due to the adjacent vegetation. The Development is therefore considered to constitute an effect of

negligible magnitude upon a feature of medium sensitivity, the potential effect of which is assessed as negligible.

- Woodbank Farmhouse, HB Number 43018; and
- Little Lun Farmhouse, HB Number 42985

These two farms lie in farmland to the west of Windygates, over 3 km west and west-north-west from the Development. The settings of both are determined by their surrounding gardens, and proximity to the associated barns and outbuildings. Woodbank lies in close proximity to the A915 which lies immediately to the south and has a substantial barn/warehouse close to its eastern side. Little Lun has screening from mature trees to its south and east. The settings of both buildings are considered to be defined by their gardens, proximity to outbuildings and other ancillary structure

It is considered that neither of these buildings will receive any effect upon their settings. In both cases the turbine will constitute an effect of negligible magnitude upon features of medium sensitivity, and the effect upon their settings is therefore assessed as negligible and therefore not significant in terms of the EIA Regulations.

- Cameron Bridge HB Number 16683; and
- Balfour Bridge HB Number 42987

These two bridges carry minor roads over the River Leven, and are 2.7 km and 4.9 km respectively from the Development. The settings of both bridges are considered to be directly related to the river and Leven valley, and the roads which they carry. These are not considered to be affected by the Development and the views of the spans are limited to the riversides.

The potential effect of the Development for both is considered to be of negligible magnitude upon features of medium sensitivity. The potential effect upon their settings is therefore assessed to be negligible and therefore not significant in terms of the EIA Regulations.

- Cameron Hospital, Haig House HB Number 16684;
- Cameron Hospital, Pavilion wards and Loges HB Number 43384 (5 entities); and
- Cameron House, HB Number 43009

These related structures are all part of the Cameron Hospital in Windygates (with the exception of Cameron House, now in private ownership) and lie between approximately 2.5 – 2.8 km north-west of the Development. All are closely related to the River Leven at Cameron Bridge, Windygates. Their settings are defined by their relationship to each other and the grounds in which they are situated, the perimeter of which is marked by trees. The setting also includes their relationship to the river (and distillery beyond).

The Development will not affect the interrelationship of these buildings to each other and their surrounding spaces, even where the turbine may be visible at distance and above trees and intervening structures from within the hospital's grounds. The architectural and historic interest in the buildings is not considered to be jeopardised. Their settings are considered to receive an effect of negligible magnitude from the Development. The buildings are of medium sensitivity by virtue of their level of designation, and the potential effect upon their settings is therefore assessed to be negligible and therefore not significant in terms of the EIA Regulations.

- Diagio Distillery, workshop and store HB Number 43008

These buildings form an angled range adjacent to the river, and are faced to the south by the modern buildings of the distillery. This industrial and riverside location is considered to form the setting of the building. This is not considered to be affected by the Development (an effect of negligible magnitude upon a building of medium sensitivity). Therefore the potential effect of the development upon the building's setting is assessed as negligible and therefore not significant in terms of the EIA Regulations.

- Lydiard, Milton of Balgonie HB Number 42989

This building lies to the north of the A911 approximately 4.6 km north-west of the Development, within its own grounds, the perimeter of which is defined by mature plantation. Its primary facing is south. Its setting is considered to be defined by the wooded perimeter of the garden, and by the properties on either side.

The extensive screening around it will prevent there being more than close range views towards the property. The setting of the house is not considered to be affected by the presence of the turbine at distance to the south-east, even where local screening might allow it to be seen from within the garden or within the property. This is considered to be an effect of negligible magnitude upon a feature of medium sensitivity, and the potential effect upon the setting of this listed building is therefore assessed as negligible and therefore not significant in terms of the EIA Regulations.

- Greig Institute, Leven HB Number 37349;
- 40 High Street (TSB), Leven HB Number 46500;
- St. Margaret's Church HB Number 37347;
- St. Peter's Church HB Number 46495;
- St Andrew's Church and Bain Hall HB Number 46494 (2 entities);
- Scoonie Parish Church HB Number 37346;
- Carberry House, walled garden and boundary wall HB Number 46492; and
- Carberry House sundial, HB Number 37350

The buildings and structures listed above are all located within Leven at distances of between 2.6 to 3.2 km north-east of the Development. They are all considered to have settings determined by their street side locations and can be characterised as urban.

These settings are not considered to be changed, even where the turbine may visible above and behind intervening structures, and the architectural and historic interest in the buildings will not be harmed. In all cases the magnitude of the potential effect upon these structures of medium sensitivity is considered to be negligible. The potential effect upon their settings is therefore assessed as negligible and therefore not significant in terms of the EIA Regulations.

- Cockburn House, Kennoway HB Number 10003;
- Arnot Gospel Hall, Cupar Road HB Number 10004;
- Hawfield House, Cupar Road HB Number 10005;
- Kenmont, Kennoway Village HB Number 10006;
- St. Kenneth's Church HB Number 10013;
- Ingot Hill House (former manse) HB Number 10014;
- Old Church, yard, session room and watch house HB Number 10015; and
- Seton House, Kennoway Village HB Number 10020

All of the above listed buildings and structures are located within Kennoway and Kennoway Village at a distance of between 4.2 to 4.8 km north-north-west of the Development. All are considered to have settings that are determined by their street side location or relationships to each other or other neighbouring structures and spaces within an essentially urban environment.

These settings are not considered to be affected by the turbine, taking into account the distance from the Development as well as and screening afforded to the buildings by intervening structures and planting both locally within Kennoway, and between Kennoway and the Development. The architectural and historic interest in the structures will not be harmed, and the character of their current setting as village/urban is not considered to be changed. The effect is considered to be of negligible magnitude upon features of medium sensitivity. The potential effect upon the settings of all of these features is therefore assessed to be negligible and therefore not significant in terms of the EIA Regulations.

- Duniface Farmhouse, steading and other structures HB Number 42982 (3 entities)

The Listing includes the Farmhouse, steading, outbuilding and boundary walls. The farm lies approximately 3 km north-north-east of the Development. Its setting is defined by its relationship to the modern farm buildings to its north, the garden to its south, the boundary

of which is defined by matures hedges and trees and with the A915 immediately to the south of the garden.

The farmhouse has a south looking aspect over the garden, in which the turbine may be visible between the screening vegetation on the perimeter of the garden, and above the urban environment of Methil and Methilhill. The screening prevents there being long views towards the farm in which the turbine would also be present. The potential effect of the Development is considered to be low in magnitude upon a feature of medium sensitivity, and this effect is limited to views from the farm (mainly upper floor) towards the south. The potential effect on the wide setting is therefore assessed as being of minor significance and this is not significant for purposes of the EIA Regulations.

- Kingsdale House and ancillary buildings HB Number 10009 (2 entities)

The house lies approximately 4.2 km north-north-east of the Development. The house lies within its own grounds with a principal entrance on its northern side, and is approached from the west. More distant views towards the house are afforded by access tracks to north and south, which skirt the surrounding fields in order to provide views. It has an open aspect facing south, across a landscaped garden with some mature planting. The immediate setting of the house is considered to be formed by its place within its grounds and surrounding farmland, and the interrelationship of house to its ancillary structures and the walled garden. This setting will not be affected.

However, the turbine will be visible from the southern elevation of the house in the centre of views. However, given the distance of the turbine this is considered to constitute an effect of only low magnitude upon a feature of medium sensitivity. The potential effect upon the setting of the house and associated structures is therefore assessed as minor and this not significant for purposes of the EIA Regulations.

- Balcurvie House with walled garden HB Number 43006 (2 entities)

The house lies within its own grounds with a walled garden adjacent to the east. It lies north of the small settlement of Balcurvie, approximately 3.8km north-north-west of the development. It is approached from the east with south facing entrance. Its setting is considered to be defined by its relationship to related structures (including farm buildings to the north and walled garden to east) and the fields which surround it. Mature tree line the perimeter of the adjacent field to the south.

There are no long views towards the property in which the turbine will be present, and the setting as described above is not considered to be changed. It is possible that the turbine will be visible in glimpsed or occasional views above intervening structures in Balcurvie, and through the screening afforded by the tree along the property boundary to the south of the house. However, given the distance, the presence of the turbine is considered to constitute an effect on the house's setting that is negligible in magnitude upon a feature of medium sensitivity, and this is assessed as negligible and this not significant for purposes of the EIA Regulations.

- Durie Home Farm Dovecot HB Number 16701

This structure is located immediately adjacent to the barns and outbuildings of Durie Home farm, approximately 4 km north of the Development. This spatial relationship is considered to define the setting of the structure, and this is not affected by the turbine. There is limited visibility towards the dovecot, except across the field to its west, in which the turbine will not be visible. Visibility from the structure is not considered to be essential to its setting. The development is therefore considered to constitute an effect of negligible magnitude upon a feature of medium sensitivity, and the potential effect upon its setting is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

- Leven Hall, Broom, Leven HB Number 46508

The hall lies within its own grounds, within the urban environment of Leven, approximately 3.2 km north-east of the Development. Its principal elevation faces south-east, away from the Development location. Its urban location limits the availability of long views towards the Hall,

however, the turbine will be visible from the upper floors of the building in views towards the south-west, but only above the intervening urban and industrial structures within Methil and Leven. This is not considered to cause any change in the character of views over the area, and the magnitude of the effect is therefore considered to be negligible in magnitude (upon views in one direction from a feature of medium sensitivity). The potential effect upon the setting of the buildings is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

- Silverburn House estate, offices HB Number 16679

The offices are approximately 4.4 km north-east of the Development, and lie within a well wooded setting adjacent to other outbuildings associated with the estate. This setting is not considered to be affected by the Development, even if the turbine were visible above or through the intervening vegetation immediately adjacent on the western side of the buildings. The effect is considered to be negligible in magnitude, upon a feature of medium sensitivity, and the potential effect upon its setting is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

- "Obertal", Largo Road, Leven HB Number 37352

This building is a detached villa dating to the 1930s. It lies within its own plot at the end of a row of detached properties facing south-east over the A915 (Largo Road) on the outer edge of Leven. Its setting is considered to be limited to its own plot of land, with adjacent dwelling to west, a road to south and farmland to north and east. The turbine is will not be present in primary views to south and east, and will only be visible above intervening structures within Leven and Methil, in views to the south-west. The potential effect of the development is considered to be negligible in magnitude, upon a feature of medium sensitivity and therefore the potential effect upon the setting of the building is assessed as negligible and this not significant for purposes of the EIA Regulations.

Grade C(S) Listed Buildings

For purposes of this assessment Grade C(S) is considered to be locally important and of low sensitivity. Only those lying within 2 km of the proposed turbine location have been considered here, numbering 46 in total. All of these lie within the settlements of Methil and Buckhaven.

- Miners cottages, Cowley Street, Denbeath HB Number 46071 (24 entities)

Twenty four of these records refer to the two curved terraces of single story miners cottages along Cowley Street (Denbeath, Methil) which all appear under the same HB Number. The cottages were originally built in the late 19th century and reworked in the early 20th century. Their setting is considered to be urban and street side, facing south with more modern housing on the southern side of the road. Industrial units lie in close proximity to north and north-west.

The turbine will be visible the street frontages, but above intervening structures. The turbine will be between 680 to 850 m to the south of the terraces. The street side character and urban setting is not considered to be affected, even where the turbine is visible, and the architectural and socio-historic interest preserved in the fabric of the buildings will also not be harmed. The effect is considered to be low in magnitude, upon assets of low sensitivity, and the effect upon the setting of these cottages is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

- St. Andrews Square, Lower Methil, HB Number 46074 (12 entities)

This terrace of early 20th century local authority housing lies approximately 1.2km north-east of the proposed turbine and are located on the south and eastern sides of a small square, which is open to the street on its north western side. The main entrances to the properties face to the north and west. There are adjacent residential properties in views from both front and rear of the terrace.

The setting is considered to be defined by the surrounding street and houses and is urban in character. This setting is not considered to be changed, even where the turbine is visible, and the architectural and socio-historic interest preserved in the fabric of the buildings will also not be harmed. The effect is considered to be low in magnitude, upon assets of low sensitivity, and the effect upon the setting of these cottages is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

The remaining category C(S) buildings within Methil include a Roman-Catholic Church (St. Agatha's, HB Number 46079) and three recreational establishments (White Swan Hotel, HB Number 22713; East Dock Bar, HB Num 46075; and Tower Bar, HB Number 22714). A war memorial (HB Number 46077) lies in open ground to the west of the Category B listed Methil Parish Church (see above). In all cases the settings are considered to be urban and street side, and are not considered to be subject to potential effects of more than low magnitude, which are considered to be negligible and this not significant for purposes of the EIA Regulations..

Within Buckhaven there are another 6 category C(S) buildings, including the Parish Church (HB Number 46068), the Royal Bank of Scotland (HB Number 46069) the community centre (HB Number 46070), the Miners Welfare Institute (HB Number 46072) and former Denbeath Parish Church and Hall (HB Number 50126, 2 entities). Again, all are considered to have street side settings which are urban in character. The presence of the proposed turbine will not substantially change the character of this setting, even where visible in views between or above intervening structures. The architectural and socio-historic interest of the individual buildings is also not affected. The potential effect upon the settings of these buildings is considered to be low in magnitude and this is assessed as negligible and this not significant for purposes of the EIA Regulations.

Designed Landscape and Historic Gardens

There are two Inventoried Designed Landscapes within 5 km of the Development boundary. These are Letham Glen and Wemyss Castle. Further consideration of these landscapes is also given in the Landscape and Visual Assessment (Chapter 6).

- Letham Glen (Inventory Number 2127)

This Garden is located north-east of Leven, and incorporates land on both sides of the Scoonie Burn, a deep cut burn running into Largo Bay through the coastal terrace and is approximately 3.5 km north-east of the proposed turbine location. The Garden is in public ownership and well-used as a local recreational amenity. This Garden is has few views out to the surrounding landscape due to its topographical location, and its well wooded nature. This deep set, well wooded glen is considered to form the setting of the Garden. Although predicted to lie within the ZTV, it is considered that there will not be significant intervisibility with the proposed turbine, and this constitutes an effect of negligible magnitude upon a feature of medium sensitivity. The potential effect of the development upon the setting of this Garden is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

- Wemyss Castle (Inventory Number 2132)

The Garden is located along the northern coast of the Firth of Forth, being approximately 3-8km south-west of the Development at its nearest point. The park is centred on the Category A listed Castle (itself approximately 5.1 km from the development). The enclosed park at Wemyss extended along the coast from 'Weems Town' (West Wemyss) to the Chemyss Burn by the early-mid 1700s. By 1775, the park was well delimited by perimeter planting alongside the West Wemyss to East Wemyss road. By the early 19th century a public road north of the Castle, dividing it from the 'orchard', had been transformed into a tree-lined drive. Wooded pleasure grounds lay to the south-east of the Castle and an ornamental parkland approach led to West Wemyss. Outer areas of the policies were planted with serpentine perimeter belts and clumps.

The extent of the designed landscape remains unchanged. Although the majority of the designated area is predicted to lie within the ZTV, is it likely that the extensive tree cover

available within the park and in particular, within the formal lawns close to the Castle itself, and along the principal avenues will limit the extent to which the turbine will be visible. The internal associations of the buildings and spaces within the parkland will not be affected, even where the turbine may be visible above tree lines and at some distance, and the architectural record of the development of the castle will not be subject to change. The Garden is considered to be outstanding by Historic Scotland and is therefore of high sensitivity, but the Development is considered to constitute an effect of low magnitude due to its limited intervisibility from within the parkland, and the fact that the primary associations within the park are not affected. The potential effect of the development is therefore considered to be minor change in setting, with some visibility above historic skylines. This is not significant for purposes of the EIA Regulations. It is noted that any effect upon the park's setting is temporary and will last for only the year period for which consent is sought.

Conservation Areas

A number of conservation areas have been identified within 5 km of the Development boundary. These are in Leven, Kennoway and Coaltown of Wemyss.

- Leven

The Conservation Area consists of a small area of Leven above the promenade, approximately 3 km to the north-east of the proposed turbine location. It setting is considered to be urban, and limited by the surrounding parts of Leven and the promenade and sea front to the south. This is not considered to be changed, even where the proposed turbine will be visible. Views towards the turbine will already include the existing chimney of the former power station (see Viewpoint 5 and photomontage presented at Figure 5.15e showing a viewpoint from the promenade). The effect is considered to be of low magnitude upon an asset of medium sensitivity, and therefore the potential effect of the Development upon the setting of the conservation area is assessed as being of minor significance and this is not considered to be significant for purposes of the EIA Regulations.

- Kennoway

The conservation area covers parts of the centre of Kennoway along the former high street, and west of the A916. It lies approximately 4.2 km north of the proposed turbine location. Although predicted to lie within the ZTV, it is likely that the turbine will not have and significant visibility from within the area, due to intervening structures and vegetation. The area is set within Kennoway, with urban development to north, south and east, and it is bounded to its west by the Kennoway Burn. This setting (and the internal relationships between the buildings and spaces that make-up the area) is not considered to be affected by the development, even where visible. The effect is considered to be of negligible magnitude, upon an asset of medium sensitivity. The potential effect of the development upon the setting of the area is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

- Coaltown of Wemyss

The area lies approximately 4.7 km west of the Development (at its closest point) and incorporates almost all of this planned settlement. The majority of the streets run approximately north-east to south-west, so that properties generally have facing north-west to south-east. The settlement is bounded by mature trees to its south. Approaches to the area from the north-east will not include the turbine in view. Approaches from the south-west will have only occasional views including the turbine, due to distance and the trees and structures at the western end of the village.

Intervening structures limit views out of the core of the area and views to the south are limited by tree cover on the settlement boundary. The interrelationship of the structures and spaces within the settlement will not be affected by the Development, even where visible in occasional glimpsed views. The magnitude of the potential effect is considered to be negligible upon a feature of medium sensitivity. The effect of the proposed development upon the setting of the conservation area is therefore assessed as negligible and this not significant for purposes of the EIA Regulations.

10.5 Mitigation Measures and Residual Effects

10.5.1 Mitigation Measures

No recorded features within the site will be directly affected by the construction and decommissioning of the Development. As a result of previous development of the onshore element of the site, industrial with substantial depths of made ground, there is considered to be no potential for unknown archaeological remains to exist which may be damaged.

No mitigation is proposed or considered necessary in respect of any direct impacts.

No mitigation is proposed or considered necessary or practicable in respect of the minor effects upon the settings of any cultural heritage assets. The Development lifespan is of limited duration and is considered temporary and fully reversible.

10.5.2 Residual Effects

No residual direct effects are anticipated upon cultural heritage features within the Development site as no potential for such remains to exist has been identified.

There will be changes in the settings of some cultural heritage features (as noted in section 10.5.2 above). These are temporary, lasting for the 5 year life-time of the demonstration turbine test facility, and fully reversible upon the decommissioning of the Development.

10.6 Cumulative Effect Assessment

For purposes of this assessment the consented schemes at Methil Dock (a single turbine approximately 1.7 km north-east of the Development), Little Raith (9 turbines, approximately 18 km to the south-west) and Lochelbank (12 turbines, approximately 28 km to the north-west) as well as the proposed Westfield windfarm (5 turbines, 15 km to the west) are considered to form part of the baseline for cumulative assessment. All other windfarms are considered sufficiently distant to not cause significant cumulative effects on cultural heritage assets in relation to the Development.

Of the windfarms identified above, none are considered to have any potential for significant cumulative effects upon the settings of any cultural heritage features, primarily due to the distance between the schemes and the Development, and taking into account the limited duration of the demonstration project.

The single operational turbine at Methil dock means that wind turbines an already existing local feature within the industrial and urban environment of Methil and Leven (and the coastal strip). Whilst the proposed demonstration turbine is significantly larger and of a different configuration it will not form a wholly new element in the landscape, as wind power generation is already an established feature within the local environment and the historic character of the area as a product of succeeding phases of industrial and urban use, will not be changed.

This assessment accords with the Landscape and Visual Assessment, which concludes that there will not be any significant cumulative effects upon any historic gardens and designed landscape, nor any settlements (Chapter 5: *Landscape and Visual Assessment* of this ES.

10.7 Summary of Effects

Table 10.8 Summary of Effects

Potential Effect	Mitigation	Residual Effect
Construction Effects		
None.	None proposed or considered necessary.	None.
Operational Effects		
No significant effects (i.e., effects of "moderate" or "major" significance) are predicted upon the settings od any cultural heritage assets.	None	None.
Relocation Effects		
Restoration of existing condition in terms of visual settings (all other factors remaining unchanged)	None	Restoration of existing setting.

10.8 Statement of Significance

No significant direct effects are anticipated as there are no known archaeological features within the site, nor is there considered to be any potential for any unknown remains to exist and therefore no mitigation proposed or considered necessary.

No significant effects are anticipated to occur to the settings of any cultural heritage assets arising from the construction, decommissioning and operation of the Development. Although a number of not significant (i.e. effects of minor or negligible significance) have been identified, these are considered temporary (lasting only for the 5 year consented life of the demonstration turbine) and are fully reversible upon the decommissioning of the Development.

11 SOCIO-ECONOMICS, TOURISM, LAND-USE AND COMMERCIAL FISHING

11.1 Introduction

This chapter of the ES evaluates the potential effects associated with the Development on the following receptors:

- Local and national Economy;
- Tourist attractions and recreation facilities around the Development (excluding the landscape and visual effects which are considered in Chapter 5: Landscape and Visual of this ES);
- Land-use; and
- Commercial Fishing.

This chapter contains the following sections:

- Guidance and consultation;
- Assessment Methodology and Significance Criteria;
- Baseline Description;
- Assessment of Potential Effects;
- Mitigation Measures and Residual Effects;
- Cumulative Effects Assessment;
- Summary of Effects; and
- Statement of Significance.

11.2 Guidance and Consultation

11.2.1 Policy and Guidance

Relevant national, regional and local planning policy documents are referred to in Chapter 4: *Planning Policy* of this ES. The following documents have been considered for the assessment of the potential effects of the Development on socio-economics, tourism & recreation, land-use and commercial fishing;

- Guidelines for Environmental Impact Assessment[1];
- A Handbook on Environmental Impact Assessment[2];
- CEFAS (Centre for Environment, Fisheries and Aquaculture Science), Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA (Food and Environmental Protection Act 1985) and CPA (Coast Protection Act) Requirements, June 2004[3]; and
- A report on the perceptions of the fishing industry into the potential socio-economic impacts of offshore wind energy developments on their work patterns and income[4] .

11.2.2 Reference Material

The following sources of information have been used to inform the baseline description set out in this Chapter:

- National Statistics Online (www.statistics.gov.uk);
- NOMIS Official Labour Market Statistics (www.nomisweb.co.uk);
- Fife Council (www.fife.gov.uk);

[1] Institute of Environmental Management and Assessment (2004) *Guidelines for Environmental Impact Assessment*
[2] Scottish Natural Heritage (2005) *A Handbook on Environmental Impact Assessment*
[3] Centre for Environment, Fisheries and Aquaculture Science (CEFAS) on behalf of the Marine Consents and Environment Unit (MCEU) (2004) *Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements*
[4] Mackinson, S. et al. (2006) A report on the perceptions of the fishing industry into the potential socio-economic impacts of offshore wind energy developments on their work patterns and income, *Science Series, Technical Report no. 133*. CEFAS SEAFISH [online]. Available at http://www.cefas.defra.gov.uk/our-science/assessing-human-impacts/offshore-renewable-energy.aspx?RedirectMessage=true). [Accessed on 14/03/2012]

- DECC Maritime Data/DTI online GIS Shipping Database (www.maritimedata.co.uk);
- Crown Estate (http://www.thecrownestate.co.uk/); and
- Centre for Environment, Fisheries and Aquaculture Science (http://www.cefas.co.uk/projects/renewable-energy.aspx).

The economic value of UK Offshore Wind Industry has been based as per the information provided in the National Renewables Infrastructure Plan[5] and Towards Round 3: Building the Offshore Wind Supply Chain[6] document.

The relevant policies and action plans from the UK and Scottish Government highlighting the importance of offshore industry has been identified from the UK Renewable Energy Strategy 2009, Securing a Renewable Future: Scotland's Renewable Energy[7], the reports from Forum for Renewables Development Scotland (FREDS[8]) and the Renewables Action Plan[9].

Baseline conditions have been established through reference the Environmental Statement for the Consented Development (2010)[10] and further desktop studies, site visits and consultations.

Information concerning the public's perception of windfarms has been gathered from surveys across all parts of the United Kingdom. The details of these surveys are provided where applicable throughout this chapter.

11.2.3 Consultation

Relevant organisations were contacted with regard to the Development. Table 11.1 lists the relevant responses related to commercial fishing and marine recreation and tourism.

Table 11.1 Summary of Consultation Responses

Consultation	Response
Royal Yachting Association (RYA) (Scotland)	RYA Scotland does not foresee any adverse impact on recreational boating of this proposal
Scottish Fishermen's Federation	No comments to make.

In addition to the responses from the formal scoping exercise for this Development, the consultation responses published in the Consented Development application (Arcus, 2010) have been considered in producing this chapter. These are summarised in Table 11.2 below.

Table 11.2 Summary of Consultation Responses Consented Development

Consultation	Response
East Lothian Yacht Club	Club members seldom use this area.
Fife Fishermen's Association	Provided contact information for local fishing groups in the area who should be consulted
Forth Ports/Methil Docks Harbour Master (FPMD)	No impact on commercial shipping. Only smaller coast vessels heading for Methil transit this area and location of turbine does not interfere with the passage of these vessels.

[5] Highland and Island Enterprise and Scottish Enterprise (2009) National Renewables Infrastructure Plan http://www.scottish-enterprise.com/nationalrenewablesinfrastructureplan.pdf
[6] BVG Associates (2011) Progress in building the offshore wind supply chain, The Crown Estate, February 2011 http://www.bvgassociates.co.uk/Publications/BVGAssociatespublications.aspx [Accessed on 14/03/2012]
[7] Scottish Government : Securing a Renewable Future: Scotland's Renewable Energy http://www.scotland.gov.uk/Publications/2003/03/16850/20554 [Accessed on 20/03/2012]
[8] FREDS - http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Resources/17613 [Accessed on 20/03/2012]
[9] Renewables Action Plan - http://www.scotland.gov.uk/Publications/2009/07/06095830/0 [Accessed on 20/03/2012]
[10] 2-B Environmental Statement (Arcus, 2010) - Methil Offshore Demonstration Wind Turbine

Consultation	Response
Non Affiliated Creel Fishermen, South East IFG Executive Committee	Do not see any problem with stage 1 as the turbine will be located only 15 metres from the shore this shouldn't affect any fishing or fishing vessels
Scottish Canoe Association	No significant landscape or seascape concerns. In particular, concerned if the development would result in tidal flows close to shore being altered or landfall facilities leading to additional dangers for small craft navigating along the coast of Methil.

11.2.4 Assessment Methodology and Significance Criteria

The scale of significance described below has been used to assess the potential and residual effects of the Development against baseline conditions. The assessment process aims to be objective and quantifies the effects as far as possible; however some effects can only be evaluated on a qualitative basis.

This EIA assesses the effects of the construction, operational and decommissioning phase for the Development. The Development will test offshore turbines for a maximum of 5 years from the commencement of operation of the first turbine, following which the turbine will be removed and the site decommissioned.

The assessment considers the effects and defines them as:

- Negligible/No effect: either no change or no detectable change to a location, environment or sensitive receptor;
- Minor: a detectable but non-material change to a location, environment or sensitive receptor;
- Moderate: a material, but non-fundamental change to a location, environment or sensitive receptor; and
- Major: a fundamental change to a location, environment or sensitive receptor or in breach of recognised legislation, policy or standards.

For assessing significance, consideration is given to the national, regional and local baseline situation. The magnitude of the impact is determined in proportion to the area of impact relevant to each receptor. For the purpose of the assessment, a moderate or major effect is deemed to be 'significant' in terms of the EIA Regulations.

In terms of socio-economic factors, potential effects would be significant if the Development resulted in any fundamental or material changes in population, structure of the community, and economic activity during the construction or operation phases.

With respect to land-based tourism and recreation, the assessment of potential effects was undertaken broadly following the Scottish National Heritage (SNH) "Guide to Outdoor Access Assessment"[11]. The potential indirect effect of the Development on tourism and recreation is closely related to public attitudes towards wind turbines in the landscape and a number of studies have been conducted on the subject. The relevant conclusions from the most recent studies are discussed later in this chapter.

The physical effects of the Development on existing land use are assessed by considering the possible effect of the Development on the current land use of the site. Significant effects would be those which resulted in a material or fundamental change in the predominant land use of the site.

The effects on commercial fishing are assessed on the basis of the report Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements published by CEFAS in conjunction with SEAFISH[12] . If the Development results

[11] A Handbook for Environmental Impact Assessment: Appendix 5 Outdoor Access Impact Assessment (2009) Scottish Natural Heritage http://www.snh.org.uk/pdfs/publications/heritagemanagement/EIA.pdf - [Accessed on 20.03.2012]

[12] Mackinson, S. et al. (2006) *A report on the perceptions of the fishing industry into the potential socio-economic impacts of offshore wind energy developments on their work patterns and income*, Science Series,

in a material or fundamental change in the fish populations, navigation of commercial fishing vessels and results in a socio-economic impact on their work patterns and income then they are considered to be major. Effects on marine-based tourist activities will be considered separately within the tourism & recreation section.

11.3 Baseline Conditions

11.3.1 Socio-Economics

11.3.1.1 The Economic Value of UK Offshore Wind Industry

This section has been based on documents listed in section 11.2.2 Reference Material

There is a huge potential for offshore wind in the UK due to the availability of natural renewable resources. Scotland has around 25 % of Europe's potential offshore wind resources[13]. Its strong offshore winds provide the ideal conditions for technology which can harness this powerful resource and it has been identified that the east coast is of particular potential providing a very suitable location for the development of offshore wind due to the gently shelving nature of the sea bed in this area[14].

The relevant policies and action plans from UK and the Scottish Government and the key leadership role played by Crown Estate to establish the offshore renewable industry has created development opportunities within this sector. A report[15] prepared by BVG Associates on behalf of the Crown Estate states that in order to meet legally binding EU targets of generating 20 per cent renewable energy by 2020, the UK will need to generate around 35 per cent of its electricity from renewable sources. Scotland has the most ambitious targets within the European Union with expectations to generate an equivalent of 100 % of electricity demand by renewable sources by 2020[16].

In order to achieve these targets, the report by BVG forecasts that a cumulative installed capacity of around 23 GW by 2020, with a further 6 GW in construction would be necessary. The forecast is based on the understanding of the status of individual projects and their supply chain, and the establishment of a commercial environment that will allow the annual and cumulative installation capacity to reach 33 GW by 2020 [17]. The projected increase by 2020 is shown in Figure 11.1.

Technical Report no. 133. CEFAS SEAFISH [online]. Available at (http://www.cefas.defra.gov.uk/our-science/assessing-human-impacts/offshore-renewable-energy.aspx?RedirectMessage=true). [Accessed on 14/03/2012]

[13] Scottish Government Marine Energy – Offshore wind (online) http://www.scotland.gov.uk/Topics/marine/marineenergy/wind [Accessed on 28/03/2012]

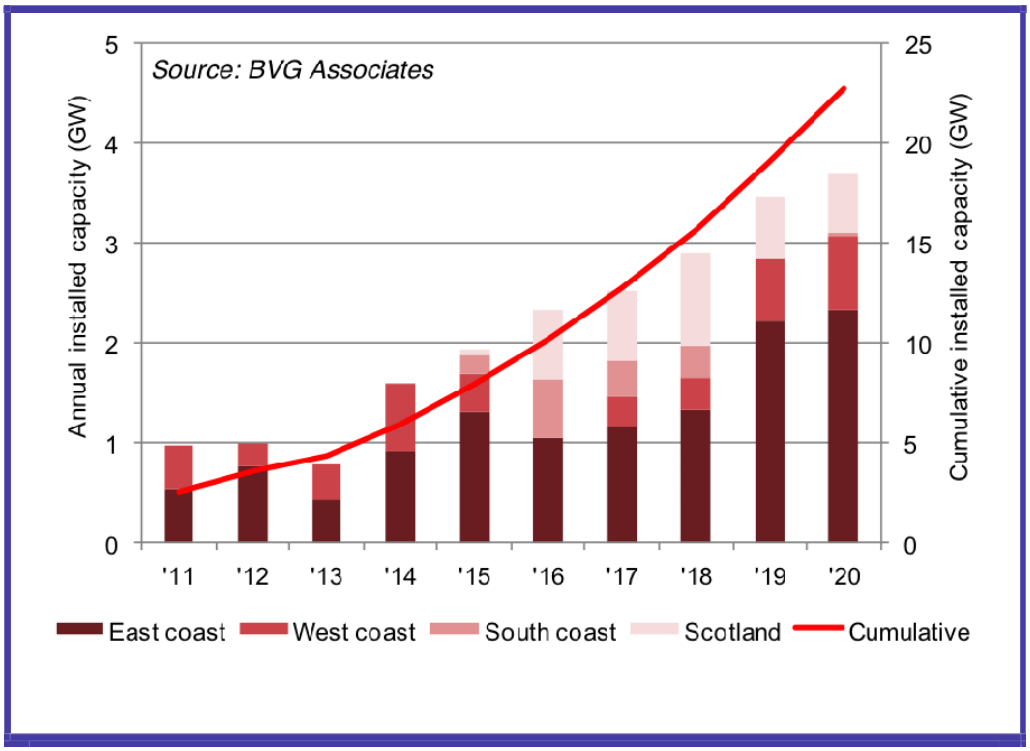
[14] Scottish Government Marine Energy – Offshore wind (online) http://www.scotland.gov.uk/Topics/marine/marineenergy/wind [Accessed on 28/03/2012]

[15] BVG Associates (2011) Towards Round 3: Progress in building the Offshore Supply Wind Chain (online), Available at: http://www.bvgassociates.co.uk/Publications/BVGAssociatespublications.aspx [Accessed on 21/03/2012]

[16] Scottish Government. Scotland's Renewables Ambition and Paths to Delivery (August 2011) Online at: http://www.scotland.gov.uk/Publications/2011/08/04110353/3 [Access on 08/0/2012]

[17] BVG Associates (2011) Towards Round 3: Progress in building the Offshore Supply Wind Chain (online), Available at: http://www.bvgassociates.co.uk/Publications/BVGAssociatespublications.aspx [Accessed on 21/03/2012]

Figure 11.1 The projected annual and cumulative UK offshore installation by 2020[18]

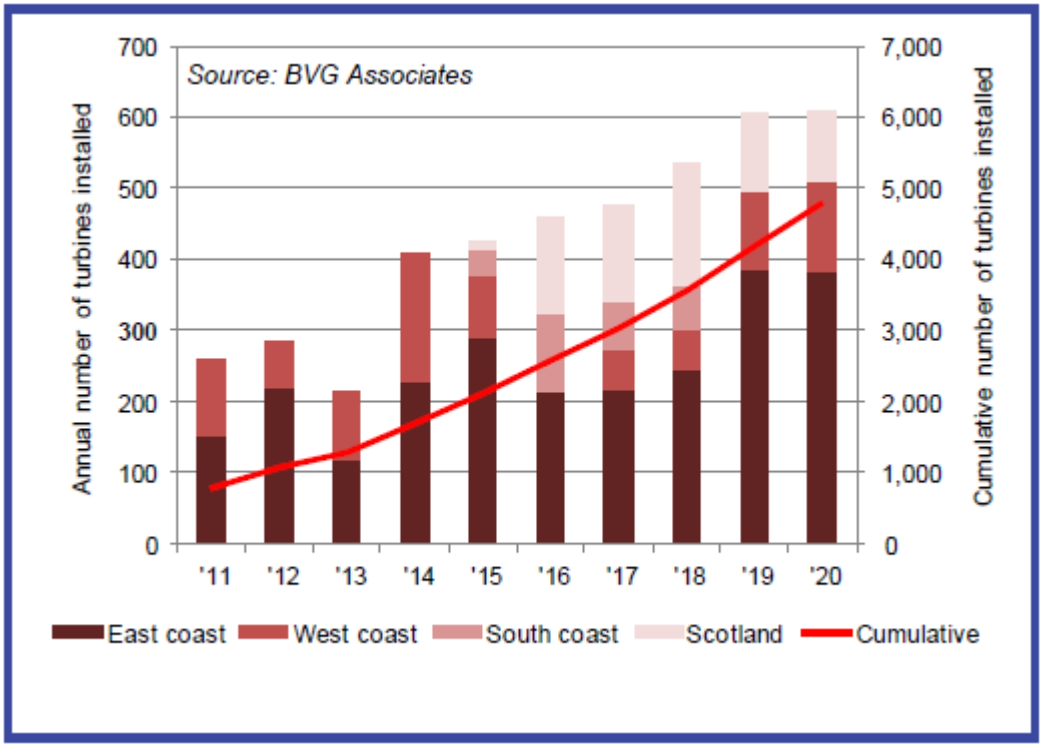


The projected increase has the potential of installing 600 offshore turbines per year until 2020. The estimated number of turbines projected to be installed offshore in UK by 2020 is shown in Figure 11.2. Further examination of these projections suggests that there are massive economic opportunities from this sector with estimates of a total capital investment ranging from £100bn to £120bn in supply chain i.e. turbine component manufacturing, foundation, installation vessels and subsea cables. The UK market is therefore a central focus for manufacturing companies targeting the offshore market[19].

[18] BVG Associates (2011) Towards Round 3: Progress in building the Offshore Supply Wind Chain (online), Available at: http://www.bvgassociates.co.uk/Publications/BVGAssociatespublications.aspx [Accessed on 21/03/2012]

[19] Renewable UK (2010) Rebirth of UK Manufacturing Industry (online), Available at: http://www.bwea.com/pdf/press/RenewableUK_Rebirth-of-UK-Manufacturing_Mar-2010.pdf [Accessed on 21/03/2012]

Figure 11.2 The projected number of turbines installed offshore in UK by 2020 [20]



There are a number of drivers for industrialisation of offshore wind in the UK. Firstly, an existing dominant home market in offshore wind. Secondly, the economic opportunity UK has due to the existence of a strong manufacturing and innovation pedigree and the recognised expertise in offshore engineering[21]. The relevant opportunities and constraints within the market that favour the establishment of a UK based turbine manufacturer are listed below:

- ***Skill Availability***: There exists a major opportunity to develop skills in the UK offshore wind industry. In 2011 the Renewable Energy Strategy stated that the UK offshore wind industry supported 3,100 jobs and has the potential to create 40,000 to 70,000 in operation and maintenance, turbine and component manufacturing, research & development.
- ***Turbine Manufacture and the Need for Test Facilities***: Despite new turbine technologies being developed for the offshore market, at present, few proven turbines that are specifically designed for offshore operation are available. However, until these turbines are tested, developers continue to face a challenge of whether to adopt newer technology with the potential for low cost energy or continue with the existing technology. This is a concern for all developers as it increases both the technical and commercial risk of large-scale offshore developments. There is a need to develop knowledge of new offshore machines and to develop confidence and relationships between turbine manufacturers and offshore project developers. Test facilities are key to developing such relationships.
- ***Lack of Coastal Turbine Assembly and Large Component Manufacture***: Currently, very few turbines manufacturing facilities have direct access to coastal load-out facilities and there is a need for these facilities to be consented and

[20] BVG Associates (2011) Towards Round 3: Progress in building the Offshore Supply Wind Chain (online), Available at: http://www.bvgassociates.co.uk/Publications/BVGAssociatespublications.aspx [Accessed on 21/03/2012]
[21] BVG Associates (2011) Towards Round 3: Progress in building the Offshore Supply Wind Chain (online), Available at: http://www.bvgassociates.co.uk/Publications/BVGAssociatespublications.aspx [Accessed on 21/03/2012]

constructed prior to the anticipated demand. The FEP already contains Burntisland Fabrications (BiFab) who are suppliers to the offshore renewable market, further development of a turbine test facility at the Development site has the potential to strengthen the FEP location as a supplier to the offshore renewable market;

- ***Supply Forecast:*** With little choice, the turbine market is not functioning as a competitive system with Siemens and Vestas leading the market by building a pedigree in offshore wind. The commitment to manufacture in the UK by four wind turbine manufacturers – Siemens Wind Power, GE Energy, Gamesa, Samsung and Mitsubishi – in 2010 is a highly significant step in building confidence, enabling wide ranging and in-depth discussion between UK suppliers and the wind industry about supply to UK-based assembly facilities. The Applicant, Scottish Enterprise, are committed to promoting the development of industry including the renewable industry in Scotland.
- ***New Technology:*** It is expected that variants of today's turbines will remain core products dominating sales into 2012/13, with next-generation, larger technology only taking over towards 2015. This means that for some time, the market will be dominated by technology adapted for offshore use, rather than fundamentally designed for offshore use22.

The Development of a turbine test facility at the FEP and its direct and indirect impacts on the economy is further assessed in section 11.6.1.

11.3.1.2 Local Authority Population and Economy

The Development site will be located on the northern shore of the Firth of Forth at FEP, Methil. The coastal town of Methil is located 2.3 km south-west of Leven and approximately 12 km north-east of Kirkcaldy in Levenmouth ward.

Fife is Scotland's third largest Local Authority area based on the population. Based on the most recent NOMIS figure (2010) the population of Fife was 365,000 representing 7% of Scotland's total, and a rise of 4.6 % since 2000. The population is expected to continue to grow by 10 % to around 40,000 by 2033[23]. The majority of the population is concentrated in west and central whereas the north and north-east is predominantly rural in nature[24] .

Fife region has seen a continuous shift from traditional manufacturing economy to a service based economy with majority employed in the public service sector. Between 1998 and 2008 there has been 10.7 % decline in the number of manufacturing employee jobs however in line with the rise in service based economy, jobs in this sector have risen by 8.7 %.[25]

The latest statistics (October 2010 – September 2011)) show Fife has a higher population of those who are economically active; 78.1 %, compared to both, Scotland as a whole; 76.9 % and the UK; 76.1 %. However, since 2008, unemployment has been rising and current unemployment figures from 2011 stand at 9.1 % as compared to 7.9% in both Scotland and the UK[26].

[22] BVG Associates (2011) Towards Round 3: Progress in building the Offshore Supply Wind Chain (online), Available at: http://www.bvgassociates.co.uk/Publications/BVGAssociatespublications.aspx [Accessed on 21/03/2012]

[23] Fife Community Planning – State of Fife Report 2010/2011 – Available at: http://publications.1fife.org.uk/uploadfiles/publications/c64_1011StateofFifeReport.pdf [Accessed on 14/03/2012]

[24] Fife Council (2007) *State of the Environment Report 2006-2007;* - Available at *http://www.fife.gov.uk/publications/index.cfm?fuseaction=publication.pop&pubid=143B8C26-EDD4-86BE-C3297C51B7D445D6* [Accessed on 14/03/2012]

[25] NOMIS - Employee jobs Time series. (up to 2008) http://www.nomisweb.co.uk/reports/lmp/la/2038432135/subreports/abi_time_series/report.aspx? [Access 09/03/2012]

[26] NOMIS – Economically Active Time Series http://www.nomisweb.co.uk/reports/lmp/la/2038432135/subreports/ea_time_series/report.aspx [Accessed 09/03/2012]

Between 1996 - 2006 Fife's average annual growth in productivity is 1.3%, comparatively lower than the average, 1.5% for Scotland and 1.7 % across the UK as a whole[27]. That is coupled with lower average workplace earnings, i.e. £442.90 gross average (median) weekly earnings compared to that across Scotland; £488.80.

11.3.1.3 Ward Population and Economy

In the past, coal mining, large-scale manufacturing and port-related were major employers. In the light of the current recession period, resulting in downturn of the finance sector and the depleting oil resources, the case for other upcoming sectors mainly manufacturing and renewable energy has been strengthened. Approximately 20% of the workers in Levenmouth are employed in manufacturing. In 2006, £1 million was invested in opening up a satellite campus by Adam Smith's college with the aim that it will equip the local population with the skills required for the potential renewable energy opportunities in Fife due to the creation of FEP.

Scottish Enterprise together with Fife Council, acknowledge that there are massive opportunities to attract new companies particularly within the offshore renewables sector to the region in the next 10 years[28] . The Fife Renewable Opportunity document states that Fife has the skilled workforce, infrastructure and experienced industries in engineering and manufacturing to serve the renewable energy sector[29] .

11.3.1.4 Fife Energy Park

FEP, a key project is a joint venture between Scottish Enterprise and Fife Council aimed to role in the development of Scotland's Renewable Energy Infrastructure and provide long term jobs. To date, almost £17 million has been invested in FEP for strengthening the infrastructure and encouraging further growth and employment[30]. The development of offshore wind farms also holds opportunity for employment in the surrounding area for suppliers and service operators.

Located on the east coast of Scotland, FEP offers over 500,000 square metres of industrial space, of which 300,000 square metres is available land for development with quayside access to the open sea. It is a unique facility in an ideal location that has been developed for companies working in the renewable, oil and gas energy sectors and associated supply chains[31].

Burntisland Fabrication (BiFab), a large scale fabrication manufacturer for the off-shore energy market has centres located in at the FEP, as well as Burntisland and Arnish, employing over 900 people. The company has previous experience of manufacturing support structures for wind turbine demonstration projects and has further received investment for other offshore projects in the UK. BiFab has been identified as a potential supplier if the Development is consented.

The Hydrogen Office[32] located on the FEP promotes and demonstrates the potential of storing surplus renewable energy as hydrogen. The building, located within the Energy Park is powered by a novel renewable and hydrogen energy system including a 750 kw wind turbine, 30 kW electrolyser, 10kW hydrogen fuel fell and a geothermal source heat pump. The project, initiated by the Business Partnership, has been initiated to support the accelerated development of the renewable, hydrogen, fuel cell and energy storage industries in Scotland and provides access to the technology whilst promoting sector development, and facilitating research and educational opportunities.

[27] Fife Partnership and Scottish Government - A stronger future for Fife – 2009-2012 http://www.cvsfife.org/publications/draftsoa.pdf [Accessed 09/03/2012]
[28] Fife Economic Forum (2009) *Growing Fife's Future - Fife Renewable Energy Opportunity*, Fife Council.
[29] ibid
[30] Scottish Development International (December 2011)http://www.sdi.co.uk/news/2011/12/New-road-at-Fife-energy-park.aspx [Accessed 09/03/2012]
[31] Scottish Enterprise- FEP – (online) http://www.scottish-enterprise.com/your-sector/energy/energy-how-we-can-help/research-and-development-support/fife-energy-park.aspx [Accessed 28/03/2012]
[32] The Hydrogen Office (Online) http://www.hydrogenoffice.com/index.asp [Accessed on 28/03/2012]

The creation of FEP is a key investment and main site of business and industrial activity in Levenmouth. Five companies including Burntisland Fabrication (BiFab) and Ocean Power Delivery have recruited more than 30 staff from Levenmouth Ward in the last 5 years at Fife Energy Park. On completion of the park, it is expected to generate further employment within the local economy[33] .

11.4 Recreation and Tourism

Fife is flanked by the River Tay to the north and to the south by the Firth of Forth. Fife is an important international tourist region that centres on its natural environment, particularly its coastline and golf centres, the majority of which are located in the eastern and northern parts of the region. Tourism is an important and growing sector in Fife, in 2009, tourism had a value of an estimated £267 million to the local economy[34], accounting for around 12,000 jobs (full-time and part-time) and representing 8.6 % of the workforce in Fife[35]. Information from site visits and the State of the Environment Report for Fife[36] indicates that although the landscape in Fife is an important tourism resource, the Development is located within Fife's more industrial area that has a strong urban presence in East Wemyss, Buckhaven and Methil[37] .

There are no formal on-site public rights of way or recreational opportunities. There are a few local recreational and tourist attractions located in the vicinity of the Development[38]:

- Leven Beach located approximately 3.9 km NE from the Development;
- Leven Links Golf course located approximately 3.9 km NE from the Development;
- Macduff Castle located approximately 2.5 km SW from the Development; and
- Wemyss Castle located approximately 5 km SW from the Development.

Other potential landscape and cultural heritage designations such as National Parks, Area of Great Landscape Value, Historic Parks and Gardens is further discussed in Chapter 5: *Landscape and Visual* and Chapter 10: *Cultural Heritage* of this ES.

The recreational routes of regional and national importance in the vicinity of the Development are listed below;

- The Fife Coastal Path, a part of the international North Sea Trail, stretches approximately 90 miles (150 km) from North Queensferry to Tay Bridge. The 11.2 km (7 miles) section from East Wemyss to Lower Largo is located approximately 560 m from the Development[39];
- The section of the National Cycle route no. 1 (part of North Sea cycle route) that extends from Edinburgh to Aberdeen passes approximately 6.8 km (4.2 miles) from the Development at its closest point[40];
- The regional cycling route no. 63 passes approximately 5.8 km (3.6 miles) from the Development at its closest point[41]; and
- The Visit Scotland website suggests that Fife Coastal Driving Route largely follows the coastline in Fife[42]. A map of the route is currently not available.

[33] Fife Economic Forum(2008) *Economic Profile Levenmouth*, Fife Council
[34] Fife Tourism Partnership – Tourism Strategy 2010-2020 Available online http://www.tourismnetfife.co.uk/sites/default/files/fife_tourism_partnership_strategy_2010_to_2020_doc.pdf [Accessed on 21/03/2012]
[35] Fife Tourism Partnership – Tourism Strategy 2010-2020 Available online http://www.tourismnetfife.co.uk/sites/default/files/fife_tourism_partnership_strategy_2010_to_2020_doc.pdf [Accessed on 21/03/2012]
[36] Fife Council (2007) *State of the Environment Report 2006-2007*
[37] EnviroCentre and Centre for Sustainability (2007) *State of the Environment Report 2006-2007,* Fife Council.
[38] Tourist attractions were identified from Ordnance Survey 1:25,000 scale maps.
[39] Fife Coastal Path, *East Wemyss to Largo* [online]; Available at http://www.fifecoastalpath.co.uk/ [Accessed on 14/03/2012].
[40] Sustrans GIS dataset
[41] Regional Cycling route identified from Ordnance Survey 1:50,000 scale maps

There are several small islands located within the Firth of Forth including Inchkeith, Craigleith and Bass Rock. A tourist ferry operates to the island Inchholm to the south west of the Development site; however, access to the rest of the islands in the Firth of Forth is generally limited.

The RYA Scotland, local RYA clubs, boat clubs and marinas were consulted with regards to the Development and following consultation, it was confirmed that the RYA does not foresee any adverse impacts on recreational boating. There are no landing facilities in the vicinity of the demonstration turbine and as such no effects are predicted. Chapter 12: *Navigation* of this ES provides further information on marine recreational activities in the area surrounding the Methil Docks/FEP.

Any potential visual impacts of the Development will be discussed within Chapter 5: *Landscape and Visual* of this ES.

11.4.1 Public Attitudes towards Windfarms

The potential impact of the Development on tourism is closely related to the perception of the windfarms by those visiting the area. Individual attitudes towards windfarms are subjective in nature and subject to a value judgement that differs amongst members of the public. It is however, relevant to note that the Development will comprise a single demonstration wind turbine installed at any one time, will be operational for a maximum period of 5 years, and is located within an industrial area. A summary of studies carried out across the UK to establish an overview of public perception of windfarm development is presented below.

11.4.1.1 Tourism and Offshore Wind Farms (2003/04)

North Hoyle is UK's first offshore windfarm that was constructed in 2003[43] . In 2004, RBA Research undertook a study to determine if tourists experienced a change in perception after the windfarm was operational. 96% of tourists in the area expressed that windfarm had no effect. Similarly, only 4% of the tourists felt that the presence of Gwynt y Môr[44] offshore wind farm (consented in 2008) would make them less likely to return to the area[45].

In 2003, prior to the construction Scarweather Sands offshore windfarm, Greenpeace carried out a poll to determine if visitors were likely to return on holiday if the development went ahead[46]. The survey that was based on 650 visitors revealed that 96% of the visitors would return if the windfarm was constructed. Only 4% said that they were less likely to return. The majority of the visitors (83%) felt it would not make any difference.

11.4.1.2 Public Attitudes towards Renewables in the UK (2007)

In March 2007, Allegra Strategies undertook a comprehensive study into UK consumer views on Energy Efficiency and Alternative Energy Sources[47]. Key findings in relation to wind energy were as follows:

- Renewable energy sources featured highly when consumers were asked which source of energy would be best for society. Most popular was wind power cited by 19.9% of consumers, second was solar at 17.9%, third most popular was nuclear at 10.5% (not a renewable source);
- Wind power was believed to be the best energy source for society because there is plenty of wind in the UK, wind is considered to be a clean and natural source of

[42] Visit Scotland, *Fife Coastal Route* [online]; Available at http://classiccars.visitscotland.com/route/more/fife/ [Accessed on 14/03/2012].
[43] The windfarm is located 4-5 miles off North Wales coast comprising of 30 turbines
[44] The windfarm is located 8 miles off North Wales coast comprising of approximately 200 turbines
[45] BWEA (2006) *The impact of windfarms on the tourist industry in UK* [online]. Available at: http://www.bwea.com/pdf/tourism.pdf [Accessed on 14/03/2012]
[46] Greenpeace (2003) *Poll shows windfarm could be a boon for tourism*, Sample: 650 visitors [online]. Available at: http://www.greenpeace.org.uk/media/press-releases/poll-shows-wind-farm-could-be-boon-for-tourism [Accessed on 14/03/2012]
[47] Allegra Strategies (2007) *UK Attitudes to Energy Efficiency & Alternative Energy Sources*.

energy, better for the environment, will not run out like fossil fuels and is cost efficient in the long-term;

- Consumers perceived windfarms as a good solution to benefit the environment. 18% of the public thought windfarms were aesthetically pleasing versus 6.4% who viewed windfarms as an eyesore. For a number of respondents the benefits of wind energy outweighed the visual impact and respondents were unsympathetic about other consumers complaints regarding the visual impact of windfarms;
- Many consumers believed wind turbines should be used more widely to produce clean energy and they generally responded positively to wind turbines in their local area;
- 70.1% of respondents stated that they would be happy to have a windfarm located close by, compared with 17.3% who would not;
- 85.9% of respondents who had wind turbines in their local area expressed positive feedback. 5.3% of residents were opposed; and
- Most consumers in UK (47.8%) favoured large–scale renewable such as wind energy as their most preferred source.

11.4.1.3 Scottish Tourism and Windfarms (2007)

In June 2007, Glasgow Caledonian University was commissioned by the Scottish Government to assess whether Government priorities for wind farms in Scotland are likely to have an economic impact (positive or negative) on Scottish tourism[48] .

The study, which reported in March 2008, concluded that "the effects are so small that, provided planning and marketing are carried out effectively, there is no reason why the two are incompatible". It also found that three quarters of tourists felt that wind farms had a positive (39%) or neutral (36%) impact on the landscape.

11.4.1.4 Public Attitudes towards Windfarms

More recently a YouGov online poll commissioned by Scottish Renewables found attitudes towards windfarms to be more positive than five years ago. This survey found that 78% of respondents agreed that "Wind farms are necessary so that we can produce renewable energy to help us meet current and future energy needs in Scotland" compared with 73% in 2005[49].

New Research (April 2012[50]) by MORI for RenewableUK shows that 67% of respondents are in favour of the use of wind power in the UK, 28% of which are "*Strongly in favour".* 8% responded with opposition with only 3% stating *"strongly opposed".*

These studies highlight the varying opinions of visitors and residents regarding wind energy development, however, they suggest in all cases, that the majority of those surveyed do not have a negative attitude towards wind farms and support the use of the UKs wind resource.

11.4.2 Land-Use

The FEP site comprises 133 acres of semi-derelict industrial land in Methil. Scottish Enterprise is the landowner, having acquired the site from Wemyss Estate Trustees and Crown Estate in 2005.

A major redevelopment programme with investment totalling over £20M is currently underway at the FEP to establish a state of the art industrial facility for energy in Scotland, delivering excellence in engineering, fabrication and assembly.

[48] Glasgow Caledonian University (2007) The Economic Impacts of Wind Farms on Scottish Tourism [online] Available at: http://www.scotland.gov.uk/publications/2008/03/07113554/0 [Accessed 14/03/2012]
[49] Scottish Renewables (2010) More Than Three Quarters of All Scots Support Growth of Wind Farms. Available at http://www.scottishrenewables.com/news/more-three-quarters-all-scots-support-growth-wind-/ [Accessed 14/03/2012]
[50] RenewableUK. UK Public Supports Wind Energy (2012) online at: http://www.bwea.com/media/news/articles/pr20120423.html [accessed on 08/05/2012]

The turbine will be installed 48.3 m from the FEP boundary and will be connected to FEP by bridging structure. Site offices and construction workshop will be located within FEP close to the demonstration turbine.

11.4.3 Commercial Fishing

The Development will be located in International Council for Exploration of Seas (ICES) area 41E6 as shown on Figure 12.1. Chapter 12: *Navigation* of this ES provides further information on the consultation undertaken with fishing organisations, type of commercial fishing vessels that operate in Firth of Forth and the level of fishing activity carried out in the area.

Consultation undertaken with the Scottish Fisherman's Federation was reported in the application for the Consented Development and stated that there is limited use of the area due to the shallow water depths and smaller vessels fish in the area (Arcus, 2010). This view was confirmed by consultation in the preparation of this application during the initial scoping process in February 2012.

11.5 Information Gaps

No responses were received from local fishing groups consulted during the EIA process.

11.6 Assessment of Potential Effects

The assessment of socio-economic, tourism and recreation, land-use and commercial fishing effects aim to predict the likely impacts (both positive and negative) arising from the Development.

11.6.1 Socio-economics

Social and economic effects can be divided into:

- Direct effects: opportunities that can be created that will as an immediate effect of the development, for example opportunities in the construction and operation of the site;
- Indirect effects: opportunities that will be created by the Development further down the supply chain. For example companies providing services to the proposed Development during construction and operation; and
- Induced effects: for example employments created by the additional spend of wages into the local economy and the purchasing of basic materials, equipment and office space for staff.

11.6.1.1 Construction

It is estimated that the Development and setting up of the Scottish subsidiary will directly create job opportunities for five local staff in the areas of project management, legal and accountancy services, in addition to generating opportunities for up to 60 local workers to establish site facilities, office, workshop and grid connection cabling and buildings during the 4month development and construction period. This represents short term, minor effect at a local level.

For the supply of different components of the turbines, which is a significant component of the project, there may be opportunity for numerous companies to supply parts and materials that will be utilised within the turbine.

Owing to the nature of the project requirements, local and regional businesses are also well positioned which will be advantageous to the process of tendering for contractors. Examples of direct opportunities for local and regional contractors and companies include supplying various building materials (e.g. fencing, concrete, cement, stone, etc.) and mechanical, electrical and supervisory services.

In addition to the above impacts, the project will also result in the turbine generating up 7 MW of green energy that will be supplied to the grid network.

Overall, construction of the Development will bring about a short term, minor, positive effect through increase in employment and business opportunities and generation of green energy on site. Consequently, socio-economic effects arising from the construction phase of this turbine are considered to be not significant.

11.6.1.2 Operation

The new turbine designs include innovative developments and advancements in turbine technology. The operation of the turbine would be monitored on an ongoing basis from the control compound located on the FEP. Turbine parts may need to be replaced and changed throughout the testing of a turbine, and there is potential for more than one turbine to be tested at the site throughout the 5 year period. This would require the removal and replacement of the installed turbine. It is reiterated only one turbine will be in place at the site at any one time. It is estimated that the Development will support the equivalent of up to 6 full-time maintenance and administrative staff. It is anticipated that the operation of the Development will therefore have a negligible effect on the economy during this period. This effect is not significant.

11.6.1.3 Decommissioning

Socio-economic effects during the de-commissioning phase are anticipated to be of a similar nature and scale as construction effects, thereby representing a short-term, minor positive, effect acting at a local or regional level. Consequently, socio-economic effects arising from the decommissioning phase of this turbine are considered to be not significant.

11.6.1.4 The Economic Value and Impact of the Development

Scottish Enterprise is Scotland's main economic development agency and aims to deliver a significant, lasting effect on the Scottish economy.

The purpose of the facility is to test prototype and new models of an offshore wind turbine, The turbine is a new design to be deployed in the forthcoming offshore wind farm developments including the Scottish Territorial Waters and the UK Government's Round 3 offshore sites and as a result, the project has a higher value and impact on the economy at both local and national levels.

There are direct and indirect job outcomes and growth factors in the embedding of expertise within the local area, that are difficult to quantify but lead to significant impacts in the longer term.

The Developer is committed to working in partnership with national and local agencies to maximise the knowledge opportunity at all levels, from operational/installation training through to degree level and postgraduate research work. In the future, there are opportunities for the development of technician level training and industry skills development and this will make a major contribution to enhancing the areas reputation and helping to make the aspiration of an Industry Centre of Technology in Fife a reality.

In addition to this, successful delivery of the Demonstration Project in Fife will help to:

- Remove barriers in the UK industrialisation of offshore wind;
- Increase local industry and academic collaboration, thereby building knowledge capacity in the local area;
- Make significant progress in integrated system technology for offshore wind;
- Facilitate the growth and development of the industry, develop industry process, workforce skills and industry culture in the Fife area; and
- Raise the profile of Fife at an international level.

As stated in Chapter 1: *Introduction* of this ES, Scottish Enterprise has been in discussion with various turbine manufacturers regarding the testing of turbines at the Development. The demonstration turbine is the first step to bringing turbine manufacturing to the FEP and that it is potentially worth 100 m of investment with the creation of up to 500 jobs. Whilst not a direct effect of the Development this would present a significant benefit to the local, regional and national economy and support the development of the offshore wind industry in Scotland.

11.6.2 Recreation and Tourism

Potential effects on recreation and tourism resources are categorised as:

- Direct physical effects: for example construction activities with rights of access and marine recreational activities; and
- Indirect effects: such as the effects of noise and changes in view of tourists and recreational users.

11.6.2.1 Construction

The onshore elements of the Development will be located within the FEP which is owned by Scottish Enterprise. The seabed is owned by The Crown Estate from whom a lease is required for the offshore elements.

With regard to the land based area surrounding the Development, there are no opportunities for formal or informal recreation within the immediate vicinity, as the FEP is a secure site for health and safety Reasons. The construction of the wind turbine is not predicted to have any indirect or direct effects on any land based recreational and tourist facilities.

During construction the area surrounding the turbine will not be accessible to marine recreational users for health and safety reasons. The construction area will be limited to that in the immediate vicinity of the turbine location and will not preclude recreational users from utilising the coastline around the Development. The construction period will be short term (approximately 4 months). Overall, this is considered as a negligible effect. Potential navigational issues on marine recreational vessels is further discussed and assessed in Chapter 12: *Navigation* of this ES.

Overall, there effect on recreation and tourism during construction is negligible and therefore not significant.

11.6.2.2 Operation

The land-based or sea-based recreational resources will not experience any direct effects during the operation of the Development. The indirect effect on visibility is assessed in Chapter 6: *Landscape and Visual Assessment*, of this ES. There is no significant visual effect on National Cycle Route 1 and 76 and Regional Cycle Route 63 due to no or limited intervisibility between these locations and the Development.

The Fife Coastal Path will experience significant impacts on local views of the Development along 6.5 km of the route. Beyond this section of the 150 km coastal route, there will be no significant impact due to distance, screening and limited visibility. This is discussed in Chapter 6: *Landscape and Visual Assessment,* of this ES

With regard to general effects on tourism in the area, as detailed above, studies have been undertaken to determine the effects of typical windfarms on tourism in the UK. Overall, the studies suggest that the majority of those surveyed do not have a negative attitude towards windfarms. The Development would only be present in this location for a maximum of 5 years, following which the effects would be fully reversible upon removal of the turbine. As such any effects will be temporary, reversible and short term in nature.

Overall, the effects of the Development on tourism and recreation during operation would be negligible and therefore not significant.

11.6.2.3 Decommissioning

Effects on recreation and tourism during the de-commissioning phase are anticipated to be of a similar nature and scale as construction effects; therefore no significant effects are predicted.

11.6.3 Land-Use

11.6.3.1 Construction

The turbine will be located offshore with associated onshore works will be part of the redevelopment of the FEP. This area of the FEP is currently derelict and unused and this will

constitute the utilisation of brownfield land in Fife region. This is a positive change in land-use from the current unused former industrial land and is considered a minor, short-term, positive effect at a local and regional level.

Overall, these effects are not significant. Any potential impact on coastal hydrology due to the Development is further discussed in Chapter 9: *Water Resources and Coastal Hydrology* of this ES.

11.6.3.2 Operation

During operation, land ownership would not change as a result of the Development. The value of the land used for the Development would be higher than the value of the land for its current use, due to the FEP redevelopment.

This represents a minor, long-term, positive effect at a local level that is considered to be not significant.

11.6.3.3 Decommissioning

The Development has a 5 year operational period, after which it would be removed. No additional land-use effects associated with de-commissioning are predicted.

11.6.4 Commercial Fishing

11.6.4.1 Construction

The construction phase will last for 4 months in total, with the offshore drilling and substructure installation having a duration of approximately 2 months. Given the location of the demonstration wind turbine, there will be a temporary 500 m exclusion zone for fishing vessels during construction for health and safety reason, the safety zone will be declared to ensure that there are no safety risks to the fishing vessels due to the presence of jack-up barges during the construction phase. This is considered to be a short term, negligible effect.

Any spoil arising during drilling of the foundation piles will either be utilised within FEP site works or removed from site and disposed at a waste facility. There will be underground cabling involved as the cable will run along the bridging structure between the turbine and the shore.

Consequently, no potential financial losses are predicted on commercial fishery vessels, given the small scale, location and type of Development, duration of construction activities, number of fishing operations within the vicinity and availability of alternative fishing grounds in the area.

The effect on commercial fishing is therefore negligible and not significant.

11.6.4.2 Operation

There will be no exclusion zone once the turbine is operational. Consequently, no potential financial losses are predicted on commercial fishery vessels, given the small scale, location and type of Development, duration of operation, number of fishing operations within the vicinity and availability of alternative fishing grounds in the area. Further measures related to navigation of commercial vessels and lighting of turbines is discussed in Chapter 12: *Navigation* of this ES. No significant effects are predicted.

11.6.4.3 Decommissioning

Effects on commercial fishing during the de-commissioning phase are anticipated to be of a similar nature and scale as construction effects as described above, is therefore effects are negligible and not significant.

11.7 Mitigation and Enhancement

There are no significant effects predicted during the 5 year operational period of the Development. Therefore, no further mitigation is proposed.

11.8 Residual Effects

As there is no mitigation proposed the residual effects are as per the assessment of effects presented in Section 11.6.

11.9 Cumulative Effects

The nearest cumulative wind farm developments to the development site are The Hydrogen Office, located approximately 1.7 km to the north-east and the 2-B application for two offshore turbines approximately 1.6 km south of the Development. Additional developments are located further afield including, Westfield Wind Farm, located approximately 15 km to the west, Little Raith Wind Farm 18.5 km south west and Lochel Bank Wind farm approximately 28.8 km northwest of the Development. The appropriate scale for considering cumulative developments depends on the nature of the potential effect. These are considered in turn, for each category of potential effect.

11.9.1 Socio-Economic Effects

Local socio-economic effects have been defined as acting at local scale. Given the low magnitude of effect predicted on socio-economic receptors, even with additional wind farms, the cumulative magnitude of beneficial effects is considered to be not significant as it is considered unlikely to lead to a fundamental change in local economic activity. The potential exists, should a large enough number of wind farms be consented in the area, job creation may occur to support the industry. However, this is likely to depend on a range of economic factors other than the wind farm, and is considered to be not significant.

11.9.2 Tourism and Recreation

Cumulative visual effects on outdoor recreational and tourism facilities such as rights of way resulting from the Development in conjunction with other wind farms in the area are assessed in Chapter 5: *Landscape and Visual* of this ES. As noted in Section 11.6.2, no significant effects on tourism are predicted and hence no significant cumulative effects are anticipated.

11.9.3 Land Use

Given the positive change in land-use from the current unused former industrial land in additional to the operation Hydrogen Office turbine already located at Methil Docks; it is considered a short-term, positive effect at a local and regional level. Given the limited footprint of this Development and the Hydrogen project this is not considered to be significant.

11.9.4 Commercial Fishing

Given the negligible effect predicted on commercial fishing receptors, there are no cumulative effects to be considered as no other wind developments are located offshore which would impact on commercial fishing in the area.

11.10 Summary of Effects

A negligible impact is anticipated during the temporary construction phase and 5 year operational phase on local and national economy, tourism and recreational resources, land-use and commercial fishery.

Construction, operation and decommissioning of the Development will not result in any fundamental or material changes in population, structure of the local community, long term employment, local services, tourism and recreation, land use or commercial fishing activities.

Positive effects include those on local employment during the construction phase and local economic and land use effects during the operational phase. However, none of these effects are considered significant. This applies whether or not the wind farm is developed in isolation or is considered cumulatively with other sites in the region.

11.11 Statement of Significance

There are no significant effects predicted during the construction, operation or decommissioning phase on the socioeconomics, tourism and recreation, land-use and commercial fishery resources

12 NAVIGATION

12.1 Introduction

This Chapter of the ES evaluates the navigational effects associated with the Development. It considers shipping navigation, fishing vessel movements, recreational vessel movements and other navigational issues. The socio-economic effect of the Development on commercial fishing and recreation is assessed within Chapter 11: *Socio-Economics, Recreation, Tourism and Land-Use* of this ES and the effect of the Development on telecommunication and existing infrastructure is assessed within Chapter 13: *Telecommunication and Existing Infrastructure* of this ES.

This chapter contains the following sections:

- Guidance and Consultation;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects
- Mitigation Measures and Residual Effects;
- Cumulative Effects;
- Summary of Effects; and
- Statement of Significance.

12.2 Guidance and Consultation

12.2.1 Policy and Guidance

The following documents have been considered for the assessment of the potential effects of the Development on navigation:

- Offshore Wind Farms Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements Version 2 June 2004, Prepared by Centre for Environment, Fisheries and Aquaculture Science (CEFAS) on behalf of Marine Consents and Environment Unit (MCEU)[1];
- DTI Guidance on the Assessment of the Impact of Offshore Wind Farms: Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms, November 2005[2].
- Maritime and Coastguard Agency (MCA), Dept. of Transport[3]; and
- MCA Marine Guidance Note MGN 371 Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues, (www.mcga.gov.uk)[4].

The following sources of information have been used to inform the baseline description set out in this Chapter:

- Marine Coastguard Agency (MCA), Marine Guidance Note 371 Offshore Renewable Energy Installations (OREIs) – Guidance on the UK Navigation Practice, Safety and Emergency Response Issues[5]; and
- DECC Maritime Data/DTI online GIS Shipping Database (www.maritimedata.co.uk)[6].Baseline conditions have been established through

[1] http://www.cefas.co.uk/publications/files/windfarm-guidance.pdf
[2]http://www.dft.gov.uk/mca/mcga07-home/shipsandcargoes/mcga-shipsregsandguidance/mcga-windfarms/offshore-renewable_energy_installations/guidance-on_the_assessment_of_the_impact_of_offshore_wind_farms.htm
[3] www.dft.gov.uk/mca
[4] http://www.dft.gov.uk/mca/mcga-mnotice.htm?textobjid=0BD60265A97A9E76
[5] Marine Coastguard Agency (MCA), (2008), Marine Guidance Note 371 'Offshore Renewable Energy Installations (OREIs) – Guidance on the UK Navigation Practice, Safety and Emergency Response Issues', Available online at: http://www.mcga.gov.uk/c4mca/mgn371.pdf
[6] Department of Energy and Climate Change (DECC), (2010), Maritime Data, Available online at:

desktop studies and consultation. Additional information was also obtained via a scoping exercise (outlined in Chapter 2: *EIA Methodology* of this ES).

12.2.2 Consultation

As part of the scoping and assessment process, relevant organisations were contacted with regard to the Development. Table 12.1 summarises the responses received.

Table 12.1 Summary of Consultation Responses

Consultation	Comments	Response
Chamber of Shipping	No major concerns regarding the proposal however, due to proximity to shoreline. Request that Northern Lighthouse Board advice is taken on any lighting and marking measures that may be necessary.	The response from the Northern Lighthouse Board are provided below.
Forth Ports/Methil Docks Harbour Master (FPMD)	No comments from an environmental or navigational perspective. A marine works license would be required; this is normally requested once a Marine Licence has been granted.	This is noted. Liaison with Forth Ports is ongoing.
Maritime and Coastguard Agency	The scale and location of the project suggests a limited impact on shipping and navigation however, the ES should supply detail on possible impact on navigation for commercial and recreational craft. A navigational risk assessment should be submitted in accordance with MGN 371 (and 372) and the DTI/DfT/MCA Methodology for Assessing Windfarms.	The appropriate guidance including MGN 371 has been considered in the preparation of this chapter.
Marine Scotland	The ES should include the following details on possible impact on Navigation for both commercial and recreational craft: • Collision Risk; • Navigational Safety; • Visual Intrusion and Noise; • Risk Management and Emergency Response; • Marking and Lighting of Tidal Site and information to Mariners; • Effect on small craft navigational and recreational equipment; • Weather and risk to recreational craft which lose power and are drifting in adverse conditions, and; • Evaluation of likely squeeze of small craft into routes of large commercial vessels.	Details on the potential impacts on navigation are stated throughout this Chapter of the ES. Marine Scotland's comments have been considered throughout the production of this Chapter. Section 12.4 of this chapter provides an explanation as to why collision risk modelling is not required for this Development.

http://www.maritimedata.co.uk/default.aspx

Consultation	Comments	Response
Northern Lighthouse Board	Previous comments given for the Consented Development still stand: • Require navigational warnings be broadcast during data gathering, surveying, installation and cable laying/trenching operations; • Navigational risk assessment to be undertaken; • Vessels engaged in works shall exhibit signals in accordance with the international regulations for preventing collisions at sea 1972 (colregs); • Formal recommendations for lighting and marking will be given through the Coast Protection Act 1949 – Section 34 process; • Statutory sanction of commissioners of northern lighthouses must be sought to deploy, exhibit and subsequently remove any proposed navigational lighting or buoy stations; • Welcome opportunity to meet developer and harbour authorities to discuss the navigational impact, and the effect the structures may have upon the existing aids to navigation adjacent to the proposed site; • Local information regarding navigational traffic, fishing and recreational movements may be provided by Forth Ports Plc as the harbour authority within whose area the device will be deployed; • No markings of the turbine or meteorological mast are required; • Content with findings outlined in section 9.6 of the Scoping Report; and • Notice to Mariners and appropriate publication of Development required. We would advise that no marking of the turbine or Met Mast is required.	Ongoing consultation with the Northern Lighthouse Board will be undertaken to determine the nature of the required warnings, such as during the benthic survey. There are no cable laying operations associated with the Development. An assessment of the risk to navigation is presented throughout this Chapter. Vessels will comply with all applicable legislation. The turbine will be equipped with flashing yellow lights, fog horns, yellow paint and radar reflectors. Red aviation lights will also be installed. It is noted the Commissioners of Northern Lighthouses will need to be consulted throughout. The Applicant would welcome the opportunity for ongoing consultation to ensure all navigational safety requirements are met. Forth Ports have been consulted in the preparation of the application.
Ports and Harbours Branch, Scottish Government	No comments	
The Royal Yachting Association Scotland (RYA)	The RYA does not foresee any adverse impacts on recreational boating.	

Consultation	Comments	Response
Scottish Canoe Association	• The reports provided for the above were found to be confusing, hinting that this was a totally land-based project, and then the map hinting that it would be at high or low tide level. Nowhere was the location absolutely clear; • Sea kayaking is a very major activity in the Firth of Forth, this stretch of water being amongst one of the three most popular in Scotland; • Any shore-based hazard that tends to put sea kayakers away from hugging the shore can be dangerous, and close into shore paddling is practiced whenever the sea state or weather conditions dictate that; and • It is suggested that when the location is absolutely clear, that the SCA is approached again, for advice on any necessary mitigation for safety, including any connection to the shore that impedes progress across e.g. a beach.	Figure 1.1, 1.2 and 1.3 of this ES shows the location of the turbine and the associated infrastructure. It is noted that sea kayakers prefer to stay close to the shore in difficult conditions. Given the development constitutes a single turbine, location at the mean low water mark, this is not expected to present a significant obstacle in relation to sea kayakers. The development will be connected to the beach by a bridge which will connect from the turbine to the quay wall of the FEP. As such access to the beach will not be impeded.
Scottish Fisherman's Federation	No comments to make.	
South East Inshore Fisheries Group	Fishermen who trawl for Nephrop are concerned of the potential disruption to fishing activities when the cables are laid. Lack of observational data on the effects of offshore Wind developments of the seabed, on fish, shellfish, cephalopods, crustaceans and bivalves. Little observational data during the operational phase. Requested a survey of the area pre and post Development. Asked for one of the trial turbines to be located in Methil docks as this is used but known to harbour fish, lobster etc. A study could be carried out looking at stocks: • Pre-development; • During development; and • During operation of the wind turbine. Creels and fish traps could be placed in the area where the turbine is to be sited during the above periods. Acoustic surveys could gain an indication of fish life in the area to assess any changes.	As noted in Chapter 7*: Ecology* of this ES the cable will be attached to the bridge connecting the turbine with the shore and hence will not be laid on the sea bed. Comment on fish surveys is made in Chapter 7: *Ecology* of this ES.

The following local organisations were also consulted:

12.2.2.1 Recreational Sailing Clubs

- Largo Bay Sailing Club;
- Dysart Sailing Club; and
- Elie & Earlsferry Sailing Club.

12.2.2.2 Fishing Associations

- Fife Creel Fishermen's Association;
- Methil Creel Fishermen;
- 10 Metre & Under Fishermen's Association; and
- Cockenzie & Port Seton Fishermen's Association.

Consultations with local fishing and recreational groups will continue throughout the development process.

12.3 Assessment Methodology and Significance Criteria

The potential impacts on shipping and navigation from offshore windfarm developments are not easily categorised using the significance criteria outlined within Chapter 2: *Environmental Impact Assessment Methodology* of this ES. Therefore the impact assessment methodology is based on an impact being either significant or not significant. This approach is linked to the impact on vessel routeing, which uses the impact assessment terminology described below:

- **Not significant.** Impacts that are slight in terms of vessel routeing (minor deviations around the turbine) and low risk in terms of vessel navigation, collision risk and response to marine incidents.
- **Significant.** Impacts that are moderate in terms of vessel routeing (large deviations around the turbine) and high risk in terms of vessel navigation, collision risk and response to marine incidents. Risks should be assessed, appropriate control measures are in place, residual risks are as low as is reasonably practicable.

12.4 Baseline Conditions

The Department of Energy & Climate Change Maritime Data/DTI online GIS Shipping Database website (www.maritimedata.co.uk) was consulted for baseline maritime information for the area around the Development. Further information was also obtained from consultations.

12.4.1 Shipping

The Development is located to the south of the Port of Methil on the northern shores of the Firth of Forth. The Port of Methil has two docks able to take vessels up to 3,000 dwt[7]. The port specialises as a woodpulp and timber distribution centre and these two commodities contribute most of its traffic. Other commodities handled through the port include dry bulk, fertiliser imports, road salt in the winter and export of stone and coal.

Consultation with Forth Ports, Methil Docks Harbour Master (FPMD) indicated that they had no concerns with the Development from an environmental or navigational perspective.

The Maritime Data online GIS system (www.maritimedata.co.uk) shows that the Development is located in an area of very low density for shipping activity for vessels such as ferries, however, shipping density is high to very high in this area for cargo and tankers.

This area is also an important recreation sailing area identified as a RYA UK Sailing area, with RYA Yacht Clubs located along the coast and with numerous recreational routes of medium use. However RYA confirmed they do not foresee any adverse impacts on recreational boats.

[7] DWT or Dead Weight Tons is the cargo capacity (tonnage) of a vessel measured in metric tons.

The Development is located within ICES statistics rectangle 41E6[8]. Figure 12.1: Fishing Activity shows the location of fishing activity within ICES Rectangle 41E6 and adjoining ICES Rectangle 41E7. Radar survey vessel tracks from coastguard surveys shows the main area of radar activity is further offshore (ICES Rectangle 41E7) compared to the Development location (ICES Rectangle 41E6).

12.4.2 Fishing Vessels

Fishing satellite (covers fishing vessels of overall length 15 m and over) and fishing surveillance (sightings and patrols) data from the Maritime Data online GIS system show that the Development is in an area of very low density for fishing vessels. The Firth of Forth area is however classed as an area of high density in terms of fishing effort based on number of days fished, derived from logbook data submitted by UK fishing vessels. As of March 1st 2012, Methil and Leven Port has seven fishing vessels under 10 m registered at the port[9]. In 2008 this port had 20 vessels landing fish.

There are relatively few large fishing vessels active in ICES Rectangle 41E6. The majority of fishing activity in this area consists of smaller fishing vessels of less than 15 metres in length.

Figure 12.1 shows that there is relatively little activity near the Development. Within ICES rectangle 41E6 fishing activity is located further offshore than the Development. The majority of fishing activity is located further out to sea in ICES rectangle 41E7.

Scottish Fisherman's Federation, an umbrella organisation covering local fishing associations in the area, were consulted but provided no comments. Previous comments on the Consented Development (Arcus 2010) indicated only smaller vessels fish in the Forth as there is very limited use of this area for fishing due to the shallow water depths. Additional details were provided on Methil Boat Club which has two trawlers and registered fishing boats which lay creel in the area.

Further information on effects on commercial fishing is provided in Chapter 11: *Socio-Economics, Tourism, Land-Use and Commercial Fishing* of this ES.

12.4.3 Recreational Vessels

Methil Boat Club operates out of Methil Harbour. In addition, the nearest RYA clubs are listed in Table 12.3 below.

Table 12.3 Nearest RYA Clubs[10]

RYA Club	Activities	Approximate Location from Development
Largo Bay Sailing Club	Racing, Powerboat, Training Centre	6 km north east
Dysart Sailing Club	Racing, Boating, Watercraft	7.5 km south west
Elie & Earlsferry Sailing Club	Racing, Cruising, Ribs, Boating, Watercraft, Windsurfing	12 km east

The nearest RYA Scottish marina is Anstruther Harbour located approximately 20 km around the coast to the north east, which has 100 berths for leisure and small fishing vessels. RYA does not foresee any adverse impacts on recreational boating.

The Firth of Forth is classed as a RYA UK sailing area and is crisscrossed by a number of recreational cruising routes. The closest of which are a RYA Scotland cruising route to the

[8] Statistical rectangles were introduced by the International Council for the Exploration of the Seas (ICES) to standardize the division of the seas for statistical analysis. Each ICES statistical rectangle is '30 min latitude and 10 longitude in size, and are thus approximately 30 nautical miles square.
[9] Marine Management Organisation UK Vessel List 2012 Vessels 10m and under, March [online] http://marinemanagement.org.uk/fisheries/statistics/vessel.htm [Access on 27/03/2012]
[10] RYA Clubs, Maritime Data [Online] http://www.maritimedata.co.uk/ [Accessed 27/03/2012]

east of the Development which passes north south down from Largo Bay and an Upper Forth Boat Club cruising route which runs roughly parallel with the coast to the south of the Development. Both of these routes are classed as having medium usage. The Development is not located on either of these cruising routes. The Development is not located within any RYA UK racing areas[11]. The nearest racing areas are approximately 20 km to the south east adjacent to the North Berwick coast, near the location of East Lothian Yacht Club and approximately 15 km to the south west near Burntisland.

The Firth of Forth is an area used by sea kayakers who, as per the consultation response of the Scottish Canoe Association, may need to stay close to the shore during difficult conditions.

12.4.4 Navigational Aids, Anchorage and Water Depths

The level of the quayside in this area is +4.2 m Ordnance Datum (OD). The seabed level at the Development location is -4.9 m Chart Datum (CD) or -7.8 m OD. The turbine base would be located -1.1 m CD or -4m OD. The water depth around the Development is +0.7 m at Mean Low Water Springs (MLWS) and +5.5 m at Mean High Water Springs (MHWS) based on published tidal data for Methil. Please refer to Figure 3.3 Cross Section for more information. However the coastal defences in this area have been breached and boulder material is slipping into the sea. It is therefore possible that the base of the turbine may actually be partially uncovered by the water during low tide.

The Admiralty Chart for the area (734 Firth of Forth, Isle of May to Inchkeith) shows that the Development is not next to any navigational aids such as major lights and lit buoys (see Figure 12.2: Admiralty Chart). The nearest navigational aids are located approximately 0.45 nautical miles (NM) to the north east at the entrance to Methil Docks. A lit buoy is located approximately 0.8 NM to the south of the Development. Mooring buoys are located approximately 0.2 NM north east of the Development. The nearest anchorage area is a small vessel anchorage area located approximately 0.54 NM further offshore to the east.

12.4.5 Emergency Services

The nearest lifeboat station is located at Kinghorn, approximately 15 km southwest of the Development site. The crew and lifeboat are available 24 hours a day, every single day of the year to assist the MCA (Coastguard Agency) in effecting rescues between Elie Ness/Aberlady to the east, and Inchcolm/Granton to the west[12].

In 2012, the lifeboat and crew spent 56.9 hours at sea, rescued 42 people and saved 4 lives[13].

12.4.6 Information Gaps

Responses were not received from all fishing groups and sailing clubs consulted.

12.5 Assessment of Potential Effects

12.5.1 Shipping

Baseline data confirmed that there are no commercial shipping movements near the Development. FPMD confirmed that the Development will not have any impact on commercial shipping as the location is well clear of the shipping and navigational lanes in the area. They indicated that the only vessels that will be transiting this area are small coasters heading for Methil, however they confirmed that the location of the Development will not interfere with the passage of these vessels.

An effect of not significant on shipping is predicted due to the following factors:

- The shallow depth of water in which the Development is located;

[11] For maps showing locations of recreational sailing areas see Department of Energy & Climate Change Maritime Data/DTI Shipping Database website (www.maritimedata.co.uk).
[12] Kinghorn Lifeboat Station (online) http://www.kinghorn.org.uk/ [Accessed on 30/03/2012]
[13] Kinghorn Lifeboat Station Rescues (Online)
http://www.kinghorn.org.uk/rescue_search.php?year=2011&qry=&mode=Search [Access 03/03/2012]

- The nearshore intertidal location of the Development;
- That the Development will be connected to shore with a bridge;
- Consultation with FPMD has confirmed the Development is well clear of any shipping and navigational lanes; and
- The DECC Maritime Data/DTI online GIS Shipping Database indicates that the Development is located within an area of very low density for shipping.

Shipping collision risk modelling is not therefore considered necessary for the Development.

12.5.2 Fishing Vessels

Figure 12.1 indicates there is relatively little fishing vessel activity (vessels 15 m and over) near the Development.

Previous consultation (Arcus 2010) with The Scottish Fisherman's Federation indicated that only smaller vessels fish in the Forth. They confirmed they have no concerns with the Development as it is nearshore and there is very limited use of this area for fishing due to the shallow water depths. Non Affiliated Creel Fishermen, South East IFG Executive Committee similarly stated they have no problem with the Development as the turbine would be only 15 m from shore and so should not affect any fishing or fishing vessels (the Development is now 35 m from the MHWS). Creel fishing occurs in the area, although further offshore than the proposed turbine. Methil Boat Club lay creel in the area and requested that they do not want a permanent exclusion zone around the turbine.

No further comments were received from local fishing associations and no concerns were raised.

An effect of not significant on fishing activity is predicted due to the following factors:

- The shallow depth of water in which the Development is located;
- The nearshore intertidal location of the Development;
- That the Development will be connected to shore with a bridge;
- Data gathered from the DECC Maritime Data/DTI online GIS Shipping Database indicates that there is relatively little fishing vessel activity (vessels 15 m and over) near the Development, with the majority of fishing activity located further out to sea; and
- Consultation with the Scottish Fisherman's Federation and local fishing associations confirmed the there is very limited use of this area for fishing due its near shore location and the shallow water depths and no concerns were raised.

Collision risk modelling for fishing vessels is not therefore considered necessary for the Development.

12.5.3 Recreational Vessels

Consultation with FPMD had no comments although they recommended consulting local groups as part of their initial response for the Consented Development (Arcus 2010).

The RYA Scotland, local RYA clubs, boat clubs, marinas and Scottish Canoe Association were consulted with regards to the Development.

RYA Scotland confirmed they had no objections to the Development. Scottish Canoe Association required further clarification on the turbine location. No further comments were received from local sailing clubs.

Any changes in tidal and current flows close to shore resulting from the turbine foundation are considered to be of negligible magnitude, due to the limited nature of the turbine foundation. Further information on effects on tidal and current flows is given in Chapter 9: *Water Resources and Coastal Hydrology* of this ES.

It was noted by the Scottish Canoe Association that there was concern about the Development preventing access to the shore area. The turbine is connected by a bridge above the water to the shore, being a single turbine development the Development is very limited in

extent. As such this is not expected to present a significant navigational issue to sea kayakers using the area.

Due to the negligible effect predicted on local tidal and current conditions, the near shore location of the Development, and that no significant concerns were raised, the potential for the Development to effect the navigation of local recreational users along the coast off Methil is assessed as not significant.

12.5.4 Navigational Aids

FPMD confirmed that the Development will not impede any existing navigational aids (Arcus 2010).

The Civil Aviation Authority stated that the turbine is required to be fitted with aerodrome related lighting, in accordance with Article 219 of the UK Air Navigation Order 2009[14]. Should the Development receive consent then details will need to be provided to the Defence Geographic Centre to be chartered on aviation maps. They also require the rotor blades, nacelle and upper two thirds of the tower of the wind turbine to be painted white to follow international aviation regulatory documentation. Further information on effects on aviation is provided in Chapter 13: *Telecommunication and Existing Infrastructure* of this ES.

The Northern Lighthouse Board stated that on receipt of a Coast Protection Act 1949 section 34 consent request via the Scottish Government, they will give specific advice on the marking and lighting of the Development, based on guidance given in IALA Recommendation O-139 - The Marking of Man-made Offshore Structures, December 2008[15].

This guidance states that individual structures (individual wind turbine) should be marked as follows:

- The tower should be painted yellow all round from level of Highest Astronomical Tide to 15 metres or the height of the Aid to Navigation, if fitted, whichever is greater;
- White light flashing Morse code << U >> (●●−); and
- Aids to navigation should be mounted below lowest point of arc of rotor blades and should be exhibited at height of at least 6 metres above level of the Highest Astronomical Tide. Aids to navigation should have availability of not less than 99%.

Initial indications from The Northern Lighthouse Board suggest no markings will be required on the turbine, this will be confirmed during the application process and conditioned where appropriate.

12.5.5 Emergency Services

There is a lifeboat station at Kinghorn approximately 15 km to the southwest, however, FPMD confirmed this would only operate in the area of the Development if undertaking an emergency response.

In the event of an incident at the Development, access may potentially be required by an RNLI lifeboat. RNLI lifeboats have a high degree of manoeuvrability and should not have a navigational issue operating around the Development.

12.6 Mitigation Measures and Residual Effects

12.6.1 General

The following general mitigation measures will be followed:

- Information on the location of the Development will be provided to FPMD and to mariners via "Notices to Mariners", radio navigational warnings and marking on admiralty charts;

[14] The Air Navigation Order 2009 (SI 2009 No. 3015) HMSO. Available at: http://www.caa.co.uk/docs/33/CAP393.pdf.
[15] IALA Recommendation O-139 On The Marking of Man-Made Offshore Structures Edition 1 December 2008. International Association of Marine Aids to Navigation and Lighthouse Authorities.

- Appropriate navigational markings will be used following Northern Lighthouse Board recommendations and based on guidance given in IALA Recommendation O-139 The Marking of Man-made Offshore Structures. Any navigational markings would also be agreed with FPMD. Appropriate aviation lighting will also be installed as per CAA guidelines (for further information on aviation lighting refer to Chapter 13: *Telecommunication and Existing Infrastructure* of this ES);
- Scottish Enterprise will continue to consult with FPMD, local fishing associations, RYA Scotland, local boat clubs and the Scottish Canoe Association throughout the development process to ensure there is a good level of awareness of the Development;
- FPMD do not consider an exclusion zone for commercial vessels is required around the Development. No permanent exclusion zone is considered necessary around the Development for fishing vessels or recreational craft, although if considered necessary at a later stage FPMD has confirmed that this could be implemented by the Port Authority;
- FPMD, local fishing associations, RYA Scotland, local boat clubs and the Scottish Canoe Association will be informed of any major maintenance operations involving sea access/use of vessels throughout the 5 year operational life of the Development;
- Appropriate emergency response procedures will be developed; and
- The Development would be removed after its 5 year demonstration period.

12.6.2 Construction

The following mitigation measures will be followed during construction of the Development:

- Prior to the commencement of construction FPMD, local fishing associations, RYA Scotland, local boat clubs and the Scottish Canoe Association will be informed of the construction schedule and of any exclusion zone around the Development during the temporary construction phase for health and safety purposes;
- Once construction has commenced FPMD, local fishing associations, RYA Scotland, local boat clubs and the Scottish Canoe Association will be kept informed of progress and will be informed of any changes in the construction schedule;
- During construction the working area around the turbine would be established and clearly marked;
- Prior to the commencement of construction the location of the Development and construction working areas around the turbine would be provided in "Notices to Mariners" and radio navigational warnings;
- Any craft involved in construction of the Development shall exhibit signals in accordance with the International Regulations for Preventing Collisions at Sea 1972 (COLREGS)[16].
- Craft involved in construction of the Development will have set safety procedures to follow including taking account of any local marine activity in the area and ensuring unnecessary risks are not introduced; and
- All construction vessels will be equipped with a Maritime VHF radio combined transmitter and receiver.

12.6.3 Residual Effects

The Development is anticipated to be not significant in terms of navigation. With the implementation of the above mitigation measures no residual effects on navigation during the temporary construction phase and 5 year operational phase are anticipated.

[16] Convention on the international Regulations for Preventing Collisions at Sea, 1972 (COLREGs). Adopted 20 October 1972. Available at http://www.imo.org

12.7 Cumulative Effect Assessment

The nearest cumulative wind turbine to the development site is The Hydrogen Office, located approximately 1.7 km to the north-east however, as there will not be a significant effect on shipping, fishing and recreational vessel movements in the area no cumulative effects are anticipated.

12.8 Summary of Effects

The magnitude of effect is considered not significant during the temporary construction phase and 5 year operational phase on shipping, fishing vessel activity, recreational vessel activity and emergency services. In addition the Development will not impede any existing navigational aids.

12.9 Statement of Significance

The Development will not have a significant effect on navigation. In addition a number of mitigation measures will be put in place to ensure navigational safety at all times.

No significant effects on navigation are therefore predicted.

13 TELECOMMUNICATIONS AND EXISTING INFRASTRUCTURE

13.1 Introduction

This chapter of the ES will assess and evaluate the effects associated with telecommunications, aviation and television reception at the Development. Where appropriate, mitigation measures are proposed.

This chapter contains the following sections:

- Assessment Methodology and Significance Criteria;
- Baseline Description;
- Assessment of Potential Effects;
- Mitigation Measures;
- Residual effects;
- Cumulative effects; and
- Statement of Significance.

13.1.1 Assessment Methodology and Significance Criteria

The initial assessment consisted of a desk-based assessment of all telecommunication, aviation and television infrastructure.

The assessment was carried out using a variety of sources such as:

- CAA Aviation Maps; and
- Ordnance Survey of UK Maps.

The following types of installations and infrastructure have been considered in the assessment:

- Telecommunications link ends;
- Civil Airports and Radar;
- All other licensed and unlicensed civil airfields
- Ministry of Defence (MoD) airfields and Radar; and
- Television Transmitters.

13.1.2 Consultation

Relevant organisations were contacted for their response on the Development and whether this will impact upon any existing telecommunications links or other infrastructure. The responses are shown in Table 13.1. No response has been received from the MoD to date. Their response reported in the ES for the Consented Development (Arcus, 2010) is shown in Table 13.1.

Table 13.1: Summary of Consultation Responses

Consultee	Response
Arqiva	Confirmed that the proposed turbine is unlikely to affect any of their Re-Broadcast Links (RBL) or microwave links.
Atkins Global	One link has been identified within the area that is likely to be affected by the Development, the link is operated by Forth Ports Plc.
Forth Ports Plc	Atkins identified a link within the vicinity of the Development operated by Forth Ports Plc. Contact made with Forth Ports Plc but no response received.
BAA Airports Ltd	BAA would have no aerodrome safeguarding objections to the revised wind turbine proposals at this site.
Civil Aviation Authority (CAA)	No objection. The response provided information on aviation lighting, turbine colour, requirements for aviation mapping and suggests consultation with emergency services air support units.
Joint Radio Company (JRC)	JRC advised that one microwave Point to Point is within the vicinity of the development however, this link has been cleared and JRC does not foresee any potential problems with the development.
Ministry of Defence (MoD)	Defence Estates responding on behalf of the MoD has provided general comment. For the Consented Development, MoD stated that there are no issues expected to arise from the Development in terms of the Development impacting on their facilities. However they would require candela lighting to be placed on the turbine.
NATS	The turbine will not affect NATS safeguarding criteria, therefore there is no objection.
OFCOM	Identified three telecommunication and microwave links in the vicinity of the Development and provided details of the relevant operators.
Everything Everywhere Ltd -Orange	No response received.
Scottish and Southern Energy (SSE)	JRC response on behalf of SSE, do not foresee any potential problems
Vodafone	Confirmed that one link may be affected and link ends provided. Confirmed that 100 m minimum separation from turbine to link is required. A figure was also provided that determined the link would not be affected by the Development.

13.1.3 Guidance

Various documents exist which provide guidance for wind energy developers in relation to aviation and telecommunications. The most important of which are:

- Wind Energy & Aviation Interests – Interim Guidelines. Wind Energy, Defence and Civil Aviation Interests Working Group[1];
- Best Practice Guidelines for Wind Energy Development, British Wind Energy Association (BWEA)[2];
- Tall Structures and their Impact on Broadcast and Other Wireless Services[3]; and
- RA323 – Guidelines for Improving Digital Television and Radio Reception[4].

[1] Working Group for Wind Energy, Defence and Civil Aviation Interests *Wind Energy and Aviation Interests – Interim Guidelines* (2002) [online] - http://www.bwea.com/pdf/Wind-Energy-and-aviation-interim-guidelines.pdf - [accessed 22/03/2012]

[2] British Wind Energy Association *Best Practice Guidelines for Wind Energy Development* (1994) British Wind Energy Association [online] – http://www.bwea.com/pdf/bpg.pdf - [accessed 22/03/2012]

[3] OFCOM Tall Structures and their Impact on Broadcast and Other Wireless Services (2009) [online] - http://licensing.ofcom.org.uk/binaries/spectrum/fixed-terrestrial-links/wind-farms/tall_structures.pdf - [accessed 22/03/2012]

[4] Ofcom *RA323 Guidelines for Improving Digital Television and Radio Reception*(2001) [online] - http://www.ofcom.org.uk/static/archive/ra/publication/ra_info/ra323/ra323.htm - [accessed 22/03/2012]

The British Wind Energy Association (BWEA) and Ofcom guidance highlights that the effects of construction and decommissioning phases of a wind farm development on telecommunications, aviation and television reception should not be assessed, and it is not recommended practice to do so[5]. Although this is the case, in relation to below ground infrastructure, there is potential for effects to occur during construction and decommission. Any effects that do occur during these phases are classified as temporary, short-term effects.

Any potential effects associated with the operational phase of the Development are classed as long-term effects. These can potentially apply across all infrastructure elements described within this chapter.

13.2 Baseline Conditions

13.2.1 Telecommunication and Microwave Links

Ofcom identified three microwave links that either travel through or end in the vicinity of the Development. Due to the close vicinity of these links to the site, further information was sought from each link operator, Vodafone, Scottish and Southern Energy (SSE) and Everything Everywhere Ltd - Orange.

The Joint Radio Company (JRC) were also consulted and response based on radio link infrastructure operated by Scottish Hydro (Scottish & Southern Energy) and Scottish Power and Scotia Gas Networks. It was advised that one microwave Point to Point is located within the vicinity of the development however, this link has been cleared and JRC does not foresee any potential problems with the development

Atkins Ltd has taken over telemetry link operations from CSS Spectrum Management (CSS). They identified one link in the vicinity of the Development.

13.2.2 Aviation and MoD

The nearest airport to the Development is Dundee Airport, which is located approximately 31.5 km north of the site. The airport does not have any radar facilities. The nearest international civilian airport with radar is Edinburgh Airport, which lies approximately 33.4 km south west of the Development.

Fife airfield is the closest airfield to the Development, and is situated approximately 12.7 km west of the site. Again, this airfield has no radar capabilities.

Royal Air Force (RAF) base Leuchars is the nearest military airfield to the Development, located approximately 23.4 km north east of the site. This airfield is a key airfield for the RAF, with the base being responsible for maintaining "*Quick Reaction Alert (North)*"[6]. There is an airshow for the public held at RAF Leuchars annually.

No airports or airfields are situated within 10 km of the Development.

13.2.3 Television and Radio Reception

In the UK, Ofcom and the BBC are jointly responsible for the terrestrial television and radio reception. All distribution and communication links which are required for reception are provided and operated by Arqiva and National Grid Wireless, on behalf of the broadcasters.

At present, British television is undergoing a period of transition. Traditionally, both analogue and digital signals have been broadcasted simultaneously. However, in 2008, the UK Government began to phase out the transmission of analogue signals region by region, and replacing the analogue transmissions with digital[7]. This process is known as the Digital Switchover (DSO). The last region to be switched over is due to be transferred over in October 2012.

[5] Best Practice Guidelines for Wind Energy Development, British Wind Energy Association (BWEA). http://www.bwea.com/ref/bpg.htm

[6] Royal Air Force, 2012, "Welcome *to RAF Leuchars*" [online] - http://www.raf.mod.uk/rafleuchars/ - [accessed 22/03/2012]

[7] Digital UK *Digital Switchover* (2010) [online] - http://www.digitaluk.co.uk/ - [last accessed 22/03/2012]

Consultation with the BBC is essential in order to fully assess the potential effect of the Development on television reception. This is done via the BBC online assessment tool which provides estimates of how many homes will be affected with alternate service, and how many without. The tool also shows which receivers in the area may be have their signals affected. Table 13.2 shows the details of the transmitters in the area.

Table 13.2: Local Television Transmitters

Transmitter	Coordinates	Power	Distance from the Development (km)
Black Hill	NS828647	500 kW	64.2
Craigkelly	NT223872	100 kW	18.4

Both transmitters have had the DSO between April and June 2011[8].

13.2.4 Data Gaps

Everything Everywhere Ltd (Orange) and Forth Ports Ltd did not provide a response to current round of consultation undertaken as part of the EIA.

13.3 Potential Effects

13.3.1 Telecommunication and Microwave Links

As discussed previously in this chapter, in general effects on telecommunications and microwave links are only likely to occur during the operational phase of the Development, and therefore any impact will be considered as a temporary negative effect.

Consultation with all operators highlighted by Ofcom has confirmed that the Development is located outwith the operators' recommended minimum safeguarding distance. As Forth Ports Ltd and Everything Everywhere Ltd (Orange) did not respond the location of their link paths is not known, however as the Consented Development did not require special mitigation we do not anticipate any issues

Arqiva have confirmed that they do not operate any links within the vicinity of the Development that could be affected. No detrimental effects are anticipated.

JRC has confirmed clearance of the nearest link to the development, and no detrimental effects from the Development are anticipated.

13.3.2 Aviation

Wind turbines, as with other tall obstacles such as pylons, television masts or trees, can have an effect on aviation infrastructure by virtue of their physical presence. There are specific criteria for safeguarding the airspace surrounding airfields. The Development does not lie within a safeguarding zone.

Turbines also have the potential to impact upon the provision of Air Traffic Services (ATS). This can happen through several different mechanisms, depending on the specific equipment being used. Generally concern lies with the potential effect wind turbines can have upon primary surveillance radar. This type of radar is used by numerous civil and military aerodromes and by NERL (National Air Traffic Services En Route Plc).

BAA, CAA, and NERL were all consulted in reference to this assessment to ensure that all potential civil aviation and defence issues were considered.

BAA has confirmed that they have no aerodrome safeguarding objections in relation to the Development.

[8] BBC, 2010, 'Digital Switchover Schedule' [online] - http://www.bbc.co.uk/reception/transmitters/dso.shtml - [last accessed 22/03/2012]

In their scoping response the CAA highlighted that although they had no objections or observations; aviation lights will be required to be installed on the turbine that is visible at night from all directions. It will also be necessary to chart the Development on Civil Aviation Maps, as it is a requirement for all structures taller than 300 feet (91 metres) to be charted.

During the scoping period, NATS highlighted that they do not expect the Development to have any adverse impacts on their operations, therefore they have no objections.

The 180 m and 200 m tip height maps were analysed for the Development as these are the closest maps to the Development. The map shows that the Development is not located within an area which may impact upon NERL operations.

Defence Estates have responded on behalf of the MoD, with a general response to consultation. Previously, they responded in relation to the Consented Development confirming that there would be no potential effects with regards to the Development affecting MoD operations (Arcus 2010). The Development does not lie within the line of sight of any radar facilities and no further issues are anticipated.

13.3.3 Television and Radio

Wind turbines and similar structures have the potential to create interference which may detrimentally effect television and radio transmissions. This happens either by reflection or blocking of electromagnetic signals which pass by the turbine, or by the turbine itself emitting an electromagnetic signal[9]. This can occur in any direction within 500 m of a turbine (known as the reflection zone) or within an area with a radius of up to 5 km in the line of site between transmitter and receiver (shadow zone)[10].

As the Digital Switch Over (DSO) has already been completed at the identified transmitters, it is unlikely that transmissions will be detrimentally effected. Digital transmission reception does not generally suffer from the same ghosting effects as analogue; however there may be sudden picture degradation which would only occur in extreme circumstances. Reflections and blocking from other objects (such as trees or multi-storey buildings) close to the receiver can cause similar effects. These effects are much less likely to occur than if analogue was being transmitted.

The BBC online assessment wind farm tool was used to assess how many homes the Development may affect. The results indicate that up to 3857 homes that have no alternative off-air service may be affected, and 2291 homes which may have alternative off-air service may be affected.

Due to the location of both transmitters being southwest of the Development, the homes identified by the BBC tool are likely to lie to the north and east of the site. Due to the relative positions of the masts and the turbine, the zone of potential effect lies entirely over the Firth of Forth and the turbine is located over 500 m from the closest residential property. Figure 13.1 shows the Zone of Potential Television Interference.

13.4 Mitigation Measures and Residual Effects

13.4.1 Telecommunications and Microwave Links

As no potential effects have been identified on existing microwave links within the vicinity of the Development, no mitigation is anticipated.

[9] Communities and Local Government (DCLG) (2004). Planning for Renewable Energy: A companion Guide to PPS 22. Online http://www.communities.gov.uk/publications/planningandbuilding/planningrenewable [Accessed 22/03/2012]

[10] Ofcom (2009). Tall structures and their impact on broadcast and other wireless services. Online - http://licensing.ofcom.org.uk/binaries/spectrum/fixed-terrestrial-links/wind-farms/tall_structures.pdf [Accessed 22/03/2012]

13.4.2 Aviation

As no effects have been predicted on aviation or defence receptors, no mitigation is necessary.

13.4.3 Television and Radio

In the unlikely event that any adverse impacts with regard to television or radio reception are reported, these can be resolved through various technical solutions which will be confirmed between the Developer and the Scottish Government. Given the DSO has already taken place there are likely to be few or no residual effects on television.

If reception is affected then mitigation measures will be sought. These are likely to be either:

- Retuning of television receivers to a different mast and subsequently a stronger signal; or
- Provide alternative off-air service – i.e. provide digi-boxes to affected residences.

Effects will be investigated for up to one year after the Development becomes operational. After mitigation, no residual effects are predicted on television or radio reception.

13.5 Cumulative Effects

The nearest cumulative wind turbine to the Development site is The Hydrogen Office, located approximately 1.7 km to the north-east of the turbine location. However, as no effects are predicted on telecommunications, aviation or television transmission from the Development, no cumulative effects are expected to arise as a result of the Development.

13.6 Summary of Effects

The Development will have a negligible or no effect on existing telecommunications, aviation and MoD activities or television reception, following the implementation of the appropriate mitigation.

13.7 Statement of Significance

Existing telecommunications and aviation will not be affected by the Development. Effects on television and radio reception are considered unlikely however in the event of adverse effects being reported and proven to relate to the turbine, the appropriate mitigation, as would be implemented.

Once mitigation has been implemented, no significant effects are predicted on telecommunications or existing infrastructure.

14 SHADOW FLICKER

14.1 Introduction

This chapter of the ES provides an assessment of the potential effects of shadow flicker resulting from the Development. Shadow flicker is an effect that can occur when the shadow of a moving wind turbine blade passes over a small opening (window), briefly reducing the intensity of light within the room, and causing a flickering to be perceived.

The chapter predicts the maximum potential number of hours of shadow flicker effects that may be received at potential receptors within the zone of potential effect using a computer model. However, the model does not predict whether or not effects would actually be received at a particular receptor due to localised screening provided by vegetation or other buildings and, moreover, whether all of the effects require mitigation.

The likelihood and duration of this occurring depends upon certain combinations of relative sun, turbine and window locations, turbine orientation, times of day, days of the year and weather conditions.

The flickering may have a perceptible effect on amenity if it affects occupied rooms of a house at sufficient intensity and duration. Shadow flicker from the Development could not give rise to human health effects as individuals with photosensitive epilepsy are generally sensitive to flickering light between 3 - 50 Hertz (Hz)[1] . The frequency of the Development is calculated to be less than 0.5 Hz and is considered to be below the frequency known to trigger effects in these individuals[2] .

Therefore, any potential shadow flicker effects from the Development are purely an effect on amenity, rather than having the potential to affect the health or well-being of occupants.

This assessment is supported by Technical Appendix 14.1.

14.2 Guidance and Consultation

14.2.1 Relevant Guidance

The following guidance has been considered in carrying out the shadow flicker assessment.

PAN 45 Renewable Energy Technologies and Annex 2 Spatial Frameworks and Supplementary Planning Guidance for Wind Farms has been replaced with web based renewables tool[3] providing guidance and advice which states shadow flicker can only occur within buildings where the flicker effect appears through a narrow window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the potential site.

This Scottish guidance has been used to inform this assessment along with The Best Practice Guidance to Planning Policy Statement 18: Renewable Energy (PPS18)[4] on the planning issues associated with renewable energy specifically in Northern Ireland. Paragraphs 1.3.72 to 1.3.78 provide information on Shadow Flicker.

PPS18 has been revoked however it remains a reference point for best practice with regard to shadow flicker. PPS18 states that only properties within 130 degrees either side of north relative to the turbines can be affected, as shadows are not cast to the south, and that at distances greater than 10 rotor diameters the likelihood of flicker occurring is very low. It

[1] Epilepsy Action (2007), Other Possible Epilepsy Triggers [online]. Available at: http://www.epilepsy.org.uk/info/photo_other.html [Accessed on 06/02/2012]
[2] Epilepsy Action (2007) Photo-sensitive Epilepsy [online]; Available at: http://www.epilepsy.org.uk/info/photosensitive-epilepsy/triggers#turbines [Accessed on 06/02/2010]
[3] Scottish Government (2012) Onshore Wind Turbines http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/themes/renewables/Onshore [Accessed on 14/03/2012]
[4] Planning and Environmental Policy Group (2009) Best Practice Guidance to Planning Policy 18 'Renewable Energy' Northern Ireland Department of the Environment, Belfast.
Available at:
http://www.planningni.gov.uk/index/policy/policy_publications/planning_statements/planning_policy_statement_18__renewable_energy__best_practice_guidance.pdf (accessed on 07/02/2012)

goes on to state that where shadow flicker could be a problem, developers should provide calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the effect.

More recent guidance published in 2009 in Northern Ireland provides further information in relation to significance criteria. Although the Guidance only applies in Northern Ireland, it has been drawn up taking account of similar material available for other parts of the UK and the Republic of Ireland. Paragraphs 1.3.72 to 1.3.78 of this guidance provide information on Shadow Flicker. The Best Practice Guidance to Planning Policy Statement 18: Renewable Energy (PPS18)[5], Northern Ireland has therefore also been used to inform this assessment.

The Guidance recommends that shadow flicker effects should not exceed 30 hours per year or 30 minutes per day at offices or houses within 500 m of a wind turbine[6].

14.2.2 Consultation

A Scoping Report was provided to Marine Scotland in February 2012. In the subsequent scoping opinion Fife Council stated that the shadow flicker assessment, as presented in the Scoping Report was acceptable. The Scoping Report presented a method undertaken for the Consented Development, however adapted for the new turbine dimensions.

In scoping response for the Consented Development (Arcus, 2010) Fife Council stated that the ES should include a shadow flicker assessment on potential receptors due to the Development. The EIA should also include remediation measures in the event that individual properties experience shadow flicker. This assessment is presented within the chapter and Technical Appendix 14.1.

14.2.3 Assessment Methodology

This assessment considers the effects of the operational phase for the Development. Shadow flicker is a phenomenon that only occurs once the turbines are installed and thus no shadow flicker effects are anticipated during the construction phase of the Development, until turbine construction has been completed.

The proposed turbine will be decommissioned and removed from the site within 5 years at which point the potential for shadow flicker will be removed.

Properties with the potential to be affected by shadow flicker have been identified by mapping the area around the proposed turbine location within a distance of ten rotor diameters (1720 m) and 130 degrees either side of north (the 'shadow flicker study area') using GIS (Geographical Information System). Figure 14.1 shows the shadow flicker study area for the Development.

The resulting map shows that there are a number of potential receptors within the area in which effects could occur, however it is not practical or considered necessary to assess the effects of shadow flicker on all potential receptors. Ordnance Survey Master Map Address Layer 2 data[7], site visits and photographs were used to narrow down the potential receptors to a number of representative assessment locations.

Based on the above criteria, three groups of potential receptors were selected for further analysis:

- Permanent two- storey dwellings situated along the edge of the Development with a potentially clear view;
- Receptors such as Randolph Wemyss Memorial Hospital and Denbeath Primary School; and

[5] Planning and Environmental Policy Group (2009) *Best Practice Guidance to Planning Policy 18 'Renewable Energy' Northern* Ireland Department of the Environment, Belfast.
[6] Ibid, pp. 26.
[7] For more information, please refer to OS website
http://www.ordnancesurvey.co.uk/oswebsite/products/osmastermap/layers/addresslayer2/

- Multiple storey dwellings that are less likely to be screened by other intervening buildings.

Ordnance Survey Address Layer 2 data was used to confirm the locations of the initial representative assessment locations.

A recognised computer software package[8] was then used to calculate theoretical times and durations of flicker effects for these initial representative locations.

This software creates a mathematical model of the Development site and its surroundings, based on:

- Turbine location, hub height, number of blades and rotor diameter;
- Topography (obtained from Ordnance Survey Landform Profile Elevation Data on 10 m horizontal grid);
- Latitude and longitude of the Development site (used in calculating the position of the sun in relation to time of day and year); and
- A cut-off distance of 1720 m (10 rotor diameters) from the turbine employed during the calculation.

The resulting analysis was then used to create a shadow flicker contour map using WindFarm and GIS. The contour map displays the theoretical annual duration of shadow flicker for grid points at 50 m horizontal intervals at 3.0 m above ground level (AGL), representing the average of ground and first floor levels. The map (Figure 14.1) indicates that the number of shadow flicker hours decreases further away from the turbine and that flicker effects would be most pronounced along axes running southeast to northwest and southwest to northeast. It was therefore used to further inform the choice of the assessment locations and include those that were within the worst-affected areas. As a result, the final choice of assessment locations has undergone an iterative approach/subsequent revisions and refinement based on further analysis.

The final assessment locations are listed and further described in the section 14.3 Baseline Description. The final assessment locations together with the shadow flicker contour map based on the final assessment locations is shown on Figure 14.1.

Certain worst-case assumptions are made in the calculation, including:

- Weather conditions are such that shadows are always cast during each day of the year i.e. bright sunshine all day, every day. In reality, for much of a given year, weather conditions will be such that shadows would not be cast, or would be weak and thus would not give rise to flicker effects;
- The turbine rotor will always be facing directly towards a given window, maximising the size of the shadow and duration of the effect;
- The turbines will constantly rotate; and
- There will not be intervening structures or vegetation (other than topography) that may restrict the visibility of a turbine, preventing or reducing the effect.

The above calculations are intended to indicate a theoretical maximum in potential duration of effects and to provide an approximation of the times of day and year rather than a precise prediction.

The prediction tool is worst-case and the model does not take into account the precise location and dimensions of windows within the facades of houses and the uses made of the rooms that may be affected.

Because the worst-case scenario assumes that weather conditions are such that shadows would be cast at all times, a reduction factor has been applied to the predicted duration of effects, based upon an estimate of the likely duration of bright sunshine that occurs in Fife during each month of the year (please see Table 14.1 below). This has been calculated from

[8] ReSoft, "WindFarm" Release 4.2.1.2

sunshine data for the year 2000 – 2011 sourced from the UK Met office[9], website and sunrise and sunset times sourced from the US Naval Almanac website[10] . The likely hours of shadow flicker per annum have been calculated from those predicted by the software using the ratio for the month in which effects occur for each receptor which receives the highest percentage of bright sunshine. Further details are provided in the ES Volume III - Technical Appendix 14.1: Shadow Flicker.

Other factors such as the potential for screening by vegetation or intervening structures; and the varying orientation of the turbines due to varying wind direction will also reduce or prevent flicker incidence in practice as compared to the theoretical maximum suggested by the calculation. The turbine would also be in a test phase and will not be operating in the same manner as standard onshore turbine as an engineer will be daily accessing the machine to test the different components. This will further contribute to a reduced flicker incidence than the model predicts.

Table 14.1 Ratio Percentage of bright sunshine each month for Fife

Month	Percentage of bright sunshine
January	0.26
February	0.32
March	0.35
April	0.39
May	0.41
June	0.33
July	0.32
August	0.33
September	0.34
October	0.31
November	0.34
December	0.25

14.3 Baseline Description

The assessment locations are listed in Table 14.2 below and shown on Figure 14.1. Assessment locations that are multiple storey dwellings are highlighted in bold.

Table 14.2 Potential Assessment Locations

Ref	Assessment Locations	Easting	Northing	Approximate Distance from the turbine (m)
1	Lady Wynd	336146	698111	712
2	Wellesley Road	336408	698754	563
3	Bethune Way	336099	698024	789
4	Randolph Wemyss Memorial Hospital	336326	698751	623

[9] UK Met Office (2010) Leuchars, Scotland– Historical Station Data [online]. Available at http://www.metoffice.gov.uk/climate/uk/stationdata/leucharsdata.txt [Accessed on 06/02/2012]
[10] US Naval Observatory, Astronomical Applications Department (2010) Times of Sunrise/Sunset for One Year Calculated for the location (Methil): N 50° 20, W 05° 02' [online]. Available at (http://aa.usno.navy.mil/data/docs/RS_OneYear.php) [Accessed on 02/02/2010]

Ref	Assessment Locations	Easting	Northing	Approximate Distance from the turbine (m)
5	Denbeath Primary School	336217	698851	770
6	**Anderson Lane**	335973	697964	929
7	**Den Walk**	335895	698719	984
8	**Omar Crescent**	335940	698534	889
9	**Den Walk**	335975	698872	980
10	**Braehead Gardens**	335969	698077	890
11	**Clyde Street**	336521	698992	694
12	**Wellesley Road**	336524	698876	589
13	Ward Street	336304	698898	739
14	**Swan Court**	336898	699242	889
15	**Swan View**	336723	699126	769
16	**Wellesley Road**	336283	698618	588

As it was not possible to visit all these properties to obtain details of the positions, sizes and orientation of their windows, the following assumptions have been made based upon photographs and Ordnance Address Layer Data 2 for the above assessment locations:

- All windows have been assumed to measure 1 m by 1 m;
- Windows for residential buildings are assumed to be situated at a height of 3.0 m above ground level (representing the average of ground and first floor levels);
- Windows are assumed to be facing one of the cardinal compass point directions (north, south, east and west) and only those windows facing the proposed turbine location directly or obliquely have been modelled;
- The Randolph Wemyss Memorial Hospital and Denbeath Primary School are assumed to be double storey buildings. Bearing this in mind, the windows for the Hospital and Primary School are assumed to be at heights 3 m and 6 m above ground level; and
- In the case of multiple storey buildings, the windows are assumed to be situated at an interval of 3.0 m for each level.

The above assumptions provide a level of accuracy consistent with the assumptions discussed in Section 14.2.3 Assessment Methodology.

14.4 Information Gaps

No data gaps have been identified within the assessment.

14.5 Assessment of Potential Effects

14.5.1 Construction

No shadow flicker effects are anticipated during the construction phase of the Development, until turbine construction has been completed.

14.5.2 Operation

Table 14.3 details the results of the calculations carried out for assessment locations.

A shadow flicker contour plot showing the annual theoretical maximum of shadow flicker effects predicted to occur due to the Development is shown on Figure 14.1. The predicted shadow flicker effect decreases in number of hours further away from the Development. The figure shows the worst-case areas that are shaded in pink between a maximum of 91 to 100 hours per annum without taking into to consideration the percentage of bright sunshine.

Table 14.3 lists the theoretical months and times of day during which effects are predicted to occur per annum. It also shows the likely annual duration of the shadow flicker event based on the ratio of the highest percentage of sunshine for the month over which the effects occur. For those locations which receive effects over multiple months the highest percentage of sunshine for the highest month has been used.

As can be seen from Table 14.3, effects may theoretically exceed 30 hours per annum however, when the percentage of bright sunshine is taken into account, effects are decreased and based on calculations alone, there is potential that effects may exceed 30 hour at 5 locations. However, all of these locations are located over 500 m from the turbine as per the recommended guidance (PPS18) as discussed in section 14.2. It is also advised that the greater distances from the turbine the less pronounced any effect will be. This is because there are fewer occasions when the sun is low enough to cast long shadows, and at distance, the blades of the turbine do not cover the sun but partly mask it, therefore weakening the shadow. As a result the effects calculated are not considered to be significant.

Charts showing the times of day and month of the year that theoretical maximum shadow flicker effects for each assessment location which are predicted to occur along with discussion of the results are presented in Technical Appendix 14.1.

Table 14.3 Predicted Shadow Flicker Effects

Ref	Assessment Location	Orientation	Height (m)	Days per year	Max Daily Duration (minutes)	Average Daily Duration (minutes)	Theoretical Annual Duration (hours)	Months during which effects could occur	Ratio of percentage of bright sunshine	Likely Annual Duration (hours)	Times of day when effects could occur
1	Lady Wynd	North	3	123	60	49.8	101.7	Late April – Mid August	0.41	41.7	Early mornings (during sunrise hours)
		East	3	124	60	49.2	102.2			41.9	
2	Wellesley Road	East	3	115	72.6	53.4	102.0	Late January - Early March October to late-November	0.35	35.7	Early mornings (during sunrise hours)
		South	3	115	72.6	53.4	102.1			35.8	
3	Bethune Way	North	3	109	55.2	48.6	88.3	May - Mid August	0.41	36.2	Mornings
		East	3	109	55.2	48.6	88.6			36.3	
4	Randolph Wemyss Memorial Hospital	East	3	95	66	51.0	80.7	Late January – Early March End September – Mid November	0.35	28.2	Mornings
			6	96	66	50.4	81.0			28.6	
		South	3	95	66	51.0	80.7			28.2	
			6	97	66	50.4	81.1			28.4	
5	Denbeath Primary School	East	3	83	54.6	42.0	58.1	End January – Start March Mid October – Mid November	0.35	20.3	Early Mornings(during sunrise hours)
			6	84	54.6	42.0	58.7			20.5	
		South	3	83	54.6	42.0	58.1			20.3	
			6	84	54.6	42.0	58.7			20.5	
6	**Anderson Lane**	North	3	109	47.4	39.6	72.3	End April – Mid August	0.41	29.6	Early Mornings (during sunrise hours)
			6	109	47.4	39.6	72.2			29.6	
			9	111	47.4	39.0	72.2			29.6	
			12	111	47.4	39.0	71.9			29.5	
		East	3	109	47.4	40.2	72.5			29.7	
			6	109	47.4	39.6	72.4			29.7	
			9	111	47.4	39.0	72.4			29.7	
			12	111	47.4	39.0	72.1			29.6	
7	**Den Walk**	East	3	55	42.6	33.0	30.5	Late February – Mid March Late September – Late October	0.35	10.7	Mornings
			6	55	42.6	33.6	30.6			10.7	
		South	3	55	42.0	33.0	30.4			10.6	
			6	55	42.0	33.6	30.6			10.7	
8	**Omar Crescent**	East	3	59	46.2	36.6	36.0	Early March – Start April Early September – Start October	0.35	12.6	Mornings
			6	60	46.2	36.0	36.0			12.6	
		South	3	59	46.2	36.6	35.8			12.5	
			6	60	46.2	36.0	35.9			12.6	
9	**Den Walk**	East	3	60	43.2	33.6	33.8	Early February – Early March Early October – Early November	0.35	11.8	Early Mornings
			6	61	43.2	33.6	34.0			11.9	
		South	3	60	43.2	33.6	33.8			11.8	
			6	60	43.2	34.2	33.9			11.9	
10	**Braehead**	North	3	92	48.0	36.0	55.6	Mid-April – End May	0.41	22.8	Early Mornings

Ref	Assessment Location	Orientation	Height (m)	Days per year	Max Daily Duration (minutes)	Average Daily Duration (minutes)	Theoretical Annual Duration (hours)	Months during which effects could occur	Ratio of percentage of bright sunshine	Likely Annual Duration (hours)	Times of day when effects could occur
	Gardens		6	89	48.0	37.2	54.8	Mid-July – End August		22.5	
			9	89	48.0	36.6	54.1			22.2	
			12	87	48.0	36.6	53.5			21.9	
			15	85	48.0	37.2	52.8			21.6	
		East	3	92	48.0	36.6	55.8			22.9	
			6	89	48.0	37.2	55.0			22.6	
			9	89	48.0	36.6	54.3			22.3	
			12	87	48.0	37.2	53.7			22.0	
			15	85	48.0	37.2	53.0			21.7	
11	**Clyde Street**	East	3	103	58.8	52.2	89.7	End October – Start February	0.34	30.5	Morning hours
			6	101	58.8	52.8	88.4			30.1	
		South	3	103	58.8	52.2	90.0			30.6	
			6	101	58.8	52.8	88.7			30.2	
12	**Wellesley Road**	East	3	125	67.8	59.4	124	Mid-October - Mid-February	0.34	42.2	Morning hours
			6	124	67.8	60.0	123.6			42.0	
		South	3	125	67.8	60.0	124.4			42.3	
			6	124	67.8	60.0	123.9			42.1	
13	Ward Street	East	3	105	57.0	41.4	72.0	Mid-January - Late-February Mid-October -End November	0.34	24.5	Morning hours
		South	3	105	57.0	41.4	72.1			24.5	
14	**Swan Court**	South	3	53	37.8	31.8	28.2	End November – Mid January (This is the worst-case effect for window located at 3.0 m AGL. The effect decreases gradually for windows located at a higher elevation) -	0.34	9.6 hours is the maximum hours of shadow flicker likely for windows located at 3.0 m AGL. The effect would decrease to 1.3 hours for windows located at higher elevations.	Early Afternoon (during noon) -
			6	51	37.2	31.2	26.4				
			9	49	37.2	30.0	24.7				
			12	47	36.6	29.4	22.9				
			15	44	36.0	29.4	21.4				
			18	42	35.4	28.2	19.6				
			21	40	33.6	26.4	17.5				
			24	37	31.2	24.6	15.3				
			27	34	29.4	23.4	13.1				
			30	31	26.4	21.0	10.8				
			33	28	24.0	18.6	8.6				
			36	24	20.4	15.6	6.2				
			39	17	16.2	13.2	3.8				
		West	3	53	37.8	31.8	28.3			9.6 hours is the maximum hours of shadow flicker likely for windows located at 3.0 m AGL. The effect would decrease to 2.1 hours for windows located at higher elevations	
			6	51	37.2	31.2	26.5				
			9	49	37.2	30.6	24.8				
			12	47	36.6	29.4	23.0				

Ref	Assessment Location	Orientation	Height (m)	Days per year	Max Daily Duration (minutes)	Average Daily Duration (minutes)	Theoretical Annual Duration (hours)	Months during which effects could occur	Ratio of percentage of bright sunshine	Likely Annual Duration (hours)	Times of day when effects could occur
			15	44	36.0	29.4	21.4				
			18	42	35.4	28.2	19.7				
			21	40	33.6	26.4	17.6				
			24	37	31.2	25.2	15.4				
			27	34	29.4	23.4	13.2				
			30	31	27.0	21.0	10.9				
			33	28	24.0	18.6	8.6				
			36	24	20.4	15.6	6.3				
			39	24	20.4	15.6	6.3				
15	**Swan View**	East	3	71	51.0	42.6	50.2	Mid- November - Late-January (This is the worst-case effect for window located at 3.0 m AGL. The effect decreases gradually for windows located at a higher elevation)	0.34	17.1 hours is the maximum hours of shadow flicker likely for windows located at 3.0 m AGL. The effect would decrease to 8.3 hours per annum for windows located at higher elevation.	Late Mornings
			6	69	50.4	42.0	48.2				
			9	68	49.2	40.8	46.2				
			12	66	48.6	40.2	44.2				
			15	64	48.0	39.6	42.1				
			18	62	46.8	39.0	40.0				
			21	60	46.2	37.8	37.9				
			24	58	45.0	37.2	35.7				
			27	56	43.8	36.0	33.4				
			30	54	42.0	34.8	31.2				
			33	52	40.8	33.6	28.9				
			36	49	39.0	32.4	26.6				
			39	46	37.2	31.8	24.3				
		South	3	71	51.0	42.6	50.5			17.2 hours is the maximum hours of shadow flicker likely for windows located at 3.0 m AGL. The effect would decrease to 8.3 hours per annum for windows located at higher elevation	
			6	69	50.4	42.0	48.5				
			9	68	49.8	40.8	46.5				
			12	66	49.2	40.2	44.4				
			15	64	48.0	39.6	42.4				
			18	62	47.4	39.0	40.2				
			21	60	46.2	37.8	38.0				
			24	58	45.0	37.2	35.8				
			27	56	43.8	36.0	33.6				
			30	54	42.6	34.8	31.3				
			33	52	40.8	33.6	296.0				
			36	49	39.6	32.4	26.7				
			39	47	37.8	31.2	24.3				
16	**Wellesley Road**	East	3	90	68.4	53.4	79.8	Mid February – End March	0.35	27.9	Morning Hours

Ref	Assessment Location	Orientation	Height (m)	Days per year	Max Daily Duration (minutes)	Average Daily Duration (minutes)	Theoretical Annual Duration (hours)	Months during which effects could occur	Ratio of percentage of bright sunshine	Likely Annual Duration (hours)	Times of day when effects could occur
		South	3	90	68.4	52.8	79.6	Mid-September - Mid-October		27.9	

14.6 Mitigation

Due to the short-term nature of the Development and the low magnitude of likely effects predicted, no mitigation for shadow flicker is proposed at this stage.

However, in the event that shadow flicker does occur resulting in complaints and that these complaints are proven to constitute a Statutory Nuisance, then measures are available which would allow for flicker to be reduced or prevented to comply the terms of any notice that may be issued under the terms of the Environmental Protection Act 1990 (as amended).

For example, a control system can be employed as part of the wider turbine control system to calculate, in real time, whether shadow flicker may affect a particular property, based on pre-programmed co-ordinates for the properties and wind turbine, and the intensity of sunlight, as measured by a device attached to the turbine tower. When the control system calculates that the sunlight is bright enough to cast a shadow and that the turbine is orientated in such a way that shadow will fall on a particular property, it would then automatically shut the turbine down, re-starting it when the shadow has moved away from the property. An option also exists within this mechanism to define larger areas to which shutdowns may be employed.

14.7 Residual Effects

Following implementation of any mitigation measures, all shadow flicker affects are considered to be not significant as a result no residual effects are predicted.

14.8 Cumulative Effects

The consented Hydrogen Office Wind Turbine at Methil Docks is located within 10 rotor diameter of the proposed Development. A shadow flicker study area has been mapped around the area of the operational Hydrogen Wind Turbine within a distance of ten rotor diameters (560 m) and 130 degrees either side of north. Figure 14.2 shows the zone of effect for both turbines, the area of overlap between the two shadow flicker study areas shows there are locations where cumulative effects could potentially occur. Table 14.4 shows the locations assessed for cumulative effects.

Table 14.4 Cumulative Assessment Locations

Ref	Assessment Locations	Easting	Northing	Approximate Distance from Methil turbine (m)	Approximate Distance from Hydrogen Office turbine (m)
1	Wemyss Place	337726	699595	1534	280
2	Pinpoint Ltd	337739	699688	1617	247
3	Harbour View	337691	699807	1690	313
4	High Street	337634	699842	1640	314
5	South Street	337539	699722	1541	447

The same assumptions have been applied in the cumulative assessment as discussed earlier in section 14.3 Baseline conditions.

Following computer modelling of the above locations, Table 14.5 lists the theoretical months and times of day during which cumulative effects are predicted to occur per annum. It also shows the likely annual duration of the shadow flicker event based on the ratio of the highest percentage of sunshine for the month over which the effects occur. For those locations which receive effects over multiple months the highest percentage of sunshine for the highest month has been used.

As can be seen from Table 14.5, effects may theoretically exceed 30 hours per annum as a maximum however, when the percentage of bright sunshine is taken into account, effects are

decreased and based on calculations alone, effects are likely to be less than the 30 hours threshold. As a result the effects calculated are not considered to be significant.

Charts showing the times of day and month of the year that theoretical maximum cumulative shadow flicker effects for each assessment location which are predicted to occur along with discussion of the results are presented in the ES Volume III – Technical Appendix A14.1.

Table 14.5 Predicted Cumulative Shadow Flicker Effects

Ref	Assessment Location	Orientation	Height (m)	Days per year	Max Daily Duration (minutes)	Average Daily Duration (minutes)	Theoretical Annual Duration (hours)	Months during which effects could occur	Ratio of percentage of bright sunshine	Likely Annual Duration (hours)	Times of day when effects could occur
1	Wemyss Place	North	3	95	43.2	38.4	61.0	Early May – Early August Mid November – End January	0.41	25.0	Early Morning Mid Afternoon
		East	3	95	43.8	39.0	61.8			25.3	
		South	3	65	29.4	24.6	26.7			10.9	
		West	3	65	29.4	24.6	26.7			10.9	
2	Pinpoint Ltd	North	3	69	46.2	36.0	41.1	Early April – Early May Early August – Early September End November – Mid January	0.41	16.9	Early Morning Mid Afternoon
		East	3	68	46.8	37.2	41.9			17.2	
		South	3	56	28.2	23.4	21.9			9.0	
		West	3	56	28.2	23.4	21.9			9.0	
3	Harbour View							Start March – Late March Mid-September – Mid October Start December – Mid January	0.35	0	Morning Mid Afternoon
		East	3	46	36.6	29.4	22.6			7.9	
		South	3	86	36.6	24.0	34.8			12.2	
		West	3	39	23.4	19.2	12.4			4.3	
4	High Street							Mid-March – Early April Early September – Late September Start December – Mid January	0.39	0	Morning Mid Afternoon
		East	3	46	36.6	29.4	22.6			8.8	
		South	3	92	36.6	24.6	37.8			14.7	
		West	3	44	25.2	21.0	15.3			6.0	
5	South Street							Late March –Start April Early September – Mid September Early December – Start January	0.39	0	Early Morning Mid Afternoon
		East	3	34	27.0	21.6	12.1			4.7	
		South	3	69	26.4	19.2	22.3			8.7	
		West	3	35	22.2	18.0	10.3			4.0	

14.9 Statement of Significance

An assessment of the potential of shadow flicker effects to occur has been carried out as per the updated PAN 45 web based tool and Guidance for PPS18. The assessment identified numerous potential receptors within the "shadow flicker study" area in which shadow flicker effects may occur and for the purpose of the assessment has been narrowed down to representative assessment locations.

A computer model predicts the likely times and duration of effects at these locations. The effect is predicted to exceed the recommended criteria at five locations however; as no properties are located within 500 m of the development, the predicted effects are in accordance with the Northern Ireland Guidance PPS18.

In practice, the effect is expected to be further reduced by potential screening and intermittent use of the turbine during testing.

If shadow flicker does occur at properties resulting in a loss of amenity; appropriate control measures will be implemented to prevent the flicker effects at sensitive times to avoid unnecessary loss in generation. Following implementation of such mitigation measures, all shadow flicker affects are considered to be not significant.

An additional assessment carried out calculates the cumulative effects of shadow flicker effects from the proposed turbine in conjunction with an operational turbine at the Hydrogen Office. The likely predicted cumulative effects are less than the recommended criteria and therefore are not considered to be significant.

15 MISCELLANEOUS ISSUES

15.1 Introduction

This chapter of the ES describes and assesses the potential effects of the Development on:

- Access and Transport;
- Climate and Carbon Balance; and
- Health and Safety Considerations.

15.2 Access and Transport

A Scoping Opinion from the Marine Scotland advised that the ES should provide information related to delivery route and access issues particularly those impacting on the trunk road network.

As stated in Chapter 3: *Project Description* of this ES, the majority of the turbine components (abnormal loads) will either be manufactured on site or delivered by sea to the nearest suitable water port i.e. Forth Ports. Therefore, an abnormal loads study relating to preferred route options for delivering the turbines is not required.

Vehicular access to the site will be via the entrance to the FEP which is suitable for Heavy Goods Vehicles (HGVs). It is not proposed to construct any additional tracks within the FEP, due to the nature of the ground and the current use of the site.

Overall, the traffic generated during the construction of the test facility will be minimal and use the surrounding trunk road network and as such will have no significant effects on the surrounding road network. Similarly, the traffic generation during the operational phase is very low and there will be negligible increase in traffic in the surrounding road network during the operation of the Development.

For the aforementioned reasons, the construction, operation and decommissioning of the Development will have a negligible effect on the capacity of the surrounding road network and is not considered to be significant.

15.3 Climate and Carbon Balance

The demonstration wind turbine will generate electricity during the operational period of 5 years beginning 2013. During its operational lifespan, the Development has the potential to displace electricity generated from fossil fuels and consequently prevent CO_2 from being released. The actual amount of CO_2 released through electricity generation in the UK relates directly to the generating plant in use at any given time. This mix changes on a daily basis and will change in the future as UK generating plant is replaced and fuel costs change and as a consequence it is not possible to predict exactly the amount CO_2 release the Development will prevent over its lifetime.

The Department of Energy and Climate Change (DECC) Digest of UK Energy Statistics 2011[1] states that, in 2010, 398 tonnes of CO_2 were released each gigawatt hour (GWh) when generating electricity from gas; this increased to 909 tonnes per GWh when generating from coal. The average CO_2 release from the fossil fuel mix, which also includes oil, was 590 tonnes per GWh.

Whilst not its primary purpose, the Development will result in the generation of a renewable source of energy thus reducing the need for power generation from thermal technologies. This will result in the electricity produced creating a saving in emissions of CO_2, with associated environmental benefit.

As the Development is a test facility it is highly likely that its electricity production will vary significantly over the 5 year operational period as turbines are installed and their operational

[1] DECC (2011) *Digest of UK Energy Statistics 2009* (DUKES) Chapter 5 Electricity, Table 5A. Figures for 2008 to 2010 [online]. Available at:http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx [Accessed on 27/03/2012]

parameters altered to facilitate testing. In order to calculate the exact amount of CO_2 released through electricity generation in the UK, it is necessary to know the electricity generation rate of machinery at any given time. This mix changes on a daily basis, and will change in the future as UK generating plant is replaced and its efficiency improved, fuel costs change, and as a consequence it is not possible to predict the exact amount of how much CO_2 the Development will prevent over its life time.

Furthermore, due to the nature of the test facility, and the unknown performance data for the new turbine designs it is not possible to predict the energy that will be produced by the Development over its lifespan and therefore a calculation of the displacement of CO_2 cannot be made. It can however be stated that any energy generated from the site will result in the displacement of CO_2 generated from non-renewable sources and that the aim of the project, to further the development of the UK offshore wind industry, will contribute to the reduction of CO2emissions from UK power generation in the long term.

The operation of the Development has the potential, based on the same assumptions, to also displace other gases related to coal-fired electricity generation including those associated with acid rain such as sulphur dioxide (SO_2) and oxides of nitrogen (NO_X).

15.4 Health and Safety Considerations

This section considers health and safety considerations that are considered relevant to the construction and operation of the Development:

A comprehensive health and safety assessment would be carried out prior to construction by the selected contractor in accordance with relevant legislation. The construction of the site would be managed in accordance with the Health and Safety at Work Act 1974 and Management of Health and Safety at Work Regulations 1999 and would comply with all relevant Health and Safety Regulations, including:

- The Construction (Health, Safety and Welfare) Regulations 1996;
- The Construction (Design and Management) Regulations 2007; and
- The Electrical Safety, Quality and Continuity Regulations 2002.

The site would operate to BWEA '*Guidelines for Health and Safety in the Wind Energy Industry*' and *"Guidelines for Health and Safety in the Marine Energy Industry"*[2][3].

Further information relating to site safety and emergency procedures and navigation is provided in Chapter 3: *Project Description* and Chapter 12: *Navigation* of this ES.

[2] British Wind Energy Association (BWEA) (2010) *Health & Safety in the Wind Farm Industry Sector.* [online]. Available at: http://www.bwea.com/pdf/HSGuidelines.pdf [Accessed on27/03/2012]
[3] BWEA, European Marine Energy Centre Ltd. (EMEC) (2008) *Guidelines for Health and Safety in the Marine Energy Industry* [online]. Available at: http://www.bwea.com/pdf/safety/Marine_HS_Report.pdf [Accessed on 27/03/2012]