EIRGRID

East West Interconnector Project

Ireland Marine

Environmental Report

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Authorised by:	Dave Watson	Project Manager	Date:	22/09/08
Authorised by:	Mike Kelly	Project QA Rep	Date:	22/09/08

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ABBREVIATIONS

ABP	An Bord Pleanála
A&NWFA	Anglesey and North Wales Fishermen's Association
AC	alternating current (method of electrical transmission)
AMAA	Ancient Monuments and Archaeological Areas Act
AONB	Area of Outstanding Natural Beauty
APR	annual progress reports
BAP	Biodiversity Action Plan
BIM	Irish Sea Fisheries Board/Bord Iascaigh Mhara
CA	crossing agreement
pSAC	candidate Special Area of Conservation
CCW	Countryside Council of Wales
CD	chart datum
CER	Commission for Energy Regulation
CPA	Coastal Protection Act
CZMD	Coastal Zone Management Division
DAFF	Department of Agriculture, Fisheries and Food
DC	direct current (method of electrical transmission)
DEFRA	Department of Environment, Food and Rural Affairs
DoEHLG	Department of the Environment, Heritage and Local Government
EA	Environment Agency
EC	European Community
EEC	European Economic Community
EIA	environmental impact assessment
EIS	environmental impact statement
EMF	electromagnetic Field
EMP	environmental management plan
EPA	Environmental Protection Agency
ER	environmental report
EU	European Union
EWI	East West Interconnector
FEPA	Food and Environmental Protection Act
FLO	Fisheries Liaison Officer
GIS	geographical information systems
HDD	horizontal directional drilling
HSE	health, safety and environmental
HVAC	high-voltage alternating current

HVDC	high-voltage direct current
ICES	International Council for the Exploration of the Sea
IFA	Institute of Field Archaeologists
IFPO	Irish Fish Producers Organisation
IMO	International Maritime Organisation
JNCC	Joint Nature Conservation Committee
kV	kilovolt (unit of electrical potential capacity)
LAP	Local Area Plan
LAT	lowest astronomical tide
LNR	Local Nature Reserve
LTP	Local Transport Plan
MAFF	Minister for Agriculture, Fisheries and Food
MARPOL	Marine Pollution guidelines
MCA	Maritime and Coastguard Agency
MFA	Marine Fisheries Agency
MHWM	mean high water mark
MHWS	mean high water springs
MLW	mean low water
MMO	marine mammal observer
MSP	marine spatial planning
MW	megawatt (unit of electrical power)
NAVAREA	Navigational area in which particular governments are responsible for navigation and weather warnings
NDP	National Development Plan
NIEA	Northern Ireland Environment Agency
nm	nautical mile
NMI	National Museum of Ireland
NMS	National Monuments Service
NPWS	National Parks and Wildlife Service
OSCP	oil spill contingency plan
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
pSPA	proposed Special Protection Area
PWA	Protection of Wrecks Act
REDAS	resistivity data acquisition survey
RMP	Record of Monuments and Places
ROV	remotely operated vehicle
RPG	regional planning guidance

SAC	Special Area of Conservation
SEA	strategic environmental assessment
SEI	Sustainable Energy Ireland
SFPA	Sea Fisheries Protection Agency
SID	strategic infrastructure development
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TJP	transition joint pit
TSO	transmission system operator
TSS	traffic separation schemes
UAU	Underwater Archaeology Unit
UDP	Unitary Development Plan
UKHO	UK Hydrographic Office
WSI	written scheme of investigation
XLPE	cross-linked polyethylene

1 INTRODUCTION

1.1 Background

The Irish Government has identified the need for a strategic energy link, in the form of an electrical high-voltage direct current (HVDC) interconnector, which is to be developed between the Republic of Ireland (hereafter referred to as Ireland) and Great Britain (hereafter referred to as Britain).

In 2006, EirGrid and the Commission for Energy Regulation (CER) were appointed the task of arranging a competition to secure the construction of the East West Interconnector (EWI). The EWI is a major infrastructure initiative, which will involve the installation of cables between Ireland and Britain. The EWI will have the capacity to transmit 500MW of electrical power in either direction. The EWI has a planned operational year of no later than 2012. Ownership of the EWI is to be vested in EirGrid.

The proposed route is shown in Figure 1.1. The EWI will be laid between Rush in the Republic of Ireland and Barkby Beach in Wales.

The overall project consists of converter stations, and onshore cables that link the converter stations and the national electricity grids in both countries. The converter stations change the current from alternating current (AC) to direct current (DC); the proposed subsea cables will transmit direct current. Environmental reports have been compiled for the converter stations and the onshore cable routes in both Ireland and Britain. This environmental report covers the section of the EWI between the mean high water mark (MHWM) in Ireland and the median line between British and Irish waters. A similar report will be submitted (to the British consenting authorities) for the section between the median line and the MHWM in Wales.

A complete set of reports will be submitted, as requested, to An Bord Pleanála.

The project has three distinct phases: construction, operation and decommissioning. The proposed construction timetable, together with more information on construction of the development is presented in Section 4.

1.2 Developer (EirGrid)

EirGrid plc is a state-owned company established to take on the role and responsibilities of transmission system operator (TSO) in the Republic of Ireland. EirGrid plc is also the market operator of Ireland's wholesale electricity trading system.

From 1 July 2006, EirGrid took over the TSO functions formerly carried out by ESB National Grid, a business unit of ESB, in accordance with Statutory Instrument 445/2000 European Communities (Internal Market in Electricity) Regulations, 2000, as amended by S.I. 60/2005.

EirGrid has a clearly defined role in the Irish electricity system: "to develop, maintain and operate a safe, secure, reliable, economical and efficient transmission system for the benefit of our customers; to deliver quality transmission and market services." EirGrid operates, develops and maintains the national electricity grid power system, providing services equally and independently to all users of the electricity system. This includes all generators, suppliers and high-voltage customers. These services are vital to 2.1 million customers nationally, which include large and small businesses, farms and homes. EirGrid is committed to protection of natural environment in carrying out its duties.

The Electricity Generation (amendment) (EirGrid) Act 2008 enables EirGrid to construct, own and operate an interconnector and provides for other commercial and connected matters. The EWI project will be developed under this legislation.

1.3 Need for the Project

1.3.1 European Union Policy

The EU Commission communication ‘Priority Interconnection Plan’ published in January 2007 (COM (2006) 846 final) identifies the urgent action needed to increase minimum energy interconnection levels between member states to 10%. Ireland and the UK are among the member states listed as not yet achieving the minimum target.

Interconnectors are stated to be a pre-requisite for a functioning internal market by facilitating inter-regional and cross-border transport of power and energy. Interconnection is considered an essential element for effective energy infrastructure to achieve the objectives of sustainability, competitiveness and security of supply.

Across the EU, 314 infrastructure projects ("projects of common interest") have been identified that could be cross-border in nature or have significant impact on cross-border transmission capacity whose completion should be facilitated and speeded up. These include 42 high-priority "projects of European interest", including electricity interconnection between Ireland and the UK.

1.3.2 National Development Plan

The Irish National Development Plan 2007–2013 entitled ‘Transforming Ireland – A Better Quality of Life for All’[1] highlights the development of key energy infrastructure as fundamental to the National Development Plan (NDP).

The NDP’s economic infrastructure priority establishes an energy programme with the strategic objective of ensuring the security of energy supply nationally and regionally. The supply should be priced competitively in the long term while meeting a high level of environmental standards.

1.3.3 The Energy Policy Framework 2007–2020

The Irish Government has recently published its energy policy White Paper, ‘Towards A Sustainable Energy Future for Ireland’, which sets out the Government’s energy policy framework for 2007–2020[2]. Strategic goal 1 is “Ensuring that Electricity Supply Consistently Meets Demand”. This strategic goal recognises that reliable, secure and competitively priced electricity supply must be available at all times and that it is a vital ingredient in the competitiveness of Irish industry and Ireland’s long-term economic and social development. One of the key actions to achieve this goal is the delivery of the EWI by no later than 2012.

The White Paper also sets the target of 33% of electricity being produced from renewable generation by 2020. Although Ireland aims to produce sufficient renewable energy domestically to meet this target, the EWI will allow electricity produced from renewable resources in Britain and further afield to access the grid. The EWI will enable a more diverse range of electricity sources to be used on the Irish grid, including renewable energy such as wind power (which is seen as pivotal in achieving Ireland’s renewable targets) that will reduce the reliance on fossil fuels and cut Ireland’s carbon emissions.

1.3.4 Economic Growth and Energy Demand

In recent years, Ireland has experienced (and is likely to continue to experience) high population and economic growth, accompanied by expectations for a higher standard of living. Electricity generation and transport are the key sectors influencing energy demand in Ireland. Using the latest figures from Sustainable Energy Ireland (SEI)[3], annual economic growth to 2020 is forecast to be approximately 3%. The objective

[1] Available at: http://www.ndp.ie/viewdoc.asp?fn=%2Fdocuments%2Fhomepage.asp
[2] Available at: http://www.dcmnr.gov.ie/NR/rdonlyres/54C78A1E-4E96-4E28-A77A-3226220DF2FC/27356/EnergyWhitePaper12March2007.pdf
[3] Available at: http://www.sei.ie/index.asp?locID=686&docID=659

therefore is to provide sufficient power to enable this economic growth to be sustained, while delivering cumulative improvements in energy efficiency of 20% by 2020, as stated in the Energy Policy Framework.

The SEI (2007)[3] has calculated baseline scenario energy forecasts based on a number of assumptions. SEI predicts that electricity demand will grow by 4.5% per annum to 2010 and then at a reduced rate between 2010 and 2020 (1.2% per annum). This rising demand will require increased electricity generation, which means that the EirGrid EWI is necessary to provide increased capacity to help meet this demand.

Assuming the actions identified in the White Paper are fully implemented (which includes the operation of the EWI), this will result in 17% lower final energy demand in 2020 relative to the baseline scenario. The main catalyst for this is the energy efficiency measures contained in the White Paper. In the interim however, the Generation Adequacy Report 2008–2014 predicts that in a high growth scenario, demand could exceed supply at peak times by 2013 without the EWI or other interconnection.

1.4 Project Benefits

1.4.1 Security of Supply

The EWI would increase the security of supply, as it would enable the Irish transmission system to import electricity from the larger British market when necessary. Energy security is important for Ireland, as the country has a growing economy that requires a reliable supply of high-quality power to support it.

Ireland has a target of 33% renewable generation by 2020. In reaching such levels of renewable electricity generation, there may be options for the export of power from Ireland through the EWI, thus providing a contribution to security of supply to Britain and beyond.

In addition, the EWI may provide a “blackstart” facility to restore system operations for either the British or Irish transmissions systems following the unlikely event of a system-wide power outage.

1.4.2 Promotes Competition

The increased capacity to export and import energy will lead to enhanced competition in the electricity market and, in the long-term, help reduce costs to electricity customers. Both Ireland and Wales have some of the largest potential renewable energy generation resources in Europe, but without an interconnector, the full potential of these resources may not be realised in either Ireland or Britain.

Given the geography of Ireland, the Irish electricity system is relatively isolated compared to systems in mainland Europe and even Britain, which has several interconnections with the larger European grid. Currently, there is one interconnection crossing of the Irish Sea between Northern Ireland and Scotland (the Moyle interconnector). Interconnection between the transmission systems in Northern Ireland and the Republic of Ireland is also in place, and is being further developed at present. In line with European policy, the EWI would help further the creation of a single European electricity market. By connecting to the British grid, Ireland has access to power from across Europe. This will create a more competitive market and help reduce the price of electricity for consumers. Electricity can be imported from Britain when it is cheaper or if not enough electricity is being generated in Ireland. In the event that Ireland has a surplus of supply, this can then be exported to Britain.

1.4.3 Export of Electricity

While the EWI will allow for energy importation from the British market, it will also offer an opportunity for energy generators in Ireland to access this greater market. The British energy market is approximately 10 times the size of the Irish market. Such access will allow Ireland to increase its dependence on renewable energy, as there would be reassurance that, when such energy sources do not provide sufficient power to meet demand (i.e. in the case of wind farms, when wind speeds are low), energy could be easily imported from Britain to meet demand in Ireland. On occasions when energy generated within Ireland exceeds demand, it could be exported to Britain. The EWI would allow more wind generation to be accommodated because the link to the larger British market would allow energy variations to be managed more easily.

1.5 'Do Nothing' Option

An alternative option would be to not develop the EWI and seek to generate electricity by other means. However, under the do-nothing scenario, one of the key actions identified in the energy policy White Paper – to develop the EWI to improve security of supply – would remain unrealised.

The absence of the EWI would also mean that there is a danger that the energy demands of a growing economy and population could not be met. Furthermore, EirGrid as TSO would have no direct means of exporting electricity in instances when generation exceeds demand. Customers may also suffer, as no EWI would result in less competition and may result in higher electricity costs.

It is therefore considered that the do-nothing scenario would fail to meet the White Paper's objective of ensuring a secure supply of electricity for Ireland and could hinder sustainable development in Ireland.

1.6 Structure of the Report

The environmental report is divided into 15 chapters plus the non-technical summary. The environmental report is structured as follows:

- Chapter 1 Introduction
- Chapter 2 Planning Policy and Consents Framework
- Chapter 3 Scope and Methodology;
- Chapter 4 Description of the Development and the Alternatives Considered
- Chapter 5 Landscape and Visual Impact
- Chapter 6 Ecology
- Chapter 7 Archaeology
- Chapter 8 Noise
- Chapter 9 Air
- Chapter 10 Navigation, Transport and Traffic
- Chapter 11 Water Resources
- Chapter 12 Soils, Geology and Bathymetry
- Chapter 13 Socio-economic
- Chapter 14 Cumulative Impacts and Transboundary Effects
- Chapter 15 Environmental Management.

2 PLANNING POLICY & CONSENTS FRAMEWORK

This chapter outlines the environmental consent and authorisation process under which the application to construct and operate the marine elements of the proposed EirGrid EWI will be considered. The relevant international, national, regional and local government policy framework for offshore cable installation in Ireland is described, whilst reference is also made to any local designations and their relevant supporting legislation.

The onshore elements of the development are the subject of other environmental reports to support the applications for other consents that are required for installation and operation of the whole development.

2.1 Legislative Requirements

As the installation of cables alone is not a form of development that is listed under Annex I or II of the EU Council Directive 85/337/EEC (on the assessment of the effects of certain public and private projects on the environment), the works do not fall under the remit of those regulations. However, there are a number of regulatory consents required for such installations, and this document is intended to provide the information required by the regulatory authorities in the consenting process.

An overview of the legislative requirements of these consents for Ireland is presented below.

2.1.1 Marine Consents

Foreshore Acts

In Ireland, the foreshore is owned and administered by the state. Under The Foreshore Acts, 1933 to 1998, foreshore and seabed works in Ireland require either a licence or lease, or permission from the Department of Agriculture, Fisheries and Food (DAFF) for all installations between the high water mark and the 12 nautical mile limit. Applications for foreshore licences or leases are separate from a terrestrial planning application (see Section 2.1.2. below). Leases are granted for the installation of long-term structures (e.g. piers, marinas, bridges, roads, car parks) and licences are granted for other works (e.g. laying of submarine pipelines and cables) and purposes (e.g. aquaculture). A licence will therefore be sought from the DAFF for the EWI. In line with confirmation from the DAFF, an environmental impact assessment (EIA) will not be required under the terms of this licence and applicable EIA legislation.

Consents are also required under the Foreshore Acts on privately owned landfall areas, although leases would not be necessary for any areas of privately owned foreshore.

Coastal Protection Act 1963

This act facilitates the application by promoting authorities (such as County Councils) for permission to construct coastal defences. Should such permission be granted, conditions are set for the maintenance of the defence works, and this can include the initiation of a trust fund to pay for the upkeep. In order to install the EWI cable through the coastal defences at Rush Bay North Beach car park the construction contractor will need to remove the coastal defences for a limited period of time which will be kept as short as possible. EirGrid and the contractor will ensure that Fingal County Council is given adequate prior notice of these works. The details of the works (timing, scope and reinstatement) will be agreed with the Council in advance of any work taking place.

OSPAR

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the Oslo and Paris Commissions in Paris on 22 September 1992. The OSPAR Convention entered into force on 25 March 1998. Britain and Ireland are contracting parties to the 1992 OSPAR Convention with the Department of Environment, Heritage and Local Government co-ordinating for Ireland.

The main aims of the convention are as follows:

- *Hazardous substances* – to reach concentrations equivalent to near background levels for naturally occurring substances and close to zero for man-made synthetic substances in the marine environment.
- *Radioactive substances* – to reach concentrations equivalent to near background values for naturally occurring substances and close to zero for artificial radioactive substances in the marine environment.
- *Eutrophication* – to eliminate eutrophication where it occurs in the north-east Atlantic and to prevent further occurrences.
- *Protection of ecosystems and biological diversity* – entry into force of the new Annex, and the identification of human activities that need to be addressed under it, along with promoting the establishment of a network of marine protected areas.

Dumping at Sea Act 1996

The Dumping at Sea Act (1996) implements the requirements of the OSPAR Convention[4] with respect to any dredging or dumping activities and will require a separate consent. All permit applications for the dumping of dredged spoil at sea are processed by the DAFF and Coastal Zone Management Department (CZMD). Clarification is being sought from DAFF regarding the requirement for a Dumping at Sea consent for the EWI.

National Monuments Acts 1930–2004

The National Monuments Act 1930 and its subsequent Amendment Acts constitute the primary legislation relating to the protection of maritime archaeological remains in the Republic of Ireland. The Acts place a blanket protection on wrecks over 100 years old:

> "… a person shall not dive on, damage, or generally interfere with, any wreck which is more than one hundred years old or an archaeological object which is lying on, in or under the seabed or on, or in land covered by water except in accordance with a licence … the Minister may, at his or her discretion, grant or refuse to grant a licence and may make a licence subject to such conditions as he or she thinks fit and specifies in the licence (DAHGI 1999)."

Licences will only be issued by the Minister where damage or removal cannot reasonably be avoided, is in the interests of archaeological research (and long-term conservation and storage facilities are available for any removed material) or for the purpose of conservation.

The Acts also require that finds be reported. For wrecks over 100 years old, a report must be made within four days to the Minister for the Environment, Heritage and Local Government. For archaeological objects lying on, in or under the seabed or on or in land covered by water a report must be made within four days to the Director of the National Museum of Ireland. The Minister is also authorised to issue Underwater Heritage Orders for vessels or sites (not necessarily over 100 years old) that are, or may prove to be, the site where a wreck or archaeological object lies or formerly lay, or on account of the historical, archaeological or artistic importance of the wreck or the object.

Other Requirements

A number of submarine telecommunications links are present in the Irish Sea. Agreement over crossings of these and any other existing sub-marine infrastructure or oil and gas exploration blocks should be reached with the relevant operators as a matter of good practice.

[4] OSPAR, 1996, *PARCOM Decision 96/3 on a Harmonized Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals*, Oslo.

Table 2.1: Summary of licensing requirements (Republic of Ireland)

Permit	Activity and Location	Licensing Authority
Seabed licences The Foreshore Acts 1933– 1998	Cable installation Foreshore (MHWM to 12nm limit)	Department of Agriculture, Fisheries and Food
National Monuments Acts 1930–2004	Activities affecting maritime archaeological remains	Department of Environment, Heritage and Local Government
Land owner consent	Activities affecting land properties (including ports and harbours)	Individual landowner/occupier
Crossing agreements	Oil and gas licence blocks/ cables/ pipelines crossed by the cable	Oil and gas operators and cable owners

Decommissioning

A decommissioning programme will be submitted to relevant authorities at the end of the EWI's useful life complying with the requirements of any legislation as may be in force at the time. Such specific consultations as are deemed to be required will be carried out before the decommissioning programme is submitted.

The decommissioning programme will include:

- measures to be taken for decommissioning of the cables;
- an estimate of the expenditure likely to be incurred in carrying out those measures;
- provision for determining the times at which, or the periods within which, those measures will have to be taken;
- provision for restoring the location to the condition that it was in prior to the laying of the cables (where it is proposed that the object will be wholly or partly removed from that location); and
- provision for whatever continuing monitoring and maintenance of the cable route will be necessary (where it is proposed that the cable be left in position or will not be wholly removed).

2.1.2 Terrestrial Consents

Planning and Development (Strategic Infrastructure) Act 2006

Since 2006, the responsibility for planning approval of strategic infrastructure development (SID) proposals (which specifically includes electricity interconnectors) rests with An Bord Pleanála (ABP). Accordingly, the initial stage of the application process is a (mandatory) consultation with ABP, which advises whether a SID application to ABP can be made. If ABP confirms the project is SID, it then acts as the planning authority for the application and consults the appropriate bodies.

ABP has determined that the EirGrid EWI cable is SID and its scope, for planning purposes, includes the converter station at Woodland, the onshore underground cable and the marine cable to the 12 nautical mile limit of Irish territorial waters. ABP also determined that a statutory EIA is not required but that an environmental report should be prepared for that part of the development within Irish jurisdiction.

Environmental reports are likewise being prepared for the marine and onshore elements of the project in the British jurisdiction and these reports will also be submitted to ABP as background information.

Table 2.2: Summary of onshore licensing requirements

Permit	Activity and Location	Licensing Authority
Planning permission (SID) Planning And Development (Strategic Infrastructure) Act 2006	Onshore development	An Bord Pleanála (ABP)

2.1.3 European Directives

2.1.3.1 EIA Directive

This consolidated EU Directive 85/337/EEC as amended by 97/11/EC and 2003/35/EC applies to the assessment of the environmental effects of developments that are likely to have significant effects on the environment.

While ABP has confirmed that a formal EIA is not required for the EWI, the ER will follow the principles established in the EU Directives. There are a number of regulatory consents required for such installations, and this document is intended to provide the information required by the regulatory authorities in the consenting process.

2.1.3.2 The Habitats Directive

The Habitats Directive 92/43/EEC manages the conservation of natural habitats and of wild fauna and flora and aims to sustain biodiversity through the conservation of natural habitats and wild fauna and flora in the territory of European Member States. These targets are met through the establishment of Special Areas of Conservation (SACs). The Directive has been enshrined into British law via The Conservation (Natural Habitats etc.) Regulations 1994 (Habitats Regulations), and into Irish law through the European Communities (Natural Habitats) Regulations 1997.

It is necessary to comply with the species protection provisions of the Habitats Directive. It is an offence to deliberately kill, capture or disturb European protected species, and to damage or destroy their breeding sites or resting places. Furthermore, there is a requirement to protect habitats listed in Annex 1 of the Directive. In terms of the project, it is possible that reefs (geological or biogenic) are present in the marine environment along the proposed route within British waters.

The Directive requires that any activities, plans or projects inside or outside a Natura 2000 site that are likely to have a significant effect on the conservation status of the site's features shall be the subject of an appropriate assessment of the implications for the site in view of the site's conservation objectives.

Therefore, where a proposed cable installation is located within, or would be likely to significantly affect, a designated, proposed or candidate Natura 2000 site (SAC and/or Special Protection Areas (SPA)), consenting authorities must ensure an 'appropriate assessment' is carried out under the Directive.

The proposed cable route (Figure 1.1) could potentially traverse reef habitat to the north and west of Anglesey; this habitat is listed on Annex 1 of the Habitats Directive. Chapter 6 of this report discusses potential for impacts to sites protected under nature conservation legislation.

2.1.3.3 Wild Birds Directive

The aim of the "Birds Directive" 79/409/EEC is to protect birds, their eggs, nests and habitats in the EU. This is to be achieved by the protection of the birds' potential habitats, through the preservation, maintenance or restoration of a sufficient diversity and area of habitats essential to the conservation of all species of birds. These targets are principally being met through the classification of Special Protection Areas (SPAs) under the Directive and are also known to be categorised as Ramsar sites.

There are several scientific sites of concern, largely at and adjacent to the North Wales landfall. These include the potential Liverpool Bay potential Special Protection Area (pSPA), and the area is also listed as a proposed Ramsar site. These proposed and potential listings will need to be taken into account with regards to the disturbance of species and habitats that are present. Chapter 6 of this environmental report discusses potential impacts to such designated and proposed sites.

2.2 Regional and Local Planning Requirements

2.2.1 Regional and Local Planning Policy Framework

In addition to planning approval required from ABP, an application for licences under the provisions of the Foreshore Acts, 1933 to 1998, and, where required, under the Dumping at Sea Act 1996 will also be made. Both licences will be administered by DAFF.

All local planning authorities were consulted during the preparation of this report, and the principles of their guidance notes, development plans and policies considered in this report.

2.2.2 Regional Planning Guidelines for the Greater Dublin Area

The Regional Planning Guidelines for the Greater Dublin Area in identifying that demand for electricity has grown rapidly in the Greater Dublin Area, signal the need for additional electricity supply and strengthening of electricity networks requiring new high voltage electrical infrastructure to meet increased demands from existing customers, as well as connection of new generation and large demand customers.

Plans to develop the new bulk supply points needed to address immediate requirements are required and are being put in place. Further transmission projects to facilitate future growth in the area are at a conceptual stage. New electrical infrastructure is particularly required in the peripheral parts of the Greater Dublin Area.

The Update on Regional Planning Guidelines, Item No. 410 in December 2007, identifies the EWI as one of the key strategic developments in electricity infrastructure in the Greater Dublin Area which will play a key role in securing Ireland’s energy supply needs. The interconnector is expected to bring enhanced security of supply and possibly facilitate the renewable energy sector.

2.2.3 County Plans

The purpose of a County Plan is to outline broad planning strategy to assist in planning land use and development. It interprets national and regional policies and provides a framework for the more detailed local plans that are produced by the district and borough councils (county councils in Ireland). Although the offshore elements of the EWI route lies outside of the policies of Fingal plan, they are still considered to have some relevance and have therefore been reviewed.

2.2.3.1 Fingal County Development Plan

The Fingal Development Plan 2005–2011 sets out Fingal County Council's policies and objectives for the development of the county for a six-year period from 2005 to 2011.

The project as proposed will facilitate provision of key infrastructure for the county and region and as such complies with the Fingal County Council Policy UTP51.

To support and facilitate the development of enhanced electricity and gas supplies to the county and to cooperate and liaise with statutory and other energy providers in relation to power generation in order to ensure adequate power capacity for the future needs of the county.

Fingal County Development Plan incorporates a ‘Coastal Policies namely Policy GBP17–GBP 22 and Objectives GB034–GB040. The principle of Coastal Zone

Management is supported by EirGrid and it is recognised that the Coastal Zone is a sensitive landscape and a vital asset. Therefore, best practice principles will be implemented to protect the Coastal Zone.

2.2.4 Local Planning Policies

Local Area Plans (LAPs) are prepared for specific towns and areas within the remit of the planning authority. In line with the hierarchy of plans, the contents of the Local Plan must be in line with the policies contained in the County Development Plan.

2.2.4.1 Rush Local Area Plan

The village of Rush (together with the village of Lusk) is designated as a Secondary Development Centre in the Strategic Planning Guidelines for the Greater Dublin Area. The development strategy for Rush indicated in the County Development Plan is to consolidate the existing urban form and to retain existing amenities.

The LAP process will provide the optimal development strategy for the development of these lands within Rush village. The aim is to deliver an attractively designed housing area that is integrated visually, functionally and physically with the existing village and Kenure Park, thereby protecting and enhancing the special physical and social character of this major village centre.

The LAP is focused primarily on zoning specific areas for development rather than particular policies. The area proposed for landfall is designated as Class II Public Open Space. However, the works will be temporary and the residual impact will be slight to negligible. Therefore, there are no specific requirements within the LAP for Rush.

3 SCOPE AND METHODOLOGY

3.1 Scope of the Report

This environmental report (ER) covers the section of the cable route that lies between the 12 nautical mile limit and mean high water mark MHWM in Ireland. The construction, operation and decommissioning phases of the EWI are considered in this report. Potential environmental impacts of the other sections of the project are covered by separate reports.

3.2 Scoping

In order to ensure that the ER covers the main issues of concern, a scoping report was produced and submitted to the appropriate regulators in Ireland. The objective of that report was to provide sufficient information on the project, and the environment into which it would be constructed and operated, so that the regulators (with the assistance of statutory and other consultees) could advise which issues should be the focus of the full appraisal of potential impacts.

3.2.1 Objectives

The objective of the scoping exercise is to ensure that the issues of greatest concern to various stakeholders receive appropriate consideration in the final report. The scoping/screening report was issued to the relevant regulatory authorities in Britain and Ireland in late February, and they have consulted their advisers on whether the project requires a statutory EIA and any particular concerns that they may have about the development.

Both the Marine Licence Vetting Committee (Ireland), responsible for issue of Foreshore Licences, and the Marine and Fisheries Agency (Britain) responsible for issue of Coastal Protection Act and FEPA consents, consider that the project falls below the threshold where a statutory EIA is required. However, EirGrid has committed to provide an ER that covers the same issues as a typical EIA, and focuses on the comments of the various statutory consultees who have provided responses.

These issues are listed in Table 3.1, together with reference to the section of this report in which they are further discussed.

Table 3.1: Issues raised by statutory consultees in Republic of Ireland

Consultee	Issue	Section of Environmental Report
An Bord Pleanála	Details of known wrecks should be shown to the limit of the foreshore within a corridor of approximately 500m along the alignment of the preferred cable route. Uncharted wrecks identified by a detailed marine survey will also be shown.	7
An Bord Pleanála	ABP preliminary view is that the project is not likely to have any significant transboundary effects. Nevertheless, transboundary issues will need to be addressed to provide adequate information to allow ABP to take an informed view.	14
An Bord Pleanála	All alternatives considered should be documented and a clear explanation should be provided showing how the principal features were determined.	4

Consultee	Issue	Section of Environmental Report
An Bord Pleanála	The environmental report should be presented in a clear and understandable format. A comprehensive and concise non-technical summary should be provided that is easily understood and capable of hard copy reproduction.	NTS
An Bord Pleanála	Cumulative impacts should be addressed in relation to other relevant developments in the sector and area.	14
Marine Licence Vetting Committee	Focus of the report should be on the installation phase of the project	4
Marine Licence Vetting Committee	Fisheries Science Services of the Marine Institute should be consulted for information on fish populations	6
Marine Licence Vetting Committee	National Parks and Wildlife Service (NPWS) of the DoEHLG should be consulted with regard to potential impacts on Natura 2000 sites	6
Marine Licence Vetting Committee	Scoping out of potential effects on air quality and noise during the installation phase is reasonable and valid	8 & 9
Department of the Environment, Heritage and Local Government (Underwater Archaeology)	Proposed development impacts on areas of very high archaeological potential (including shipwrecks). Meetings are required to discuss potential impacts	7
Department of the Environment, Heritage and Local Government (Nature Conservation)	If works are to produce a sound source as defined by the NPWS Code of Practice, contractor must ensure that a marine mammal observer is on board during operations	6 & 14
Department of the Environment, Heritage and Local Government (Nature Conservation)	Operations at sites close to Lambay Island must be completed prior to the beginning of the breeding/pupping season in September and not recommence until December	4, 6 &14
Department of the Environment, Heritage and Local Government (Nature Conservation)	Landfall survey should be timed so as to be completed prior to the arrival of waders at Rogerstown Estuary in the autumn.	4, 6 &14
Department of the Environment, Heritage and Local Government (Nature Conservation)	All survey vessels should take care to avoid breeding bird sites at Lambay Island during the summer months.	4, 6 &14
Central Fisheries Board	Desirable to avoid the option of using Rogerstown Estuary, given boating use, nature reserve status for birds,	4

Consultee	Issue	Section of Environmental Report
	and surveillance monitoring for Water Framework Directive	
Central Fisheries Board	Desk-study on potential impacts of electromagnetic radiation on fish and benthic invertebrates is desirable	4 & 6
Eastern Regional Fisheries Board	All proposed works must be designed and implemented in accordance with best international practice in an environmentally sound and sustainable manner	4 & 14

3.3 Consultation

In addition to the consultees who have been asked for their comments on the scoping/screening report, non-statutory consultees and organisations have also been consulted. From autumn 2007, information was provided on the cable route survey and comments sought on the survey proposals. EirGrid has continued to exchange information with those who wished to be kept informed of project progress.

The main response to aspects of the EWI installation and operation is provided in Table 3.2, together with reference to the section of this report that provides information on issue raised.

Table 3.2: Non-statutory consultees responses

Consultee	Issue	Section of Environmental Report
Irish Whale and Dolphin Group	Provided information on abundance of cetaceans in vicinity of interconnector route. Suggested that if blasting, rock breaking or drilling were proposed in the landfall areas, an exclusion zone for the protection of marine mammals should be established	6

In addition to consultation by letter and telephone, meetings are being held on an ongoing basis with statutory consultees and other groups and individuals who have expressed an interest in the project.

3.4 Assumptions and Technical Difficulties

The information contained in this ER has been drawn from existing literature, project-specific documentation, personal communications with local experts and site-specific surveys and studies. Every effort has been made to obtain data concerning the existing environment and to accurately predict the effect of the proposed development. Assumptions adopted in the evaluation of impacts are reported in the relevant sections. Where necessary, these assumptions are implicit, relying on expert judgement. Where technical deficiencies are known, or it has been necessary to make assumptions, these are documented.

3.5 Desk-based Assessment and Field Surveys

A number of studies and surveys have been carried out to gather environmental and engineering information for the project, including:

- Ecological desk-based studies;
- Intertidal ecological surveys, and seabed photography;
- Desk based review of EMF;
- Geophysical/geotechnical survey;
- Archaeological desk-based assessment;
- Desk-based landscape assessment;
- Desk-based noise assessment
- Desk-based air assessment;
- Desk-based water movement and quality assessment;
- Desk-based shipping and navigation assessment; and
- Desk-based commercial fishing assessment

More information on these and other studies is given in the appropriate chapters of the ER.

The data collected throughout these assessments and surveys have been used to define the baseline conditions – against which impacts have been measured and predicted, helping to define the mitigation measures required.

3.6 Assessment Methodology

3.6.1 Identification and Assessment of Impacts

The prediction and evaluation of the likely significant impacts of the EWI are the main focus of the ER. There are two main stages in impact assessment:

- Characterisation of the impact, i.e. a description of the changes that may arise as a result of the cable; and
- Assessment of the significance of the impact upon various aspects of the receiving environment, based on the characteristics of the impact and the receptor's sensitivity.

Published best practice guidelines have been used, where available and appropriate, including those published by the Institute of Environmental Management and Assessment, the Institute of Ecology and Environmental Management and the Institute of Field Archaeologists. More information on this guidance is given in the relevant chapters.

3.6.2 Evaluation of Significance

The evaluation of the significance of an impact is important. It is the significance that determines the resources, which should be applied in avoiding or mitigating an adverse impact, or the actual value of a positive impact. Furthermore, the combined significance of the various mitigated impacts determines the overall environmental acceptability of a project.

This report provides a description of the potential impacts and identifies suitable mitigation measures to avoid, reduce or remediate the environmental effects, so that they are as low as reasonably practicable. The assessment of the significance of the impacts has been carried out subsequently on the residual impacts, i.e. those remaining after mitigation.

Determining the significance of environmental impacts is one of the most contentious parts of the assessment process, involving value judgements and personal, expert interpretations about whether, and to what extent, a proposal is environmentally significant. For some aspects, it is notoriously difficult to attach levels of significance to potential impacts, as a large number of factors can influence judgements, including:

- The character of the receiving environment;
- The nature, magnitude and duration of the impact;
- The resilience of the affected environment;
- The confidence in the predicted impacts;
- The potential for mitigation along with the level of public concern and knowledge of the issue; and
- The perceptions and personal experience of the assessor.

Problems arise when inherent judgements made about significance lack transparency. Efforts have therefore been made throughout this ER to ensure that criteria and standards of significance have been documented and the level of certainty of data recorded.

The methodology adopted for this evaluation has been developed after a review of current best practice in this area. The assessment considers the sensitivity/importance of the receptor and magnitude/scale of change, which is likely to occur in the receiving environment after mitigation.

Difficulties arise in impact assessment when specifying a single range of criteria. For example, comparing the impacts of the development on a migratory bird will need a separate set of criteria to that of a trawlerman who needs to change his transit route to avoid the cable-lay vessel. This ER has therefore presented and explained within each relevant section the criteria that have been applied. Figure 3.1 shows how these two sets of criteria link together to define the significance of the predicted impact.

The threshold for significant impacts (where monitoring measures are proposed to determine the extent of the impact, the duration and rate of the recovery) occurs where residual impacts are considered significant or very significant. Alternatively, monitoring may be proposed to aid future understanding of the impact on the environment.

The above approach provides the broad framework within which each technical assessment for the development has been made. However, the criteria used to define magnitude and sensitivity varies from one environmental aspect to another and so, where relevant, each chapter details the individual approach taken.

3.6.3 Approach to Mitigation

Most mitigation measures will be incorporated in the design, rather than as ‘add-on’ measures to ameliorate significant environmental effects. The evolution of the design, therefore, is reported clearly in the ER, including the rationale behind the preferred choice of development design.

All other measures proposed as mitigation for the development will be reported within the relevant section of the ER. The mechanism by which these measures will be carried through and implemented on site will also be made clear.

A widely accepted strategy for mitigation exists and has been followed when considering the methods of dealing with the environmental impacts of the EWI. The strategy comprises the components listed in Table 3.3.

Table 3.3: Mitigation strategy

Avoidance	Where viable the project has been redesigned to avoid impacts. This was also considered during the assessment of alternative sites
Reduction	Reduction has been considered when all options for the avoidance of impacts has been exhausted or deemed to be impractical, for example, by considering different building alignments to reduce visual impact
Compensation	Where the potential for avoiding and reducing impacts has been exhausted, consideration has been given to compensating for residual impacts to make the proposal more environmentally acceptable
Remediation	Where adverse effects are unavoidable, consideration has been given to limit the level of impact by undertaking remedial work.
Enhancement	In addition to reducing any adverse impacts, consideration has been given to providing the opportunity for environmental improvement.

3.6.4 Assessment of the Significance of Residual Impacts

Any impact remaining after mitigation is the residual impact. An assessment has been made of the significance of residual impacts, based on the characteristics of the impact and the receptors' importance and/or sensitivity, using professional judgement and relevant standards and criteria, where available. Impacts considered include short medium and long-term impacts of direct, indirect, or secondary nature. Further details of the criteria used to assess significance are given in the relevant sections.

3.6.5 Cumulative and Transboundary Effects

While a single activity may itself result in a minor or acceptable impact, it may, when combined with other impacts (minor or significant) in the same geographical area, and occurring at the same time, result in a cumulative impact that is collectively significant. Where relevant, potential cumulative impacts have therefore been considered. Chapter 14 provides an assessment of cumulative impacts for each of the different environmental aspects covered in chapters 6–13.

Chapter 14 also provides a summary of the issues related to transboundary effects, and summarises the potential for such effects on various features of the environment.

4 DESCRIPTION OF THE DEVELOPMENT AND ALTERNATIVES CONSIDERED

This chapter describes the elements of the EWI project that are the subject of this environmental report and the alternatives that were considered in defining the proposed project. While providing a description of the facilities and installation methods, the chapter also focuses on the activities and emissions that may give rise to environmental impacts. The assessment of the effects of the construction activities is undertaken in the subsequent chapters of this report.

4.1 Alternatives

4.1.1 Introduction

This section reviews the various alternatives that have been considered through the design process, leading to the EWI project being proposed in its present form. In common with other types of linear development, the effect that a cable may have on the environment depends on a number of factors such as route selection, construction methods and cable design. The route chosen is of primary importance in minimising adverse environmental effects. The following major aspects of route development are considered:

- Connections to the Irish and British grids;
- Landfall site locations in Ireland and Britain; and
- Marine interconnector routes.

Section 4.1.2 below summarises the national importance to Ireland of the EW Interconnector cable. Chapter 1 also provides information on the need for the development.

4.1.2 Strategic Alternatives

The development of the EWI forms part of the Republic of Ireland National Development Plan 2007–2013 to promote security of energy supply, competitively priced supply and environmental sustainability targets. It is considered of critical national importance. In strategic terms, the alternatives to security of supply in Ireland have been described in other national reports. This report therefore provides no further review of strategic alternatives.

4.1.3 Grid Connections

While lying outside the scope of the proposed development, selection of a grid connection point partly determines the route of the interconnector.

4.1.3.1 Irish Grid Connections

EirGrid evaluated the potential connection points to the Irish transmission grid for a high-voltage direct current interconnector (HVDC) to Britain. Technical studies were carried out on the strongest (i.e. 400kV and 220kV) grid networks.

In reviewing the alternatives, it was concluded that:

- Dunstown 400kV substation (Co. Kildare) and Woodland 400kV substation, south-east Co. Meath are the strongest potential connection points.
- Woodland is closer to the coast than Dunstown, leading to a shorter underground cable (45km compared with 65km).
- Installing a cable through the Wicklow Mountains National Park (which also has SPA and SAC designations) to Dunstown would potentially create a greater environmental impact than the route to Woodland would.

- The Woodland option also requires a minimum amount of associated transmission grid reinforcement compared with Dunstown.
- On balance, for a given northerly location of the connection point in Wales, the Woodland option also affords a shorter submarine route.

The 400kV substation at Woodland was therefore chosen as the preferred connection point in environmental, technical and economic terms.

4.1.3.2 UK Grid Connections

Investigation of potential connection points in Wales revealed multiple points that could be considered for connection of the EWI. The following areas were investigated for connection in Wales:

- Wylfa – Anglesey, north-west Wales;
- Trawsfynydd 400kV station – Snowdonia, west Wales;
- South Wales;
- Pentir 400kV station – north-west Wales; and
- Deeside 400kV station – north-east Wales.

In considering these five alternatives, a number of constraining factors were noted. Wylfa contains no infrastructure for exporting additional power from the island of Anglesey, so additional infrastructure crossing the Menai Straits would have to be constructed.

Trawsfynydd and Pentir would require circuits traversing Snowdonia National Park, as Trawsfynydd is located within the National Park itself, and use of Pentir would require reinforcement of the circuit between Pentir and Trawsfynydd.

The construction of sufficient additional capacity in South Wales could not be accommodated within the project timescales. This is due to existing connection agreements and progress on reinforcement of the South Wales transmission system.

Therefore, Deeside was selected as the most favourable option from environmental and engineering perspectives.

4.1.4 Landfall Site Locations

Once grid connections had been selected, an assessment was undertaken to identify suitable landfall site locations in the Republic of Ireland and Wales.

4.1.4.1 Potential Landfall Site Locations: Ireland

In considering the suitability of landfall sites, it was necessary to consider a diverse range of onshore and offshore factors, including environmental, engineering and financial issues.

EirGrid considered five landfall sites:

- Portrane;
- Donabate;
- Rush North Beach;
- Rush South Beach (Rogerstown Estuary); and
- Rush harbour.

Donabate is a Blue Flag beach and has high public amenity value of regional importance. Extensive sand dunes behind the beach also make routing to the local road network very difficult. Portrane was discounted due to engineering constraints such as railway crossings and heavily built-up areas around Donabate. For both the Portrane and Donabate options, the land cable would have to be routed through Donabate village, which has very high traffic volumes so would increase the disruption caused during construction.

The remaining landfall location options are depicted in Figure 4.1. Rush harbour was discounted due to geological constraints, and the limited working area available.

Both Rush North and Rush South Beach are considered to be of local amenity importance and were regarded as favourable landing points. Both options offer ready access to the road network inland towards Woodland. However, part of Rush South Beach lies with the Special Protection Area of Rogerstown Estuary, known for its importance to species of birds for feeding and sheltering. Therefore, a landfall at Rush North Beach was selected (53 31.44 N, 06 05.07 W).

4.1.4.2 Potential Landfall Site Locations: UK

Landfall locations along the North Wales coast were considered. Three landfall sites were considered:

- Deeside, close to Deeside 400kV station;
- Point of Ayr; and
- Barkby Beach.

Access to the Deeside transmission station from the River Dee was judged unfavourable, owing to engineering and environmental constraints in the Dee Estuary. Possible cable landfalls close to Deeside are also constrained by the nature conservation designations applicable to the Dee Estuary, which in addition has a narrow tidal channel with dredged approaches.

Point of Ayr is an environmentally sensitive location, although impact could be minimised through horizontal directional drilling. Onshore from a landfall at Point of Ayr, connection with the Deeside 400kV station would require the crossing of environmentally sensitive areas (SAC and SSSI).

Barkby Beach in Prestatyn (53 20.73 N 03 24.11W) is close to Point of Ayr, but outside of the designated sites, and was therefore selected over Point of Ayr and Deeside. Additionally, the Barkby Beach option will require a shorter horizontal directional drill to cross the existing coastal defences.

Options considered at Point of Ayr and Barkby Beach are presented in Figure 4.2.

4.1.5 Marine Route Alternatives

Engineering consultancy JP Kenny investigated feasible routes crossing the Irish Sea between North county Dublin and the Northern coast of Wales. JP Kenny's evaluation of the constraints of alternative landfall locations is incorporated into Section 4.1.4, and considered all known constraints including environmentally sensitive areas, wrecks, geology, maritime restrictions and third-party assets.

In designing the route of the cable between Rush and Barkby, the following key issues were considered:

- Geological constraints:
    - Much of the southern part of the study area is characterised by an extensive sand wave field (see section 12), and the cable should therefore be routed to avoid this area.
    - Pre-quaternary rock outcrops exist on the seabed, from the north-west of Anglesey extending to approximately latitude 53° 39'. The route is therefore located to the north of this area to avoid the need to protect the cable where it is difficult to bury using conventional burial methods (may need to

have rock placement or concrete mattressing for protection from third party (fishing net) damage).

- Navigational constraints – there is a vessel traffic-separation scheme to the north-west of Anglesey; the proposed cable route avoids this separation scheme area.
- Archaeological constraints – there are a number of wrecks that are recorded in the vicinity of the route. The final route will avoid these sites.
- Ecological constraints - Lambay Island near Rush Bay constrains the available routes into the North Dublin coast, owing to its special ecological designation.

The detailed final route will not be determined until very close to the time the cable is laid, and will be subject to some fine adjustments to accommodate local constraints (including the exact location of Biodiversity Action Plan species close to the landfall at Barkby Beach).

4.1.6 Cable Alternatives

A direct current (DC) cable has been selected for use in the EWI project as high-voltage alternating current (HVAC) is not a technology currently used for long distance subsea interconnection of unsynchronised grids. Long undersea cables have high capacitance, which has minimal effects when using DC but results in high losses with AC. DC is ideal for interconnection as it overcomes many issues that AC has with synchronising one independent grid to another grid. DC can also carry more power per conductor than AC.

There are three standard types of insulation used in high voltage cables: cross linked polyethylene (XLPE), mass impregnated normally comprising oil-filled paper (MI), and oil cooled where oil is pumped through the cable providing insulation and cooling. Oil-cooled technology will not be used for the EWI; final design will determine which of the other two options is used. Comparative characteristics of XLPE and MI cables are presented below:

XLPE	- lighter than MI
	- smaller bending radius than MI
	- can have issues in unlikely event of water ingress
	- takes approx. half the time of a MI cable to joint
	- jointing operation requires less space than MI
MI	- proven technology
	- more industry experience than XLPE

4.1.6.1 Electromagnetic fields (EMF)

The flow of electric current within an electrical cable results in the production of electric and magnetic fields. Subsea electricity cables are designed to use either direct current (DC) or alternating current (AC), both of which emit EMF.

In a DC cable, the current flow is relatively constant, which results in a static EMF emission. The design of subsea high voltage DC (HVDC) cables has sufficient shielding to contain the electric field emitted by the cable but the magnetic field is not shielded. Therefore, the magnetic component of the EMF is emitted to the surrounding environment and its intensity depends on the amount of current. Under normal constant load HVDC cables do not induce electric fields in the environment, as would a HVAC cable, owing to the static nature of the magnetic field (Gill *et al.*, 2005).

Subsea HVDC cable systems can be configured in different ways. A monopole system with a cable return has one high voltage cable with a separate lower voltage return cable. A bipole system consists of two high voltage cables, one that has a high positive charge and one that has a high negative charge. In a typical bipole system, it is possible for current to be transmitted even when one cable is not functioning, as the return can be directed to earth/sea. A modified bipole system is one in which the two cables have differing polarities, however it is not possible to transmit the return current to earth/sea.

When a system conducts current through the seawater between two electrodes an electric field will be generated in the environment. The strength of this field will decrease with distance away from the electrode. The maximum electric field will be at the electrode with the field strength dependent on the magnitude of the current and the total electrode surface area. The total area of the electrode will be determined by the material used for construction.

When HVDC cable systems operate using the return current through the sea an electrochemical reaction occurs at the electrodes between ions in the sea water, water molecules and dissolved oxygen. The subsequent products of electrolysis can affect the organisms that may inhabit the area around the electrodes.

The EirGrid interconnector cable will either be a monopole with cable return, or a modified bipole configuration. In either configuration electric fields are not generated during normal operations. However, in the event of a fault developing in a cable, current may momentarily flow to the seawater or seabed before the cable is shut down. Insulating layers of the cable are monitored for the flow of current, and the cable will shut down if current is detected in the insulating layer. Magnetic fields are produced, however these are minimised if the two cables are laid side by side as they effectively cancel each other out.

4.1.7 Construction Alternatives

A general review of the most likely methods that may be used to install the cable is included in the remainder of Chapter 4.

The major alternative being considered is whether the cables should be laid in a bundle or separately. Laying the cables separately would create a wider footprint along the route, but would require less thermal shielding on individual cables. Laying the cables in a bundle will require them to have more thermal shielding, but enables them to be buried together and reduces the EMF produced. The respective EMFs in the individual cables will be of a similar strength to the earth's gravitational field and when in close proximity to each other the two EMFs cancel each other out.

4.2 The Site

The EWI will be laid from converter stations onshore at either end of the cable, then across land in both Wales and Ireland, and through their respective intertidal and sub tidal zones (or landfall zones). This document covers the offshore route between the high water marks in both Wales and Ireland, but focuses on the Irish landfall and Irish section of the Irish Sea only. Figure 1.1 presents a chart showing the proposed route.

It is likely that the construction site for the project will extend beyond this area, as there will be a requirement to locate temporary winches to pull the cable ashore at both ends.

Figure 4.3 shows the proposed alignment of the cable at the Irish landfall.

The subsea route (from high water mark to high water mark) will be approximately 188km in length.

4.3 Outline Description of the Cable and Associated Equipment

Since the earliest installations of submarine cables, design and installation methods have undergone considerable improvement with the latest vessels deploying sophisticated positioning systems (as opposed to manually deployed anchors) and a variety of burial techniques (jetting, ploughing etc) which ensure that cable installation technique selected is appropriate to the type of cable and the seabed conditions. The design details have to be finalised and some variation may be made to the cable and installation methods proposed. However, the description of the proposed installation techniques are based on a worst-case scenario for the purposes of the assessment of environmental effects.

Two HVDC cables will be laid in close proximity to each other within a route corridor of 50m within the intertidal, and a 500m corridor offshore. This 500m corridor will be subject to some restrictions based on proposed exclusions zones for issues such as archaeological potential. The two separate cables allow the transmission of power in either direction forming an electrical loop between Ireland and Wales.

One or two separate fibre optic cables will be laid in the same corridor to assist in the control of the EWI cables. The capacity of these cables will be greater than required for control, and could possibly be utilised for commercial purposes. It is proposed that the smaller diameter fibre-optic cables are bundled with the power cables, although they may be laid alongside.

Depending on the seabed conditions, all cables will be buried below the seabed surface to protect them from accidental damage (typically from trawling or anchors) or movement on the seabed. It is proposed that the cables are buried to a depth of 3m at beaches and shallow waters, 2m out to 8.5km from the coast, and 1.5m for remainder of the subsea route. The burial depth is also influenced by the hardness of the seabed. It is more difficult to achieve target burial depth in a hard seabed; in these areas, a slightly shallower burial depth may be acceptable. Where bedrock cannot be avoided, it may be necessary to lay the cable on the surface and cover it with suitable “armouring” material, such as concrete block, rock protection or “mattresses” over some of the route to protect the cable from scouring by tidal currents.

The offshore cable will be jointed at each end to onshore cable in specially constructed underground transition joint pits (TJP), which are back filled and the surface reinstated when the jointing operation has been completed.

The length of the offshore cable is approximately 188km. The cable carrying capacity of the installation vessels is approximately 70km and therefore 2–3 offshore joints are expected to be required to complete the installation.

4.3.1 Cable Design

Two types of HVDC cable are being considered for the project: mass impregnated cable and extruded (XLPE) (Figure 4.4). Both are similar in size and capable of transmitting the required power levels over 188km.

Figure 4.5 shows the relative sizes of the two power cables to be laid. The main cable will have a diameter of up to 150mm, with a central core of copper and a number of insulating layers and other sheaths around it (Figure 4.6). Depending upon the design, the weight of the cable will be up to 50kg/m. The return cable is of smaller diameter and fibre-optic cables are smaller again. The cables could be laid separately, or bundled.

4.3.2 Joint to Onshore Cable

The marine cable has a slightly different specification to the onshore cable. A transition joint pit (TJP) will be located above high water mark where these two types of cable will be joined. Figure 4.7 shows diagrammatically a typical TJP. The TJP will be constructed using reinforced concrete, approximately 2–3m in depth, up to 15m in length and 3–4m wide.

The length of the TJP may be smaller (8m in length) if the XLPE cable is used, the larger TJP is required to accommodate the mass impregnated cable.

The pit will be backfilled and the surface will be reinstated once the jointing has been completed. There will be no over ground structures associated with the TJP.

4.4 Safety and Emergency Plans

A project health, safety and environmental management system will be implemented for the project in accordance with current legislation and under best practice. A number of management plans and method statements will be produced to ensure that health, safety and environmental considerations are not compromised during construction and operational phases. These plans will ensure that the mitigation measures proposed in the environmental management section of this report and relevant consent conditions are complied with. Detailed method statements and procedures will be provided to the appropriate authorities in advance of construction and operation as required.

4.5 Project Programme

Table 4.1 presents the proposed programme of work for the EWI project through to commissioning and operation. The programme illustrates periods during which the various aspects of the project will take place. However, it should be noted that, in many cases, cable installation work would be completed in less time than the overall periods shown.

The vessel handling the cable can typically install 10km per day. The maximum length of cable held on a reel by the lay-vessel is approximately 70km. Given typical vessel cable-carrying capacities, approximately six transits will be required between the port where the reels are loaded, and the EWI route (three for each cable). These transits will be completed within a six-month period.

To ensure conditions for offshore cable installation are as safe as possible, offshore operations may need to be carried out during the summer months. The exact timing of the landfall works will be dependent upon the offshore works and licensing work permits and conditions that will be designed to limit the potential for impacts on features of conservation interest (more information on ecological seasonality is presented in chapter 6). The landfall construction may be undertaken in the winter months when there will be fewer people using the car park and beach area.

Table 4.1: Indicative schedule of works for marine cable

Activity	Duration (months)	2008				2009				2010				2011				2012	
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Offshore route survey	5																		
Environmental reporting/ compilation of permit applications	6																		
Foreshore licence and planning approval	6																		
Cable manufacture	18																		
Enabling works	24																		
Pre-lay survey, including grapnel run	6																		
Cable Installation	6																		
Commissioning and post-lay survey	6																		
Trial operation	6																		
Operation																		•	

A more detailed description of the duration of the individual cable installation landfall and connection activities is described in the text below.

4.6 Pre-Construction Phase

Engineering design has been undertaken to identify the optimal cable corridor in which the cable can be laid (avoiding subsea features and protected areas). A geophysical and geotechnical survey of the proposed cable route has been completed, providing information required to define the optimum route.

A foreshore licence in Ireland and a Crown Estate licence in the UK were granted for the geophysical and geotechnical survey works. EirGrid complied with consent conditions during the survey, including the use of a marine mammal observer onboard the survey vessel during geophysical survey work.

4.6.1 Subsea Cable Route Clearance

Before cable-laying operations commence, it will be necessary to ensure that the route is free from obstructions such as discarded trawling gear and abandoned cables identified as part of the pre-construction survey.

A survey vessel will be used to clear all such identified debris, in a “pre-lay grapnel run”. A heavy grapnel of approximately 1m width and 1m penetration depth will be towed along the cable route. It is anticipated that this run will take approximately 30 days to complete. Debris retained by the grapnel will be collected on board and disposed of in licensed onshore facilities. Abandoned communications cables will be cut and a section wide enough to accommodate the new cable corridor will be removed. The two exposed ends of communications cable will be weighted to prevent subsequent movement and left on the seabed.

The grapnel will not be deployed within 100m of any live cables or pipelines and will be carried out following close consultation with infrastructure owners and relevant authorities.

A pre-lay survey may be required closer to cable installation to finalise the route.

The cable is routed as far as possible in soft sediments to allow it to be trenched into the seabed. In the event that rock needs to be cleared from the seabed before the cable is laid (and is not removed by the grapnel), some hydraulic removal works may take place. No blasting will take place anywhere on the marine cable route to remove bedrock.

4.7 Construction Phase

4.7.1 Introduction

The marine cable installation will comprise:

- Cable landfall (including enabling works);
- Shallow water operations; and
- Offshore cable lay.

The cable will be buried completely to avoid damage and entanglement with trawling gear and anchors and to minimise the risk of the cable movement on the seabed where there may be a risk of damage due to cable fatigue. The proposed burial depth for the majority of the route is 1.5m; local changes to this depth will be based on seabed conditions and risk of third party interference (i.e. particular types of fishing, or fishing gear).

4.7.2 Cable Landfall

The cable landfall area forms the transition from the terrestrial to the marine environment, and the connection of the marine and land cables (marine cables have additional armouring by comparison with the onshore cables). The cables are joined within a TJP that will be located above the high water mark.

The landfall infrastructure comprises:

- Establishment of site works area;

- TJP;
- Duct installation; and
- Winch or Pulling device .

Figures 4.10 to 4.16 provide schematic drawings of the sequence of landfall construction operations at Rush Bay.

4.7.2.1 Works Area – Rush Bay

During TJP construction and cable jointing, the car park at Rush North beach will be temporarily closed. Access across the beach will be restricted during the period of open cut excavation of the trench and the pull ashore of the cable and subsequent backfilling. Works areas will be appropriately fenced off and warning signs erected. It may be necessary to close Kilbush Lane for brief periods during delivery of landfall construction equipment. A small temporary site office and laydown area will be required close to the car park for the majority of the construction period.

4.7.2.2 Transition Jointing Pit

The TJP will be located in the car park above Rush North Beach (Figure 4.8). Construction will require the temporary closure of the car park (for approximately three weeks during enabled work and further three weeks per cable for pull-in and then for jointing). Concrete slabs will cover the TJP in the intervening period to allow public access to the car park.

Construction of the TJP will involve excavation to a depth of approximately 0.5m below planned base level, using a backhoe digger. Material excavated from the trench will be stockpiled for reuse or removal by truck to an appropriately licensed landfill site.

The TJP sub base will be covered with compacted stone, a blinding layer of lean mix concrete, over which the steel reinforced slab and sides will be constructed *in situ.* Concrete will be brought in pre-mixed, by truck. Any part of the pit that is not occupied by the TJP will be backfilled with any remaining excavated material (if appropriate for this purpose).

The TJP will have cable entry points at either end to allow the offshore HVDC cables and the fibre optic cable to enter it on the seaward side and equivalent onshore cables to exit on the landward side. It will also contain access points for any future maintenance works. Once construction and jointing work is completed in the TJP, the car park will be reinstated.

TJP construction will involve a team of six personnel, using hand tools, a backhoe excavator and trucks to take excavated material away. Deliveries will include material for constructing the base and walls of the TJP, and ready-mix concrete trucks.

4.7.2.3 Duct Installation

There are several options for cable installation across the intertidal and beach areas that involve the use of cable duct pipes at Rush Beach, and one option that will not require installation of ducts. Variations on the two bulleted options described below are also possible. Duct pipes are likely to be constructed of polyethylene (PE). The options are as follows:

- Installation of short duct from the TJP onto the upper foreshore,

In the event that a mass impregnated cable is selected for the project, the TJP will need to be constructed parallel to the beach, rather than towards it. The cable will then need to be bent around on its approach so that it enters the TJP from the south. Installation of sleeves that have pre-formed bends may take place to ensure that the cable is retained in the correct curvature. A short duct may also be installed in the event that the XLPE cable is selected to ensure that the bend in the cable from below beach level up to the height of the car park is maintained. There may be a requirement to embed conduits in concrete to ensure they remain in position during, and subsequent to, cable pull-in. It is anticipated that installation of short conduits would require the use of a backhoe for around one week.

- Installation of longer duct from TJP to lower foreshore

For either orientation of the TJP, ducts may be installed from the TJP through to the lower part of the intertidal area. In this event, the ducts would be constructed to enable the cable pull operation to be carried out more rapidly, or to enable a scheduled delay between installation of the TJP and the major foreshore works, and the cable pull-in.

For either of the above options, the ducts would be installed using an open-cut technique, requiring the presence of a number of excavators on the beach. Where existing rock armouring is present around the high water mark at North Beach (Figure 4.9), this will need to be removed temporarily for a short period during the duct installation works, anticipated to last overall for between one and three weeks depending on construction method. It is envisaged that two or three ducts will be installed, if a third duct is installed it will carry the fibre optic cable(s) separately, and be of much smaller diameter. The ducts for the cables will be up to 400mm in diameter and can be laid in a single trench; the trench base will need to be up to 3m wide.

Length and depth of the ducts will take into account geotechnical properties of the soil in the area and be designed to mitigate risk of exposure. The seaward end of the ducts would be sealed, and contain a connection wire that runs internally from the TJP to allow future jointing.

It is estimated that excavation of a trench from the TJP to the low shore areas would involve the use of three extended-reach backhoes for a period of up to two weeks.

- Installation of cables without ducts

It is possible that the landfall could be constructed without the requirement for ducts. In this case, the cables will be laid in open-cut trenches. Trenches would be backfilled with native material after cable lay. This option is likely to require the use of three backhoes for around three weeks.

4.7.2.4 Winch or Pulling Device

To pull the cables from the vessel into the ducts, or directly into the open cut trench, and onwards to the TJP, a winch will be required. This is likely to be stationed in the car park beyond the TJP. A hauling wire or rope will be pre-installed in each duct into which the cable will be connected as it leaves the cable-lay vessel, and the other end of this wire will be connected through the sleeve to the winch. If no ducts are installed, a wire will be attached directly from the winch to the cables as they come off the vessel. It is expected that this winch will be present on the site for up to 14 days, including preparatory works. A typical winch for this purpose will weigh around 20 tonnes and may be a double drum capstan winch with a separate reel winder for the wire. The winch will be driven hydraulically and powered by electricity or diesel motors.

4.7.3 Landing Operations

For the cable landing operation, a vessel capable of operating in shallow water will be used. This may be the same vessel that will be used for the main offshore cable-lay operations.

Duct option

Prior to the cable landing operation, the seaward end of the pre-installed ducts will be exposed using an excavator or divers, depending on water level and tidal conditions. A trench will be dug from the end of the duct towards the low water mark, and running gear such as rollers will be installed in the trench to guide the cable hauling lines, and the cable. The cable will be pulled from the cable-lay vessel. As it is pulled from the vessel, floats may be attached to it to enable it to stay on the water surface, making it easier to pull. When the cable reaches the water's edge, floats will be removed and it will be pulled over the running blocks, into the duct and onwards to the TJP.

Once a sufficient length of cable has been pulled into the TJP, the running blocks will be removed, the ducts and their seaward ends will be sealed and the area around the ends of the conduits will be backfilled with excavated material. Excavated material will be sorted so that the top sandy layers are replaced at the surface during backfilling. Any beach sand not backfilled as a result will be distributed evenly over the adjacent beach by excavators for gradual dispersion by natural sedimentary processes. It is anticipated that two backhoes would be required for a period of around two weeks to carry out the excavation and beach reinstatement work for the longer pre-installed duct option. The ducts may be filled with bentonite slurry on completion of cable pulling to dissipate heat effectively. The bentonite slurry will be mixed onshore and pumped into the ducts from the onshore end.

There will be a short length of cable that remains on the sediment surface (between the low water mark and the end of the conduits). This length of cable will be buried using a trenching or jetting device deployed from the cable-lay vessel.

Depending on the specific properties of the substrate on-site, it may be necessary to use engineered sand (i.e. graded sand with specific thermal properties) at the bottom of the cable trench to enhance heat transfer away from the cables.

If installed ducts are relatively short (terminating a short distance from the car park), construction of the remaining trench (down to near low water mark) could take up to three weeks to complete with three backhoes.

Non-duct option

There are two options for the non-duct type of installation, although it is likely that a combination of both will be used:

- The first option is for the cable to be pulled from the lay vessel by a winch located above the TJP. The lay vessel can be located close to the shore, but will not need to be grounded. The cable can be pulled from the vessel at high water and floated ashore, using floats to keep it on the water surface to reduce drag. The cable is left on the shore after the pull, and burial then takes place with backhoes. A variation of this technique is that the trench is pre-constructed and the cable is floated above the trench and drops into it as the tide falls.

- The second option involves the use of rollers installed up the shore. The cable is again pulled from the cable lay vessel by an onshore winch. However, this need not be carried out at high water. When the cable reaches the exposed sand, it is pulled over the running blocks up to the TJP. It is likely that the running blocks would be installed in a pre-constructed trench, although there is also an option for post-pull burial of the cable.

It is likely that if no ducts are pre-installed, the construction operations will involve both floatation and use of running blocks to varying degrees.

It is anticipated that for either of the non-duct options, the trench required will take around three weeks to complete and fill using three extended-reach backhoes. As there may be two cable installation operations, the whole trench would need to be constructed again when the cable-lay vessel returns to Rush Bay with the second cable, increasing the period of backhoe usage to around six weeks.

4.7.4 Transition Jointing Operations

Once the cables have been pulled into the TJP, a specially designed tent/container will be lowered onto the TJP to allow the joint with the onshore cable to be made. This contains facilities to enable the completion of the joint in all weather conditions. The trailer will sit on the pit for approximately 15 days per cable during which the construction crew will generally work 07:00–19:00 hours to make the joints. However, certain parts of the procedure (such as the application of insulation) may require 24-hour operations.

If the offshore cables are both pulled into the TJP before the onshore cables have been laid into the TJP, the offshore cables may be secured in place and left for a period (the TJP would be covered), the trailer/tent would only then be delivered to site when both onshore and offshore cables had been pulled into the TJP.

The series of schematic diagrams in Figures 4.10 to 4.16 to show the landfall construction sequence.

4.7.5 Shallow Water Cable Burial

It may be the case that a specific shallow-draft vessel will be used for cable-lay operations in the shallow water immediately adjacent to the intertidal landing area.

The shallow-water vessel will either deploy plough or jetting techniques to bury cable as it is laid to the optimal target depths, which have been calculated based on a number of factors including safety and local seabed properties. The trenching device that is deployed for shallow water cable burial will also be used to complete the burial of any cable that remains exposed or only buried to a shallow depth on the lower intertidal area from the landing operations. Once the cable has been buried in the near-shore area, the vessel will move away laying cable to the seabed as it goes.

4.7.6 Offshore Installation Operations

The cable-lay operation will be performed on a 24-hour basis to ensure minimal navigational impact on other users and to maximise efficient use of suitable weather conditions and vessel and equipment time. Notifications will be issued in accordance with statutory procedures to ensure navigational and operational safety. In addition to the installation vessel(s), additional vessels (i.e. guard vessels) will be involved with the operation.

The offshore cable-lay vessel (may be the same vessel as for the shallow water work) will arrive on site with a carousel or turntable loaded with the cable. The cable is transported via cable engines from the carousel or turntable to the part of the ship from where it is to be laid (usually the back). Under tension, it is guided over into the water (and into a plough if burial is simultaneous with lay). It is laid onto the seabed for later burial, or emerges from the plough at a point below the seabed consistent with the specified burial depth.

The cable-lay vessel will be equipped with a ROV and supporting camera equipment. In selected areas, such as at cable and pipeline crossings and close to any boulder areas, the ROV will be used to check the cable touch down position.

The laying supervisor will control the main cable handling equipment parameters, including the payout length and speed, cable tension and angle, and also the navigation and ROV screens for any other touch down monitoring when required.

The cable-lay vessel will have a capacity to carry up to 70km of single cable on a reel onboard. The cable will be reeled out onto the seabed with the end sealed against seawater ingress. Once all the cable on the reel has been laid, the cable-lay vessel will return to the base port used by the cable manufacturer to pick up the next reel of cable. While the cable-lay vessel is in transit to and from port, the end piece of the cable will be sealed and dropped on to the seabed; it is likely that guard vessels will remain *in situ*. It is expected that transits to pick up cable from port could take up to two weeks (per submarine cable joint).

4.7.7 Offshore Cable-jointing and Burial

The cable will be laid straight through from one side of the Irish Sea to the other. The only interruptions to this will be any joints that need to be made at the landfalls or in mid-sea due to the lengths of cable that have been manufactured.

Cable jointing

The reels of main cable will be manufactured in specific lengths that will require jointing together at sea. The number of sections (and therefore joints) required will depend on the capacity of the cable lay vessel. The jointing process is expected to take 3–6 days to complete and while this is taking place the cable vessel may use anchors to hold position. Cable connection will take place on-board the lay-vessel. The cable end that was laid previously on the seabed will be lifted, and once the joint has been made, it is dropped to the seabed and the vessel moves away laying cable from the new reel.

Cable burial

Cables are buried using the technique most suitable for the seabed type in the area. Options are either to simultaneously lay and bury the cable, or use separate vessels whereby one vessel creates a trench into which another vessel lays the cable.

Exact details of the methods to be used will not be known until the final design stage is completed. Although it is optimal to use only a single method, it is likely that the methods used will vary over the cable route. However, the main burial methods of ploughing and trenching are outlined below, and the constraints to their use are listed in Table 4.2.

Ploughs

Figure 4.17 shows a typical displacement plough. Ploughing is used widely, as the technology is relatively simple and – provided the geology, bathymetry and soil mechanics allow – can be used to minimise environmental impacts. There are a number of different types of plough that could be employed to ensure that the cable is buried:

- **Displacement plough**: these create an open V-shaped trench into which the cable is laid. This technique requires high pulling forces, as a large amount of seabed is displaced;

- **Non-displacement plough**: this uses a thin-bladed ploughshare, through which the cable is run; therefore, no open trench is created and minimal disturbance is caused to the seabed. The non-displacement plough has two additional design variations:

    - ***Jetting plough***: this uses water jets to lubricate the blade, and subsequently requires less pull strength to bury cable to the same depth as a conventional share;

    - ***Vibro-plough***: this uses vibration, and is particularly useful in thick clay. This is usually mounted directly on a barge and is therefore only available for shallow (<10m) works.

Trenchers

Should a trencher be selected for use, either of the following options could be employed:

- **Jet trencher:** high-pressure water jets are used to fluidise the seabed below the cable, resulting in the cable sinking to the desired burial depth. These may be deployed either onto a cable that had already been laid or directly as the cable is laid. Jet trenchers are usually sled mounted (and vessel-towed), mounted on ROVs, or mounted on self-propelled tracked vehicles. Jetting devices tend to be used where the seabed is relatively soft. They require high-power generation equipment on the lay or burial vessel. Jetting disrupts the sediment immediately along the cable route.

- **Mechanical trencher:** these are used where the seabed is too hard for the other techniques. They are usually track-mounted and cut a trench, including through bedrock, with moving parts such as a rock-cutting wheel. Trenchers tend to generate high turbidity levels and are subject to a high level of maintenance and repair.

Figure 4.18 shows a typical cable trencher.

Table 4.2: Information on different burial devices

Plough type	Optimal seabed type	Footprint width and backfill method	Limitations
Ploughs			
Displacement	Most, including soft rock	8m; either backfill blades or natural	Only in water >10m depth
Non-displacement (inc. jetting plough)	Most, but sup-optimal in sand	Up to 5m; no trench created	
Non-displacement vibro-plough	Boulder clay	Up to ~5m; no trench	Only in water <10m depth
Jet trencher			
Jet trenchers	Sub-optimal in rocks/ cobbles	~4m; natural backfill	
Mechanical trencher			
Mechanical trencher	All	Up to ~5m; natural backfill	High turbidity.

Pipeline and cable crossings

The cable will cross four existing submarine telecommunications and power cables (Table 4.3). Specialist construction techniques are therefore required to ensure safety and integrity of both the existing and proposed structures. Crossings are made following a formal crossing agreement (CA), which describes rights and responsibilities between the parties. It is likely that cables for the Gwynt Y Mor offshore windfarm off the North Wales coast will be installed before the EWI cables are installed, and that these will also have to be crossed.

Table 4.3: EWI crossing points for existing cables

Cable	Easting (m)	Northing (m)	KP
Hibernia Seg	346970.16	5941811.77	52.06
ESAT 2	345189.24	5941818.69	50.28
Sirius Seg Sth	371720.63	5940788.76	77.19
North Hoyle Cable	467598.48	5912025.91	180.05

The specific design of each crossing will depend on the factors including the content of the CA and local seabed properties. In essence, however, crossings will consist of the following:

- **Survey**: detailed pre-construction survey to determine exact burial depth and location of existing structure;

- **Bridge**: bridging materials (such as rock dump or aggregate) are deposited on the existing structure by a support vessel around two days prior to the main cable lay operation;

- **Crossing**: burial (e.g. by trenching or ploughing) of the main cable lay length will cease at a pre-agreed distance from the crossing. Acoustic markers will be used to accurately define a corridor over the existing structure and to lay the cable over the centreline of this. Once the main cable-lay vessel has cleared the area and re-engaged the burial device to the seabed at a distance from the crossing, burial at the crossing will commence. Burial operations will take place moving away from a point in close proximity to the existing installation to reduce the risk of damage to cables. This is performed by the support vessel jetting in any exposed cable either side of the crossing and then placing rocks or aggregates over the crossing to both stabilise it and ensure safety from trawling and anchors.

Ports and Supply Bases

Vessels will operate from established ports that will also be used as supply bases. Space will be required on the quayside for mobilisation and storage of cable, equipment, mobile offices and associated infrastructure. The construction contractor will determine which ports are required for any local support.

Possible support ports would include Holyhead, Mostyn, Arklow, Dublin, Dun Laoghaire, Liverpool, Belfast, Douglas and Rotterdam. Re-supply will likely take place from the base port used by the cable manufacturer. The contractor will finally determine the support and supply bases.

4.7.8 Post-lay Burial Survey

Following cable burial operations, a geophysical survey will be commissioned to provide information on burial depths throughout the length of the subsea cable. This survey will last for approximately 15 days, and use standard geophysical techniques and possibly remotely operated vehicle (ROV) operations.

4.7.9 Contractors' Responsibilities and Communication

EirGrid will ensure that construction contractors operate within all applicable legislation and relevant industry best practice, and comply with relevant Irish and British standards.

Prior to and during the course of construction, EirGrid will communicate with the local community (e.g. through leaflets and newspaper advertisements) to inform it of the nature of the project, its duration and progress. Suitable channels of communication will be set up to deal with causes of concern and any complaints. This will include engaging a fisheries liaison officer (FLO) to ensure that other marine users are informed of the cable-lay and other vessel movements particularly during the construction operations. The FLO will be responsible for ensuring that operations are notified via the Marine Notices issued by the Maritime and Coastguard Agency in the UK, and Maritime Safety Directorate, Department of Transport.

4.7.10 Emissions

A number of potential installation options are described in the sections above. In order to enable a robust assessment of potential impacts from construction work associated with the EWI project, a series of tables have been compiled (Table 4.4 to Table 4.6) that describe the characteristics of the project upon which the assessment of impacts can be made. Actual assessments are made in chapters 5–13. The tables are based on worst-case scenarios, and therefore any impacts described in chapters 5–13 are likely to be less than described.

4.7.10.1 Landfall

The landfall construction is estimated to take up to 13 weeks, although this will not be continuous and will be undertaken over two or more separate periods comprising:

- one week for TJP construction;

- three weeks for installation of ducts to the lower intertidal area, and closure of the trench;
- two weeks each time the vessel arrived on the shore for each cable to be pulled in; and
- four to five weeks when jointing operations for each cable are taking place in the car park. The TJP will be covered temporarily with slabs during the interim period to enable car access over the pit.

The above scenario is "worst case" and it is expected that actual periods will be shorter than indicated. During these periods there will be increased levels of traffic, which will be generated by deliveries of plant, cement and other materials, and staff vehicle movements. A worst-case estimate is that there will be six construction vehicle movements per day (delivery of plant and materials or removal of spoil using trucks), in addition to staff car movements.

In terms of air emissions, installation of the cable without the use of ducts is likely to produce the largest impact, with a total of 19 "backhoe" weeks required (Table 4.4).

Table 4.4: Number of plant and duration at Rush landfall

Activity	No. Backhoes	No. of Weeks	Total
Construction of TJP	1	1	1
Excavation of trench and installation of cable 1	3	3	9
Excavation of trench and installation of cable 2	3	3	9
Total			19

4.7.10.2 Near Shore and Offshore

There are options for offshore cable installation in terms of simultaneous or separate lay and burial. The vessel air emissions and effluent discharges are affected by the size of the vessels' engines and by the number of days that the vessels spend working on the project. Table 4.5 presents a worst-case estimate of fuel usage for the EWI installation works.

Table 4.5: Estimated usage of fuel from offshore cable installation

Activity	Vessel	Number of days	Fuel consumption per day (m^3)	Total
Grapnel run (30 days per cable)	Survey vessel	60	4	240
Near shore cable lay (1 week at each end of each cable)	Cable lay	28	10	280
Offshore cable lay (20 days per cable)	Cable lay	40	15	600
	Guard vessel	40	3	120
Cable collection transits (2 weeks each, 3 per cable)	Cable lay	84	16	1344
	Guard vessel	84	3	252
Cable burial (15 days per cable)		30	10	300
Cable burial survey	Survey Vessel	15	4	60
Total				3196

Discharge of food waste and black and grey water is estimated based on the number of crew on each vessel, and the number of days the vessels spend at sea. Table 4.6 presents a worst-case estimate of man-days at sea.

Table 4.6: Estimated number of man days at sea from offshore cable installation

Activity	Vessel	Number of days	No. of crew	Total
Grapnel run	Survey vessel	60	15	900
Offshore cable lay	Cable lay	40	50	2000
	Guard vessel	40	5	200
Cable collection transits	Cable lay	84	50	4200
	Guard vessel	84	5	420
Cable burial	Burial vessel	30	40	1200
Cable burial survey	Survey vessel	4	15	60
Total				8980

Cable laying will generate subsea noise from the different specific operations, vessel engine noise and cable burial are likely to be the activities which produce the highest sources of sound. Measurements of subsea cable burial noise are unavailable, but could be considered comparable to dredging operations, for which Nedwell *et al.* (unpublished) have estimated sound levels at source to be 180–190 dB re 1 μPa at 1 m. Noise levels from vessel engines are likely to be approximately the same.

4.8 Commissioning Phase

Commissioning tests will be carried out to verify the operational characteristics of the subsea cable. Typical tests include:

- Continuity tests (HVDC cables);
- Insulation resistance test (HVDC cables);
- Time domain reflectometry (TDR) (HVDC cables);
- DC voltage withstand test (HVDC cables); and
- Test on fibre optic cable.

Each section of the submarine power cable will be tested using specialist equipment (DC mobile test set) onboard the lay vessel to verify its operational capability before and after infield jointing.

4.9 Operational Phase

Under normal circumstances, the cables will operate without any subsea works required. However, some survey work will be required to monitor cable burial. Cable integrity will be monitored remotely from the land to identify any potential faults. Monitoring of integrity will include the following tests:

4.9.1 Routine Maintenance

During the first few years of project operation, a number of tests and surveys will be conducted on an annual basis, these will include:

Insulation resistance test (IR) – to establish whether satisfactory level of insulation exists between the cable conductor and earth.

Time domain reflectometry (TDR) – used to characterise and locate faults in a metal conductor. A TDR transmits a short rise time pulse along the conductor. If the conductor is of uniform impedance and properly terminated, the entire transmitted pulse will be absorbed in the far-end termination and no signal will be reflected toward the TDR. Any impedance discontinuities will cause some of the incident signal to be sent back towards the source. This is similar in principle to radar.

An optical time-domain reflectometer (OTDR) is an opto-electronic instrument used to characterise an optical fibre. An OTDR injects a series of optical pulses into the fibre under test. It also extracts, from the same end of the fibre, light that is scattered and reflected back from points in the fibre where the index of refraction changes.

4.9.2 Survey

While the cable route and burial depth will have been specifically designed to minimise the requirement for regular surveys, some will be necessary. The depth of cable burial will be monitored to ensure that it is not allowed to freespan, and that sediment has not moved such that the cable becomes close enough to the surface to be snagged by fishing gear. Cable burial surveys are likely to entail the use of a survey vessel with one or a combination of divers, ROV and remote cable survey system and side-scan sonar.

4.9.3 Emissions

Air emissions and black and grey water discharges will be much lower for planned operations than they are for the construction phase. Table 4.7 and Table 4.8 present estimates of fuel usage and aquatic discharges based on estimated survey frequency, and sizes of vessels and crew likely to be required for the work. It is likely that annual surveys will take place in the first few years of operation, and this will then reduce in frequency to perhaps one in five years towards the end of planned life (40 years). Fifteen surveys are estimated overall.

Table 4.7: Estimated usage of fuel from offshore cable surveys

Activity	Vessel	Number of days	Fuel consumption per day (m^3)	Total
Side-scan/ROV survey (15 days per annual survey, 15 surveys).	Survey vessel	225	4	900
Total				900

Table 4.8: Estimated number of man days at sea from offshore cable surveys

Activity	Vessel	Number of days	No. of crew	Total
Side-scan/ROV survey (15 days per annual survey, 15 surveys).	Survey Vessel	225	15	3375
Total				3375

4.9.3.1 EMF

Section 4.1.6.1 provides a brief description of why a DC cable has been selected for the EWI project, and of why a magnetic field is produced from operation of a HVDC cable. Configuration of the EirGrid cable could produce a magnetic field that is greater than the earth's magnetic field on the surface of the seabed. However, given the shielding present in the cables and the burial depths proposed, a field of greater strength than background is predicted to extend for a distance of only 5.5m either side of the cable route. If the two HVDC cables are laid closer together than 10m, this field will be reduced, as the magnetic fields produced by each cable (with current running in opposing directions) cancel each other out. No electrical fields will be emitted from the EirGrid HVDC cable.

4.9.3.2 Heat

There are minimal emissions as the cable is subsea buried and surrounded by water, which is sufficient for any heat to be dissipated easily.

4.9.3.3 Noise

No noise will be generated from operation of the cable. However, geophysical survey operations are likely to provide a source of subsea noise, and a marine mammal observer will accompany such operations to ensure that impacts to marine mammals are minimised.

4.9.4 Repair

Towed fishing gear or anchors in rare circumstances cause damage to cables. Should the cable develop a fault, tests will be made on the cable to determine the location of the fault. The tests are non-intrusive, requiring current injections into the cable. Any repair work will require a deep-sea vessel capable of pulling onboard the cable to allow cutting, insertion of cable section and jointing operations on the vessel.

To insert two joints and a cable in a span where cable damage is found would take up to 28 days (7 days for each of 4 joints). Where new cable has been inserted, it will be necessary to place this in a loop on the seabed prior to burial.

It should be noted that there is a limited number of vessels capable of undertaking such repair works, therefore the start of any repair operation could be delayed by a number of weeks or months waiting for a vessel to become available.

4.10 Decommissioning Phase

The EWI will pass through Irish territorial waters, requiring a foreshore lease/licence to be issued by the Department of Agriculture, Fisheries and Food. In UK territorial sea, the EWI will pass through Crown Estate territory, also requiring a lease/licence. Typically, a lease/licence will be from 40 years to 99 years for a power cable. This period generally reflects the perceived economic lifetime of the cable system.

The proposed development has a theoretical design life of 40 years, although a service life of many years more could easily be achieved and refurbishment could also extend this if necessary. In general, it is thought that, given the inert nature of cables, leaving them in place once they are out of service can have less environmental impact than removing them. However, depending on the legislative requirements at the time, in addition to environmental and economic factors, decommissioning options in the future may include recovery and/or dismantling.

Decommissioning of the subsea portion of the cable will be subject to agreement between EirGrid plc, the Minister of Communications, Energy and Natural Resources, DEFRA (MFA) and other appropriate authorities, and be in line with relevant legislation and industry best practice at the time.

5 LANDSCAPE AND VISUAL IMPACT

5.1 Introduction

This chapter comprises a landscape and visual impact assessment of the proposed landfall of an offshore cable together with its onshore, underground transition joint pit (TJP) and includes an appraisal of the following:

Landscape impacts including:

- direct impacts upon specific landscape elements on and adjacent to the work area;
- effects on the overall pattern of the landscape elements that give rise to the landscape character of the site and its surroundings; and
- impacts upon any special interests in and around the site.

Visual impacts:

- direct impacts of the cable work upon views in the landscape; and
- overall impact on visual amenity.

5.2 Study Methodology and Scope of Appraisal

The assessment for land-based development is undertaken in accordance with the document 'Guidelines for Landscape & Visual Impact Assessment 2nd Edition', published in the UK by The Landscape Institute and Institute of Environmental Assessment (2002). However, as this project is being undertaken in a coastal area and is confined to a short section of beach, the landscape appraisal criteria and visual appraisal criteria used have been adapted using guidance included in the 'Guide to Best Practice in Seascape Assessment' document, published by the Marine Institute (2001).

A preliminary desk-based assessment of relevant published information was undertaken followed by more detailed site-specific appraisals.

The principal objectives of the appraisals are:

- to identify and classify the existing landscape likely to be affected by the construction and operation of the proposed development;
- to identify the principal 'visual receptors' with views of the proposed development; and
- to assess the significance of the landscape and visual effect, taking into account the measures proposed to mitigate any impacts identified.

5.3 Baseline Study

Both the landscape and visual assessments include baseline studies that describe, classify and evaluate the existing land/seascape and visual resources, focusing on their sensitivity and ability to accommodate change. The initial study area was set to a radius of approximately 1km from the centre of the site on the basis that, at this distance, this form of development, when seen by the human eye, would be perceptible but would only form an apparent small element in the wider landscape without effecting the overall quality or character of the view. This is descriptive of a magnitude of change that would be assessed as small or less and, when set against a receptor of high or medium sensitivity, would not have 'significant' effects in planning terms.

The following sources of information were obtained or consulted during the course of the assessment:

- Consultations with the client regarding the development proposals;
- Aerial photography;
- Ordnance Survey mapping at 1:10,000, 1:25,000 and 1:50,000 scale; and
- Site photographs to confirm data derived from available mapping and to identify and assess potential impacts.

5.4 Method of Appraisal

The landscape and visual impact appraisals have been made with reference to criteria relating to the sensitivity of the receiving land/seascape and visual receptors, and the magnitude of change associated with the introduction of the proposed scheme into the land/seascape and visual context of the study area. The criteria are summarised below.

5.4.1 Land/Seascape Character Appraisal Criteria

Local land/seascape character has been defined by taking account of landform, hydrology, vegetation, settlement, land use pattern, and cultural and historic features and visual associations between the land, coastal areas and the sea.

Receptor (Landscape) Sensitivity

The overall landscape sensitivity is derived by combining the assessed values attributed to landscape condition, landscape value, character sensitivity and effects on landscape elements and landscape visual sensitivity, to define an overall capacity within the range of high, medium and low. To assist in transparency of the process, Table 5.1 can be used to summarise these combinations.

Table 5.1: Landscape receptor sensitivity

Criteria	Category
HIGH	Low capacity to accommodate change. Natural remote area, steep coastline with sea facing slopes or cliffs extensive views diverse form to coastline. Regional and above planning designations
MEDIUM	Medium capacity to accommodate change. Rural area with some development, variable topography with intermittent sea views with a variable coastline form. Local value or local planning designation
LOW	Large capacity to accommodate change. Developed or urban coastline with flat coastal plain, degraded areas or visual detractors, simple form to coastline. Low value without designation

Since each criterion has a varying weight in its contribution to sensitivity the overall value of capacity is determined by professional judgement.

Magnitude of Change

Magnitude of change has been predicted by considering the anticipated loss or disruption to character forming land/seascape elements (e.g. coastal landform, vegetation, buildings, and watercourses etc.), which would arise through introduction of the proposed scheme.

Table 5.2: Definition of magnitude of landscape impact

Criteria	Category
Large	The proposals would result in a landscape or seascape to be permanently changed or degraded
Medium	The proposals would be out of scale with the character of the area and would result in a noticeable change to a landscape or seascape
Small	The proposals would appear small scale and result in minor change to the landscape or seascape of the area

Significance of Landscape Effects

The significance of the landscape character effects is determined by the assessment of landscape sensitivity set against the magnitude of change as indicated by the matrix in Table 5.3.

Table 5.3: Significance of landscape effects

Magnitude	Sensitivity		
	High	Medium	Low
Large	Major	Major/moderate	Moderate
Medium	Major/moderate	Moderate	Moderate/minor
Small	Moderate/minor	Minor	Negligible

5.4.2 Visual Appraisal Criteria

Receptor (Visual) Sensitivity

The locations from which the proposed development will be visible are known as visual receptors. In accordance with the 'Guidelines for Landscape & Visual Impact Assessment 2nd Edition', for the purposes of the visual appraisal the visual receptors have been graded according to their sensitivity to change against criteria set out in Table 5.4.

Table 5.4: Visual receptor sensitivity

Receptor sensitivity	Description
HIGH	Low capacity to accommodate change. Natural remote area, steep coastline with sea facing slopes or cliffs extensive views diverse form to coastline. Regional and above planning designations
MEDIUM	Medium capacity to accommodate change. Rural area with some development, variable topography with intermittent sea views with a variable coastline form. Local value or local planning designation
LOW	Large capacity to accommodate change. Developed or urban coastline with flat coastal plain, degraded areas or visual detractors, simple form to coastline. Low value without designation

Visual Magnitude of Change

The visibility of the proposals and the magnitude of their change upon a view and the resulting significance of visual effect are dependent on the range of factors already outlined, together with, the angle of the sun, the time of year and weather conditions. In the appraisal, magnitude of change is ranked in accordance with Table 5.5.

Table 5.5: Definition of magnitude of visual impact

Magnitude	Examples
Very Large	The development would result in a dramatic change in the existing view and/or would cause a dramatic change in the quality and/or character of the view. The development would appear large scale and/or form the dominant elements within the overall view and/or may be in full view the observer or receptor. Commanding, controlling the view.
Large	The development would result in a prominent change in the existing view and/or would cause a prominent change in the quality and/or character of the view. The development would form prominent elements within the overall view and/or may be noticed easily by the observer or receptor. Standing out, striking, sharp, unmistakeable, easily seen.
Medium	The development would result in a noticeable change in the existing view and/or would cause a noticeable change in the quality and/or character of the view. The development would form a conspicuous element within the overall view and/or may be readily noticed by the observer or receptor. Noticeable, distinct, catching the eye or attention, clearly visible, well defined, obvious.
Small	The development would result in a perceptible change in the existing view, and/or without affecting the overall quality and/or character of the view. The development would form an apparent small element in the wider landscape that may be missed by the observer or receptor. Visible, evident.

Significance of Visual Effect

The significance of the visual effects is determined by the appraisal of receptor sensitivity set against the magnitude of change as indicated by the matrix in Table 5.6.

Table 5.6: Significance of visual effects

Magnitude	Sensitivity		
	High	Medium	Low
Very large	Severe	Major	Major/moderate
Large	Major	Major/moderate	Moderate
Medium	Major/moderate	Moderate	Moderate/minor
Small	Moderate/minor	Minor	Negligible

5.5 Baseline Conditions

5.5.1 Landscape Character of the Site and Its Surroundings

Rush Bay lies within the Coastal Character Area, described as following in the Fingal County Development Plan: Landscape Character Assessment (Appendix B). The *Coastal Character Area* forms the eastern boundary of the county and contains a number of important beaches, islands and headlands that together create a sensitive and nationally important landscape of high amenity and landscape value. The land is generally low lying, with the exception of some prominent headlands and hills in the northern part of the area, and Howth and the offshore islands which mark the southern and eastern parts of the Coastal Character Area.

Views along the coast are generally contained within headlands, ridgelines, and town ports, creating a number of visual compartments. These are identified as coastal zones on the Landscape Character map in the Development Plan. Rush is designated as Landscape Group 6.

LG6 - Rush

The coastal area around Rush is noted for the extensive horticultural industry and a seaside resort popular with day trippers from adjoining areas. This section of the coast is flatter than the section around Skerries further north and is a link between these more robust coastlines and the lower lying, more subtle landscapes of the Rogerstown, Malahide and Portmarnock estuaries. The area south of Main Street is characterised by multiple horticultural smallholdings that are serviced by a confusing network of small laneways. Development in this area is a mixture of glasshousing, market gardening, caravans, permanent dwellings, seaside huts, chalets and disused plots. There has been considerable residential development in the area in recent years in the form of single homes.

The North Beach area is characterised by caravan parks, wooden chalets/huts and some single permanent dwellings.

As well as a general description of the local landscape character, a further site-specific land/seascape character of its surroundings can be described as follows.

North Rush Beach and Residential Areas

This Blue Flag beach has a shallow gradient inter-tidal zone and soft sand above high water. Mechanical scouring by tractor regularly cleans deposited seaweed on the inter-tidal area. Beyond the beach are low vegetated cliffs with the lower sections protected by large random rock breakwaters.

Above these low cliffs are the northern urban areas of Rush. The local building vernacular is whitewashed houses with small windows and built from mud or rubble walls. The current buildings are however predominantly white, rendered, modern, detached, non-vernacular bungalows or commercial property along with variety of holiday mobile homes set close to the beach edge. These properties are mostly detached within mature gardens and set on narrow lanes amongst a patchwork of small agricultural fields.

Summary of Landscape Sensitivity

The landscape sensitivity of the study area can be assessed against the various criteria values, given to each of the land/seascape character components. In addition, consideration is given to the nature and size of the development. Overall, the area has a large capacity to accommodate such change. It is a developed, urban, simple form coastline with a relatively flat coastal plain and many visual detractors and without formal designation. On this basis, the landscape sensitivity is judged to be low.

5.6 Appraisal of Impacts

This section aims to identify the issues relating to the impacts of the EWI during construction, operation and decommissioning.

The main characteristics of the proposed development that have been considered as part of this appraisal are described below.

5.6.1 Characteristics of the Proposed Development

Landscape and visual impacts will result during the relatively short construction period and potentially the decommissioning phase (if the cable and TJP are removed). As both the cable and TJP will be buried up to 3m deep, no effects are anticipated during the operational stage.

For the purposes of this report, impacts are assessed for the construction phase only and based on the following aspects of the onshore work:

- Site works including excavations of the car park to construct the TJP and trench across the beach;
- Construction activities, including the construction of the TJP and pipe ducts (see 4.7.2.2 and 4.7.2.3 respectively);
- Use of excavators, winches, cement mixers and other machinery;
- Task lighting;
- Cable-laying barge; and
- Site office and storage areas for excavated sand and construction materials.

Further detail of the construction phase are found in section 4.7

It is anticipated that landfall and jointing development works will be constructed in advance of the cable landing operations to reduce interference with the car park and beach during summer months. This work will be split into two or more non-consecutive periods, each lasting for approximately three weeks.

5.6.2 Construction Stage Impacts

Landscape Impacts

The works will include excavation and restoration of parts of the beach to form the cable trenching, temporary removal and reinstatement of a section of stone breakwater and of the existing car park surface (some material excavated from the car park may be removed to licensed landfill site). No removal of other landscape elements such as hedges or trees is anticipated. The excavated material from the trench (sand) will be stockpiled on the beach for short periods. These changes will be out of scale and noticeable, though they will not result in any permanent change to the land/seascape. In accordance with Table 5.2, this would result in a medium magnitude of change.

Consequently, when set against landscape sensitivity assessed as low, the significance of land/seascape effect is moderate/minor and not significant.

Visual Impacts

During the construction period, temporary visual impacts will be evident because of construction operations, including the use of cable barge, excavators, other construction equipment such as task lighting, and excavated, stockpiled beach sand and other materials. The location of site compounds and lay-down areas will be selected to minimise visual impacts.

Due to the land/seascape character, land uses and receptor types in the study area, the planned construction operations will be perceived as an uncommon feature in the local landscape. The sensitivity of the large majority of visual receptors in closest proximity to the proposed construction activities can be classified as high sensitive receptors. These include occupiers of residential properties, users of outdoor recreational facilities, (including public rights of way, beach and coastal paths), whose attention or interest may be focused on the landscape; and holidaymakers where the development will result in temporary changes in the landscape setting. The visual assessment has been undertaken for the two distinct working areas (car park and beach) rather than for any individual viewpoint, or receptor.

Work in the car park area to construct the TJP will benefit from some screening effect provided by adjacent buildings or other structures. Work is also expected to be low key and not dissimilar to construction work related to domestic house building. At long distance, such as the north end of the beach or harbour wall, this part of the construction work would be assessed as a perceptible change in the existing view without affecting the overall quality of the view. Closer distance views would result in a more noticeable change in the quality of the view. This would give a medium magnitude of change.

Work to form the trench across the beach, bringing and pulling the cable onshore and restoring the beach will involve operations that are more extensive, using unfamiliar out-of-scale equipment (cable barge) and creating stockpiles of beach sand.

These operations will have less of a screening effect, as they will occur on the open beach or water. This will result in a prominent change in the existing view and may be noticed easily by the observer or receptor. This part of the construction work would give a large magnitude of change. It should be noted however, that the construction works will be generally confined to Rush Bay and will therefore no impact on the views along the coastal character area (which are generally contained within the headlands, ridgelines and town ports).

As there are receptors with high sensitivity, the significance of visual effect would be major for the cable-laying operations. TJP construction is assessed as having less effect as receptors are major/moderate. However, both ratings of visual effect would be ‘significant’ in planning terms, although temporary in nature.

5.7 Mitigation

As landscape and visual impacts are only expected to arise at construction stage, the most important mitigation measure would be to keep this period as short as possible. However, the sensitive nature of this coastal landscape and visual impact of any proposed development will be carefully considered when undertaking this strategic development. Other mitigation measures to be considered are those that would reduce residual impacts. Such measures would include:

- restoring the car park surface to match the existing;
- reforming the stone breakwater and bank to its present condition using the retained boulders; and
- restoring the sand beach to existing profiles.

5.8 Summary of Residual Impacts

The residual impacts are those that are likely to remain after a period of time following mitigation. For the purposes of this study, they are assessed at one month after scheme completion and take into account the mitigation measures adopted as described above.

Once installed, the cable will be buried under the beach, and the TJP constructed below the existing car park will only have small inspection chamber covers to indicate its presence. Mitigation measures at the end of construction would eliminate any change in magnitude, in terms of both landscape and visual effects.

On this basis, no residual impacts are anticipated from this development.

6 ECOLOGY

6.1 Assessment Methodology

6.1.1 Overview of Activities

Information on ecology was collated from the following two main sources for the offshore cable route and landfall components of the proposed development:

- **Desk-based assessment** (using published data and literature) of the cable route and landfall; and surrounding areas. In addition, a brief desk-based assessment of the potential for impacts from electromagnetic fields (EMF) from HVDC was commissioned by RSK from Dr Andrew Gill of Cranfield University, and;
- **Survey**:
  - **Offshore**: An environmental baseline survey of the entire cable route was commissioned by EirGrid and undertaken by Fugro Survey Ltd on board the R/V *Meridien* between 13 December 2007 and 3 June 2008, which included acquisition of underwater video and still photography. The route surveyed was focused on a 500m route corridor running between Rush (County Dublin) and Barkby Beach, Prestatyn (Wales).
  - **Landfall**: an intertidal walkover survey of the proposed landfall at Rush (North Beach) was undertaken by RSK Environment Ltd on 21 and 22 of July 2008, from the upper intertidal down to the waterline at low water.

6.1.2 Assessment Sensitivity

Having established the existing environmental conditions using the sources described above, the assessment process then aims to determine the significance of any impacts posed during the construction, operation, and decommissioning phases of the project on the biological environment. The general methodology used for the assessment of significance is described in detail in Section 3.

When assessing significance, the magnitude of change and the importance and/or sensitivity of the receptor have been taken into account. The criteria for assessment are presented in Table 6.1 and Table 6.2 below, with Table 6.3 providing the significance.

The specific criteria used to determine the significance of the residual effects (i.e. those remaining after mitigation measures) on the biological environment are presented in this chapter. The threshold for significant impacts, where monitoring measures may be required, is where residual impacts are considered to be significant or very significant, as defined in Table 6.3.

Table 6.1: Magnitude of impact

Magnitude	Description
Large	Substantial adverse changes in an ecosystem or population. Changes are well outside the range of natural variation and unassisted recovery could be protracted
Medium	Moderate adverse changes to an ecosystem or population. Potential for recovery within several years without intervention is likely
Small	Minor adverse changes to an ecosystem or population. Changes might be noticeable, but fall within the range of natural variation
Negligible	Changes in an ecosystem or population that are unlikely to be noticeable (i.e. well within the scope of natural variation)

Table 6.2: Receptor sensitivity

Receptor Sensitivity	Description
High	An internationally designated site or candidate site; or A regularly occurring, nationally significant population of any internationally important species; or A regularly occurring and nationally significant number of an internationally important species during a critical phase of its life cycle
Medium	A nationally designated site; or A viable area of a priority habitat; or A regularly occurring significant population of any nationally important species; or A regularly occurring significant number of a nationally important species during a critical phase of its life cycle
Low	A regionally or locally designated site; or A viable area of a key habitat; or A regularly occurring, locally significant number of a regionally important species during a critical phase in its life cycle; or A non-significant number of a nationally or internationally designated species
Negligible	No site designation, species present common and widespread.

Table 6.3: Significance of impacts

Significance	Description	
Very Significant	Substantial adverse changes in an ecosystem or population, especially an internationally designated site, or to a regularly occurring, nationally significant population of any internationally important species, especially during a critical phase in its life cycle. Changes are well outside the range of natural variation and unassisted recovery could be protracted	*Significant Impacts where monitoring may be required*
Significant	Moderate adverse changes to an ecosystem or population, especially a nationally designated site, or to a regularly occurring regional or county significant population of any nationally important species, especially during a critical phase in its life cycle. Potential for recovery within several years without intervention is likely; however it is recognised that a slight level of impact may remain	
Moderate	Minor adverse changes to an ecosystem or population, especially a regionally or locally designated site, or to a regularly occurring, locally significant number of a regionally important species during a critical phase in its life cycle. Changes might be noticeable, but fall within the range of natural variation. Effects are short-lived, with unassisted recovery occurring in the near term, however it is recognised that a low level of impact may remain	
Slight	Changes in an ecosystem or population that are unlikely to be noticeable (i.e. well within the scope of natural variation)	
None	No detectable change to an ecosystem or population	

6.2 Scope of the Assessment

This section covers the ecology of marine (subtidal) and intertidal sections of the Irish section of the EWI only. “Intertidal” is used within this document to mean the area between the mean high water (MHW) and mean low water (MLW) marks. This section therefore encompasses the area stretching from the MHW mark in Ireland to the median line between Irish and British waters.

This document excludes all onshore (terrestrial, i.e. landward of the MHW mark) components, which are covered in a separate environmental report.

In response to the scoping document issued to statutory consultees, the main concern in terms of potential impacts to ecology was the construction phase of the project. More specifically, the following aspects were raised:

- Potential impacts on fish, particularly migratory species (salmon and trout) and those of conservation importance;
- Potential impacts from disturbance by vessels and/or landfall operations to breeding seals, cetaceans and birds (both breeding seabirds and overwintering waders) in adjacent areas; and
- Potential impacts on any nationally important habitats on the shore and offshore.

These issues are addressed in some detail below, while other issues considered of lesser significance (e.g. plankton) are examined in less detail.

6.3 Baseline Conditions

6.3.1 Plankton

Plankton is a collection of organisms that live in the water column, drifting passively in water currents. The organisms comprise animals (zooplankton) and plants (phytoplankton). Plankton distribution and abundance is influenced heavily by physical factors such as nutrient availability, stratification and mixing.

Plankton is of great ecological importance given its contribution to higher trophic levels, such as fish and benthic invertebrates. In addition, many species of commercial fish have planktonic, or partially planktonic, eggs and/or larvae.

In temperate continental shelf seas diatoms and dinoflagellates dominate the phytoplankton assemblage. Zooplankton is typically dominated by copepods such as *Calanus finmarchicus*, *Pseudocalanus elongates* and *Paracalanus parvus*. Maximum densities of zooplankton are found in late spring and early summer in the surface layers of the western Irish Sea. The peak concentrations tend to occur approximately one month after the peak phytoplankton concentrations.

6.3.2 Benthic Invertebrates

6.3.2.1 Data Review

Benthic organisms are those that inhabit the seabed, comprising infauna (those living in or burrowing beneath the sediment) and epifauna (living on the sediment or rock surfaces). Diversity and abundance of benthos varies as a consequence of physical factors such as water depth, and sediment characteristics, of which particle size and organic content are key variables. Certain species of benthic invertebrates associate with each other, forming recognisable groupings or communities. Benthic communities in the Irish Sea have been mapped by Mackie (1990), based on sampling of the infauna. In addition, Ellis *et al.* (2000) sampled numerous stations across the Irish Sea using beam trawls to determine the demersal assemblages (fish and invertebrates associated with the seabed, including epifauna) present. Information from both of these sources is presented in Figure 6.1, which clearly indicates that a number of habitats are traversed.

Infaunal communities crossed by the EWI cable route are as follows.

The Shallow *Venus* community, which occurs in shallow (5–40m) near-shore high-energy sands, is often regarded as having two sub-communities: the *Tellina* sub-community (in fine stable sands; typical species include the bivalve *Fabulina fabula* and polychaete *Magelona mirabilis*) and the *Spisula* sub-community (medium to coarse sands; including the bivalve *Spisula elliptica* and polychaete *Nephtys cirrosa)*.

The *Abra* community also occurs inshore in small pockets in shallow (5–30m) near-shore muddy sands/muds with rich organic contents. Typical species include the bivalve *Abra alba* and polychaete worm *Pectinaria koreni*.

The Deep *Venus* community occurs in coarse sand/gravel shell sediments at moderate depths (40–100m), characterised by species such as the sea urchin *Spatangus purpureus*, and bivalves *Glycymeris*, *Astarte sulcata* and *Venus* spp.

The *Brissopsis* community occurs in offshore muds at shallow to moderate depth (15–100m). Typical species include the urchin *Brissopsis lyrifera* and the brittlestar *Amphiura chiajei*, and this community coincides with the area of *Nephrops* fisheries.

According to *Ellis et al*. (2000), the *Pleuronectes-Limanda* demersal assemblage was recorded in Irish inshore waters relatively close to the cable route. This assemblage is dominated by flatfish (plaice, dab, Dover sole *Solea solea* and solenette *Buglossidium luteum*) and starfish *Asterias rubens* and *Astropecten irregularis.*

In the main offshore section of the proposed cable route (St George's Channel), the *Echinus-Crossaster* and the *Nephrops-Glyptocephalus* assemblages may also be present. This latter community is characterised by a flatfish (witch, *Glyptocephalus cynoglossus*), Norway lobster (*Nephrops norvegicus*), edible crab (*Cancer pagurus*) and red whelk (*Neptunea antiqua*).

As part of the SensMap project, EcoServe (2000) performed a survey of the regional coastline, including the proposed landfall beach and adjacent shallow subtidal, which was surveyed in July 1999. These biotopes were mapped according to (Connor *et al*., 1997a, b), and are presented in Figure 6.2.

Figure 6.2 shows that the proposed cable route passes through the "barren sand" biotope on the upper intertidal, with some this area covered by strandline algae, with associated talitrid amphipods. The remainder of the intertidal along the cable route then consists of a clean sand shore with an amphipod and polychaete fauna, with lugworm *Arenicola marina* often conspicuous. At the subtidal, the habitat changes to one characterised by the heart urchin *Echinocardium cordatum*, and razor clam *Ensis* spp. The greater diversity of biotopes in the rocky area to the east and south-east of the proposed cable route is clearly evident.

Baseline intertidal survey

The intertidal walkover survey over the cable landfall corridor in July 2008 recorded only those species and habitats typical of a sandy beach on the east coast of Ireland, and did not record any of particular conservation interest. Results were very similar to that recorded by EcoServe in 1999 (Figure 6.2). Figure 6.3 shows a view down shore from the upper intertidal, looking along the proposed cable route.

The terrestrial environment changed rapidly into the intertidal on the slope down the bank from the car park, which included rock armouring. Here, vegetation on the beach side was dominated by maritime grass (*Spartina* sp.). Below this, the beach was characterised by a 15m-wide band of fine, dry, barren sand with no signs of fauna; the small amount of dried algae on the strandline here did not contain any visible amphipod crustaceans. The upper limit of the next zone was marked by a recent strandline (comprising dried fucoids, dead *Mytilus* shells, dried *Flustra foliacea*, and occasional lumps of coal and plastics). This zone, which continued approximately 30m down-slope from the previous zone, was freely draining. It comprised sand with shell fragments and small stones, covered by dead drift algae on the seaward side of this zone (*Ulva lactuca* and *Enteromorpha* sp.). No visible fauna was recorded.

This zone ended with a distinct change of topography to flat, rippled, poorly draining medium sand. This was notable in the presence of dense lugworm *Arenicola marina* casts. Sieving of sediment also recorded several banded wedge shells *Donax vittatus* (a bivalve mollusc), and standing water here contained abundant crangonid shrimp and rare juvenile shore crab *Carcinus maenas*. A single periwinkle *Littorina littorea* was recorded on one of the rare boulders (otherwise devoid of fauna) on the beach here.

Seaward of this zone, conditions changed only slightly to give more variable beach topography (such as slightly elevated sandbars), and less dense lugworm casts, with no other visible fauna. Sediment here was medium sand, which was anoxic at around 15cm depth; this habitat did not change appreciably for a distance of around 200m. The border of this zone and the most seaward of the zones was marked by a band of more gravelly sediment, before going into rippled sand with abundant sand mason worm *Lanice conchilega* (Figure 6.4) and lugworm; a single small polychaete (probably *Nereis* sp.) was also recorded from sieving. This zone extended to the waterline when the beach was surveyed on a low water of 0.5–0.7m above CD. Within 100m of this was a small rock island that could not be accessed, was exposed only at low tide and apparently vegetated with oarweed *Laminaria digitatum*.

To the east and south of the intertidal cable corridor on Rush North Beach, an extensive rock platform is present. Although this is outside the cable landfall corridor, the area where it bordered the beach was surveyed briefly. While no protected or rare species or habitats were recorded, it was found to be of some nature conservation interest, comprising a relatively rich diversity of species and habitats. Flora was dominated by a thick overgrowth of the serrated wrack *Fucus serratus* (with some bladder wrack *F. vesiculosus* also present), along with patches of sea lettuce *Ulva lactuca* and gutweed *Enteromorpha* species; oarweed *Laminaria digitata* was also recorded in rockpools.

Fauna recorded in this area included polychaete worms (keel worm *Pomatoceros* sp.; scale worm, Polynoidae) molluscs (common limpet *Patella vulgata;* chiton, Polyplacophora, winkle *Littorina* sp., dog whelk *Nucella lapillus*, edible mussel *Mytilus edulis*); crustaceans (barnacles, Balanomorpha; amphipod shrimps, Gammaridea; hermit crab, Paguridae; shore crab *Carcinus maenas*), echinoderms (brittlestar, probably *Ophiothrix fragilis*) and fish (butterfish *Pholis gunnellus*).

Baseline subtidal survey

The spring 2008 environmental baseline survey involved the acquisition of underwater video and still photography. A summary of the survey results is discussed below.

Description of communities is largely limited to assessment of visible epifauna from photography. In general, these communities were restricted to coarser sediments, and were dominated by colonial species such as *A. digitatum* (dead men's fingers), horn wrack (*Flustra foliacea*), Ross coral *Pentapora fascialis* and several species of sponge. In coarse sediment areas, starfish were prominent: *A. rubens* was common, while other species (*C. papposus*, *Henricia oculata* and *Luidia ciliaris)* were also occasionally recorded. In certain coarse sediment areas, dense beds of the brittlestar *Ophiothrix fragilis* were also observed; these can be important areas for benthic productivity and as feeding grounds for fish, including commercial species.

A small number of epifaunal taxa associated with finer sediment areas were recorded, such as the sea pen *Virgularia mirabilis*, hermit crabs (order Paguroidea), brittlestars (*Ophiura* sp. and *Amphiura* sp.) and occasionally the heart urchin *Spatangus purpureus*.

Based on seabed photography and examination of sediment collected by grab, fauna in the silt and clay habitats appeared polychaete dominated, with high densities of terrebellomorphs recorded from some areas and the errant predators *Nephtys* sp. and *Glycera* sp. seen throughout these habitat types. Also prominent, if less evenly distributed within the silt and clay habitats were spatangoid urchins (predominantly *Brissopsis lyrifera*), the langoustine *Nephrops norvegicus* (also known as scampi or Dublin Bay prawns) and the crab *Goneplax rhomboides*.

In coarser sediments, polychaetes again appeared dominant, with both *Nephtys* and *Glycera* again being recorded along with tubicolous species such as *Chaetopterus variopedatus* and *Lanice conchilega*. Alongside the polychaetes there appeared to be a reasonably diverse range of molluscs (such as the dog cockle *Glycymeris glycymeris*, the tellin *Abra prismatica* and nut shells *Nucula* sp.) and amphipod crustaceans.

Benthic communities of conservation interest

No benthic communities of particular conservation interest (such as those associated with biogenic reefs formed by species such as *Sabellaria* or *Modiolus*) were recorded in Irish waters based on initial results from Fugro's environmental sampling work.

6.3.3 Fish and Shellfish

Information on the commercial fisheries operating in the area of the proposed cable route is provided in Chapter 12, which by its nature includes some information on those species present.

Diversity and abundance

Beam trawl surveys conducted throughout the Irish Sea from 1993 to 2001 (Parker-Humphreys, 2004) provide valuable information on the diversity and relative abundance of demersal fish species over the area of the proposed EWI cable route. The most common species included:

- **Commercial flatfish:** plaice *Pleuronectes platessa*, sole *Solea solea*, dab *Limanda limanda,* lemon sole *Microstomus kitt*;
- **Commercial roundfish**: cod *Gadus morhua*, whiting *Merlangius merlangus*, monkfish *Lophius piscatorius*;
- **Elasmobranchs (sharks and rays):** lesser spotted dogfish *Scyliorhinus canicula*, thornback ray *Raja clavata* and spotted ray *Raja montagui*;
- **Non-commercial fish**: poor cod *Trisopterus minutus*, bib *T. luscus*, scaldfish *Arnoglossus laterna*, common dragonet *Callionymus lyra*, gurnards (Triglidae sp.), pogge *Agonus cataphractus*, lesser weever *Echiichthys vipera.*

The summer 2008 environmental baseline survey recorded a small number of fish from underwater photography along the cable route. The included gobies (Gobiidae indet.), flatfish (probably plaice or dab) on finer sediment, and dogfish (*S. canicula*) and red gurnard (*Aspitrigla cuculus*) in coarser offshore grounds.

In addition to these more common species, a number of species of nature conservation interest have been recorded from the area, including the basking shark *Cetorhinus maximus*, which is more common in the western Irish Sea, and sunfish *Mola mola*.

The Central Fisheries Board sampled a number of estuaries in Ireland in 2006, the nearest of which was inner Dundalk Bay approximately 55km to the north of the proposed landfall. This site was sampled in September 2006 and although some distance away, it is likely to reflect the fish diversity found at the landfall location. The intertidal area was dominated by flatfish (principally plaice and flounder), with significant catches of juvenile flatfish. Lesser sandeel, dab and sprats were common in the shallow subtidal (Central Fisheries Board, 2008).

Angling data from the Eastern Regional Fisheries Board provide useful location-specific information on those species expected inshore around the area of the proposed Irish landfall. In the shallow intertidal and/or estuary areas, sandeel, mullet and flatfish are known, with the North Beach at Rush being known for its bass fishing. Further offshore, a wide range of species are expected from sand, mixed and reef bottoms, including elasmobranchs (spurdog, rays, dogfish, occasional tope), whitefish (e.g. cod, whiting) and other species (Eastern Regional Fisheries Board, 2006).

Spawning and nursery grounds

Data on seasonal fish sensitivity in the Irish Sea were summarised by Coull *et al*. (1998) for a range of commercial fish species, including information on spawning and nursery areas. These data are presented in Table 6.4.

Table 6.4: Spawning sensitivities of commercial fisheries species in Irish waters along the proposed cable route (source: Coull *et al*., 1998)

Species	Spawning location	Period
Cod	Landfall/inshore	January–April
Plaice	Offshore (St George's Channel)	December–March
Lemon sole	Inshore and offshore	April–September
Sprat	Inshore and offshore	May–August
Nephrops	Offshore	January–December (peak in April–June)

Coull *et al.* (1998) also provide information on the distribution of nursery areas of commercial fisheries species. In Irish waters, herring, cod, haddock, whiting and lemon sole use more inshore waters, while *Nephrops* utilise nursery grounds further offshore.

Migratory and protected fish

All the three species of lampreys (Petromyzonidae) that occur in Ireland are listed under Annex II of the EC Habitats Directive, and Kelly and King (2001) summarised their distribution in Irish waters. While the brook lamprey *Lampetra planeri* is recorded from the Boyne and Liffey catchments (to the north and south of the landfall, respectively), this species is exclusively found in freshwater. The river lamprey *Lampetra fluviatilis,* which is anadromous (i.e. uses coastal/marine habitat and then ascends rivers to spawn), are the least widely reported of the three species in Ireland, although it is recorded from the lower Boyne river to the north, contributing to its SAC status. The sea lamprey *Petromyzon marinus* is also anadromous and this species is more widely distributed in Ireland, although it is not recorded in the Boyne or the Liffey catchments (Kelly and King, 2001). Shad are related to herring, and are also anadromous; both the allis *Alosa alosa* and twaite shad *A. fallax* occur in Ireland and are designated as Annex II species. Four SACs in Ireland have been designated based on their importance to shad, although these are all in the south of the country (King and Roche, 2008); shad are apparently not known as being regularly recorded in the area of the proposed cable route. The smelt *Osmerus eperlanus*, an anadromous Irish Red Data book species, has not apparently been recorded from the east coast of the Republic of Ireland (Quigley *et al*., 2004).

Both salmon (*Salmo salar,* an EC Habitats Directive Annex II species) and sea trout (*Salmo trutta*) are anadromous and occur in rivers and coastal waters throughout Ireland. Both species are of great importance to recreational and commercial fisheries. The inshore areas of the proposed cable route are likely to be used by both species, given that important rivers exist relatively nearby: for example, the River Boyne, to the north of the proposed cable route, is designated an SAC partly based on the presence of salmon and is renowned as a salmon and sea trout fishing river.

6.3.4 *Birds*

In relation to the proposed EWI cable route and landfall, two distinct groups of birds can be considered as relevant:

- **Onshore birds**: comprising those species that feed on benthic flora and fauna in the shallow intertidal, such as waders and wildfowl (ducks and geese); and
- **Offshore birds**: those species that generally feed further offshore than the intertidal on fish or invertebrates by diving or pursuit, such as terns, auks (e.g. guillemots), divers and scoters.

Onshore

During the intertidal walkover survey on 21/22 July 2008, a number of birds were observed using the intertidal and shallow subtidal areas. At low water, approximately 20–30 unidentified terns (*Sterna* sp., possibly common/arctic) were seen to be roosting on the shoreline and on the small macroalgae-covered intertidal island (within 50m of the low water line), in addition to feeding in very shallow water. A small number of black-backed gulls were also observed on the beach.

A single cormorant was observed hunting in the shallow subtidal, within 100m of the low tide shoreline. On the rock platform to the E/SE of the cable route, a number of oystercatchers and herring gulls were also observed.

Although the cable landfall at Rush North Beach is close to the Rogerstown SPA, the nationally important wader species that occur within the SPA are unlikely to occur in significant numbers around the landfall. Rogerstown SPA is cited for its internationally important assemblages of Brent goose and nationally important greylag goose, common shelduck, Eurasian teal, northern pintail, northern shoveler, Eurasian oystercatcher, ringed plover, European golden plover, grey plover, northern lapwing, red knot, dunlin, sanderling, black-tailed godwit, Eurasian curlew, common redshank and common greenshank. Most of these species are typical of an estuarine environment, such as that found within the SPA, and rarely occur in significant numbers outside of this environment. As Rush North Beach is a non-estuarine sandy beach, it is unlikely that any of the bird species cited in the Rogerstown SPA will occur in significant numbers, with Eurasian oystercatcher, ringed plover, grey plover, dunlin, Eurasian curlew and common redshank the only species that may occur in small numbers.

Offshore

Due to the proximity of breeding colonies at the nearby islands of Rockabill, Lambay and the Skerries (see Designated Sites, below), offshore seabirds are a key component of the ecosystem in inshore regions of the proposed EWI cable route.

6.3.5 *Mammals*

Aquatic mammals found in the vicinity of the EWI cable route and landfalls mainly comprise the following:

- Cetaceans (whales, dolphins and porpoises); and
- Pinnipeds (seals).

Several species of cetacean have been recorded from the Irish Sea (Reid *et al*., 2003), including the following from along, and adjacent to, the proposed cable route. These include:

- Harbour porpoise *Phocoena phocoena*: numerous records throughout the Irish Sea and within the cable corridor;
- Bottlenose dolphin *Tursiops truncatus*;

- Risso's dolphin *Grampus griseus*: a number of sightings recorded close to the cable corridor; and
- Minke whale *Balaenoptera acutorostrata,* recorded close to the offshore cable corridor.

Two species of seal occur commonly in the area: the common seal *Phoca vitulina* and the grey seal *Halichoerus grypus.*

The only breeding colony of grey seals on the east coast of Ireland is found on Lambay Island, approximately 6km south-east of the cable landfall; this island has been designated an SAC as a result. Grey seals here produce pups from September to November (NPWS, 2007).

As part of the geophysical survey of the proposed cable route (in December 2007–February 2008), a marine mammal observer (MMO) was based on the survey vessel. Only two records were made of marine mammals in Irish waters, both inshore: that of harbour porpoises near Lambay Island, and of bottlenose dolphins near the Skerries (Coppock, 2008).

In addition to cetaceans and pinnipeds, the otter *Lutra lutra* may be found in shallow intertidal areas of the marine environment (such as estuaries), particularly during winter. To the north of the cable landfall, the River Boyne is designated as an SAC partly on the basis of the presence of otters there. As such, otters may reasonably be expected to occur occasionally in the area; however, they are unlikely to be found on exposed sandy beaches, preferring rocky coastlines.

6.3.6 Designated Sites

The Habitats (92/43/EEC) and Birds (79/409/EEC) directives are of fundamental importance for the management of coastal areas. Under these directives responsibility is delegated to UK and Ireland (member states) to designate Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) to protect habitats and species. SPAs and SACs together form *Natura 2000* (a European network of protected sites) and can facilitate sustainable management of the coast.

The EWI cable and landfalls do not encroach on any areas designated for their conservation interest. Areas of such interest located in the vicinity of the route and landfalls are discussed below. The descriptions comprise a brief summary of those principal features (such as habitats and species) relevant to the proposed development in marine and intertidal waters, and exclude (or only discusses briefly) features likely to be of little relevance.

European and international designations applicable to both Britain and Ireland include:

- **SPA**: site designated under the EU Birds Directive for protection of rare, vulnerable and regularly occurring migratory species;
- **SAC**: site designated under the EC Habitats Directive for protection of specific habitat types and species most in need of conservation; and
- **Ramsar Site**: wetland sites of international importance protected under the Ramsar Convention.

Figure 6.5 shows that although the cable route does not pass directly through any designated sites, it is in relatively close proximity to several designated areas, described below.

Rogerstown Estuary

Rogerstown Estuary is a relatively small, narrow estuary immediately south of Rush and is designated as a Ramsar, candidate SAC and SPA site. It is an important winter waterfowl site, supporting internationally important populations of Brent geese, with another 14 species at nationally important levels, including greylag goose, shelduck, shoveler, oystercatcher, lapwing and redshank.

Rockabill

Rockabill SPA (north-east of the landfall) consists of two small, low-lying islets around 7km off the coast and is one of the most important tern colonies in Europe, with, for example, 75% of the entire north-western European population of roseate terns. The area also supports a nationally important population of black guillemot.

Skerries Islands

The Skerries Islands (north of the landfall) are a group of three small, uninhabited islands situated between 0.5km and 1.5km off the coast, and are designated as an SPA based on their importance both to breeding seabirds and wintering waterfowl. Breeding colonies of cormorant, shag, herring gull and great black-backed gull are of national importance; wintering waterfowl includes internationally important numbers of Brent geese and nationally important numbers of cormorants, purple sandpiper and turnstone.

Lambay Island

Lambay Island SPA and SAC is approximately 4km off the coast, and south-east of the cable landfall. It is important for seals and supports a high diversity of breeding seabirds including internationally important populations of cormorant, shag, razorbill and guillemot, and several other species of national importance. It also has the largest colony of puffin and the only colony of Manx shearwaters on the east coast of Ireland. It also supports a nationally important number of wintering greylag geese. Lambay Island supports the only breeding colony of grey seals on the east coast of Ireland.

Rush Bay North Beach

The intertidal rocky platform to the south of the cable landing area has been used extensively by students from University College Dublin, amongst other universities, as a site for numerous scientific experiments. These experiments tend to focus on the exclusion of certain species (such as algal grazers or predators) from small areas of the rock to investigate such effects on the other species present. Long term monitoring of the abundance of various species also takes place. It is understood that an application is being made to designate the site as a Scientific Exclusion Zone, with members of the public being encouraged not to collect animals from the site.

Whilst the EirGrid construction works will not directly affect the site, EirGrid will ensure that those using the rocky platform for monitoring are informed well in advance of beach works such that they can collect data before the sandy area is disturbed.

6.3.7 Seasonal Sensitivities

Table 6.5 presents a summary of seasonal sensitivities for the various ecological features that the EWI route either passes through or close by. EirGrid will endeavour to ensure that where such sensitive periods cannot be avoided in the construction programme, that all other possible measures to minimise and mitigate any potential impacts are employed.

Table 6.5: Seasonal sensitivities for various ecological features

<table>
<tr><th></th><th>J</th><th>F</th><th>M</th><th>A</th><th>M</th><th>J</th><th>J</th><th>A</th><th>S</th><th>O</th><th>N</th><th>D</th></tr>
<tr><td>Plankton</td><td colspan="12">No particular seasonal sensitivities</td></tr>
<tr><td>Benthos</td><td colspan="12">No particular seasonal sensitivities</td></tr>
<tr><td>Nephrops</td><td></td><td></td><td></td><td colspan="3">Peak spawning</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="13">Fish</td></tr>
<tr><td>Cod</td><td colspan="4">Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Plaice</td><td colspan="3">Spawning</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Lemon sole</td><td></td><td></td><td></td><td colspan="6">Spawning</td><td></td><td></td><td></td></tr>
<tr><td>Sprat</td><td></td><td></td><td></td><td></td><td colspan="4">Spawning</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="13">Birds</td></tr>
<tr><td>Wading birds</td><td colspan="3">Feeding/roosting</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Feeding/roosting</td></tr>
<tr><td colspan="13">Mammals</td></tr>
<tr><td>Grey seals</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">Pupping</td><td></td></tr>
<tr><td>Cetaceans</td><td colspan="12">No particular seasonal sensitivities</td></tr>
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6.4 Potential Impacts

This section describes those impacts to the marine environment that could potentially occur from the EWI. These are described before and after any mitigation measures have been applied, and any residual impact is described.

6.4.1 Construction Phase

6.4.1.1 Vessel and Construction Activity

The cable lay and associated vessels (e.g. guard vessels, re-supply, workboats) will marginally increase the level of vessel activity in the marine environment at any one time. In addition, the presence of equipment and plant on the foreshore during cable landfall will represent possible disturbance. The presence of construction vessels and plant may result in impacts from the following:

- Disturbance of marine birds;
- Disturbance of intertidal birds;
- Disturbance of seals;
- Subsea noise; and
- Vessel-derived discharges.

Marine bird disturbance

The inshore area of the EWI cable route is adjacent to several significant breeding colonies of seabirds during spring and summer months. While construction activity is unlikely to affect the breeding colonies themselves, vessel activity through areas where high densities of seabirds are on the surface (e.g. resting or surfacing between feeding dives) may therefore cause avoidance/flight behaviour, resulting in temporary displacement from optimal areas.

However, any such disturbance will take place within the context of existing sources of disturbance, such as shipping, and both commercial and recreational fishing vessels in the area. As such, the disturbance to seabirds caused by presence of construction vessels in any one place at any one time is considered to be a slight, temporary and short-term impact.

Intertidal bird disturbance

The sandy intertidal area of the landfall is not of particular significance for wading birds, especially when compared to adjacent areas (e.g. Rogerstown Estuary) outside of the zone of likely impacts. However, a small number of wading and seabirds are known to use the foreshore at low tide for feeding and roosting. Activity on the foreshore by plant, vehicles and personnel is likely to displace those birds within the immediate vicinity.

This impact, however, will only be of slight significance. Activity on the foreshore will be limited spatially and intermittent, lasting a maximum of approximately seven weeks overall. During that time, any displaced birds are able to relocate to other intertidal environments, including those further along Rush Beach and those offering better feeding opportunities (e.g. Rogerstown Estuary). Any displacement would also take place within the context of existing sources of disturbance: Rush Beach is already subject to a wide range of activities where humans are present on the foreshore, such as dog walking, cycling and use of vehicles. Impacts to intertidal birds are therefore assessed as being short-term, temporary, and of slight significance.

Seal disturbance

Although seals will be present throughout the year along the proposed cable route, pregnant, nursing and pup grey seals will be present at Lambay Island during the critical period of September–November, and these individuals are likely to be particularly sensitive to human disturbance such as movement of vessels, vessel noise, and the appearance of humans. The limited duration of this key life cycle period and the national importance of the area to grey seals (as the only breeding colony on the east coast, and one of the SAC qualifying features of this site) further highlight the importance of this potential impact.

If seals are disturbed during this period, this is likely to result in avoidance behaviour, such as seeking refuge in water. This may have energetic consequences to both mother and pup seals, such as disturbing suckling behaviour and using sub-optimal habitat or haul-out areas. Disturbance may also increase the likelihood of abandonment of or separation from pups, and the risk of accidents to pups (e.g. drowning) if hauled out on sub-optimal or unsuitable areas.

The proposed cable route does not pass within close proximity to Lambay Island (approximately 5km distant). As construction vessels are likely to remain on or close to the cable route, it is therefore unlikely that vessels will approach the island to within a distance that may cause avoidance behaviours described above, particularly in the context of existing commercial and recreational vessel usage of the area. However, given the importance of the site nationally and the small timeframe of this key life-cycle stage, a precautionary approach is appropriate. Therefore, this impact during the peak sensitive period of September–November is deemed as being temporary, medium-term (as even small effects on reproductive success could affect local seal population recruitments) and potentially significant. Outside of this period however, seals are not deemed to be particularly prone to human disturbance by normal vessel activity, and potential impacts in this period would be temporary, short-term, and of slight significance.

Subsea noise

The presence of vessels and the use of subsea equipment (e.g. ploughs) will result in subsea noise being generated. The most sensitive receptors to subsea noise are marine mammals, particularly cetaceans; fish may also be impacted to a lesser extent.

Ambient sea noise is the background sea noise comprised of a broad range of individual sound sources, some of which are natural and some of which are man-made. The sources of noise may be distant, such as that from shipping, or may be close to the receiver, such as that from waves breaking. These sounds combine to produce an overall continuum of pre-existing noise that defines the background noise environment in which marine animals live.

Nedwell (2003) presented a significant body of underwater noise measurements taken in the period April 2003 to January 2004 at operational and construction-stage windfarm sites in the UK. The measurements showed that the levels of background noise at typical shallow windfarm sites are towards the upper bound of typical deep-water background noise levels. The overall sound pressure level varied significantly during the day due to local ship movements. In general, the levels were near the upper bound of the deep-water ambient noise levels presented by Wenz (1962), the average level being around 120dB re 1 μPa.

No percussive works (e.g. seismic, blasting or piling) are planned as part of the project, therefore noise will not be of a magnitude that has the potential to cause physical damage or death to any of these receptors. The highest levels of noise generated are likely to be as a result of any trenching activities through bedrock (such areas are very limited along the route), although the vast majority of the cable route is through soft sediments where ploughing or trenching will be used for cable burial.

Measurements of noise levels from ploughing and jetting operations are not available, although they may be comparable to those generated by dredging operations. Nedwell *et al*. (2008, unpublished) suggest that dredging noise may be 180–190dB re 1 µPa. They concluded that by using published hearing threshold levels for a number of toothed whale species, that mild avoidance might be observed in harbour porpoise when the sound source level is 75dB above hearing threshold, and that such a sound level would be present around backhoe dredging operations for a distance of around 130m.

Marine mammal researchers have observed humpback dolphins in Hong Kong around dredging activities a number of times, and areas in which dredging occurs have not been abandoned by dolphins (ERM, 2006). The observations by the researchers appear to show that the dolphins show short-term, avoidance of the immediate works areas of dredging activities (in the order of movements of several hundreds or thousands of metres). Due to the very slow vessel speeds and low intensity of underwater noise generated there is no prior evidence to suggest that dolphins have ever suffered physical injury from dredging activity.

As the cable burial operations will be relatively slow moving, and of continuous sound levels, it can be assumed that any marine mammals towards which the burial operations advance, will have adequate time to move away from the operations should they be disturbed.

Noise generated will cause a temporary local increase in ambient noise levels, and in some cases may cause a localised, short-term and temporary moderate impact from nuisance, with subsequent avoidance behaviour. It should be noted that any noise generated by construction activities is alongside existing anthropogenic sources generated on the seabed, such as the use of razor clam dredges and towed otter boards by the commercial fisheries operating in the immediate area.

Vessel-derived discharges

The presence of construction vessels in the area in addition to normal vessel activity will marginally increase the risk of a pollution incident. In the most minor of incidents, this may comprise, for example, a small accidental spillage of a litre of lubricant oil from the deck of a barge; a worst-case scenario may occur if the cable lay vessel collided or grounded, releasing its entire fuel capacity. In both scenarios seabirds (particularly diving seabirds) and seals (particularly pups), would be at greatest risk.

In a worst-case scenario, and given the national importance of the seal pupping site at Lambay Island and the breeding and wintering seabird populations, a major release of oil in these sensitive locations would comprise a significant medium-term impact of national, and possibly international significance.

6.4.1.2 Sediment Disturbance

Disturbance to the sediment during construction operations may arise from a number of operations, including grapnel clearance, jetting/ploughing, cable burial, anchoring, beaching of shallow water cable-lay vessels and placement of mattresses at cable/pipeline crossings. They will potentially impact the environment in three main ways:

- Direct loss of biota along the actual footprint of works, such as along the cable route;
- Sediment suspension (e.g. clogging of gill structures) and smothering in adjacent areas; and
- The introduction of new habitat (e.g. rock mattressing at cable/pipeline crossings).

Direct loss of biota

It is likely that a high proportion of benthic invertebrates along the cable corridor "footprint" will be lost through mortality, injury or displacement as a result of coming into contact with the route clearance grapnel or cable laying machinery. This is more likely to affect sessile or less mobile species (e.g. epifaunal soft corals, bivalves and tube-living polychaete worms), compared to more mobile species such as crustaceans. It is also likely to affect populations of longer-lived species (such as some bivalves) more than shorter-lived species, such as small polychaetes.

While these represent a direct loss to the benthic community, it also represents an indirect loss to those species that may feed on benthos, such as fish (including commercially important species) and some diving seabirds (such as common scoter).

However, this impact is limited by two main factors for the vast majority of habitats over the cable route. Damage to biota will only occur over a very small percentage of the areal extent of similar adjacent habitat in the Irish Sea. In addition, the majority of habitats encountered along the route are relatively homogenous soft sediment, and re-colonisation is expected to begin almost immediately after the construction period.

Studies conducted on the benthos on a cable route one year after construction of a HVDC cable in the Baltic Sea over a range of soft sediment types generally indicated no obvious changes to species composition, abundance or biomass. However, in one of the deeper study areas (of around 30–35m water depth) where bottom processes are less dynamic, there were some indications that mean size of individuals was smaller compared to pre-construction (Andrulewicz *et al*., 2003). It is therefore reasonable to assume that a similar impact may take place over some of the proposed cable route, although it would also be expected that fauna on the cable route eventually attain the same size as those outside the impacted area.

Any impacts that do occur as a result of the grapnel runs or cable lay activity will occur within the natural background of impacts to benthic communities, such as that from towed fishing gear (e.g. suction dredges, otter boards and beam trawls) and, in shallower water, physical effects such as winter storms. Cable will be laid along the same route that the grapnel has cleared, burial will then follow, resulting in two discrete events for each cable line. Although two continuous lengths of seabed are affected, the collective duration and area of the impact will be insignificant compared to that from persistent commercial fishery activity. As such, this impact is assessed as being a temporary, short-term and slight for most benthic habitats.

Sediment suspension

The suspension of sediment into the water column may affect organisms by clogging gill and feeding structures and having a smothering effect. This may be particularly applicable to sessile or infaunal benthos and less mobile fish (such as juveniles) in the immediate vicinity of the cable laying activity (including disturbance from the grapnel run). More mobile taxa, such as adult fish and mammals, will simply vacate the area during the short-term and temporary increase in turbidity; indeed, such suspension may present opportunistic feeding opportunities for predatory fish on dislodged benthos, for example. Although sediment suspension in the water column may cause very localised minor reductions in plankton productivity in shallow water, this is deemed to be insignificant in the context of the available area, and in the context of naturally high turbidity in shallow inshore waters of the Irish Sea.

The degree of sediment suspended into the water column will depend on two main factors: the seabed type and the cable burial techniques used.

Coarser sediments (such as gravel and sand) are generally present in shallower, higher-energy environments and will settle back to the seabed in a relatively short space of time. In addition, the generally larger size of the constituent particles means that they are less likely to present an impact in terms of clogging gill and feeding structures.

However, suspended coarser sediment, once settled out, could potentially smother organisms under the deposition area. Conversely, finer particles (such as muds) are usually present in low-energy deeper environments and because of their size both take longer to settle out (therefore allowing for potentially greater dispersion by currents) and have a greater potential to clog gill and feeding structures. While shallow water, coarser-grained benthic communities may be better adapted to cope with suspended sediment, deeper waters communities may be less able to do so, although even these are likely to be exposed to some anthropogenic sediment suspension (e.g. from the use of trawling for *Nephrops*).

Jetting techniques will cause a greater amount of sediment suspension compared to the use of ploughing equipment. Given the potential worst-case scenario of using jetting equipment through deeper-water fine mud communities, this could represent a short-term, temporary and moderate impact. Impacts to coarser-grained benthic communities from sediment suspension are assessed as being within the range of that experienced during existing conditions, and are therefore deemed as being short-term, temporary, and slight.

Placement of mattressing

In areas of cable/pipeline crossings and where the required burial depth cannot be achieved, it may be necessary to use concrete mattresses or other substrate (e.g. gravel, rock) to cover the cable for protection. Placement of this will result in the introduction of a new habitat, and smothering and direct mortality of infaunal organisms directly beneath it. This will comprise a permanent, long-term impact of slight significance.

However, any such mattressing will be colonised rapidly by epifaunal organisms such as sponges, hydroids, bryozoans and soft corals, along with accompanying epifauna such as crustaceans and gastropod molluscs. As such, this will represent an increase in local diversity and abundance, particularly in areas of lower diversity, such as mobile sands. This will comprise a permanent, long-term slight positive impact to the marine environment.

6.4.2 Operation Phase

Potential impacts during the operational phase of the EWI are deemed to be few, and will ordinarily be limited to the presence of the cable in buried sediment. As such, it is only likely to potentially impact benthos and fish, with plankton, birds and mammals deemed as being unaffected.

Physical presence of the cable

As the cable will be buried to a target depth of around 1.5m for the majority of the route, this will not affect benthic communities, the vast majority of which inhabit the topmost 30cm of sediment. Fauna that re-colonise sediment above the cable are therefore unlikely to be denied suitable habitat, and any impact on deep-burrowing species will be minimised by the relatively small areal extent (and linear nature) of the affected area. Impacts are therefore permanent, long-term and slight.

Electromagnetic fields

Section 4.9.3.1 provides a description of the magnetic fields which may be produced from operation of the EWI cables. No electrical fields are expected from the operation.

A number of organisms that live within the marine environment are known to react to, or have the potential to detect electromagnetic fields (Gill and Taylor, 2001). Such organisms present in Irish Sea waters include cetaceans (whales, dolphins and porpoises), chelonians (turtles), teleosts (bony fish, e.g. salmon and eel), elasmobranchs (sharks, skates and rays), holocephalans (chimaeras, e.g. ratfish), agnathans (jawless fish, e.g. lampreys), crustaceans (lobsters, crabs, prawns and shrimps) and molluscs (snails, bivalves and cephalopods, e.g. squid). Whilst the mechanism of how these organisms detect magnetic fields is still unknown, it is generally acknowledged that these organisms are able to use magnetic cues, such as the earth's geomagnetic field (approximately 50 μTesla), to orient in their environment during migration. Organisms with a magnetic perception function are suggested to be very sensitive to minor changes in the magnetic field (Walker *et al*., 2003).

Few studies have considered the effects of HVDC magnetic fields on marine organisms. The only reported studies indicate a minor effect on European eels (*Anguilla anguilla*) of short term (minutes) deviation from their migratory route (Ohman *et al*., 2007) for a 5μT emission at 60m. Based on the EirGrid cable configuration, the same magnetic field would be present at approximately 57m. Hence, no reaction would be predicted for species with the same sensitivity as eels that passed more than 57m away from the cable. Furthermore, any reaction within the zone of potential reaction would be expected to be very short term.

Based on current understanding of sensory abilities of species it is predicted that elasmobranches, holocephalans and lampreys are the main marine organisms other than eels that may be disturbed by the cables if they move closer than 57m from a cable (Poléo *et al*., 2001). These organisms are known to be sensitive to both electric and magnetic fields; however, no evidence exists of any detrimental effects. From existing knowledge, it may be expected that there will be some response closer to the cable but it is likely to be short-lived, similar to the eels, and there is no existing evidence to suggest that impacts will be greater than slight.

Inspection and Repair

In the years immediately following installation of the cable, annual surveys will be undertaken to monitor the burial depth of the cable. These surveys will involve the use of a vessel and equipment such as side-scan sonar and magnetometers. The emissions of noise from such sonar equipment may provide some disturbance to marine mammals and fish, though the sources are no greater than "fish finder" echosounders used typically used by fishing vessels.

Should non-routine events arise, such as repairs to damaged cables, impacts similar to that in the construction phase would occur. This would include localised displacement of easily displaced seabirds by repair vessel(s) and sediment disturbance. However, these activities would likely be limited to a small area and be temporary and short-term in nature, with an overall slight impact.

6.5 Mitigation

6.5.1 Construction

6.5.1.1 Vessel and Construction Activity

Marine bird disturbance

As construction vessels will only be operating within a limited area during any one time, and be restricted to the cable route and its immediate vicinity, the areal extent of the affected area will be minimised.

All vessels will avoid surface aggregations of seabirds, where possible (and safe) to do so, to minimise the amount of incidents where seabirds are displaced or have cause to take flight.

Intertidal bird disturbance

Construction works in the intertidal area will be confined to a designated "working width" (a cordoned-off corridor), within which all construction activity and plant/vehicle movement will take place. No vehicles or plant will operate outside of this area to limit the potential for disturbing any wading birds along the shoreline. Construction activity will only be limited to the sub-optimal feeding environment of the sandy beach, and will not take place on the adjacent rocky platform, where more waders (e.g. oystercatchers) may be present; these birds will therefore not be disturbed.

Landfall works will be scheduled for completion prior to the arrival of waders in the Rogerstown Estuary in autumn.

Seal disturbance

No construction activity or related vessel activity will take place close to Lambay Island in September to December, to avoid potential disturbance to pupping seals.

Subsea noise

The cable route has been designed as far as possible to deliberately avoid those areas of substrate that will require trenching through bedrock and hard sediment, therefore minimising the potential for more powerful noise sources. In the event that cable lay through rock is required, such as with a trencher in the subtidal or use of a backhoe in the intertidal, all necessary precautions will be undertaken to minimise the potential for disturbance to marine mammals, particularly cetaceans. An MMO will be appointed for any such works and operate according to NPWS guidelines. Use of an MMO will allow for work to be suspended temporarily if cetaceans are present in the area while any activities generating significant sound sources are about to commence or are taking place.

Vessel-derived pollution

All construction vessels will use waste management plans and operate within strict IMO regulations for pollution prevention. Any waste discharged at sea (such as treated black or grey water or macerated food waste) will be according to MARPOL regulations, and effectively involve treatment before discharge, and limitations on discharge close to the coast.

Fuel spill

Appropriate measures will be undertaken to ensure navigational safety (such as communication of the nature and location of construction works to the maritime community) and minimise the risk of accidental events such as collisions. The construction vessels will carry an oil spill response plan, in which crews will be trained. Vessels will also be equipped with facilities to deal with onboard minor spills (e.g. spill kits).

6.5.1.2 Sediment Disturbance

Direct loss of biota

The “footprint” of the cable will be minimised as far as possible as part of normal engineering and economic considerations, which will limit the potential impact to benthos. Any deployment of equipment or vessels onto the seabed will be kept to a minimum to reduce impacts.

Sediment suspension

Techniques (such as ploughing) to minimise the suspended sediment load generated will be used as far as possible, with use of jetting to be kept to a minimum, particularly in deeper areas of fine sediment.

Placement of mattressing

The minimum amount of mattressing required to fulfil engineering and safety considerations will be used, which will reduce the areal extent of habitat alteration. Chemically inert materials approved for use in the marine environment will be used.

6.5.2 Operation

Physical presence of the cable

The two HVDC cables will be 15cm or smaller in diameter and will be buried at a target depth of at least 1.5m. This design depth will minimise any potential negative impacts on re-colonisation of sediment over the cable by benthic infauna, given that the majority is found within the top 30cm of sediment, with little fauna found below this.

Inspection and Repair

During cable burial monitoring surveys, the use of side-scan sonar equipment will be necessary. EirGrid will ensure that a marine mammal observer is present on the survey vessel to minimise potential impacts to marine mammals in line with NPWS guidance.

The HVDC cable has been designed to eliminate any requirement for routine maintenance or repair throughout its lifetime, therefore greatly reducing potential impacts. However, accidental damage caused by third parties may occur that would require repair (with associated impacts to, for example, benthos).

To minimise the risk of accidental damage or other non-routine activity (e.g. exposure of cable by adjacent dredging works and associated change in sedimentary regime), the cable and its route has undergone extensive assessments based on potential risk factors such as seabed type, seabed topography and human activity (e.g. dredging, trawling).

Electromagnetic fields

Production of a magnetic field is considered the only potential impact during the operational lifetime of the cable. Design of the project has minimised the potential for generation of EMF, by selection of a DC cable rather than AC, and by using a bipole rather than monopole system. Further mitigation to reduce the potential for magnetic fields is present in the cable shielding, and by burial of the cable to a target depth of at least 1.5m below the seabed where possible.

6.6 Residual Effects

6.6.1 Construction

6.6.1.1 Vessel and Construction Activity

Marine bird disturbance

It is anticipated that a small percentage of those seabirds present in the area and resting on the surface will be displaced temporarily from the area around the cable lay vessel, due to the presence of vessels and humans. However, this impact is deemed to be no more than that normally encountered through other surface vessel traffic. As such, with the applied mitigation measures, the impact is deemed to be short-term, temporary and slight.

Intertidal bird disturbance

Some of the intertidal environment at the landfall will be denied as feeding or resting habitat to wading and seabirds during the period of construction, owing to the presence and activity of equipment and plant. However, this area will be a small percentage of the available habitat on Rush North Beach, and even less significant when compared to other more desirable habitats. As such, this impact is assessed as being short-term, temporary and slight.

Seal disturbance

As construction work will not take place around Lambay Island, disturbance impacts to seals are deemed no greater than that from existing vessel traffic. As construction vessels will only be present for a limited timescale, and only represent a small increase in local vessel activity, residual impacts are deemed temporary, short-term, and slight.

Subsea noise

Although noise generated from cable-laying activities will be within the magnitude of that from other existing anthropogenic sources (e.g. trawling, dredging), it will represent an increase in sound levels locally, albeit temporarily. The levels of noise, however, are not deemed to be of that likely to cause death or injury to any receptor, and measures will be in place (e.g. MMOs) to avoid deleterious interactions with cetaceans in close proximity to works. As such, this impact is short-term, temporary, and of slight significance.

Vessel-derived pollution

Routine operation of all vessels according to procedures (e.g. waste management) will not ordinarily result in residual impacts, with, at worst, very short-term, temporary and negligible impacts to the water column from discharge of treated waste such as grey water and food waste (in line with applicable regulations).

Fuel spill

The chances of a potentially significant impact from a construction vessel fuel spill (e.g. from collision or grounding) occurring are very low, due to the measures (e.g. safety, communication and engineering) in place to prevent it. In addition to those measures, an oil spill contingency plan will be in place, agreed with the coastguard. As such, the residual impact is assessed as being short-term, temporary and slight.

6.6.1.2 Sediment Disturbance

Direct loss of biota

There will be mortality and displacement of benthic infauna along the cable construction route, although this will be within the range of that already occurring (e.g. through trawling or storm damage). Impacts will be temporary and short-term (as re-colonisation will occur within one or two years), and, given the area affected (compared to the surrounding area of similar habitat), slight impact.

Sediment suspension

In coarser-grained environments, impacts are likely to be short-term, temporary, localised and of slight impact, occurring within the range of that expected through existing human or natural sources. In deeper and/or finer grained sediments, and particularly if jetting is used, impacts are likely to be slightly more significant due to the receiving environment and the organisms inhabiting it being less adapted to such sources of disturbance. Any impacts are likely to occur further afield from the source (due to plume dispersion) compared to sandier sediments; as such, residual impacts for finer sediments are deemed as being short-term, and of moderate significance.

Placement of mattressing

The minor negative impact (loss of infauna) of this aspect combines with the minor positive impact (increase in species diversity due to provision of hard substrate) to give an overall residual impact after mitigation of no change, or slight positive impact.

6.6.2 Operation

6.6.2.1 Electromagnetic Fields

Section 6.4.2 provides a description of potential impacts from emission of a magnetic field from each of the HVDC cables. It is estimated that eels may be able to detect the magnetic fields at a distance of 57m from the cables; this distance is predicted on the assumption that cables will be laid more than 10m apart. In the event that they are laid closer together, the 57m will be reduced, hence reducing the impact, though it is still considered slight.

7 ARCHAEOLOGY

7.1 Scope of the Assessment

This chapter assesses the potential impact of the EWI upon the known and potential marine archaeology along the proposed cable route in Irish jurisdiction. A similar report will be produced to cover the proposed cable route in British jurisdiction.

The assessment examines the records of vessel losses at sea, estimated locations of losses and known wreck sites on the seabed, together with the details of the vessels concerned, within one kilometre of the proposed cable route.

Examination of a preliminary geophysical field report prepared by Fugro OSAE GmbH has been undertaken to determine if any reported anomalies could be identified as potential wreck sites or other sites of archaeological interest. In addition, geophysical data collected along the centreline of the cable route in Irish territorial waters have been subject to archaeological assessment.

Limitations in the scope of the report have been identified, and recommendations for further study have been highlighted (see section 7.7).

Recommendations for monitoring and mitigation of construction and operational works have been presented to limit the impact of the EWI upon the known or potential archaeological resource.

7.2 Assessment Methodology

7.2.1 *Introduction*

The methodology adopted for this assessment accords with archaeological desk-based assessment best practice as defined by the Institute of Field Archaeologists' (IFA) *Standard and Guidance for Archaeological Desk-based Assessment* (IFA, 2001) and as laid out in the COWRIE Guidance Note (WA 2007a). The Framework and Principles for the Protection of the Archaeological Heritage document (DAHGI, 1999) has also been consulted during the course of the preparation of this report.

The assessment of impacts reflects the requirements of European Council Directive 85/337/EEC as amended by Directive 97/11/EC and Directive 2003/35/EC on Environmental Impact Assessment.

7.2.2 *Study Area*

The proposed cable route (Figure 1.1) will run from Rush Bay (North Beach) in the Republic of Ireland, to Barkby Beach on the north coast of Wales near Prestatyn.

To provide archaeological context, a study area was established consisting of a buffer zone of one kilometre on either side of the cable route. Records of known maritime sites and casualty positions within this study area were captured. Key sites outside of the study area were also recognised and captured as part of the data-gathering exercise.

In addition, the potential for prehistoric sites within the study area have also been assessed. Changes in sea level over time and environmental conditions have been reviewed to identify the periods when the area was dry land and suitable for human occupation.

7.2.3 *Assessment of Impact*

The assessment of impact on the archaeological resource is determined by comparing the expected impact of the development proposal with the relative degree of importance of the known archaeological resource (Table 7.1). The known archaeological resource has been allocated a relative degree of importance based on the following criteria. This grading is purely an arbitrary classification designed to determine the relative importance of the sites within the study area.

Table 7.1: Scale of relative importance assessment criteria

Scale	Importance
High	Internationally and nationally importance resources; any site with statutory protection
Medium	Regionally important resources, not legally protected of a defined extent, nature and date
Low	Locally important resources which are not rare or have group importance
Negligible	Resources that have little value, or where remains have been previously destroyed
Uncertain	Resources whose archaeological importance is unknown

The magnitude of the impact of the proposed development is judged by comparing the footprint of the development proposals (in this case the construction area and cable routes) against the location of the known cultural heritage resources. Table 7.2 outlines the criteria used to determine the judged magnitude of impact:

Table 7.2: Magnitude of impact assessment criteria

Scale	Impact
Large	Complete destruction of a site or feature
Medium	A high proportion of site or associated deposits damaged or destroyed
Small	A small proportion of site or associated deposits damaged or destroyed
Negligible	Deposits will not be destroyed or damaged by direct impact of development
Uncertain	The extent or the nature of the deposits is unknown and the impact cannot be determined.

The scale of impact has been assessed by comparing the importance of the known cultural heritage resource against the magnitude of impact on it. The criteria for determining the significance of impact are outlined in Table 7.3.

Table 7.3: Impact criteria

		Importance				
		High	Medium	Low	Negligible	Uncertain
Magnitude	**Large**	**High**	**High**	**Moderate**	**Slight**	Uncertain
	Medium	**High**	**Moderate**	**Moderate**	**Slight**	Uncertain
	Small	**Moderate**	**Moderate**	**Slight**	None	Uncertain
	Negligible	**Slight**	**Slight**	None	None	Uncertain
	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain

High and moderate impacts are considered significant in terms of impact assessment and, as such, require mitigation. Mitigation measures to avoid, reduce or ameliorate the negative effects on the cultural heritage resource will be determined on a site-by-site basis.

7.3 Preliminary Data Gathering and Survey

The principal sources consulted in this assessment are as follows:

- Records of wrecks and obstructions collated by the UK Hydrographic Office (UKHO);
- Records of known archaeological sites from the Record of Monuments and Places (RMP), maintained by the National Monuments Service (NMS) of the Department of the Environment, Heritage and Local Government (DoEHLG), Republic of Ireland;
- Records of wrecks and documented losses from the Shipwreck Inventory of Ireland, compiled by the Underwater Archaeology Unit (UAU) of the NMS;
- Records of archaeological finds held in the topographical files of the National Museum of Ireland (NMI);
- Reports of excavations carried out in the vicinity of the study area in Ireland, held in the online excavations bulletin database (www.excavations.ie);
- Various secondary sources relating to submerged palaeo-landscapes and archaeology, and the wider Palaeolithic and Mesolithic archaeology of northern Europe;
- Secondary sources relating to known and potential wreck sites and casualties, including historical charts and sailing directions held by the UKHO and the Trinity College Map Library;
- The Receiver of Wreck, at the UK Maritime Coastguard Agency, regarding reports of historic wrecks;
- Preliminary geophysical field report by Fugro OSAE detailing the geophysical survey of the proposed cable route with initial results; and
- Geophysical survey datasets: Sidescan Sonar data in the form of raw, un-mosaiced xtf files; magnetic data in the form of raw Ascii text files; boomer data in seg-y or Coda format; swathe data as processed/cleaned up xyz data; and all relevant trackplots in digital (GIS) form and survey logs.

Records of known wrecks and documented losses have been compiled into gazetteers, which are included within Appendix 7.1 and listed in a number sequence starting at WA 2001. Documented losses were listed in a number sequence starting at WA 1001 and are listed in Appendix 7.2.

7.4 Baseline Conditions

7.4.1 Background

The archaeological heritage of the study area is related closely to sea-level change over time. For long periods since the first recorded hominid activity in Britain in 700,000 BP, much of the Irish Sea basin would have been dry land. At times when temperate conditions coincided with low sea levels, areas of what is now the seabed would have been dry land suitable for human occupation.

Glaciation has shaped the landscapes of Ireland with ice sheets having moulded the landscape in a number of ways, including:

- Erosion caused by glaciers;

- Erosion caused by glacial outwash;
- Deposition of sediment caused by glacial outwash; and
- Topographical change caused by the effect of the mass of the ice sheet upon the landmass.

While the potential for widespread archaeological remains to exist in situ on the seabed is limited, localised survival of sediments containing archaeological material is known off the coast of North Wales, and archaeologically important derived material may exist in secondary contexts, deposited as a result of the glacial processes described above.

Since the Neolithic period, sea levels are thought to have fluctuated within five metres of present day levels, within a generally rising trend. From this time onward, the archaeological heritage of the study area is concerned principally with maritime activity, particularly evidence of seafaring.

Within this context, the archaeological baseline of the study area and wider area has been established through a review of known recorded sites and features (primarily wrecks) and by review of archaeological evidence, including that suggestive of seafaring over time, in an effort to investigate the potential for currently unknown archaeological remains.

It is worth noting that, while this section focuses on wrecks, other archaeological remains can be equally as important. Artefacts and cargoes may be lost during trans-shipment though the vessel itself survives the event. Equally, artefacts and cargoes of certain types can survive seabed conditions that result in the deterioration of the vessel. In some cases, items lost during trans-shipment can be equally valuable to the archaeological record.

The morphology, geology and seascape are described in detail in Section 12.

7.4.2 Recorded Sites and Features

Charted Sites

Positions of known wreck sites have been obtained from the United Kingdom Hydrographic Office (UKHO). A distribution map of known wreck sites around the coast of Ireland is currently being compiled by the Underwater Archaeology Unit of the National Monuments Service (DoEHLG). This was not complete at the time of this assessment, and so has not been used as a source of data; however, it is considered a primary data source and will be consulted if it becomes available within the timescale of the proposed development.

There are 16 sites charted by the UKHO within the study area, four of which are recorded as wrecks, (Figure 7.1 - WA 2001, 2002, 2003 and 2005).

One other site is recorded as an obstruction (WA 2004).

The four shipwrecks in the study area can be grouped broadly according to their dates of sinking, as follows:

- Two World War I losses (WA 2001, 2005);
- One steamship of unknown date (WA 2002); and
- A modern wreck (post-World War II) (WA 2003).

A description of these wrecks is provided below with further detail provided in Appendix 7.1.

Charted Wrecks in Irish Jurisdiction

Within Irish jurisdiction, there are two World War I losses. The first is a wreck thought to be the British steamship *Polwell* (WA 2001), torpedoed and sunk by a German submarine while *en route* to France on 5 June 1918. A UKHO survey from 1984 indicates the wreck to be 10m high, 80m long and with a beam of 20 metres. It appears to be upright, intact and oriented north-east–south-west. A UKHO recorded dive report from 1985 indicates that the cargo may have been coal.

The second of the two World War I losses is the *Glenford* (WA 2005), a British steamship that was captured by German submarine U 101 and sunk by gunfire. A UKHO survey in 1984 revealed that the wreck was in a general depth of 78 metres and partially covered by sand. The wreck site is 50m long, 40m wide and 3.2m high.

The most recent wreck in the study area is the *Sharelga* (WA 2003), an Irish trawler that sank on 18 April 1982. The skipper reported being dragged for two miles at high speed when the trawler nets became entangled with a mystery object, believed to be a submarine. The British Government later confirmed this. The wreck was located by a UKHO geophysical survey in 1984. It stands 9m off the seabed intact and upright, with a length of 20m and a beam of 6m.

In addition to World War I and recent wrecks, there are two unidentified wrecks charted within the part of the study area. The first is WA 2002, a wreck located by the UKHO in 1983 and marked on Kingfisher Trawling Plots as a possible steamboat. A UKHO survey in 1984 failed to re-locate the wreck. No subsequent searches have been carried out to verify its location.

The second of the two unidentified sites is WA 2004, recorded on charts as a wreck in 1955. The site was surveyed in 1984 and described as an object lying roughly north–south at a depth of 80 metres, with a length of 3–4 metres and a height of 1.7 metres. The wreck's status was amended subsequently to that of an obstruction.

7.4.3 Recorded Losses

General

In addition to charted sites recorded by the UKHO and described under Section 7.4.2, there are records of vessels lost in the area for which the exact position and extent of survival (if any) is not known. Recorded losses of this type are attributed to named locations, which represent losses within a broader area. Therefore, any losses recorded at these locations do not necessarily lie within the study area; if they do, they may not necessarily lie at the position ascribed to them.

Due to the nature of historical record keeping in regard to maritime losses, the current data on which assessments of maritime archaeology is based are biased towards vessels lost in the last 250 years. In addition, it should be noted that while records of losses from the eighteenth century onwards are relatively extensive, they only reflect a proportion of the wrecks lost in recent centuries.

Therefore, whilst the baseline data may account for archaeological sites that are known already, the potential for the existence of previously unknown archaeological remains limits the reliability of current data sources as a guide to archaeological potential. Accordingly, records of documented losses have been obtained from the Shipwreck Inventory of Ireland, maintained by the National Monuments Service (DoEHLG). These records have been reviewed as described below and form part of the overall assessment of impact, primarily relating to the potential for undiscovered remains/sites, as described in Section 7.4.4 below.

Shipwreck Inventory of Ireland

The Shipwreck Inventory of Ireland was being updated at the time of this assessment. The latest version of the inventory was made available and examined for losses attributed to named locations that could lie in the study area. Any losses attributed to the harbours near the study area such as Rush, Loughshinny, Portrane, Lambay Island, Skerries, Balbriggan and Rogerstown, were investigated. This list was then narrowed down to exclude wrecks that were described positively as being at locations outside of the study area. The remaining wrecks were listed in the number sequence WA 1001–1078 for ease of reference and further details are listed in Appendix 7.2.

The temporal distribution of the losses shown in the table below is not thought to be indicative of an absence of maritime losses during earlier periods, nor is it thought to be a comprehensive catalogue of all losses during the periods shown.

Date	Pre-1800	1801–1850	1851–1900	1901–1913	1914–1918	1918–1938	1939–1945	1946–present	Not known	Total
No. Losses	9	20	33	6	2	2	0	0	4	**76**

7.4.4 Potential for Undiscovered Sites/Remains

As described under Section 7.4.3 above, in addition to charted (recorded) sites recorded by the UKHO and described under Section 7.4.2, due consideration has been given to reference sources that provide an insight into the archaeological heritage of the study area and surroundings.

Whilst these sources do not identify specific sites that could potentially be affected by the proposed development, they facilitate the establishment of the archaeological heritage of the area and allow a judgement to be made as to the likelihood of previously undiscovered remains being found during construction. This section provides an overview of the archaeological heritage, as summarised in Table 7.4.

7.5 Geophysical Assessment and Results

7.5.1 Data Processing

The data within Irish territorial waters have been assessed from the landfall at North Beach out to the median line within a 500m corridor centred on the cable route.

The objectives of this review of geophysical data are to:

- Confirm the presence of any previously located marine sites and to comment on their apparent character;
- Identify, locate and characterise hitherto unrecorded marine sites; and
- Correlate the results with the desk-based assessment.

Wessex Archaeology reviewed the following geophysical datasets:

- Sidescan Sonar data in the form of raw, un-mosaiced xtf files;
- Magnetic data in the form of raw Ascii text files;
- Boomer data in seg-y or Coda format;
- Swathe data as processed/cleaned up xyz data; and
- All relevant trackplots in digital (GIS) form and survey logs.

Table 7.4: Summary of archaeological heritage and potential for undiscovered remains

Period	Outline Description	Site/features within or Adjacent to Study Area
Neolithic: 4,000–2,500 BC	Exchanges between Ireland, Wales, England and Scotland are evidenced by: • The adoption of agriculture, which would have required the introduction of non-indigenous species of plants and animals for food production; • Cultural contacts between Wales and Ireland, possibly connected to the proven trade and exchange of artefacts during this period; • The circulation of polished stone (porcellanite) axes between Britain and Ireland; and • The discovery in Ireland of worked stone artefacts made of Arran pitchstone, Welsh dolerite, Cornish gabbro and Cumbria tuff. A few examples of possible sea-going Neolithic log boats have been uncovered from maritime settings along the east coast of Ireland. The boats discovered during offshore trenching for a pipeline at Gormanston, Co. Meath, approximately 15 kilometres north-west of the study area.	Neolithic activity on the Irish coast adjacent to the study area is reflected by the presence of a passage grave on a small headland at the northern end of North Beach between Rush and Loughshinny.
Bronze Age: 2,500–500 BC	Log boats continued to be used and there is potential secondary evidence for hide-covered boats in the form of a shale bowl from Caergwrle, Clwyd, which features decoration suggested to represent such a vessel. There is also evidence for sewn plank boats being discovered near the coast or in intertidal environments, suggesting that they could have been used along the coasts of Wales and Ireland (log boats being found in river environments). Sewn-plank boats would have extended the windows of opportunity available to seafarers to conduct the sea-based trade that became more common during the Bronze Age. The most common trade during the Bronze Age is likely to have been in the raw materials that facilitated the period's technological innovation. There is a suggestion that significant trade across the Irish Sea may have occurred with Irish metalworkers importing tin from the mines of Cornwall and Devon. The potential for future coastal finds is reinforced by the discovery of two Early Bronze Age perforated antler artefacts from Borth and Mochras (Shell Island).	Three cist burials associated with the Neolithic passage grave near Rush, including food vessels was recovered from the site in 1934 and 1965.
Iron Age:	Trade and exchange of ideas between Britain, Ireland and continental Europe in the Iron Age is attested to by the distribution of artefacts of Hallstatt and La Téne type, particularly swords, suggesting trade links across the Irish Sea. A skull and jaw of a Barbary ape, indigenous to North Africa and discovered in Navan Fort in Co. Armagh, has	

Period	Outline Description	Site/features within or Adjacent to Study Area
	been radiocarbon-dated to 390–20 BC.	
500 BC–AD 400	Contact between the Mediterranean and Wales in the pre-Roman British Iron Age is suggested by the discovery of a Greco-Roman anchor stock 30 metres offshore at Porth Felen on the Llyn Peninsula. From the anchor's decoration, it is likely to date to the late second century BC. There is relatively little tangible evidence for settlement activity in the prehistoric Iron Age in Ireland, although a promontory fort at Drumanagh, less than 500 metres from the study area, is likely to date to this period. It has been suggested that a site at Drumanagh may in fact be an emporium or trading post. It is possible that Roman vessels could have travelled through the study area and landed between the headlands around Rush, Loughshinny and Skerries. Artefacts found on the eastern coast of Ireland suggest contact or trade between Ireland and Roman Britain. A cemetery found on Lambay Island off the Dublin coast suggests contacts between Roman Britain and Ireland may have included limited settlement of Roman Britons in Ireland. The presence of Roman burials at Lambay Island, which could have been a navigational marker or indeed a navigational hazard for vessels approaching the north Dublin coast, further indicates the potential for Roman maritime activity in the area. A high volume of seafaring at the end of the Roman period from AD 370 to 410 resulted from political confusion in Europe and the Roman Empire sank quickly into anarchy.	

Period	Outline Description	Site/features within or Adjacent to Study Area
Early Medieval: 400–1168	Early medieval contact between people around the Irish Sea basin may have followed relatively regular routes based on prominent landforms, such as Lugnaquillia in Co. Wicklow, Slieve Donard in the Mountains of Mourne, Merrick in the southern Scottish uplands, Scafell Pike in the Lake District, Snaefell on the Isle of Man, and Snowdon in North Wales. The western seas were busy with missionaries, pilgrims and holy men spreading Christianity at this time, with repeated sea voyages between Ireland and the European continent in this period. From the fifth and sixth centuries, a large Irish community of the Deisi tribe was established in Dyfed. The extent of this settlement is demonstrated by the distribution of inscriptions using the early Irish 'Ogham' alphabet throughout Dyfed. These are the only Ogham inscriptions known outside Ireland. In AD 683, the Saxons devastated Magh-Breagh, thought to be East Meath, just inland from the study area. During this period, traffic was also coming from further afield than the Irish Sea basin. Pottery of post-Roman date from the eastern Mediterranean, North Africa and Bordeaux is known from several sites in Wales. In the eight and ninth centuries, Viking raids began to occur in the Irish Sea basin, starting with the monasteries of the Western Isles, then the east coast of Ireland, the Isle of Man and Wales. There are several records of Viking raids in or near the study area at this time, including: • Reachrainn, modern day Lambay Island; • St. Patrick's Island; and • The oratory of Lusca, modern day Lusk.	

Period	Outline Description	Site/features within or Adjacent to Study Area
Medieval: 1169–1600	The Anglo-Norman Invasion of Ireland in 1169 led to the development of Norman towns and castles, most of which were centred around the eastern coast of Ireland and the stronghold in the Dublin area known as The Pale. Ports on both sides of the study area had begun to develop and expand by the medieval period, and trade and shipping were becoming more intensive and frequent as the links between Britain and Ireland deepened following the invasion. Despite the importance of maritime transport for these trade links, there is little direct archaeological evidence for trade during this period. Only a few shipwrecks are known, none of which are located within the study area. In the fourteenth and fifteenth centuries, the expansion in herring fishing saw the beginning of large scale trade across the Irish Sea. The Bristol and Bridgewater trade and Chester trade were the two main shipping routes across the Irish Sea. Dublin and the nearby town of Drogheda became Chester's main trading partners. Liverpool also began to develop trade routes to Ireland after being granted borough status by Royal Charter by King John. Fisheries were important in the development of Rush and the surrounding villages of Loughshinny and Skerries. With the development of trade in coal and slate, flotillas of sea-going 'cottes' would land fish at Bridgewater and return to Wexford with coal. A medieval wreck found at Pwll Fanog in the Menai Strait consisted of a pile of stacked Llanberis slate, under which some timber structure survived; the vessel has been radiocarbon dated to around 1470.	

Period	Outline Description	Site/features within or Adjacent to Study Area
Post-medieval: 1601–1800	The Plantations of Ireland, between 1534 and 1609, involved the transfer of land ownership to an immigrant landlord class, mainly of English and Scottish origin, designed to replace the native Irish and Anglo-Irish chieftains and lords. Military control of ports along the northern and eastern coasts of Ireland was central to the success of the colonisation. The planted communities in Ireland required regular contact with Britain to ensure their administration and logistical support. The rapid expansion of Dublin in the seventeenth century led to the coal trade increasing in importance. In 1696, coal was ranked third in the list of Irish imports from Britain. The herring trade continued to expand during the post-medieval period, with increasing commercial importance seeing ships from Ireland, France and Spain arriving along the western and northern coasts of Wales to exploit the herring shoals. International trade supplemented the coastal trade and fisheries in developing the coastal towns of north county Dublin in the eighteenth and nineteenth centuries, with Rush considered to be one of the chief haven towns of Ireland until trade declined in the nineteenth century. The small seaport of Rogerstown between Portrane and Rush was busy with small trading craft, fishing boats and smugglers. Small vessels would travel up Rogerstown Inlet on a flood tide, then goods were landed and transported to Meath and Dublin. The development of the port of Liverpool from the seventeenth century onwards was to become an important influence on the level of maritime traffic travelling through the study area.	

Period	Outline Description	Site/features within or Adjacent to Study Area
Industrial: 1800–1930 (Ireland)	Many ports saw huge expansion during the Industrial Revolution, as the level of coal exported continued to increase. As with the trade in slate, the scale of the coal trade is reflected by the ports that were established solely to deal with its export. The beginning of the nineteenth century saw the construction of coastal fortifications along the Irish coastline. Exploitation of the Irish coast was beginning to decline as a direct result of the withdrawal of the fishing bounties in 1830. Despite this decline, the study area at Rush, Skerries and Balbriggan was still likely to have been busy with trade coming from Britain and the rest of Europe, as well as the beginnings of the large-scale emigration of people from Ireland following the Great Famine. For this period, the greatest potential for shipping losses and wrecking events most likely occurred during the two World Wars. The prominence of Cardiff and the proximity of major ports such as Bristol and Liverpool to Wales were contributing factors to extensive submarine activity during both World Wars.	

Data were summarised and cross-referenced to the gazetteer of known sites held in the project database and mapping system. The data were reviewed to identify anomalies. Particular reference has been made to:

- The correlation of anomalies with previously recorded sites;
- Anomalies indicative of hitherto unrecorded sites; and
- The absence of anomalies in the vicinity of previously recorded sites.

7.5.2 Shallow Geology

The sub-bottom data acquired by boomer source were assessed as this dataset had greater penetration than the alternative chirp source dataset. Understanding the shallow geological succession allows a more informed archaeological assessment to be made and hence a brief description of the shallow geology is given here. A fuller description is presented in Section 13.

Based on the analysis of the sub-bottom data, there appear to be three distinct units with the lowest unit overlain by layered sediments and finally fine-grained sediments. These units have been compared with descriptions of the geology in the area (Jackson *et al*., 1995 and Fugro OSAE GmbH 2008) to produce the following interpretation:

Sedimentary Unit	Interpretation
Unit 1	Cardigan Bay Formation till (Pleistocene)
Unit 2	Surface Sands Formation (Holocene)
Unit 3	Possible upper Surface Sands Formation or fine-grained seabed sediments (Holocene)

Unit 1, the upper till of the Cardigan Bay Formation, is considered to be the product of Weichselian glacial processes during the Upper Pleistocene (Jackson *et al*., 1995).

Unit 2 appears to have been laid down during a Holocene marine transgression (Jackson *et al*., 1995).

Unit 3 may be a continuation of the Surface Sands Formation or may consist of sediments that are more recent.

The sediments in this area are of little prehistoric archaeological or palaeo-environmental interest as the upper boundary of Unit 1 consists of an erosion surface. However, it is noted that the most recent sediments may contain more recent archaeological remains including shipwrecks and/or aircraft.

7.5.3 Maritime Sites

Both the magnetometer and side-scan sonar datasets along the centre line of the cable route were analysed with a view to locating anomalies of potential archaeological interest. However, none were seen in either dataset.

In addition, the side-scan sonar data from an anomaly categorised as a wreck by Fugro OSAE (W1) was assessed. This feature was located along the South Beach landfall option and not the current route (Appendix 7.3). It lies approximately 90m north of the South Beach option and approximately 1500m south of the North Beach option. This feature, 7000, is a patchy dark reflector measuring 14.3m x 7.3m x 0m. It is distinct from its surroundings and is indeed a possible wreck. The measurements given by Fugro OSAE are 16.4m x 0.9m x 5.8m but the object does not appear to have any height. A smaller dark reflector, 7001, measures 2.4m x 2.2m x 0m and is situated 6m to the south-west of 7000 (Figure 7.1). Feature 7000 is not at the position of any known wreck sites but there numerous known losses at nearby named locations, which may correspond to the wreck. The magnetometer data do not extend as far south-west as this location and it is therefore unknown if the features have a magnetic signature.

7.6 Potential Impacts

7.6.1 Identification of Impacts

Potential Effects

The potential effects resulting from construction can be summarised as follows:

- Potential damage to shipwrecks, aircraft and prehistoric land surfaces during any pre-construction seabed preparation, such as the towing of snagging devices;
- Potential damage to prehistoric land surfaces through the disturbance of sediments during intrusive geotechnical survey;
- Potential damage and destruction of shipwrecks and aircraft during intrusive geotechnical survey;
- Potential damage and destruction of shipwrecks, aircraft and prehistoric land surfaces during ploughing or water jetting; and
- Potential damage to shipwrecks, aircraft and prehistoric land surface caused by the deployment of vessel moorings.

Due to the nature of the project, i.e. the laying of an electrical cable, it is anticipated that there will be no adverse effects on the archaeological resource resulting from operation.

Impacts upon Recorded Sites and Features

None of the charted wreck sites lie within 50 metres of the proposed cable route and, as such, are unlikely to be damaged by the cable burial process. However, such sites could be vulnerable to damage or destruction caused by large cable-laying vessels deploying moorings in their vicinity.

Similarly, the charted wrecks are unlikely to be vulnerable to the intrusive geotechnical surveys that may be conducted along the proposed cable route but may be vulnerable to damage or destruction caused by survey vessels deploying moorings in their vicinity.

Therefore, the magnitude of impact of the proposed development is rated small on all recorded sites (refer to Table 7.3).

Impacts upon Previously Undiscovered Sites and Features

Any submerged prehistoric land surfaces could be damaged or destroyed by the cable-laying process or damaged by the deployment of vessel moorings in their vicinity. Similarly, any unknown wreck site could be damaged or destroyed by the cable-laying process, or damaged by the deployment of vessel moorings in their vicinity. Any impacts on unknown wrecks, aircraft and prehistoric land surfaces during preconstruction geotechnical survey and during the cable burial phase will be localised.

The study area crosses the Irish Sea on a route that has been known to mariners from at least the Romano-British period. Consistent use of this sea route in the medieval and post-medieval periods suggests that the archaeological potential of the area, in the form of currently unknown wrecks, should be classified as high. The evidence for submerged prehistoric sediments, reflected by the Neolithic axe found off Anglesey, further adds to the potential archaeological sensitivity of the area, suggesting the presence of a submerged palaeo-landscape within which archaeological material may be preserved.

Therefore, the scale of relative importance (Table 7.1) for the discovery of unknown archaeological remains is uncertain, as are the magnitude and significance of impact (Table 7.2 and Table 7.3).

Summary of Impacts

Where direct disturbance of archaeological deposits and material cannot be avoided during the cable burial, effects will be permanent and negative. The residual impact of changes in scour and sedimentation associated with the burial of the cable may also be negative where wrecks, aircraft and/or prehistoric deposits are exposed to erosion.

7.7 Mitigation and Monitoring

In the absence of any further survey data pertaining to known wreck sites, each site will be subject to archaeological exclusion zones. Each exclusion zone will take the form of a 100-metre buffer, based on the cardinal extents of the wreck site, rather than on the centre point for which the position is given. This will result in a significance of impact of none for all known wreck sites. In the event that other constraints require that the cable route needs to impinge on an exclusion zone, a detailed geophysical survey with the express intention of identifying archaeological interest will be carried out to determine the exact extent of any features, the scope of the survey would be agreed with DoEHLG. The route would then be designed to ensure no impingement on the potential site.

To mitigate against negative impacts on previously unknown archaeological sites and features, the data and logs obtained during the course of future geotechnical surveys will also be reviewed by a suitably qualified geoarchaeologist and any relevant data arising from the review process will be incorporated into the design and assessment process at the earliest opportunity.

All archaeological mitigation works be presented within a written scheme of investigation and agreed with the relevant authorities.

7.8 Residual Impacts

Given the archaeological mitigation proposed above, residual impacts to the archaeological resource are predicted to be negligible.

8 NOISE AND VIBRATION

8.1 Introduction

This chapter of the environmental report provides an assessment of the impacts that may arise to existing noise sensitive receivers from installation and operation of the EWI. As the majority of the work will be sited offshore, this section deals predominantly with impacts that could arise from the temporary construction and installation works and at the cable landfall at Rush North Beach. Impacts from noise created during the offshore installation works are discussed in section 6.

8.2 Assessment Methodology

8.2.1 General

Potential impacts and mitigation measures have been identified from preliminary design information, knowledge of the impacts of construction projects and appropriate mitigation measures from previous projects. Noise levels from the likely construction activities have been predicted based on the methodology provided by BS 5228: 1997 'Noise Control on Construction and Open Sites'.

BS 5228 provides procedures for noise control from construction activities. Part 2 of BS 5228 recommends the use of 'all reasonably practicable means' of noise control. These practicable noise controls should take into account local circumstances and operational limitations, and may utilise restricted hours of working, engineering noise controls, noise barriers and the setting of boundary or community noise limits.

Noise predictions have been based on a worst-case scenario as the design of the cable jointing pit in Rush North Beach car park has yet to be finalised. This assessment is based on the largest predicted pit length (15m) as described in Chapter 4.

BS 5228 includes a database of reference noise levels for a wide range of items of construction plant and activities. Where possible, reference is also included to more representative modern data, such as that provided in 'Update of noise database for prediction of noise on construction and open sites'. This document was published by the Department for Environment and Rural Affairs (DEFRA) in 2005, and provides more up-to-date information than that contained in BS 5228.

8.2.2 Assessment of the Significance of Impacts

When assessing significance, the magnitude of change and the importance and/or sensitivity of the receptor have been taken into account. The criteria for assessment are presented in Table 8.1 and Table 8.2, with Table 8.3 providing the significance.

Table 8.1: Magnitude of impact

Magnitude	Description
Large	Readily perceived change over a long period of time (ten years or more) or a readily perceived increase affecting a small area of high sensitivity over a medium period of time (around five years)
Medium	Readily perceived change over a medium period of time (around five years) or a readily perceived increase affecting a small area of high sensitivity over a short period of time (up to around one year)
Small	A small change that can only be perceived on occasions
Negligible	No perceptible effect

Table 8.2: Receptor sensitivity

Receptor Sensitivity	Description
High	Residential area
Medium	Area used primarily for leisure activities and not already exposed to significant levels of noise
Low	Area used primarily for leisure activities and already exposed to significant levels of noise
Negligible	All other areas such as those used primarily for industrial or agricultural purposes

Table 8.3: Significance of impact

Significance	Description
Very Significant	Readily perceived change over a long period of time (around ten years or more) in a residential area
Significant	Readily perceived change over a short to medium period of time (from under one year to around five years) in a residential area or a readily perceived increase affecting area used primarily for leisure purposes over a long period of time (around ten years or longer)
Moderate	Change that is only perceived on occasions over long period of time (ten years or more)
Slight	Change that is only perceived on occasions over a short to medium period of time (up to around five years)
None	No perceptible change

8.2.3 Construction Activities

Five main activities involved in the construction at North Rush Beach could give rise to noise impacts:

- Excavation of the TJP. This is understood to involve excavation of a long pit using a backhoe.
- Excavation of a trench from the TJP to the low water line and installation of ducting. It has been assumed that this is likely to involve three backhoes for a period of three weeks.
- Casting of the walls and base of the TJP within the excavation. This will involve concrete deliveries by concrete mixer, erection of formwork, placing of reinforcement by small crane, pouring and vibration of concrete with concrete pump and vibrator.
- Winching of cable from the cable lay vessel through the trench to the TJP. The cable would need to be a relatively continuous pull for two separate periods of approximately 48 hours. The final choice of winch and position will be subject to detailed engineering. However, it may involve the use of a 20-tonne diesel/hydraulic winch, located 10–15 m behind the TJP.
- Backfilling. It has been assumed that this would involve three backhoes.

8.2.4 Traffic and Transportation

During construction, there will some additional traffic generated by deliveries and movements of construction staff. Possible noise impacts from traffic are considered in this section (impacts on traffic and access are assessed in Sections 10 and 12).

Operational activities associated with the project are such that the traffic generated will be negligible.

8.2.5 Uncertainty and Technical Difficulties Encountered

At present, the precise size and position of the TJP within the car park has yet to be finalised. To complete as robust an assessment as possible, it has been assumed that the source of any noise and vibration could be at the edge of the car park closest to residences. Such work is likely to create higher noise levels than the trenching work on the beach, which will be located further from residences.

8.3 Baseline

8.3.1 Ambient Noise Levels

Noise levels in coastal areas at times can be surprisingly high due to surf noise and wind. At other times when the sea is flat and calm, background noise levels can be very low. Background noise levels can therefore be highly variable. It is likely that typical ambient $L_{Aeq,1hr}$ levels may be as low as 40dBA at times during daytime and may be as high as 50dBA. However, baseline noise monitoring would be required to confirm this (this has not been conducted in the area of the North Rush Beach).

8.4 Potential Impacts

8.4.1 Construction Noise

Noise levels from construction activities have been predicted using the sound power levels and methodology provided by BS 5228. The plant and equipment used for the noise calculations are shown in Table 8.4.

Noise levels have been predicted at various distances from the source based on the likely distances between the noise sources and the nearest potential noise sensitive receivers.

Taking a worst-case point of view, the nearest potentially affected residence is 15m from the proposed TJP. When predicted noise levels at this distance are compared with the likely background noise levels of between 40dBA and 50dBA during daytime, it is clear that significant increases in noise level would be expected for the relatively short period of construction.

The predicted noise levels below allow 5dBA reduction of noise sources.

Allowing a 3dBA increase for façade reflection it is evident from the above that the noise level criterion of 75dBA at 1m from the façade of an occupied residence can be complied with if the activity is located approximately 20m away.

While the potential increases in noise level due to construction are high (potentially up to 40dBA), the expected period of construction is relatively short. Noise level impacts will also be intermittent and, apart from the cable pull, only occur during daytime. The impact is therefore considered slight in the long-term but nearby residences may be disturbed significantly for a relatively short period.

The cable installation would require a relatively continuous pull for two separate periods of approximately 48 hours (one period for each cable). The noise levels predicted above are likely to result in significant disturbance at night to distances of up to around 300m if unmitigated.

During cable jointing operations (which will take place within a tent or trailer placed over the TJP), there may be a requirement for some continuous operations, in particular the application of insulation to the joint. Noise from cable jointing operations will be generated from the use of hand held power tools, with noise levels at the closest property expected to fall to around 62dBA.

Table 8.4: Indicative predicted noise levels at various distances for construction activities

Activity	Plant Items	SWL	% on time	Distance from Works					
				10m	15m	20m	30m	40m	100m
				Predicted $L_{Aeq,1hr}$					
Excavation of pit	Backhoes x 3	110	80	73	70	67	63	61	53
	Road truck	113	80	59	59	60	60	60	62
	Combined			73	70	68	65	64	62
Excavation of trench	Backhoes x 3	110	80	78	75	72	68	66	58
Casting of pit	Concrete truck	112	50	73	69	67	63	61	53
	Concrete pump	108	50	69	65	63	59	57	49
	Concrete vibrator	112	50	73	69	67	63	61	53
	360 excavator	110	80	73	70	67	63	61	53
	Crane	109	50	70	66	64	60	58	50
	Combined for whole activity			79	75	73	69	67	59
Pulling of cable	Winch	115	80	78	75	72	68	66	48
Backfilling	Backhoe x 3	110	80	73	70	67	63	61	53
Cable Jointing	Power Tools	105	80	65	62	59	55	53	45

8.4.2 Construction Vibration

Levels of vibration from construction activities are likely to be insignificant.

8.4.3 Operational Noise

During normal operation, the TJP and buried cables will generate no noise. There will therefore be no noise impact.

8.4.4 Construction Traffic Noise

An estimate of the daily construction traffic movements and flows have been calculated based upon the known requirements for construction and assuming a 12-hour working day Monday to Friday, and work on Saturday mornings. Construction of the TJP and cable landing area, which will contribute the greatest numbers to traffic movements, have also been assumed to be undertaken simultaneously (to provide worst case traffic intensity). Although it is assumed that construction will take three months to complete in total (within a longer window), the majority of construction traffic movements are assumed to take place in two to four 3-week periods during this longer period (predicted increases over and above baseline traffic flows will be proportionally bigger than if calculated over shorter periods of intense work than over the complete period).

The highest contribution that construction traffic will make to traffic will be on Kilbush Lane where in a worst-case scenario, there may be in the region of six construction traffic movements per working day (delivering plant and materials), staff vehicle movements will be in addition. For the purposes of this assessment, it has been assumed that the traffic movements will be evenly spread over the 12-hour day, resulting in less than one vehicle movement per hour, either entering or exiting the site.

These increases in traffic on Kilbush Lane are therefore considered unlikely to be significant, especially for relatively short-term construction works. Increases in L_{Amax} levels may occur on local roads due to delivery trucks. During daytime, however, these increases in L_{Amax} level are unlikely to cause significant disturbance.

In the event that all movements took place over an hour, there may be a slight impact.

8.5 Mitigation

8.5.1 Construction Noise

A construction noise management plan will be produced before construction works commence. This will detail noise mitigation measures that will be employed including procurement of the quietest plant available, operational procedures for minimising noise levels, details of physical mitigation measures such as noise barriers. It will also include details of community liaison measures such as letterbox drops, complaints handling procedures and contact numbers. It will also detail noise and vibration monitoring programmes to be carried out during construction, and be agreed with Fingal County Council.

To minimise the potential for noise impact, the site will be screened by at least a 2.5m-high, heavy plywood hoarding constructed on the sides of the site facing residences. This would provide between 5dBA and 7dBA reduction in noise level for some activities.

The cable installation would require a relatively continuous pull for two separate periods of approximately 48 hours (one period for each cable). The noise levels predicted above are likely to result in significant disturbance at night to distances of up to around 300m if unmitigated. It is therefore important to source the quietest possible winch suitable for the job. It is also suggested that a temporary enclosure be constructed around the winching operation.

If continuous operations are also required for the cable jointing operation, these will be agreed with Fingal County Council, and notifications will be given to residents well in advance.

These measures, including a design for the temporary noise enclosure would be detailed in the Construction Noise Management Plan.

8.5.2 Construction Traffic

Public roads will be used for moving materials and construction machinery. Disruption caused by transporting construction materials from the agreed site access locations to their final destinations will be minimised to reduce impacts on public highways.

A traffic management plan will be produced prior to construction to control and minimise the impacts of construction traffic on roads and other road users. Limitations on delivery times and numbers of deliveries per hour may be imposed to minimise noise impacts at the most sensitive times of day (i.e. early morning).

8.5.3 Construction Vibration

Vibration levels from construction activities are expected to be insignificant.

However, in the event that ground conditions require any activity to be introduced such as a hand-held compacter plate, which is likely to generate vibration in the construction of the transition jointing pit then vibration monitoring will be conducted at the nearest potentially affected residences. The results of this monitoring should be compared against building damage standards such as British Standard (BS) 7385-2:1993 *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* and human annoyance standards such as British Standard 6472 *'Evaluation of Human. Exposure to Vibration in Buildings (1 Hz to 80)*.

8.5.4 Operational Noise

Once constructed, the installation will generate no noise and therefore result in no noise impact.

8.5.5 Traffic Noise

No mitigation measures will be required in relation to onshore traffic noise impacts once the interconnector is constructed.

8.6 Residual Impacts

8.6.1 Construction Noise

The noise level criterion of 75dBA at 1m from the façade of an occupied residence discussed above, can be complied with at approximately 20m (assuming a 2.5m-high plywood hoarding is constructed on the sides of the site facing residences.). This allows a 3dBA increase for façade reflection.

Residual (i.e. after mitigation) impacts will comprise significant noise increase in $L_{Aeq,1hr}$ at the nearest residences intermittently during the construction phase. Increases of up to 40dBA may occur. These increases however would only occur during daytime and over a very short time period of a number of days during the construction period. These impacts would also only occur at a relatively small number of residences near Kilbush Lane and Skerries Road. The predicted noise levels with noise mitigation in place are shown in Table 8.4.

The shore pull phase of the work is weather-dependent and costly. A relatively continuous pull for two separate periods of approximately 48 hours would be required. In the absence of noise mitigation, the noise levels predicted above are likely to result in significant disturbance at night to distances of up to around 300m. It is therefore important to source the quietest possible winch suitable for the job. This may comprise an electric winch with a remote power generator or other alternative. A temporary noise enclosure would be constructed around the winching operation. An acoustic consultant will be employed to produce a detailed noise management plan for this operation, which would detail the sound power level of the actual winch to be used, the noise mitigation measures to be implemented including the design of the temporary noise enclosure and the resulting noise level at the potentially affected residences.

An exemption from the rules applying to general construction work will be sought for the pull-in works, and for any requirement for extended working hours for completion of the cable joints.

8.6.2 Construction Vibration

Vibration levels from construction of the TJP are expected to be insignificant.

8.6.3 Traffic Noise

With the traffic management plan in place, noise impacts caused by construction traffic will be very short-term and insignificant.

8.6.4 Operational Phase

There will be no residual noise impacts once the transition jointing pit and cable are installed. However, if the cable needs to be repaired and/or maintained, there may be temporary minor impacts.

9 AIR QUALITY

9.1 Introduction

This chapter of the environmental report provides a qualitative assessment of potential air quality impacts associated with the installation and operation of the EWI cable. The assessment focuses specifically on potential impacts associated with the construction and operation of the interconnector cable between the high water mark at Rush, and the median line between Ireland and Britain.

Although emissions to air from cable laying, survey and support/guard vessels will occur offshore, these will be temporary in nature (it is anticipated that the Irish section of cable laying and burial operations will be completed within a six-month period) and minimal in the context of emissions from the number of marine vessels typically operating in the Irish Sea. Landfall construction works at Rush North Beach are not anticipated to be significant in terms of scale or potential impact, and are predicted to take place for a period of approximately 13 weeks in a longer overall construction phase.

Comments from the Marine Licence Vetting Committee on the previously submitted scoping report for the proposed scheme suggests that air quality is not a significant concern for the EWI project. This is reflective of the temporary nature of the cable laying and landfall works and the location of potentially sensitive receptors with respect to offshore (cable laying) operations.

9.2 Assessment Methodology

9.2.1 General

Potential impacts and mitigation measures have been identified from information received by data collection, professional experience of impacts associated with construction works and appropriate mitigation measures from previous projects.

9.2.2 Assessment of the Significance of Impacts

When assessing the significance of impacts, the magnitude of change and the importance and/or sensitivity of the receptor have to been taken into account. Suitable assessment criteria are presented below in Table 9.1 to Table 9.3.

Table 9.1: Magnitude of impact

Magnitude	Description
Large	The impact is on a global, continental or national scale
Medium	The impact is on a regional scale
Small	The impact is limited to a small area, perhaps a 1–5km radius from source
Negligible	The impact is limited to the immediate vicinity (less than 1km) of source (e.g. within site boundary)

Table 9.2: Receptor sensitivity

Receptor Sensitivity	Description
High	Hospitals and clinics, high-tech industries, painting and finishing, food processing
Medium	Schools, residential areas, food retailers, greenhouses and nurseries, horticultural land use, offices
Low	Farms, light and heavy industry, outdoor storage

Table 9.3: Significance of impacts

<table>
<tr><th>Significance</th><th colspan="2">Description</th></tr>
<tr><td>Very Significant</td><td>Irreversible change that could have an extensive effect and include areas remote to the development area over a long time period (greater than 20 years)</td><td rowspan="2">Significant impacts where monitoring may be required</td></tr>
<tr><td>Significant</td><td>Moderate adverse change with changes to areas remote from the site over a moderate time period (<20 years)</td></tr>
<tr><td>Moderate</td><td colspan="2">Slight changes just outside the accepted limits of normal variation with little or contained offsite effects, detectable within a medium time period (5–10 years)</td></tr>
<tr><td>Slight</td><td colspan="2">Change only just detectable within the site and surrounding areas over a short timescale (less than 10 years)</td></tr>
<tr><td>None</td><td colspan="2">An impact causing effects that are not readily noticeable.</td></tr>
</table>

9.3 Baseline Air Quality

The Environmental Protection Agency (EPA) has, in conjunction with individual local authorities, a duty to monitor various environmental quality parameters in Ireland. This is enshrined in Section 65 of the Environmental Protection Act, 1992.

Ambient air quality, therefore, is monitored continuously at a various roadside, urban and rural locations across Ireland. The measurement data are collated by the EPA, and an annual report on air quality is subsequently produced. The most recent report, *Air Quality in Ireland (2006) – Key Indicators of Ambient Air Quality* (published in 2007), indicates that ambient concentrations of key pollutants such as nitrogen dioxide (NO_2), fine particles (PM_{10}), sulphur dioxide (SO_2), lead (Pb), benzene (C_6H_6) and carbon monoxide (CO) currently meet relevant air quality standards protective of human health across all locations in Ireland.

In terms of vehicle emissions, the components of greatest concern with respect to human health impacts are NO_2 and PM_{10}. In 2006, the highest measured annual average NO_2 concentration (35 $\mu g/m^3$) was recorded at Whitehaven Street in Dublin. This is below the annual average standard of 40 $\mu g/m^3$. In terms of annual average PM_{10} levels, the maximum concentration in 2006 (32 $\mu g/m^3$) was measured in Wexford. Again, this is below the annual average standard of 40 $\mu g/m^3$.

Whilst no air quality measurements are made in Rush Bay (the nearest continuous monitoring station is situated in Kilbarrack, Dublin), it is assumed that because annual average NO_2 and PM_{10} concentrations at some of the most urban sites in Ireland (such as locations in Dublin) are within relevant limits, air quality in Rush will also meet national standards. Although no offshore air quality monitoring data were available for review, again, it is assumed that pollutant concentrations are within relevant limits in the Irish Sea (although elevated PM_{10} concentrations may be apparent at sea due to the entrainment of sea salt/spray in the air).

9.4 Existing Environment

The nearest potentially sensitive receptors to the landfall site at Rush North Beach are likely to include residential properties in and around Rush, recreational users of the beach and people inhabiting the caravan park adjacent to the beach.

9.5 Air Quality Impacts During Construction

9.5.1 Onshore Landfall Construction

The construction works associated with the cable landfall will potentially result in fugitive emissions of dust and plant exhaust emissions caused, predominantly, by the following site activities:

- Excavation of the transition joint pit (TJP) in the car park at Rush North Beach (located above the high water mark). This will be carried out using standard construction plant such as a JCB backhoe;
- Excavation of a trench from the TJP to the low water line and installation of ducting. It is assumed that this will involve three backhoes;
- Casting the concrete base of the TJP within the excavation. This will involve concrete deliveries by concrete mixer, erection of formwork, pouring and vibration of concrete with a concrete vibrator;
- Winching of cable from the shoreline through the trench to the TJP. It has been assumed that this will be achieved using a 20-tonne winch; and,
- Backfilling. It has been assumed that this will involve up to three backhoes.

Emissions to air from construction and staff vehicles travelling to and from the site will also occur, with a small number of additional vehicle movements per day predicted for Kilbush Lane during the construction phase. Construction works are predicted to take three to four months to complete, although the majority of traffic movements will take place over two to four 3-week periods during this time.

Whilst construction works will have the potential to result in fugitive dust emissions and therefore possible nuisance impacts, these are unlikely to be significant. The transition joint pit construction site will cover a small area and will be fully fenced off from the public when work is taking place. Trenches across the beach will also be fenced off while they are open. Furthermore, the prevailing westerly/south-westerly wind will ensure that any fugitive dust emissions that do escape the site will generally disperse towards the Irish Sea and away from the residents of Rush and the surrounding coastal fringe area.

As discussed above, although various items of plant will be utilised on site to construct the TJP and other elements (such as a winch to pull the cable onshore), construction works are only anticipated to occur for a period of three to four months, with concentrated phases of activity planned for two to four 3-week periods during this time. Associated plant emissions will therefore be temporary in nature. All plant will meet relevant emissions standards and will be suitably maintained during the landfall construction works.

The movement of vehicles to and from the site along Kilbush Lane will result in additional emissions to air. However, the incremental increase in vehicle movements during the construction phase is unlikely to result in significant air quality impacts on residents situated along Kilbush Lane and other roads used by construction and staff vehicles accessing the landfall construction site. National air quality monitoring data indicate that background concentrations of pollutants of concern (predominantly NO_2 and PM_{10}) are currently below relevant air quality limit values. An increase in concentrations of NO_2 and PM_{10} as a result of the small number of additional vehicle movements per day is unlikely to result in a significant worsening or deterioration in local air quality, and is unlikely to result in an exceedance of relevant air quality standards protective of human health.

9.5.2 *Offshore Cable Laying*

It is anticipated that one cable-laying vessel and one guard vessel will be simultaneously employed offshore. Before cable installation commences, an appropriate survey vessel will be utilised for route clearance (using a grapnel) for the cable across the Irish Sea. Once the route has been cleared and the cable has been laid, a burial vessel will be employed to ensure that the interconnector is securely positioned/buried in the sediment.

Estimates of total fuel consumption for offshore operations for the whole of the cable route have been provided in Section 4 (based on the number days required for each task by various cable construction vessels). This equates to a total operational time for offshore vessels of 381 days. However, as for some of this time vessels will be operating simultaneously, this is likely to be an overestimation of the actual duration of offshore operations. It is assumed within the assessment that approximately half of the 381 days will be spent on operations within Irish waters. According to the fuel usage estimates provided in Section 4, this will result in the consumption of approximately 1600m^3 of fuel (and production of associated emissions to air) within the Irish section of the EWI route. Assuming an average fuel density of 900kg/m^3 (for marine distillate fuels), this equates to approximately 1440 tonnes of fuel consumed offshore.

DEFRA's UK Greenhouse Gas Inventory, 1990 to 2005 (published in April 2007), provides emissions factors for the combustion of liquid fuels, including fishing, coastal shipping and international marine fuel. Emission factors for carbon, nitrogen oxides (NO_X), SO_2, CO and non-methane volatile organic compounds (NMVOC) as published in the DEFRA inventory are presented below in Table 9.4, which also presents estimated emissions of each parameter.

Table 9.4: Estimated emissions from offshore vessels during construction

Emission Component	Emission Factor (kg/tonne)^	Estimated Emissions (tonnes)^^
CO_2	879.0^^^	4650
NO_X	72.3	105
SO_2	52.9	80
CO	7.4	11
NMVOC	3.5	5

Notes:
^Emission factors taken from DEFRA's *UK Greenhouse Gas Inventory, 1990 to 2005* (published in April 2007) for fishing, coastal shipping and international marine fuel oil.
^^Presented emissions are based on estimated fuel consumption of 1440 tonnes during offshore operations in the Irish Sea.
^^^Presented emission factor is for carbon not CO_2; carbon emissions were converted to carbon dioxide emissions by multiplying by 44/12.

CO_2 emissions from offshore vessels are estimated to be approximately 4650 tonnes. This is less than 0.01% of the total greenhouse gas emissions in Ireland in 2005 (approximately 70 million tonnes of CO_2 equivalent[5]).

Total mass emissions of NO_X, SO_2 and CO are estimated to be significantly less than those of CO_2, at 105, 80 and 11 tonnes respectively. It is anticipated that the prevailing westerly/south-westerly wind will generally disperse offshore emissions away from the coast of Ireland towards the Irish Sea and Britain, and therefore emissions at sea are unlikely to contribute significantly to existing ambient pollutant concentrations at the nearest sensitive receptors in and around the landfall area at Rush Bay North Beach.

[5] Source: Irish EPA (website: www.epa.ie).

9.6 Air Quality Impacts During Operation

Once the cable has been connected onshore at the TJP and the project is fully operational (i.e. construction works have ceased), there will be no emissions associated with TJP site, with the exception of occasional maintenance visits made using small vehicles.

However, during the first few years of operation, a survey vessel will be employed on an annual basis to check the integrity of the offshore cable. Employing the same emission factors presented in Section 9.5 and assuming that only half of the 900m^3 of fuel presented in Section 4 will be consumed by the survey vessel in Irish waters, annual CO_2, NO_X, SO_2, CO and NMVOC emissions are anticipated to be in the order of 1310, 30, 22, and 3 and 1.5 tonnes respectively. This summarised in Table 9.5.

Table 9.5: Estimated emissions from offshore vessels during operation

Emission Component	Emission Factor (kg/tonne)^	Estimated Emissions (tonnes)^^
CO_2	879.0^^^	1310
NO_X	72.3	30
SO_2	52.9	22
CO	7.4	3
NMVOC	3.5	1.5

Notes:
^Emission factors taken from DEFRA's *UK Greenhouse Gas Inventory, 1990 to 2005* (published in April 2007) for fishing, coastal shipping and international marine fuel oil.
^^Presented emissions are based on estimated fuel consumption of 405 tonnes during annual survey in the Irish Sea.
^^^Presented emission factor is for carbon not CO_2; carbon emissions were converted to carbon dioxide emissions by multiplying by 44/12.

9.7 Mitigation Measures

9.7.1 Onshore Landfall Construction

The dust emitting activities previously outlined can be controlled effectively by employing appropriate dust control/mitigation measures. Effective dust mitigation measures prevent dust from becoming airborne or contain dust within enclosures to prevent dispersion beyond the emission source.

Before landfall construction activities commence, agreement will be reached with the local authority to ensure that the potential for adverse environmental effects on local receptors is minimised. This includes measures to control traffic routing, site access points and hours of operation. It is recommended that, following agreement of such measures for controlling dust and general pollution nuisance from construction operations, the measures are included within a formalised Code of Construction Practice (CoCP) for the site. These controls would be applied throughout the construction period to ensure that dust emissions are mitigated. Construction activities would therefore be controlled to reduce as far as possible any potential environmental impacts. Such mitigation is anticipated to include:

- Damping down of site haul roads by water bowsers during prolonged dry periods;
- Regular cleaning of hard-surfaced site entrance roads;
- Ensuring that dusty materials are stored and handled appropriately (e.g. wind shielding or complete enclosure, storage is away from site boundary, drop heights of materials are minimised, water sprays are used where practicable to reduce dust emissions);
- Ensuring that dusty materials are transported appropriately (e.g. sheeting of vehicles carrying spoil and other dusty materials);
- Restricting vehicle speeds on haul roads;
- Construction of hoardings to prevent dust breakout; and

- Incorporation of appropriate dust monitoring into site management practices to inform site management of the success of dust control measures used.

The traffic effects of the proposed development during the construction phase will be limited to a finite period and will be along the traffic routes employed by construction and employee vehicles. Implementation of the agreed CoCP will help ensure that air quality impacts associated with construction vehicles and plant are reduced as far as practicable.

Overall, construction effects on air quality will be minimised through the implementation of mitigation measures outlined in the CoCP. This will help reduce the amount of dust that escapes the site boundary and additional measures to control/suppress dust may be employed where construction activities are in very close proximity to sensitive receptors. Any construction effects on air quality will be temporary, i.e. during the construction phase only.

9.7.2 Offshore Cable Laying

No specific mitigation measures have been identified for offshore cable laying operations. It is assumed that all vessels employed offshore will be suitably maintained throughout the relatively short-duration of the cable laying exercise, and that all vessels will meet relevant emissions standards. Offshore operations are not anticipated to result in a significant and prolonged incremental increase in emissions above those that are currently observed in the Irish Sea.

9.7.3 Operational

No specific mitigation measures have been identified for the operational phase of the project. It is assumed that the vessel employed for the annual survey during the first few years will be suitably maintained throughout the relatively short duration of each annual survey.

9.8 Residual Impacts

Following the adoption of the mitigation measures presented above in Section 9.7, no significant residual air quality impacts are anticipated. Although, as previously discussed, during the first few years of the project there will be emissions associated with annual offshore survey vessels.

Based on the assessment criteria presented in Table 9.1 to Table 9.3, the impact significance of the onshore construction works can be classified as slight, as although receptors in and around Rush North Beach can be deemed of medium sensitivity, the magnitude of impact, following the implementation of appropriate mitigation measures, can be classified as negligible. Similarly, the overall impact of offshore operations (both pre and post-construction of the interconnector cable) can be deemed slight, as although emissions to air are likely to have a wider geographical impact than dust emissions from construction activities (and therefore classified as small), the potential to significantly impact on onshore receptors is minimal. No significant onshore air quality impacts are anticipated once the site is fully operational.

Emissions of CO_2 and other parameters from offshore operations are not predicted to be significant and, for CO_2, are anticipated to represent a small fraction of total annual CO_2 emissions from Ireland as a whole.

10 Navigation and Traffic & Transportation

10.1 Introduction

This chapter of the environmental report provides an assessment of the impacts that may arise to existing navigational interests from installation and operation of the EWI. Whilst the majority of the work will be sited offshore, it also reports the potential traffic and transportation impacts that could arise from the temporary construction and installation works at the cable landfall at Rush North Beach.

10.2 Assessment Methodology

10.2.1 General

Potential impacts and mitigation measures have then been identified as a result of information received from data collection, knowledge of the impacts of construction projects and appropriate mitigation measures from previous projects.

10.2.2 Assessment of the Significance of Impacts

When assessing significance, the magnitude of change and the importance and/or sensitivity of the receptor have been taken into account. The criteria for assessment are presented in Tables 9.1 to 9.3 below.

Table 10.1: Magnitude of impact

Magnitude	Description
Large	Substantial changes to shipping navigation. Potential interference with international routeing measures adopted by the IMO. Potential blocking of access to port approaches or established navigational channels Changes resulting in large increased navigational risk (e.g., collision, grounding, etc.) and/or increased commercial costs due to deviation from the most economical, safe route Changes in traffic flows are well outside the range of natural variation and permanent
Medium	Moderate changes to shipping navigation. Reduction of sea room in port approaches or established navigational channels Changes resulting in moderate increased risk and/or commercial impacts to shipping due to deviation from the most economical, safe route Changes in traffic flows outside the range of natural variation but experienced over the short to medium term
Small	Minor changes to shipping navigation. Changes might be noticeable, but only temporary Changes to traffic flows might be noticeable, but only short term
Negligible	Changes in shipping navigation and traffic flows that are unlikely to be noticeable

Table 10.2: Receptor sensitivity

Receptor Sensitivity	Description
High	International routeing measures adopted by the IMO (e.g., TSS, DWR) Recognised shipping lanes essential for international navigation, e.g. Dover Strait Major ports Trunk roads (particular sensitivity at or near capacity)
Medium	National/regional shipping lanes Minor ports Local network roads and links (particular sensitivity at or near capacity)
Low	Local shipping lanes Small harbours or jetties Minor roads and access tracks (particular sensitivity at or near capacity)

Table 10.3: Significance of Impacts

Significance	Description	
Very Significant	Irreversible change which could have an extensive effect and include areas remote to the development area over a long time period (greater than 20 years).	Significant impacts where monitoring may be required
Significant	Moderate adverse change with changes to areas remote from the site over a moderate time period (<20 years).	
Moderate	Slight changes just outside the accepted limits of normal variation with little or contained off-site effects, detectable within a medium time period (5–10 years).	
Slight	Change only just detectable within the site and surrounding areas over a short timescale (less than 10 years).	
None	An impact causing effects that are not readily noticeable.	

The threshold for significant impacts, where monitoring measures may be required, is where residual impacts are considered significant or very significant, as defined in Figure 3.1.

10.2.3 Navigation

A desk-based review of issues associated with the proposed EWI route has been undertaken in relation to shipping navigation. This section summarises the findings of that review. The full report is presented as Appendix 10.1.

For the purposes of the desk-based assessment, baseline data were collated along the cable routes, including cable landfall options, to identify the following:

- Shipping routes;
- Shipping densities; and
- Navigational features (e.g. traffic separation schemes (TSS), offshore windfarms).

This data was obtained using the ShipRoutes database, which has been developed by Anatec UK Ltd. The data within ShipRoutes are taken from a number of sources such as AIS, radar, satellite vessel tracking, vessel passage plans, and Admiralty charts. The database includes information on routes taken, vessel types and intensity of routine commercial shipping. However, the database does not hold vessel activity from non-routine sources, such as fishing, naval, dredging or recreational craft.

The ShipRoutes database was queried for data on the preferred cable route (i.e. Barkby Beach to Rush Bay North Beach). It should be noted, however, that data for the alternative landfall locations were also reviewed as part of this process to inform the consideration of alternatives (see Chapter 4).

10.2.4 Traffic and Transportation

Operational activities associated with the project are such that the traffic generated is considered negligible. For this reason, the primary focus of this assessment is the potential impact from construction activities. A qualitative assessment based upon professional judgement has been made with respect to the potential impacts of the EWI.

Estimates of the daily construction traffic movements and flows have been calculated based upon requirements for construction. It should be noted that two to four periods of up to three weeks in duration have been assumed for the construction of the landfall and this has been used as the basis for estimating construction traffic flows.

10.2.5 Uncertainty and Technical Difficulties Encountered

No particular technical difficulties have been identified during the course of the assessment with respect to shipping navigation. With respect to construction traffic impacts, there was no baseline traffic flows available from Fingal County Council or indeed the central government bodies. For this reason, the assessment made is one based upon professional opinion.

10.3 Baseline

10.3.1 Navigation Routes and Vessel Types

Figure 10.1 presents an overview of the commercial shipping routes crossing the proposed cable route, and Table 10.4 notes vessel type and weight. In total, approximately 16,200 vessels cross the cable route per year, averaging 44 crossings per day. Of these, around half (51%) are cargo vessels, with ferries and tankers contributing 28 and 21% respectively. Nearly half of all vessels are between 1,500 and 5,000 deadweight tonnes (dwt), with only a small number (6%) of large vessels greater than 40,000 dwt.

Table 10.4: Annual shipping levels crossing preferred cable route

Vessel Type	Vessel Size (dwt)					Annual Total
	0–1500	1500–5000	5000–15,000	15,000–40,000	≥ 40,000	
Cargo	325	4825	1605	900	640	8295
Tanker	35	1495	1200	333	345	3408
Ferry	148	1278	3059	0	0	4485
All	508	7598	5864	1233	985	16,188

10.3.2 Shipping Density

Overall shipping density along the cable route is presented in Table 10.2. This analysis identifies several areas of relatively greater shipping activity:

- East of the Off Skerries TSS where traffic crosses between Liverpool and the TSS/Point Lynas pilot station;
- Immediately north of the TSS where traffic joins the south-west lane;
- West of the TSS where traffic crosses between Dublin and Morecambe Bay;
- Approximately midway between Rush and the TSS where ships travel north/south between the North Channel and St George's Channel; and
- Off Lambay Island and Rockabill lighthouse (east of Rush) due to north/south coastal traffic.

10.3.3 Onshore Access Routes

The primary route that will be used to construct the EWI landfall will be Skerries Road to Kilbush Lane. This road will be used for the transport of plant, construction materials and personnel to and from site.

No baseline traffic flows were available from the local and central transport authorities for these or any other local links serving the proposed construction site.

10.4 Potential Impacts

10.4.1 Navigation

10.4.1.1 Construction

Due to their limited ability to manoeuvre, offshore construction vessels for the proposed development will require an exclusion zone within which no other vessels should enter. The presence of the construction vessels along the cable route may therefore cause disruption to shipping activity in the area by requiring alteration of planned routes when they are operating within an area. This will apply to both the “routine” traffic discussed above (e.g. freighters, tankers) and “non-routine” traffic (e.g. fishing vessels, and recreational craft). As the construction vessels, when present, will be moving along the cable route, they will not affect any particular existing routes for long periods of time.

Given the baseline information and the planned construction schedule (60 days for grapnel runs, 40 days for cable lay, 80 days of guard vessel presence, 30 days for cable burial and 15 days for cable burial survey) during which the vessels will be travelling slowly along the route, the impact to navigation is considered as short-term, temporary and minor.

10.4.1.2 Operational Phase

During normal operation, there will be limited impact to shipping. The cable route will be designed such that there is a negligible risk to interfering with anchoring or other activities (such as trawling over with towed fishing gear).

There will be regular (though not frequent) surveys of the buried cable route using side-scan and possibly remotely operated vehicles (ROVs, to monitor the depth of burial), these surveys will be carried out from a vessel that will travel the whole route of the cable. Surveys are anticipated to take place once per year in the early years of operation, and this may reduce when sufficient information has been gained on sediment movements. These surveys will take approximately 15 days to complete, and while normal traffic may have to make minor diversions to avoid the survey vessel, the impact is defined as negligible.

In the event that maintenance or repair of the cable is required, vessels to perform this work will be required along the cable route. The position and amount of maintenance and the complexity of any repair will determine the length of time any vessels need to be present along the route. Vessels carrying out any repair would need to be avoided by other traffic. However, the route has been designed to limit potential for damage, and impacts to navigation from maintenance and repair are therefore considered unlikely and minor, if they do occur.

10.4.1.3 Electromagnetic Fields

The cable design will ensure that any electromagnetic fields (EMF) (which have the potential to affect ships’ compasses) produced by the current passing along the cable are minimised. Such effects also reduce with distance from the source of EMF; effects on navigation are not expected.

10.4.2 Traffic and Transportation

10.4.2.1 Construction Traffic Flow Predictions

An estimate of the daily construction traffic movements and flows have been calculated based upon the known requirements for construction and assuming a 12-hour working day Monday to Friday, and work on Saturday mornings. Construction of the TJP and cable landing area, which will contribute the greatest numbers to traffic movements, have also been assumed to be undertaken simultaneously (to provide worst case traffic intensity). Although it is assumed that construction will take three months to complete in total (within a longer window), the majority of construction traffic movements are assumed to take place in two to four 3-week periods during this longer period (predicted increases over and above baseline traffic flows will be proportionally bigger than if calculated over shorter periods of intense work than over the complete period).

The highest contribution that construction traffic will make to traffic will be on Kilbush Lane where in a worst-case scenario, there may be six construction traffic movements per working day (delivering plant and materials), with additional staff vehicle movements. For the purposes of this assessment, it has been assumed that the six movements will be evenly spread over the 12-hour day, resulting in less than one vehicle movement per hour, either entering or exiting the site.

10.4.2.2 Construction Impacts

It is anticipated that the number of movements generated by the construction phase of the project will not lead to disruption of traffic flows during construction. The increase in traffic levels will be temporary and barely noticeable, and will cease upon completion of the construction period.

In addition to temporary disruption of traffic flows, access to a small number of local dwellings in the vicinity of the construction site may be affected whilst construction is taking place. Such severance of access has the potential to cause significant disruption to these residents, albeit over a very short-term.

10.5 Mitigation

10.5.1 Construction Phase

10.5.1.1 Navigation

To minimise the potential for disruption and/or accidents during cable laying operations, notice will be given to shipping in the area via Navtex and NAVAREA warnings.

Procedures to minimise disruption near those shipping traffic hotspots identified will be considered and applied. These may include, for example, avoidance of anchoring near busy areas when construction vessels are waiting on weather, and the presence of a guard vessel at all times.

EirGrid will liaise closely with key stakeholders before and during all stages of construction. This will include local ports (e.g. Mostyn, Liverpool and Dublin) and the operators/developers of offshore windfarms off North Wales.

Collision avoidance procedures will be developed and applied. In periods of bad visibility, especially in high-density shipping areas, restrictions such as a temporary halt to construction activity may be considered to reduce the risk of collisions.

10.5.1.2 Onshore Traffic

Public roads will be used for moving materials and construction machinery. Disruption caused by transporting construction materials from the agreed site access locations to their final destinations will be minimised to reduce impacts on public highways.

A traffic management plan will be produced prior to construction to control and minimise the impacts of construction traffic on roads and other road users. The traffic management plan will be designed to:

- establish the type of construction traffic permitted to use access routes to the working areas, including particular restrictions (height, weight, etc.) and sensitive receptors;
- indicate areas of limited or no access to construction traffic;
- detail arrangements and routes for abnormal loads, which will be agreed in advance with the local highways authority;
- detail the traffic-control measures (e.g. stop-go boards, traffic lights and signage) required at road crossings and the construction site;
- ensure that areas of restricted or no access are signed adequately and provide alternative means of access or transport whilst restrictions are in place;
- inform all personnel involved in the construction, of the routes that they can and cannot use for construction access; and
- satisfy the highways authorities that all possible steps have been taken to reduce the impact of the use of construction traffic on the local communities.

The traffic management plan will be discussed with the local highways authority and the necessary procedures will be followed to receive their approval. Mitigation measures for minimising the impacts on roads and road users during transportation of materials, plant and personal will include but not be limited to:

- agreeing routes with the local highways authority to minimise traffic congestion and avoid less suitable roads and/or roads with restrictions;
- wherever practicable, deliveries of abnormal loads will be made outside peak hours and where appropriate during the night;
- a notification process will be developed to give residents of the surrounding area advance warning of potential delays on the road network as a result of abnormal loads;
- all abnormal loads will be suitably marked to warn other road users;
- using approved routes, for the transport of material and plant to the construction compound to minimise road impacts, and abiding by any restrictions agreed in the traffic management plan to further reduce impacts;
- sourcing materials locally, where possible;
- minimising the generation of wastes by reusing material on site; and
- encouraging workers to car-share.

When it is necessary for tracked plant to cross-metalled roads, the road surface will be protected using tyres or similar surface protection.

10.5.2 Operational Phase

10.5.2.1 Navigation

Once constructed, “as built” co-ordinates of the cable will be charted (e.g. on Admiralty charts) and circulated to the maritime community, which will minimise the potential for accidental damage to the cable caused through e.g. anchoring or towed fishing gear.

When monitoring surveys are planned, or any maintenance or repair of the cable is required, details of the activity to take place will be circulated to the appropriate authorities and maritime community.

10.5.2.2 Onshore Traffic

No mitigation measures will be required in relation to onshore traffic impacts once the EWI is constructed.

10.6 Residual Impacts

10.6.1 Construction phase

10.6.1.1 Navigation

Residual (i.e. after mitigation) impacts will comprise temporary minor impacts as disruption to marine traffic in the area. These will be most apparent at the traffic “hot-spots” highlighted above.

10.6.1.2 Onshore Traffic

With the Traffic Management Plan in place, and measures committed to therein, disruption to traffic is considered likely to be very short term and slight in significance.

10.6.2 Operational Phase

There will be no residual impacts to marine traffic as a result of normal operation of the proposed development. However, in the event that sediment depth over the cable reduces (as a result of natural sediment movements), there is a minor risk of a vessel anchoring on the cable and snagging it. Such areas where sediment movement may occur will be identified in the burial depth surveys, and may be subject to more frequent burial surveys than the remainder of the route.

During monitoring surveys, and in the eventuality of repair or maintenance of the cable being required, there may be temporary slight impacts as a result of disruption to shipping routes.

11 WATER

This chapter considers the potential impacts that could occur to both water movements and water quality along the marine section of the EWI route as a result of its installation and operation.

11.1 Assessment Methodology

The general methodology used for the assessment of significance is described in detail below. The specific criteria used to determine the significance of the residual effects (i.e. those remaining after mitigation measures) on the water resources is presented in this section of the report.

11.1.1 Magnitude of Impact

The magnitudes of the impacts are defined as follows.

Table 11.1: Magnitude of impact

Magnitude	Description
Large	Permanent/irreversible change to a receptor
Medium	Reversible medium to long-term change (5–10 years), outside the bounds of natural variation
Small	Reversible short-term change (up to five years), outside the bounds of natural variation
Negligible	Changes within the bounds of natural variation with no detectable effect

11.1.2 Sensitivity of Receptors in the Physical Environment

To evaluate the relative sensitivity of receptors to the proposed development, it is necessary to produce a reference list defining the degree of sensitivity as indicated by the amount of change noted in the water resources.

Table 11.2: Receptor sensitivity

Receptor Sensitivity	Description
High	European and nationally designated/protected waters or sites (for water quality and/or in support of biodiversity)
Medium	Regionally designated/protected waters or sites, coastal processes or flood defences
Low	Local (non-statutory) designated/protected waters or sites
Negligible	Not designated and not considered sensitive to change

11.1.3 Potential Significance

Potential significance has been assessed for the water resources, based on the combination of the magnitude of change and the sensitivity of the receptor, and is described below.

The threshold for significant impacts, where monitoring measures may be required, is where residual impacts are considered significant or very significant, as defined in Table 11.3.

Table 11.3: Significance of impacts

<table>
<tr><th>Significance</th><th colspan="2">Description</th></tr>
<tr><td>Very Significant</td><td>Irreversible change to a receptor of high sensitivity, which could have an extensive effect and include areas remote to the development area</td><td rowspan="2">Significant Impacts where monitoring may be required</td></tr>
<tr><td>Significant</td><td>Adverse change over a medium time period (5–10 years and beyond) to a receptor of high sensitivity with changes to areas remote from the site</td></tr>
<tr><td>Moderate</td><td colspan="2">Medium changes, detectable within a medium time period (5–10 years), to a receptor of medium sensitivity, just outside the accepted limits of normal variation with little or contained off-site effects</td></tr>
<tr><td>Slight</td><td colspan="2">Change only just detectable within the site and surrounding areas over a short timescale (less than five years)</td></tr>
<tr><td>None</td><td colspan="2">An impact causing effects that are not readily noticeable</td></tr>
</table>

11.2 Scope of the Assessment

This chapter provides a description of existing conditions in terms of oceanography and marine water quality, and focuses on the EWI cable in Irish jurisdiction up to the high water mark. Potential impacts from both installation (construction) and operation of the cable are identified. Where necessary, mitigation measures are proposed to ensure that impacts are minimised, and residual impacts following the provision of mitigation measures are summarised.

11.3 Data Sources

Data has been collated from a number of sources including the Environmental Protection Agency and the Irish Marine Institute.

11.4 Determination of Significant Effects

Many of the parameters measured in seawater are regulated by environmental quality standards, which are set by national environment agencies, under guidance from the EU. The potential impacts of the construction and operational phases of the EWI cable on seawater quality have been assessed against relevant environmental quality standards. Potential impacts to bathing beach status are also considered.

There are no specific standards in relation to water movement. However, in gross terms, coastal defence authorities would review the potential for changes to tides and currents, which may increase the requirement for defences. It should be noted that the works proposed for the EWI are not anticipated to result in an increased requirement for coastal defence works in either Ireland or Wales.

11.5 Baseline Conditions

11.5.1 Oceanography

11.5.1.1 Tides

Semi-diurnal tides are the dominant physical process in the EWI region, propagating into the Irish Sea from the Atlantic Ocean through both the North Channel and the St George’s Channel.

The sea surface level at any instant in time is the summation of the astronomical tidal level and residual water level caused by meteorological effects. Astronomical tidal levels can be forecasted accurately, although perturbations due to the atmospheric pressure, winds, and temperature are not so easily predicted. Deep atmospheric depressions and strong winds can give rise to storm surges, radically altering the predicted tides. Under extreme conditions, this can add up to two metres to the predicted high water (Hydraulics Research, 2007).

The full span of possibilities occurs within the region, from areas with very large tidal range (the range in Liverpool Bay exceeds 10m on the largest spring tides and is the second largest in Britain) to regions of very small tidal range (in the vicinity of Arklow in the St George's Channel and between Islay and the Mull of Kintyre in the North Channel). In addition, the time of high water varies little over a wide area to the east and west of the Isle of Man, where the two waves meet, forming a standing wave (DTI SEA 6).

11.5.1.2 Currents

Currents that exist at any time are the combined result of two distinct components: tidal and non-tidal water movements. Tidal currents are regular and predictable, whilst non-tidal currents are largely weather-dependent and therefore irregular and difficult to predict. Tidal currents are greatest during spring tides (every two weeks, just after full moon or new moon) and smallest during neap tides (at half moon when the solar and lunar forces are out of phase with each other).

The Irish Sea is subject to prevailing south-westerly winds. In the most simplistic form, this prevailing wind contributes to the water movements in the Irish Sea with a net flow from the south towards the north, and is responsible for spatially and temporally variable currents in the North Channel. The constricted nature of the Irish Sea basin makes it liable to storm surges resulting in unpredictable currents. However, this simplistic wind-driven model is complicated by seasonal thermal stratification, which occurs during summer.

11.5.1.3 Waves

Waves are the result of the action of wind on the sea, their size being dependent on the distance or fetch over which the wind exerts its influence. Wave height is measured by taking the difference between the crest and the trough of the wave, though as waves are never of equal size they tend to be measured in terms of significant wave height (Hs). This is determined as the mean height of the highest third of the waves and the mean time between the wave crests.

As the Irish Sea is sheltered with only two relatively narrow 'windows', along the axes of the St George's and North Channels, the majority of waves are locally generated, of fairly short period and comparatively steep. Swell waves are only present near entrances, at the southern end of the St George's Channel (although these can propagate as far as the Llyn Peninsula in North Wales) and the northern end of the North Channel.

The wind direction leading to the largest waves depends very much on the locality, for instance in Liverpool Bay winds from between the west and north-west cause the largest waves, whereas waves from the north cause the largest waves on the North Wales coast. It is suggested that the Irish coast to the west of the Isle of Man is least affected by large wave activity.

The 50-year return value of the significant wave height varies between about 8m within the Irish Sea and about 12m at its outer entrances.

The effect of waves on sediment movement can be significant during storms in the shallow areas of the eastern Irish Sea and Cardigan Bay. The impact on the coast of a given wave field depends critically on the local topography with channels enabling wave energy to approach the coast.

The proposed EWI cable route and landfall sites are exposed to severe wave conditions generated within the Irish Sea. The predominately south-westerly winds have an effective fetch length of over 200km and the waves are also enhanced by the swell entering from St George's Channel.

The Marine Institute has a buoy, 'M2 Buoy' (WMO ID: 62091), deployed in the middle of the Irish Sea (53° 28' 80N, 005° 25' 50W, in 73m water depth), recording wave conditions using an unspecified wave measurement sensor. Information from the M2 Buoy is controlled by the Marine Institute and has been displayed on the Cefas WaveNet website (http://map.cefasdirect.co.uk/wavenetmapping). Data extracted between January 2005 and January 2008 show that wave height reached a maximum of 5.3m in March 2005, with the largest waves generally being recorded between December and March each year.

HR Wallingford undertook a metocean study relating to the proposed EWI cable route. Data were collected from a number of stations and indicated that the large majority of stations showed a highest significant wave height within 5m. One station, situated in the middle of the EWI cable route in St Georges Channel, exceeded this. At this same station, wave heights reached an all-time high of 7.73m in the last 10 years and 8.90m in the last century.

11.5.2 Water Quality

11.5.2.1 Background

The EU Water Framework Directive (WFD) includes within its remit coastal waters up to one nautical mile beyond territorial water 'baseline'. The WFD takes a holistic approach, addressing inland surface water, estuarine and coastal waters and groundwater. The Directive requires that waters be managed according to hydrological units known as River Basin Districts (RBDs). Seven of these RBDs have been identified in Ireland; the management of these RBDs is under the remit of the local authorities with technical support of the Environmental Protection Agency.

Under the WFD the Irish and U.K Governments have a 15 year deadline for achieving good quality coastal waters; through coherent water quality policies based on River Basin Management Plans (RBMP).

Over the last 30 years, there have been a number of ad hoc water quality surveys carried out in the Irish Sea. Some of these surveys were undertaken as academic research (e.g. by UCNW, Menai Bridge) but more recently they have formed part of statutory exercises to demonstrate compliance with international standards (e.g. EU Dangerous Substance, Urban Wastewater Treatment and Bathing Waters Directives; OSPAR guidelines).

Since the mid-1990s, the majority of water quality investigations have focused on eutrophication in coastal waters around Britain and Ireland. The data have been captured by regulatory bodies on both sides of the Irish Sea including CEFAS (formerly MAFF), the Marine Institute (formerly Department of the Marine), the Environment Agency in England and Wales (formerly National Rivers Authority) and the Irish Environmental Protection Agency. Most of the data were collected as part of rolling-programmes and, weather and operational demands permitting, were planned to monitor inter and intra-annual changes and trends.

In general, water quality in the Irish Sea is good. Point source inputs have been addressed since the early 1990s and now regions of concern (Dublin Bay and Liverpool Bay) are largely a consequence of diffuse inputs from urbanised/industrialised localities. The significant investment in "first-time" or enhanced waste water treatment has improved conditions vastly not least with respect to "bathing water" quality. Most designated sites in North Wales and the North West regularly pass the mandatory standards with many achieving compliance with the more stringent guideline values. The situation is similar in Ireland. However, the existing standards are being made even more stringent.

The coastal waters in the vicinity of the Irish landfall are reported by the Environmental Protection Agency to be unpolluted (EPA, 2008a).

Landfall and Near Shore

The 1976 EC Bathing Water Directive (76/160/EEC) requires member states to identify popular bathing areas and to monitor water quality at these bathing waters throughout the bathing season. In Ireland, there are 131 designated sites, of which 122 are seawater-bathing areas and 8 are freshwater. They are monitored on a fortnightly basis by 18 local authorities under the auspices of the Environmental Protection Agency.

The microbiological quality of bathing water is assessed on the presence and quantity of certain bacteria. The Bathing Waters Directive lists two sets of standards, guideline and mandatory, which are based on the number of each bacteria present in a 100ml water sample. Table 11.4 lists the maximum permissible level of bacteria for each standard.

Table 11.4: Maximum permissible level of bacteria (per 100ml)

Standard	Total coliforms (numbers present)	Faecal coliforms (numbers present)	Faecal streptococci (numbers present)
Guideline	500	100	100
Mandatory	10,000	2,000	N/A

(Each designated bathing water must meet at least the mandatory standard to be classed as acceptable in quality under the regulations. The guideline standards set much stricter levels, and if bathing water meets these standards it can be classed as being of excellent quality.)

The landfall site at Rush Bay in Ireland is identified as a bathing beach and has a Blue Flag. Local Authorities manage the Blue Flag Beach Schemes which are administered at European level. Under this scheme, blue flags are awarded to beaches that meet criteria related to water quality, visitor facilities, beach management, environmental information and display facilities. This scheme has proven instrumental in the upkeep of clean beaches and helps to ensure that good water quality is maintained.

In Ireland, monitoring of water quality at designated bathing areas is undertaken in accordance with the provisions of the EU Directive concerning the quality of bathing waters. Local authorities are responsible for bathing water quality in their areas in addition to monitoring bathing water quality and making information available to the public on water quality during the summer bathing season. The bathing season in Ireland is designated as 1 June to 15 September under SI 79 of 2008.

The Quality of Bathing Water Regulations (S.I. 155 of 1992) implemented the requirements of the Bathing Water Directive (76/160/EC) in Irish law. The purpose of the legislation is to ensure that the quality of bathing water is maintained and, where necessary, improved so that it complies with specified standards designed to protect public health and the environment. A new Bathing Water Directive (2006/7/EC) came into force in March 2006 and aims to provide greater benefits in relation to improved health protection for bathers and a more pro-active approach to beach management including public involvement. The new Bathing Water Quality Regulations 2008 (SI No. 79 of 2008) transposed the 2006 Directive into Irish Law on 24 March 2008. However, the stricter standards will not take effect until 2015 (Table 11.5).

In Ireland in 2007, there was a 97% compliance with the EU mandatory standard (i.e. 127 out of 131 – EPA, 2007b). Monitoring covers the bathing season that normally extends from 1st June until the 15th September each year. Monitoring commences two weeks before the start of the season with a minimum of seven samples taken over the period.

In the Dublin area, with the exception of Balbriggan, all the beaches meet the mandatory standard with some also meeting the more stringent guideline values (Figure11.1, from EPA 2008b report).

Table 11.5: Quality standards for bathing waters

Parameter	Mandatory Standard	Guide Standard
Microbiological		
Faecal coliforms	2000/100ml	100/100ml
Total coliforms	10,000/100ml	500/100ml
Faecal streptococci		100/100ml
Salmonella	0/litre	
Enteroviruses	0 PFU/10 litres	
Physico-chemical		
pH	6–9	
Colour	No abnormal change in colour	
Mineral oils	No film visible on water surface and on odour	0.3mg/litre
Surface active substances	No lasting foam	0.3mg/litre
Phenols	No specific odour (0.05mg/litre)	0.005mg/litre
Transparency	Extinction depth of 1m for Secchi disc- equivalent to 6.665 ftu (turbidity)	Extinction depth of 2m - equivalent turbidity value not yet calculated
Tarry resides and persistent floating solids		Must be absent

11.5.3 Offshore

The Environmental Protection Agency monitors, analyses and reports on the quality of Ireland's tidal waters, which is tied in with the certification of bathing waters. Both the British Environment Agency and Irish Environmental Protection Agency monitor water quality in these areas to determine concentrations of a range of chemicals and thus demonstrate compliance, or otherwise, with relevant EU Directives.

Water, sediment and fish samples are collected from the monitoring stations annually to determine long-term trends. The analytes of interest include heavy metals and persistent organic compounds. In general, the findings establish that there are few values above background concentrations in any of the sample types.

11.6 Potential Impacts

Chapter 4 provides information on all aspects of the proposed development that could have impacts upon oceanography and/or water quality. Effectively, the sources of impacts on water quality will mainly arise during the construction phase and will result from sediment disturbance and subsequent release of suspended solids. Vessel activity during both the construction and operation phases may also present a source of impacts.

11.6.1 Construction Phase

11.6.1.1 Oceanography

Cable laying will be performed by a dedicated cable-lay vessel, which will deposit the cable onto the seabed. The same vessel may also have a device to bury the cable into the seabed as the cable is laid. It is intended that all marine installation work will be scheduled for completion within a six-month window, although actual activities in the subtidal area will be of much shorter duration. The cable laying activities themselves will not result in any modification to the wave and tidal current regime in the area.

11.6.1.2 Water Quality - Landfall and Near Shore

Construction Vessels

The cable lay and associated vessels will marginally increase the level of vessel activity in the near shore environment at any one time. The presence of construction vessels in the area in addition to normal vessel activity will provide a minimal increase in the risk of a pollution incident, potentially leading to adverse impacts on water quality. Such incidents could comprise spillage of lubricant oil from the deck of a barge or in a worst-case scenario, release of a large volume of fuel in the extremely unlikely event of a major collision. Vessels will operate in accordance with MARPOL 73/78 pollution prevention standards. Potential impacts to water quality as a result of accidental pollution incidents are expected to be short-term and localised, so no significant impact is expected.

Landfall Activities

Cable installation operations at the Irish landfall will consist of a number of phases as described in chapter 4. Creation of an open-cut trench through the intertidal area, into which ducts may be installed will result in localised displacement of the seabed and a likely increase in suspended sediment in the water column. EirGrid will endeavour to carry out installation of ducts outside of the bathing season (1 June to 15 September). Any impacts to water quality that do arise from intertidal trenching activity are expected to be temporary and localised and slight in magnitude.

The second phase will involve the pulling of the cables from the cable-lay vessel, an operation that is likely to take around two days to complete. The trench to be constructed through the beach (either from the end of pre-installed ducts, or all the way from the TJP) will be reinstated using the extracted sediment, so that the material extracted from the bottom of the trench is replaced at that depth. It is expected that the returning tide will remobilise any of the fine sediment disturbed by the installation of the conduits. However, given that this material is expected to be of similar nature to that existing in the upper layers of sand, increased concentrations of suspended sediments are not expected to last longer than one tidal cycle. The beach will revert to its original profile within a few tidal cycles, and levels of suspended solids in the area should return quickly to background. Opening of the beach trench for pull in operations will occur twice (assuming two separate cables are laid), such operations will be more than a month apart.

During the pull-in phase, the cable-lay vessel will be stationed close to the shore, so that the cables can be floated ashore. Anchoring the vessel will create some sediment disturbance, and therefore suspended solids. Impacts to water quality during cable pulling will be temporary and localised, and assessed as slight.

11.6.1.3 Water Quality – Offshore

Construction activities will effectively involve, for the majority of the subtidal route, the laying of a cable on the seabed, followed by ploughing and either jetting or trenching to allow the cable to be buried. The target cable burial depth will be 2m below the surface of the seabed out to 8.5km from the coast, and 1.5m for the remainder of the route.

During the laying of the cable, and in particular the burial operations, some localised suspended sediments will be generated through disturbance of the seabed. The finer fraction will stay in suspension for a longer period than the coarser fraction, which will more rapidly fall out of the water column and be re-deposited on the seabed. The potential impacts of localised increased suspended solids on water quality during offshore cable laying will be temporary and localised and therefore assessed as slight.

The cable-lay activities also have the potential to result in increased mobilisation and bioavailability of contaminants from seabed sediments and potential adverse impacts on water quality. It is noted, however, that the proposed cable route crosses areas where a large amount of trawling has been undertaken and hence any contaminants present will have largely been removed as a result of their location within the sediment column and trawling depths. It should be further noted that the route does not cross any marine disposal areas, or other areas where contaminant concentrations are known to be elevated. The sandy consistency of sediments along a great deal of the cable route will harbour a reduced amount of contaminants and hence their presence, magnitude and potential impacts on water quality are predicted to be slight.

The construction vessels will provide accommodation on board for various numbers of crew. Standard factors have been used in Table 11.6 to estimate the volumes of black and grey water (sewage and washroom waste) and galley waste discharged per crew member per day. It can be seen from Table 11.6 that total black and grey volume is estimated as 2245m^3, while total putrescible galley waste is estimated as 2.69 tonnes. Such discharges will be made over a very large volume of water, over a period of more than 100 days, while they may result in very localised decreases in dissolved oxygen levels in surface waters, these will be extremely temporary in nature. Impacts from this source are considered slight.

Table 11.6: Black and grey water and galley waste production estimate from cable installation operations

	Total man days	Black and grey water (m^3)	Putrescible galley waste (tonnes)
Cable installation	8980	2245	2.694
Assumptions: Black and grey water is produced at a rate of 0.250m^3 per person per day Putrescible galley waste is produced at a rate of 0.0003 tonnes per person per day			

11.6.2 Operational Phase

11.6.2.1 Oceanography

For the vast majority of the EWI cable route, the cable will be buried. However, there will be locations (particularly at crossings of other cables and pipelines) where the cable is protected on the seabed surface by use of rock armouring or by concrete mattressing. Use of these hard surfaces, in what is generally a soft sediment environment, has the potential to lead to some scour effects. The potential for any local scour is dependent upon local currents, and the mobility of the local sediment (in terms of grain size).

However, it is anticipated that because of the generally low current speeds throughout the route, scour will not be a significant issue. There will be no impacts to water movement, except very locally where rock armouring or mattressing is used. Localised physical effects as a result of the EWI cable operation are predicted to be slight.

11.6.2.2 Water Quality

Operation of the EWI cable itself will not result in any changes to water quality. While the cable route and burial depth will be designed specifically to minimise the requirement for regular surveys, some will be necessary. The presence of survey or maintenance vessels in the area in addition to normal vessel activity will provide a minimal increase in the risk of a pollution incident, which could lead to adverse impacts on water quality. Volumes of pollutants such as diesel fuel, oil or other liquids that may be released accidentally from construction vessels however are expected to be small. Any impacts to water quality as a result of accidental pollution incidents are expected to be short term and localised such that no significant effect is expected.

As discussed in section 11.6.1.3, offshore vessels create black and grey water and galley waste. The cable route surveys carried out during the operational phase of the project will also result in such discharges, as estimated in Table 11.7. These discharges are also considered localised, temporary and therefore slight in significance.

Table 11.7: Black and grey water and galley waste production estimate from cable route survey operations (assuming 15 annual surveys of 15 days)

	Total man days	Black and grey water (m3)	Putrescible galley waste (tonnes)
Cable route surveys	3375	843.75	1.0125
Assumptions: Black and grey water is produced at a rate of 0.250m^3 per person per day Putrescible galley waste is produced at a rate of 0.0003 tonnes per person per day			

11.7 Mitigation

The construction schedule and construction methodology proposed for the EWI incorporate a number of measures to minimise potential impacts on oceanography and water quality (suspended solids), including bathing water quality as discussed above.

All vessels will operate under international standards (MARPOL) with respect to black and grey water and food waste discharges, which are designed to eliminate impacts to coastal waters, and to reduce the levels of discharge in offshore waters.

Oil spill contingency plans will be put in place and adhered to prevent the release of fuel and other chemicals from vessels through collisions and ruptures.

No further mitigation measures are proposed.

11.8 Residual Impacts

The construction and operation of the EWI will have no residual impacts upon oceanography. Similarly, there will be no residual impacts on water quality beyond the construction phase.

12 PHYSICAL ENVIRONMENT

12.1 Assessment Methodology

This section considers the potential impacts to the physical environment which may occur as a result of the construction, operation and decommissioning of the proposed EWI. Baseline conditions, potential impacts and mitigation measures are addressed relating to:

- Bathymetry;
- Seabed sediments;
- Subsurface geology;
- Sediment transport; and
- Sediment contaminants.

As indicated in the project description (Section 4), a number of options for cable installation are possible. The preferred construction technique and depth of burial for the offshore electrical infrastructure will be determined, in part, as a result of the geophysical and geotechnical investigations. Each of the possible techniques for cable burial (ploughing, jetting or trenching) have advantages and disadvantages, and the data collected on the seabed and sub seabed conditions will allow the most suitable method to be utilised, which may change along the length of the cable.

These methods and their potential effects on the physical environment are considered using the criteria outlined in the following paragraphs.

12.1.1 Magnitude of Impact

As part of this physical assessment, the magnitude of potential impacts will be categorised. Table 12.1 shows the distinction between these and explanation as a result of this.

Table 12.1: Magnitude of impact

Magnitude	Description
Large	Irreversible change to a large area over a long period of time, or a small area of a highly sensitive site that is irreversibly affected
Medium	A moderate change (outside the bounds of natural variation) to an area extending outside the site and cable route, which will recover over a medium period of time (5–10 years)
Small	A slight change (within the bounds of natural variation) to an area in close proximity to the site and cable route, which will recover over a short period of time (1–5 years)
Negligible	No effect detectable

12.1.2 Sensitivity of Receptors in the Physical Environment

The relative sensitivity of receptors to the proposed development is defined in Table 12.2.

Table 12.2: Receptor sensitivity

Sensitivity	Description
High	Designated sites or strategic defences (natural or man made) affected
Medium	Coastal processes, non-strategic natural structures or flood defences affected
Low	Sediment transport and deposition affected along certain areas of the route with a change in amplitude (not direction) of waves
Negligible	No effect

12.1.3 Potential Significance

This is based on the combination of the magnitude of change and the sensitivity of the receptor. The threshold for significant impacts, where monitoring measures may be required, is where residual impacts are considered significant or very significant, as defined in Table 12.3.

Table 12.3: Potential significance of impact

<table>
<tr><th>Significance</th><th colspan="2">Description</th></tr>
<tr><td>Very Significant</td><td>Irreversible change to a designated geological site or to the physical environment which could have an extensive effect and include areas remote to the development area over a long time period (greater than 20 years)</td><td rowspan="2">Significant impacts where monitoring may be required</td></tr>
<tr><td>Significant</td><td>Moderate adverse change to the physical environment with changes to areas remote from the site over a moderate time period (<20 years)</td></tr>
<tr><td>Moderate</td><td colspan="2">Slight changes local to the development area just outside the accepted limits of normal variation with little or contained off-site effects, detectable within a medium time period (5–10 years)</td></tr>
<tr><td>Slight</td><td colspan="2">Change only just detectable within the site and surrounding areas over a short timescale (less than 10 years)</td></tr>
<tr><td>None</td><td colspan="2">An impact causing effects that are not readily noticeable</td></tr>
</table>

12.2 Scope of the Assessment

For the purposes of this section, the assessment is limited to the physical environment of the landfall and the submarine elements of the cable route within Irish jurisdiction.

12.3 Data Gathering and Site Survey

For the purposes of this ER, published information from a number of sources have been reviewed, and that data has been supplemented by results from the Fugro OSAE pre-construction geophysical and geotechnical survey which commenced in December 2007 and was completed in June 2008. Techniques used during that survey included Multibeam Echo Sounder (with motion sensor to increase accuracy of orientation), side-scan sonar, sub-bottom profiler (Pinger and Boomer), magnetometer, seabed sampling and seabed resistivity - REDAS (described by Fugro OSAE GmbH, the survey contractors, as a Burial Assessment Survey Operation see Section 12.3.1.6).

12.3.1 Geophysical and Geotechnical survey

12.3.1.1 Bathymetry

Bathymetry, or water depth, is charted by the UK Hydrographic Office, and presented on various charts of differing scale covering the whole of the EWI route (Figure 12.1). For the purposes of the EWI cable survey, more accurate information on bathymetry was required, and Fugro was tasked with carrying out a detailed survey of the bathymetry along the route.

Various different techniques, depending upon water depth, were used to collect the bathymetric data; the methods are fully described in Appendix 12.1. Figure 12.2 presents a profile of the depths across the whole proposed route, together with a more detailed profile of the section from Rush Bay to the 12-mile limit.

12.3.1.2 Side-Scan Sonar

Side-scan sonar was employed to collect data along the cable route to provide:

1. Charts of natural seabed features and any obstructions, debris or wrecks.
2. A detailed geological interpretation of the surface sediments to show sediment type variations and seabed feature changes.
3. A comprehensive interpretative report on the survey results obtained to assist the proposed route and landfall site for burial.

The methods for this part of the survey are presented in Appendix 12.1.

12.3.1.3 Sub-bottom Profiler & Boomer

Data on the shallow geology along the route were collected by use of pinger and boomer surveys, methods for which are fully described in Appendix 12.1. The main objective of this type of survey is to identify by interpretation the likely sediment type based upon its acoustic signature. Silt, sand, and shelly materials tend to be more acoustically transparent; whereas gravel, rock and till (boulder clay) tend to be more acoustically *reflective*. The main difference between these types of material is their density. Acoustically, transparent sediments are characterised by a generally lower density, and hence may be weaker and easier to bury cable in by comparison with acoustically reflective materials.

12.3.1.4 Seabed Sampling and Ground-truthing

The geophysical survey methods described above are remote, and therefore provide only an indication of the type of sediments present, intrusive surveys are required to "ground truth" the data gathered.

The geophysical data have been assessed to determine the frequency and length of any different types of sediment along the cable route. Following that assessment, Fugro undertook a ground-truthing survey using both coring and cone penetrometer testing to confirm the assumptions made on seabed and sub-seabed sediment type.

12.3.1.5 Magnetometer Results

Magnetometers measure the strength, or a component of the strength, of the earth's magnetic field. The proton precession magnetometer only measures the total size of the Earth's magnetic field; these types of measurements are usually referred to as total field measurements.

The marine magnetic survey used a scalar magnetometer, which was towed some distance behind the ship, usually along with other geophysical equipment, as the systematic survey was carried out.

The interpretation of the magnetic data results in a target list showing the position of potential targets. These data can be compared with the results from the sub-bottom survey data and also wreck data on charts and wreck listings.

Based on the magnetic data, several known man-made features could be confirmed within the survey area. Wrecks, pipelines and cable installations, with their positions obtained from public sources (e.g. nautical charts, cable awareness charts, DEAL information service) were identified and, where clearly identified, repositioned as necessary using the current high-precision positioning system, which was probably not used when these objects were first charted.

12.3.1.6 REDAS

The Resistivity Data Acquisition Survey (REDAS) measures the electrical properties of the seafloor. In seawater conditions, the electrical properties mainly depend on the porosity or the density of the seabed. Therefore, the resistivity data provide information on the soil conditions.

12.4 Baseline Conditions

A baseline description is provided to characterise the environment of the proposed development and to enable the identification of areas that may be geologically and/or bathymetrically sensitive to impacts from cable installation and operation.

The bathymetric and geological issues that have the potential to be impacted by the cable installation or impact on the installation can be grouped by location along the proposed route into:

- Irish landfall;
- Welsh landfall (*discussed under separate cover*); and
- Offshore cable route.

12.4.1 Bathymetry and Topography

In the following section, water depths refer to values below chart datum (CD) unless other wise stated. The bathymetry along the cable route has been influenced greatly by the existing geology and geological processes. The Irish Sea consists of two shelves: the east (English, Welsh and Scottish) shelf and the Irish shelf to the west. The two shelves are separated by the Celtic Trough, which is up to 70km wide and greater than 60m deep. The trough runs northwards from the Celtic Sea to the Malin Sea through St George’s Channel, the western Irish Sea and the North Channel (Irish Sea Forum, 1990).

12.4.1.1 Rush Bay, North Beach Landfall

The beach is wide and gently sloping. At the landward edge of the beach, there is a low escarpment or cliff, approximately 2m high, which will need to be crossed as part of the landfall works. The land behind this escarpment is flat. The beach appears to consist of sand, although there is evidence of rock exposed at low water on either side of the proposed route. It is likely that rock underlies the sand along the proposed route. However, survey evidence shows that the depth of sand is sufficient for cable burial to a depth of 3m in this area.

12.4.1.2 Rush Bay Coast

Figure 12.3 shows the gently sloping foreshore from MHWM to the low water mark (the photo was taken at a time where low water was at a level of approximately 0.8m below LAT).

12.4.1.3 Offshore Cable Route

Water depths across the study area vary from MHWM (0m CD) at the Irish landfall site to approximately 120m (see Figure 12.1) in the centre of St George’s Channel.

Further offshore from Rush the seabed deepens to over 50m within 15km of the landfall, with a gradient of less than 1°. The seabed then becomes flatter with a slope of about 1 in 400 into the deepest part of the route where depths are about 120m. The seabed along the route then rises at about 1 in 600 and crosses a bathymetric high where water depths are between 40 and 50m below CD. The route then crosses a deeper channel with a slope of close to 1 in 125 and depth of about 105m below CD, before passing on to the broad Welsh shelf north of Anglesey where the seabed shelves at about 1 in 1500 from 50m below CD to 10m CD within 10km of the landfall on Barkby Beach. Where sand wave fields might be encountered such as at the centre of St George's Channel, locally steeper gradients might be encountered.

12.4.2 Geology

This section presents firstly a brief outline of the solid and bedrock geology, which for the majority of the cable route, is of little significance. This is followed by a discussion of the surface sediment geology for the offshore route with specific sections of the landfall site geology.

12.4.2.1 Solid Geology

Geological features of dominance within the Irish Sea include several deep, Upper Palaeozoic to Tertiary sedimentary basins, and Precambrian to Palaeozoic basement blocks and ridges, with a dominant Caledonian, north-east–south-west structural trend. Figure 12.4 shows the underlying geological layers in relation to the cable route. During the middle to late Pleistocene, the area was subject to periods of intense erosion during glaciations, and sequences of glacial and glacio-marine sediments were deposited in the area.

Volcanic activity has resulted in the formation of ore rich veins that have been mined onshore, historically, for valuable metals. A geological map of the area that the cable route will traverse is shown in Figure 12.4.

Natural seismic activity is low near the western UK coast by comparison with the northern North Sea. The northern Irish Sea is considered to be a comparatively aseismic area as is onshore Ireland. The eastern half of the Irish Sea does tend to have a higher incidence of seismic activity associated with the bedrock fault structures, which are present in Cumbria and especially North Wales and the Welsh Borders. With the exception of the area close to Anglesey and the Menai Straits the cable route does not pass within close proximity to areas that have historical evidence of seismic activity, as such seismic activity is unlikely to be an issue in relation to cable installation or operation.

12.4.2.2 Surface Sediments

Gravelly sediments occurring extensively in the Irish Sea are mainly relict and locally derived. They occupy a broad belt in the centre of the northern Irish Sea extending from Scotland, past the Isle of Man, to Anglesey, and are predominant in St George's Channel. There are also large areas of exposed till in St Georges Channel, and areas of exposed bedrock occur locally in the North Channel and between Anglesey and the Isle of Man. The gravelly sediments and the areas of exposed till and bedrock mainly occur in regions dominated by strong tidal currents or wave action, and it is likely that the strong currents prevent the deposition of fine material.

Areas of sand in the Irish Sea tend to occur in narrow zones both in the near shore and further offshore. The sand is relatively mobile, and there is evidence that in the north-west the sand is extending over the periphery of the muddy sediments, which form the Central Mud Belt. Within St George's Channel, areas of sand waves and megaripples are known to occur. Tidal sand banks and sand ridges occur off the east coast of Ireland.

The sediment types present along the cable route are dominated by several particle sizes/categories, ranging from clay to gravel, till (boulder clay) and rock.

Shallow subsurface geology within the study area is dominated by three Quaternary geological formations with small outcrops of older bedrock, undifferentiated in this study. These include:

- Surface Sands Formation (Holocene);
- Western Irish Sea Formation (Holocene and Pleistocene); and
- Central Mud Belt (mud facies).

The Surface Sands Formation is widespread throughout the survey area and occurs as a superficial layer of sand up to 25m thick. The Surface Sands Formation may occur as one of a number of bedforms: as isolated sand waves, coalesced into sand wave fields and major sand banks; as featureless sand carpets; or sand carpets with many megaripples. Throughout the Fugro OSAE survey, the only evidence of older bedrock outcrop was in small areas at the Rush North Beach landfall area.

The Western Irish Sea Formation occurs near surface, extending from just off the Irish coast to the central portion of the route.

The mud facies occurs in the central portion of the Western Irish Sea Formation, and is composed of clays and silt; surrounding facies are composed largely of sand.

12.4.2.3 Surface Sediment Characteristics

The surface sediments located in and around the cable route are shown in Figure 12.5.

In addition to the Fugro survey, a number of site-specific surveys have been carried out as part of regional studies of the Irish Sea. These additional data have been reviewed to determine the baseline conditions in the vicinity of the proposed cable landfall sites and offshore route.

Following the use of side-scan sonar and the interpretation of the data retrieved, together with ground truthing results (the methodology adopted for the geotechnical survey is described in Section 12.3.1), it can be seen that the sediment-types along the survey route constitute material within a wide range of particle sizes from clay to gravel, till (boulder clay) and, to a very limited extent, rock.

Based on the analysis of the sub-bottom data, there appears to be three distinct units with the lowest unit overlain by layered sediments and finally fine-grained sediments. These units have been compared with descriptions of the geology in the area (Jackson *et al*., 1995 and Fugro OSAE GmbH, 2008) to produce the following interpretation:

Sedimentary Unit	Interpretation
Unit 1	Cardigan Bay Formation till (Pleistocene)
Unit 2	Surface Sands Formation (Holocene)
Unit 3	Possible upper Surface Sands Formation or fine-grained seabed sediments (Holocene)

The seismic character of Unit 1 displays dense chaotic reflectors and has an undulating erosion surface as its upper boundary. In some locations, this unit outcrops on the seabed. From an analysis of desk-top and field survey data, unit 1 is thought to be the upper till of the Cardigan Bay Formation and is considered to be the product of Weichselian glacial processes during the Upper Pleistocene (Jackson *et al*., 1995).

Overlying unit 1 in various locations along the route is unit 2, consisting of sub horizontal parallel reflectors, dipping slightly to the north-east. This unit is not present over the whole area but recurs in places along the cable route. Its maximum thickness appears to be 25m. Unit 2 appears to have been laid down during a Holocene marine transgression (Jackson *et al*., 1995).

Finally, overlying most of the cable route survey area is the seismically structure-less Unit 3, which from the geophysical and geotechnical data is likely to consist of fine-grained sands, silts and clays approximately 2m thick. It appears to be conformable with unit 2 where this latter unit is present. Unit 3 may be a continuation of the Surface Sands Formation or may consist of sediments that are more recent.

Site surveys show that surface sediment and outcrops vary along the EWI cable route; however, changes here are relatively subtle.

Figure 12.6 shows the changes in sediment type from analysis of samples taken at stations in Irish waters surveyed as part of the 2008 Geotechnical survey undertaken by Fugro OSAE.

The marine sediment collected in and around Rush Bay is composed largely of sandy silt and shell fragments (stations 1–8). In depths greater than 20m below CD, shell fragments are less obvious. Deeper still (more than 50m below CD) sands give way to silts and then these silty clays. Where the seabed is more than 100m below CD, in the centre of St Georges Channel, sandy silts return alongside silty sands (stations 24-27). Continuing east from here in shallower British waters, the sediments become coarser with medium sands and shells dominating (stations 34–40).

The Irish Sea Pilot (2004) has identified a number of coastal and seabed marine landscapes within the Irish Sea (Figure 12.7), based on various geological information. As the cable route stretches westwards (towards Rush Bay, Ireland) from the boundary between Irish and British waters, the marine landscape changes gradually:

- ►High bed-stress coarse sediment plains
  - ►Low bed-stress coarse sediment plains
    - ►Sediment wave/mega ripple fields extending into Irish waters.
      - ►Fine sediment plains
        - ►Coastal plains

Table 12.4 describes these landscapes in further detail.

Bedrock outcrops within the proposed EWI cable route are rare offshore and have not been logged previously along the cable route. However, examples of these landscapes can be found west and north-west of Anglesey, adjacent to the cable route. Large areas of gravel and gravelly sand are present across the Irish Sea. Such sediment is thought to represent a lag deposit having been reworked during the Holocene marine transgression and by present day tidal currents. The gravel lag deposits are usually less than 25cm thick. Furrows may also be present within this lag. These furrows are usually less than 1m deep, between 2m and 5m wide and about 400m to 2000m long showing parallel alignment with tidal currents. Such features were recorded along the route (Fugro, 2008).

Cobbles and boulders are found within the survey corridor and were deposited as dropstones from icebergs or by direct ice action during the last glacial maximum. They locally infill seabed depressions above till deposits and are residual sediments of current and wave action (Fugro, 2008).

Table 12.4: Coastal and seabed marine landscapes crossed by the cable corridor (Irish Sea Pilot, 2004)

Marine landscape	Associated biotope complexes	Depth (m)	Substratum	Bed stress/ current	Topography/ slope
High bed stress coarse sediment plains	4	Variable	Boulders, cobbles, pebbles and gravels	High bed-stress	Negligible slope No fines within sediment
Low bed stress coarse sediment plains	7–8	Variable	Cobbles, pebbles and muddy gravels	Low bed-stress	Negligible slope Evidence of fines in sediment
Sediment wave/ mega ripple field	5	Variable	Sands	Moderate/strong currents	Waves/ripples
Fine sediment plains	6	Variable	Sandy and muddy sands	Weak currents	Negligible slope
Coastal sediments	6	Intertidal -50m	Muds, sands and gravels	Variable	Adjacent to coastline

12.4.3 Sediment Transport and Mobility

Gravelly sediments, with glacial or local origins, are common in the Irish Sea and occupy a broad central belt extending southwards from Scotland, past the Isle of Man to Anglesey, traversing the area that the EWI will run through (Figure 12.7). Sediment is transported primarily within the Irish Sea through tide, wind and wave-induced currents. Tide and wind forces need the most consideration here, as these provide the long-term sediment transport pathways. There are several zones in the Irish Sea where the sediment that is carried in the current separates into two directions, these are known as areas of bed load parting (SEA6, DTI 2003). The sediment zone distribution is a function of a number of factors including glacial and post-glacial processes, sea level rise and hydraulic processes.

The movement of sediment, both the path taken and the amount moved, is very difficult either to measure or to predict. It is related to the extent by which the near-bed current exceeds a certain threshold. For sand and gravel, the threshold is proportional to the physical characteristics of the sediment in particular particle size and density.

Between Dublin and the North Channel, the Irish Sea is a trap for sand, with sand moving inwards towards the Isle of Man and then eastward into Liverpool Bay and the Solway Firth. In the eastern Irish Sea, the effects on sediment movement by near-surface currents are similar to those for near-bottom currents (Figure 12.8) (Ramster and Hill, 1969). Along the North Wales coast, there is a tendency for beach sand to move eastwards. South of Dublin the sand moves southward out of the St George's Channel and also northward into Cardigan Bay.

For the Irish landfall site, the dominant driver for sediment transport is tidal current. Given that existing currents are relatively weak, the residual currents and net sediment flux are low. The currents, residuals and fluxes are much greater closer inshore. Further oceanographic information on waves and tides is discussed within Section 11.

Wave energy can enhance tidal current effects in shallow water by lifting sand into temporary suspension and thereby making it available for transport by the currents.

Moderate waves may break across shallower areas such as sand banks affecting the direction of transport. The proposed cable route crosses a sandbank north of Lambay Island between KP2 and KP3. The sand bank is orientated NNW–SSE and is approximately 2km in length. Net sediment transport rates will depend on the surface sediment characteristics, the direction/strength of the tidal currents, water depths and wave conditions. Along much of the cable route, conditions established by the relatively weak currents have allowed sediments to be deposited onto the seabed, leaving large areas of sand, sandy gravel and gravelly sand. However, the sand is relatively mobile. In central areas of St George’s Channel, currents are strong enough to create small-scale, mobile bed forms, i.e. sand waves and megaripple fields. There is evidence that in the north-west the sand is extending over the periphery of the muddy sediments. The sand waves/megaripple fields are only found within central areas of St Georges channel, in water depths, which are mostly in excess of 50m.

12.4.4 Contamination Status of Sediment

Within the marine environment, chemical contaminants can become locked/stored within marine sediment over time as a result of both natural and anthropogenic activities. This can segregate contaminants to a certain extent from many other physical and biological processes such as tides that would normally disperse these and reduce concentrations.

There are three types of pollutants present in the Irish Sea as a result of anthropogenic activities:

1. Radioactive materials.
2. Heavy metals.
3. Organic substances.

The organic substances include polychlorinated biphenyls, alkylphenol ethoxylates and polycyclic aromatic hydrocarbons, which can collectively be known as endocrine disruptors. The reason these three types of materials are significant is that they all have long lives in the natural environment; they can all bioaccumulate as they pass along a food chain; and they are toxic above certain concentrations.

The Environmental Protection Agency (EPA) does not routinely sample/monitor the levels of contaminants in sediments at any sites along the length of the proposed EWI cable route. However, tighter controls as a result of both national and European legislation have led to significant decreases in the discharge rates of many of the pollutants. This decrease has been particularly significant for the metals that originated from the chemical industries established in the early part of the century.

The extent to which trace metals and trace organic compounds discharged to the marine environment are deposited into sediments depends on their solubility. Trace organic compounds in particular are not generally soluble in water and are more likely to be detected in sediments. Metals have a tendency to partition into suspended particulate matter within the water column, which is then deposited into sediments. Therefore, sediment contaminant concentrations are usually significantly greater than those found in the water column.

When examining sediment contamination, it is also important to consider the grain size of the sediment. For a given volume or weight of sediment, finer particle sizes have more potential binding sites for contaminants, therefore it is generally the rule that muddy sediments have higher concentrations of contaminants than do sands from the same areas.

The cable route does not traverse any areas that have a history of spoil dumping or naturally high levels of metals. It is therefore considered unlikely that sediment along the route contains high levels of contaminants.

12.4.4.1 Waste Disposal and Dredging

In terms of potential sources for contamination around the cable route, potentially contaminated or disturbed sites can include:

- Sewage sludge disposal;
- Dredged material disposal; and
- Marine aggregate dredging.

None of these sites has been recorded within the immediate vicinity of the Irish landfall and proposed offshore cable route, and hence the sites not discussed further within this chapter.

12.5 Potential Impacts

There is the potential for impacts to occur as a result of construction, operational and decommissioning phases of the EWI; the potential impacts from each of these phases are discussed separately below.

12.5.1 Construction Phase

The construction operations will effectively involve, for the majority of the subtidal route, the laying of a cable on the seabed, followed by either jetting or ploughing to allow the cable to be buried in a trench. The typical cable burial depth will be approximately 1.5m below the surface of the seabed, though there are areas nearer to shore where this depth is planned to be greater.

Potential impacts are described below with reference to the construction information provided in Chapter 4.

12.5.1.1 Bathymetry

Along the majority of the cable route, it is not anticipated that there will be a significant impact resulting from cable installation. The cable will be unrolled onboard the cable-laying vessel and it will then descend through the water column until it is positioned on the seabed. There are two options for cable burial, with ploughing being the most likely considered for the majority of the cable route.

- A plough may be lowered down on top of the cable (using ROVs) that will then lift the cable and channel a temporary trench that the cable will descend into; or
- A jetting rig will be lowered on top of the cable (using ROVs) that will then run along the cable, jetting water to dislodge the seabed sediment, enabling the cable to slide into the jetted depression or trench.

A third technique, trenching, will also be considered where ploughing or jetting are not feasible. Such areas include harder ground through which the plough or jetting rig will have little penetration. The trencher is effectively lowered over the cable, picks it up, and uses a grinding device to dig a narrow trench into the sediment in front of and beneath the cable. As the trencher moves along, the cable is guided into the trench behind the cutting head.

The local bathymetry will be minimally altered locally as part of the ploughing or jetting process and where cable protection (such as rock or concrete mattresses) is required. This latter aspect can be as a result of where cables are forced to run on the surface of the seabed or cross another existing cable or pipeline. There is unlikely to be an impact on bathymetry except in such situations and the potential impact is none. Where hard structures for cable protection might be required, such as at cable crossings, or where the cable crosses hard ground will extend only a short height above seabed level. All such areas are in deep water, and therefore the impact to bathymetry is assessed as slight.

12.5.1.2 Geology

Based on existing knowledge of the EWI route, a soft sediment layer is present along the majority of the cable route and a jetting or ploughing system could be used for the burial operation. However, in areas where harder material is present, such as till, an alternative burial method will be employed to reach the required depth; for example a mechanical trencher or a vibro plough (see section 4.5.2).

Should a very hard sediment layer be encountered, where all burial methods are unsuitable, it may be necessary for EirGrid to run the EWI cable along the surface of the seabed. Where this occurs, protection measures will be applied, such as rock placement (on top of the cable) or the laying of concrete mattresses over the cable. Both measures are used to counter the risk from third-party (i.e. fish trawl) interactions.

Sub-surface Geology

Vibrocore sampling from the 2008 Fugro OSAE geotechnical report (Appendix 12.1) shows that any Quaternary or older formations are found mostly beneath the anticipated cable burial depth. As the cable is designed to be buried at an average of 1.5m beneath the seabed, no impact on the underlying pre recent geology is foreseen. Hence, there will be no impacts to sub-surface geology.

Seabed Sediments

As the cable-burying activity will be largely within the surface sediments, there is more likely to be a direct impact.

Following Fugro OSAE's side-scan sonar survey (2008) and the interpretation of the data retrieved, it is clear that the sediment-types along the survey route are dominated by sediments in a wide range of particle size from clay to gravel and till (boulder clay). The presence of the various types of surface sediments along the cable route is fairly uniform, and there is no major geologically significant change in distribution.

As a result of sediment disturbance, i.e. jetting, ploughing etc., there exists the potential for the localised sediment regime to alter.

When using ploughing techniques to install the cable, a furrow is ploughed into the seabed sediment, allowing the cable to sink into this newly formed trench. As the plough continues to travel forward, it sweeps sediment that had been ploughed out previously back down into the trench on top of the cable (an example of the type of plough that may be used is shown in Figure 12.9).

Changes to the sediment regime here will be very localised, (being limited to a few metres either side of the cable) as a result of the suspension of sediment created by the ploughing technique. The impacts are therefore assessed as slight.

Where jetting techniques are employed, there is the potential for a greater impact in terms of increases in suspended sediment in the water column and, consequently, a localised change in sediment regime. The previously stationary seabed sediment that is brought into suspension by the jetting process may then potentially be transported over a wider area as a result of tidal currents. As sediment disturbance and water flow are judged minimal in the cable area, the predicted magnitude of alterations to the sediment regime as a result of the construction will be small, and none in the lifetime of the development.

Where cable protection measures such as rock placement or mattressing are applied, there may be a change in the sediment regime in the immediate area owing to the effect of these structures on the seabed current flow patterns. Initial geophysical surveys of the route show that areas where the sediment regime may not accommodate burial, i.e. presence of till or rock are minimal.

Where sand waves are present, the sediment is likely to be fairly mobile and it is anticipated that any sand waves/megaripples that may be disturbed as a result of construction works will recover rapidly. Existing currents along the cable route are in general, relatively weak and unlikely to distribute suspended sediment over a great distance away from the construction area.

The two cables will be laid separately, in two adjacent trenches, it is estimated that only surface sediments within the immediate area of the cables will be impacted.

Impacts to the sediments along the length of the cable route as a result of construction processes are assessed as slight in the short term and none in the longer term.

12.5.1.3 Contaminants

As a result of construction processes, there will be a localised increase in suspended solids in the area; more significantly when jetting in comparison to ploughing. This sediment re-suspension in turn allows for the mobilisation of any contaminants that may be present within the surface sediments. For the landfall site and associated works, the proposed development could give rise to sediment mobilisation and chemical pollution (from spillages) into coastal water if they are not controlled appropriately. Depending upon the currents, existing contaminants in the substrate could also be mobilised and assessed. However there is no evidence of any significant contamination in these sediments and hence the potential impact is seen as none.

A number of construction vessels will be present during the installation of the EWI cable. These vessels have to be considered in terms of any potential contamination that they may produce, i.e. accidental leak of diesel fuel, oil or other contaminant spills into the marine environment.

There is also potential for the contamination of surface sediments during construction periods through the accidental discharge of solid waste and/or sewage from construction vessels. There are very tightly maintained regulations in force to ensure that such contaminants and, in fact, all waste is prevented from entering the sea, hence impacts are not anticipated (mitigations are discussed in Section 12.6).

Many of these potential impacts have a resulting effect on the ecology of the area (Section 6).

The proposed cable route crosses areas where a large amount of trawling has been undertaken and hence any contaminants present will have largely been disturbed as a result of their location within the sediment column and trawling depths. Sand predominates along a great deal of the cable route, and this material tends to harbour a reduced level of contaminants by comparison with sediments such as mud, hence, even if disturbed the magnitude and potential impacts are assessed as slight/none.

There are no areas along the route which have a particular history of contamination, the only sites of potential contamination, discussed in Section 12.4.4, are located a great distance from the cable route and unlikely to be disturbed by any construction works therefore overall the potential impact from the release of residual in sediment contamination is none.

12.5.2 Operational Phase

12.5.2.1 Bathymetry and Topography

The only impact anticipated during operational processes is as a result of the presence of any cable protection. There is anticipated to be no impact resulting from the very low levels of altered seabed topography.

12.5.2.2 Geology

Subsurface Geology

There will be no impact to the underlying geology as a result of the operation of the EWI cable.

Seabed Sediments

Structures placed on the seabed to stabilise or protect cable crossings, and where the cable has been placed on the seabed and protected, will be obstacles causing a small impact on the local bottom currents. In this regard, these man-made structures can encourage scour by altering water flow and sediment transport in the area, which may affect the distribution of the surface sediments locally.

As sediment disturbance and water flow are judged minimal, except where sand waves occur, any impact would be very localised. There are no predicted significant impacts to sediment regime as a result of the cable.

Throughout the operational lifespan of the cable, there may be the requirement for maintenance and the restructuring of mattressing/rock protection. Additions or adjustments to structures on the seabed can increase the amount of suspended sediment in the water column and alter the sediment regime of the immediate area. Maintenance and modifications on the cable once initially constructed are anticipated to be minimal and extremely localised if required, hence potential impacts will be slight.

Once operational, there will be no impact to surface sediments as a result of the EWI cable.

12.5.2.3 Contamination

The HVDC cables selected for use on the EWI are inert, and therefore not a potential source of contamination.

During the cable lifetime, there will be a requirement for condition surveys along the route. These will be carried out using ROVs or side-scan equipment deployed from the surface. Vessels carrying out these surveys will be carrying marine diesel as fuel, and there is therefore a risk of accidental spillage. However, for all operations there will be appropriate oil spill contingency plans, and risk of impacts from vessel oil spills is minimal. Similar contingency plans will be in place for any survey or maintenance operations in the intertidal areas. Intertidal and subtidal impacts are therefore assessed as none.

12.5.3 Decommissioning

Well before the end of the planned lifespan for the cable, a review of current national and international legislation and best practice in respect of decommissioning options and techniques for submarine cables will be conducted. EirGrid will adhere to legislation and use best practice to ensure that activities to decommission the cable cause as little damage to the environment as possible, and will render the route of the cable as environmentally benign after decommissioning as possible.

12.6 Mitigation

12.6.1 Superficial Sediments

The design of the EWI cable route is one of the greatest mitigation measures applied to the project, it has been designed to traverse soft sediments, where burial can be more easily achieved and entailing less impact to the superficial sediments.

There is very little opportunity to mitigate further against the effects of the various cable burial techniques discussed. The tidal currents and in shallower water wave incidence will restore the seabed progressively to an equilibrium state. The areas of seabed disturbed as a result of the EWI cable installation, which has been routed through areas of sand waves/megaripples, will recover rapidly as a result of the localised sediment movement that already occurs.

Where seabed structures such as mattresses are required, the mitigation opportunity here is to keep them as low as possible and hence reduce the potential for scour or deposition around them.

12.6.2 Contaminants

Previous surveying records for surface sediments have shown no levels of significant concern for contaminants in areas along the proposed cable route. Hence, the disturbance of the seabed and re-suspension of sediment into the water column is not a major concern.

In areas where rock placement or concrete mattressing is required, i.e. where cables cross and where cables rise close to or above the seabed, appropriate materials that do not run the risk of introducing dangerous contaminants will be used.

There is a low risk of release of contaminants into the water column and on to the seabed as a result of the presence of vessels during construction and operational procedures. In an attempt to prevent the release of fuel and other chemicals from vessels through collisions and ruptures, control measures and oil spill contingency plans etc will be put in place and adhered to (this is discussed in further detail within Section 15 Environmental Management) to reduce this risk of spillage and to ensure containment.

The discharge of solid waste will not be permitted in any area over the site or cable route. Discharge of sewage (black and grey water) is permitted, for large vessels, provided that it has been treated to an acceptable standard before discharge. Further restrictions on location of discharge are listed under the April 2004 amendments to MARPOL, IMO, Annex IV (Regulations for the prevention of pollution) http://www.imo.org and these will be strictly adhered to.

12.6.3 Environmental Management Plan

An environmental management plan (EMP) will be implemented to ensure that the installation methodologies employed, and any supporting infrastructure that is required, i.e. concrete mattresses, are designed and completed in the pre-agreed format to reduce any impacts that may arise. This will cover issues such as contingency plans to prevent the release of possible contaminants i.e. marine fuel, or procedures to ensure other operations are well controlled and that the potential for mud breakout is minimised (this is discussed in further detail within Section 15 Environmental Management).

12.7 Residual Impacts

Key issues with regards to the construction and operation of the cable route, and the level of impact upon the marine environment are summarised in Table 12.5 and discussed below.

12.7.1 Bathymetry

Very localised scour can arise as a result of where the cable rises above the seabed and/or where rock-dumping or concrete mattressing is required. There will be minimal impact to the bathymetry of the area, and the impact is expected to be very localised.

12.7.2 Geology

12.7.2.1 Underlying Geology

There will be no impact upon the underlying geology.

12.7.2.2 Surface Sediments

There will be a limited effect on surface sediments as a result of the EWI cable. However, this will be limited to the cable route and a narrow corridor either side where the plough/jetter affects sediment. Any rock placement or mattressing will also affect the geology of surface sediments, i.e. the sediment regime, but impacts here will be negligible.

12.7.3 *Contaminants*

As a result of the existing geology of the area, and absence of dump sites close to the route, and the controls that are to be set in place (e.g. EMP), there will be no impact with respect to contaminants in the area.

Table 12.5: Potential impacts as a result of construction and operational periods with regards to the magnitude and sensitivity and overall significance

Key Issues	Magnitude	Receptor Sensitivity	Significance
During construction			
Bathymetry	Small	Low	Slight
Marine geology	Small	Low	Slight
Coastal processes	Negligible	Low	None
Sediment transport	Medium	Low	Slight
Contamination	Negligible (contaminants) Sediment contamination levels are low	Low (contaminants); only one potentially sensitive habitat – aphotic reefs*.	Slight
During operation			
Bathymetry	Negligible	Low	None
Marine geology	Negligible	Low	None
Coastal processes	Negligible	Low	None
Sediment transport	Negligible	Low	None
Contamination	Negligible Very little long-term change in the sediment in the vicinity of the interconnector cable following construction	Humans and all marine organisms Low (contaminants)*	None
Cable Movement	Negligible	Low	None

* Discussed in Ecology Chapter 6

Note[1]: Should cables lie above the surface of the seabed then sensitivities and significances may alter

13 SOCIO-ECONOMICS

13.1 Introduction

This chapter of the ER considers the impact of the EWI proposal on the community and economy. It reviews the baseline economic situation in the landfall areas and sets out the likely significant economic effects with respect to the fishing interest along the proposed route. It also examines the likely impacts on local people from the perspectives of recreation and tourism.

13.2 Assessment Methodology

13.2.1 General

To determine the socio-economic impacts of the development, several sources of information have been reviewed, primarily fisheries activity, regional and national statistics, regional strategies, local and structure plans and internet sources.

Potential impacts and mitigation measures have then been identified as a result of information received from data collection, knowledge of the impacts of construction projects and appropriate mitigation measures from previous projects.

13.2.2 Assessment of the Significance of Impacts

When assessing significance, the magnitude of change and the importance and/or sensitivity of the receptor have been taken into account. The criteria for assessment are presented in Table 13.1 and Table 13.2 below, with Table 13.3 providing the significance.

Table 13.1: Magnitude of impact

Magnitude	Description
Large	Substantial changes to national or regional economy. Substantial, permanent social or cultural impacts at national or regional level Changes are well outside the range of natural variation and unassisted recovery could be protracted
Medium	Moderate changes to the regional or national economy. Substantial, permanent local social or cultural impacts or substantial, permanent impacts on the local economy Potential for recovery within several years without intervention is likely
Small	Minor changes to the regional economy or moderate impacts on the local economy. Moderate local social or cultural impact. Changes might be noticeable, but only temporary
Negligible	Changes in local economy that are unlikely to be noticeable

Table 13.2: Receptor sensitivity

Receptor Sensitivity	Description
High	Objective 1 or 2 areas for assistance under the European Structural Funds, Assisted Areas, tourist attractions of regional or national importance and national trails/footpaths
Medium	Surrounding settlement Regional footpaths and recreational routes Commercial or other businesses, including shops and services Local tourist attractions Areas of particular value for rural amenity
Low	Local footpaths Rural, agricultural areas

Table 13.3: Significance of impacts

<table>
<tr><th>Significance</th><th colspan="2">Description</th></tr>
<tr><td>Very Significant</td><td>Irreversible change to attractions of national importance, sensitive economies, or fishing interests which could have an extensive effect and include areas remote to the development area over a long time period (greater than 20 years).</td><td rowspan="2">Significant Impacts where monitoring may be required</td></tr>
<tr><td>Significant</td><td>Moderate adverse change to regional or local attraction, economies or fishing interests with changes to areas remote from the site over a moderate time period (<20 years).</td></tr>
<tr><td>Moderate</td><td colspan="2">Slight changes local to regional or local attraction, economies or fishing interests just outside the accepted limits of normal variation with little or contained offsite effects, detectable within a medium time period (5-10 years).</td></tr>
<tr><td>Slight</td><td colspan="2">Change only just detectable within the site and surrounding areas over a short timescale (less than 10 years).</td></tr>
<tr><td>None</td><td colspan="2">An impact causing effects that are not readily noticeable.</td></tr>
</table>

The threshold for significant impacts, where monitoring measures may be required, is where residual impacts are considered significant or very significant, as defined in Figure 3.1.

13.2.3 Uncertainty and Technical Difficulties Encountered

No particular technical difficulties have been identified.

13.3 Baseline

13.3.1 Sources of Information

Sources of information used during the assessment include:

- Central Statistics Office, Ireland – 2006 Census; and
- Flintshire and Fingal council websites.

Information obtained from these sources provides the basis for the baseline environment upon which the impact assessment has been made. In addition to the above sources, Brown and May Marine Ltd has provided a commercial fishing assessment for the EWI route. The full investigation included consultation with the following organisations:

- Marine and Fisheries Agency (MFA), an executive of Defra, UK;
- Sea Fisheries Protection Agency (SFPA), Ireland;

- International council for the Exploration of the Sea (ICES);
- Irish Sea Fisheries Board/Bord Iascaigh Mhara (BIM);
- Irish Fish Producers Organisation (IFPO); and
- Anglesey and North Wales Fishermen's Association (A&NWFA)

The full report, focussing on those issues pertinent to Irish waters and including details of methodology used, can be found in Appendix 13.1. This section includes a summary of the findings of the report.

13.3.2 Baseline Economic Review

13.3.2.1 Population Overview

The landfall site at Rush, Ireland is within the Fingal County Council area. The results for the 2002 Census show a population increase for Fingal of 17%, from 167,683 to 196,223. Most of this growth was experienced in the Blanchardstown and Swords areas; 56% of the population growth in Fingal took place in the Blanchardstown/Castleknock area. Population levels grew by an average of 11% in Census areas that are wholly rural. The 2006 Census shows that the population of Fingal had increased by a further 22% to 239,992.

13.3.2.2 Local Economic Activity

Fingal is one of the most rapidly developing counties in Ireland. At present, about 60% of Fingal's resident workforce commutes outside of the county to work, with Dublin city being the main destination. There is also significant inward commuting to Fingal, with about half of all jobs located in the county filled by people living elsewhere. Only a small percentage of the workforce is employed in the fishing industry.

While Fingal has been successful in attracting a number of blue-chip companies that provide high-quality employment, the overall quality of jobs in the county is lower than in the Greater Dublin area generally. One of the council's core tasks is assisting in the transition to sustainable development, as set out in national and EU policy and in international agreements.

13.3.2.3 Tourism and Recreation

Due to the highly localised nature of the offshore and landfall works, consideration is only given here to the local attractions for tourism and recreation that the landfall location and immediate surrounds afford.

Rush North Beach is designated as a Blue Flag bathing beach and it is of significant local recreational value. Its importance on a county or regional scale in terms of recreational and tourist facilities and interest is less clear. The Rush Area Plan does recognise that the public open space between it and the town should be reserved for local recreational and amenity requirements, as follows:

> "Public Open Space shall be provided in accordance with the requirements laid down in the current County Development Plan as amended on the 11th November 2002 in order to meet the amenity and recreational requirements of future residents in the plan area."

During site visits undertaken for the purposes of site survey, it was observed that the beach area was well used by people in the evenings and morning, primarily walkers.

In Ireland, monitoring of water quality at designated bathing areas is undertaken in accordance with the provisions of the EU Directive concerning the quality of bathing waters. The results of samples are analysed and assessed for compliance with two sets of EU bathing standards: minimum quality standards (EU Mandatory Values) and more stringent quality targets (EU Guide Values). Rush is a designated seawater bathing area. In 2007, Rush was compliant with both mandatory and guide EU compliance values indicating good quality bathing water.

The north beach therefore appears to be a local recreational resource that, along with the defined open space, is likely to be of high local value.

13.3.2.4 Commercial Fisheries

Fishing effort and nationality

Irish (SFPA) data on effort by nationality per rectangle are presented in Figure 13.1. Rectangle 36E4 is of the greatest importance in terms of effort, and effort is almost exclusively by Irish vessels.

UK (MFA) fishing effort data on fishing effort by vessel nationality per ICES statistical rectangle are presented in Figure 13.2. This also indicates that the greatest level of fishing activity on the cable route is in rectangle 36E4. Much of the effort on the Irish side of the cable route (36E3 and 36E4), however, is from Northern Ireland-registered vessels.

Landings value

For Irish vessels, data was requested from the SFPA but not provided.

Average annual value of landings per ICES rectangle by gear type (1998–2007) provided by the MFA for British and Irish vessels landing into UK ports is presented in Figure 13.3. This clearly illustrates that rectangle 36E4 (on the western side of the cable route) is of the greatest importance to British vessels, and this comprises mostly demersal fisheries, with some pelagic fisheries.

Seasonality

Data on seasonality of commercial landings were not available from the SFPA, and therefore seasonality is not addressed here.

Vessel activity and fisheries surveillance

Satellite tracking of vessels (>15m) gives a useful indicator of areas of greater fishing activity, although it does not include smaller vessels nor can it discriminate between active fishing and steaming. Three-year averaged data for the period 2005–2007 from satellite tracking of commercial fishing vessels of Ireland is shown in Figure 13.4. Along with analysis of activity by season summarised here (included in detailed report: see Appendix 13.1), the following conclusions can be drawn:

- Year-round averaged Irish vessel activity is almost exclusively within the Irish half of the cable route, with a distinctive concentration towards the Irish side of St Georges Channel, in rectangle 36E4.
- British and Irish vessel seasonal activity shows the same relative pattern of density as the year-round average, although there is a greater concentration of vessels crossing the cable route in summer and autumn.

In addition, a low level of Belgian fishing activity in the western half of the cable route was reported from satellite tracking data.

Ports and vessels

Data on the fishing effort in days per year by landing port in the region of the EWI cable were collated. This was performed for both over-10m and under-10m vessels from SFPA (Ireland) data (2003–2007 averaged data). Ports comprising the highest proportion included:

- Over 10m: Howth, Skerries, Clogherhead and Balbriggan; and
- Under 10m: Arklow, Skerries, Howth, Clogherhead, Wicklow and Kilmore Quay.

Data from Irish Fishing Boat Register gives information on vessels registered to ports, although it is likely that only a small proportion of those vessels registered actively fish in the area. Three port registrations (Dublin, Drogheda and Dundalk) are in the area of the Irish side of the cable route and Table 13.4 presents information on the number of each vessel by gear type registered to each port.

Table 13.4: Number of vessels by gear type registered to local ports, Ireland (February 2008)

Gear type	Dublin	Dundalk	Drogheda
Pots	57	10	3
Demersal otter trawl	51		13
Drift nets	33	4	6
Shellfish dredge	28	14	14
Set gill net	8		
Trammel net	2		
Hand/pole line	1		
Drifting long line	1		
Set long line	1		
Mechanised dredge			1
Lift net		1	

Fishery type

The type of fisheries found along the cable route is relevant in terms of both the potential impact of the proposed development on the fishery, and the potential interaction of the fishery with the cable. Certain fishery methods may be relatively unimpacted by the effects of cable laying and operation (e.g. gillnetting), whereas others will be relatively more impacted (e.g. shellfish dredging). Equally, fishery methods may have a greater potential to interact with the cable (e.g. otter trawling, shellfish dredging) compared with much more benign methods such as potting.

Based on consultation with local fishermen, data was collated on the types of fishery operating along and near the cable route.

Inshore

Table 13.5 summarises information on the range of inshore fisheries for Ireland. Key inshore fisheries are mapped in Figure 13.5.

Table 13.5: Summary of inshore fishery types operating along or near the cable route in Ireland and Wales

Method	Target species	Location	Season	Notes
Potting	Edible & velvet swimming crab (VSC), lobster	VSC: productive grounds immediately S of Rush harbour	VSC: year-round. Lobster/Edible crab: June-October, offshore, N of Rush harbour	C.7 potting vessels deploying gear in area of cable route
Shellfish dredging	Razor clam, cockle	Close inshore, on/near cable route	Year-round (razor clam); peak for cockles in summer	Method penetrates seabed up to ~38cm

Figure 13.5 indicates that the EWI cable route will pass in close proximity to grounds used for shellfish dredging (razor clam) and potting (edible crab, velvet swimming crab, and lobster). Of particular interest is razor clam dredging, which operates in shallow (1–8m) inshore waters and uses jetted water (to displace sediment) combined with a dredge to capture this relatively high-value export species. Approximately 26–32 vessels in the area target razor clams, with home ports at Mornington, Balbriggan, Skerries and Howth. Shellfish grounds are classed either as “A” (where live bivalves may be offered for direct consumption) or “B” (requiring purification prior to consumption). Designated shellfish grounds are presented in Figure 13.6, although commercial fishermen consulted expressed that razor clams are fished on continuous grounds encompassing these. All grounds are currently classed as “B”, with the exception of Gormanston/Laytown, which is classed as “A”.

<u>Offshore</u>
An overview of the section of the EWI cable route showing offshore commercial fisheries is presented in Figure 13.7.

The majority of activity along the offshore section of the cable route is undertaken by twin-rig demersal trawlers targeting *Nephrops* (also known as scampi or langoustine). The proposed cable route dissects the southern portion of these grounds. It is estimated that as many as 100+ vessels from Ireland and Northern Ireland could, to varying degrees, operate in these grounds. Those fishermen consulted stated that these grounds were most commonly targeted in the summer months. The cable route however represents only a very small proportion of the available *Nephrops* grounds.

A number of other fisheries such as scallop dredging and beam trawling operate in the region of the cable route but not locally. The Irish section of the cable route is not believed to be productive whitefish trawling grounds, and similarly the eastern end of the offshore section, despite previously being a significant fishery, is only currently worked by a small number of vessels with a low level of activity.

Dependent on suitable gear technology becoming available, a dredge fishery for razor clam in deeper offshore waters may be developed in the future.

13.4 Potential Impacts

13.4.1 Construction Phase

13.4.1.1 Fisheries

All vessels (including commercial fishing vessels) will be required to adhere to safety exclusion around the lay vessel during construction.

For fishing vessels using static gear (e.g. pots), the discrete and temporary nature of the construction will not cause significant impact, as the vessels will be able to deploy gear on alternative grounds. However, such movement of gear is conditional on enough warning being given by EirGrid given through appropriate liaison and notices. Vessels fishing towed gear (e.g. trawls) will also be excluded temporarily from the construction area and may be particularly concerned about returning to a route area until post-lay burial assessments have been performed.

The relative impact of a construction exclusion zone will depend on the location of the fishery. Offshore fisheries, such as the *Nephrops* trawler fishery, will have a relatively greater area of alternative grounds on which to fish during the exclusion. However, inshore fisheries (such as the razor clam dredge fishery) have relatively smaller grounds available, and the range of the vessels involved is such that the exclusion zone represents a relatively larger proportion.

Fishermen consulted during the compilation of the Fisheries Report raised particular concerns that the following aspects should be included in the design of the EWI cable:

- A minimum cable burial depth of 1.5m should be achieved and maintained to reduce the risk of interactions with towed gear; and
- Inshore razor clam grounds should be avoided where possible.

The design of the EWI will accordingly consider these requirements.

13.4.1.2 Employment, Tourism and Recreation

The construction works will be temporary in nature and will require very few, but specialised, personnel for its installation. Whilst some local revenue may be generated from the construction workers during the construction period, overall there will be no significant economic benefit in terms of local employment.

The vast majority of the construction works will take place at sea with only a minimal disturbance on land, primarily focused on the landfall site. The works will be temporary and short term with the main impacts being possible operational noise disturbance and a reduction of public access to the areas concerned. The car park will be closed off from access for a short time (a few weeks) while the jointing pit is constructed, and during cable pull-in and cable jointing operations.

Access across the beach will be restricted during the period of open cut excavation of the trench and the pull ashore of the cable and subsequent backfilling. Works areas will be appropriately fenced off and warning signs erected. It may be necessary to close Kilbush Lane for brief periods during delivery of landfall construction equipment.

Rush North Beach is a designated bathing beach. It is also used for other local recreational use, with activities such as walking being the most popular. It is predicted that the works will have a moderate impact on such activities. However, those impacts will be localised and short-term with full access restored in a matter of weeks and so impacts are considered unlikely to be significant.

13.4.2 Operational Phase

13.4.2.1 Fishing Activities

Fishing activities along the cable route will be dependent on the burial status of the cable. In normal circumstances (i.e. achieving target/ design burial depth), restrictions will not be required. However, it may be necessary in certain areas to place restrictions upon some towed-gear commercial fishing activities (such as trawling) to ensure safety and avoid damage to the cable. Given the spatial extent of the fisheries, it is considered that a worst-case scenario would represent a small long-term impact due to the relatively small proportion of area sterilised by the cable route in comparison.

Should maintenance, survey or repair activities be required along the cable route during its lifetime, it may be necessary to impose a similar exclusion zone to all fishing vessels similar to that during construction activities. This would represent a localised, short-term, minor impact.

13.4.2.2 Employment, Tourism and Recreation

The operation of the cable itself will not provide significant local employment benefits. However, it is likely that there will be long term significant secondary benefits in employment and the national economy once the cable is operational.

It is not anticipated that there will be any impacts of the EWI during normal operation in terms of tourism and recreation.

13.5 Mitigation

13.5.1 Construction Phase

13.5.1.1 Fisheries

Effective channels of communication will be established and maintained between EirGrid and commercial fishing interests. This will include appointment of a fisheries liaison officer on the construction vessel(s) in addition to publication of the construction schedule through official notices. The establishment of a fisheries working group will be investigated to provide a forum for discussion between EirGrid and various fisheries interests.

EirGrid will inform local fishermen in advance (at least 48 hours) of operations, to ensure that fishermen using static gear can lift and redeploy it.

Suitable local commercial fishing vessels and skippers will be used for liaison and guard vessel duty during construction activities. This will ensure involvement of commercial fishing interests and effective practical communication between the construction contractors and local fishermen. EirGrid may also use local, active fishing vessels/skippers for other appropriate activities (e.g. survey) during construction works.

13.5.1.2 Tourism and Recreation

It is likely that there will be a temporary reduction in public access during certain phases of the works in terms of both pedestrians and traffic movements. Impacts upon traffic movements are discussed further in Section 10. With respect to pedestrian access, it is proposed that, as part of the traffic management plan (see Section 10), temporary diversions will be placed around the landfall works during construction to allow continued access. Access to the beach for pedestrians may be limited during periods when construction vehicles are travelling to and from the working areas. The car park and beach trench will be fenced off for safety from public access while construction operations are taking place. All necessary measures will be taken to minimise inconvenience to the public and ensure best health and safety practices are implemented. Furthermore the works on the North Rush Beach will be undertaken in consultation with Fingal County Council.

In Ireland, the bathing season is designated as between 1 June and 15 September; EirGrid will endeavour to minimise impacts on beach access during this period.

13.5.2 *Operational Phase*

Fishermen consulted as part of this assessment stated that the existing cables in the area did not affect their activities adversely. If the cable achieves and maintains satisfactory burial depths, it will therefore not represent an adverse impact.

EirGrid will issue as-laid co-ordinates of the cable, and inform fishermen of any specific areas where complete burial was not possible.

The schedule of any maintenance, survey or repair activities will be well publicised to fishermen in advance, and the duration of these activities will be kept to a minimum to reduce the duration of any exclusions.

The following aspects will be included in the detailed design of the EWI cable:

- A target cable burial depth to 1.5m maximum will serve to reduce the risk of interactions with towed gear; and

- Inshore razor clam grounds will be avoided where possible.

13.6 Residual Impacts

13.6.1 *Fisheries*

If it were necessary to place restrictions upon some towed-gear commercial fishing activities (such as trawling) to ensure safety and avoid damage to the cable, the worst-case scenario would represent a widespread minor long-term impact. However, it is anticipated that mitigation measures (through rapid burial of the laid cable) will ensure a negligible impact.

During monitoring surveys, or any maintenance or repair activities required along the cable route during its lifetime, it may be necessary to impose a similar exclusion zone to all fishing vessels similar to that during construction activities. This would represent a localised, short-term, minor impact.

13.6.2 *Employment, Tourism and Recreation*

Once operational, the EWI cable will not present local impacts to employment, tourism or recreation. However, the Irish Government’s recently published energy policy White Paper, ‘Towards A Sustainable Energy Future for Ireland’, which sets out the Government’s energy policy framework for 2007–2020, has a number of strategic goals. Strategic goal 1 is “Ensuring that Electricity Supply Consistently Meets Demand”. This strategic goal recognises that reliable, secure and competitively priced electricity supply must be available at all times and that it is a vital ingredient in the competitiveness of Irish industry and Ireland’s long-term economic and social development. One of the key actions to achieve this goal is the delivery of the EWI by no later than 2012.

14 CUMULATIVE IMPACTS AND TRANSBOUNDARY EFFECTS

14.1 Introduction

This chapter summarises the potential for cumulative impacts that may arise from the EWI. It also provides the background to, and requirement for, the assessment of transboundary effects, together with an assessment of the potential for such effects on various environmental features.

14.1.1 Cumulative Impacts

Cumulative impacts are those that may result from the combined or incremental effects of past, present or future activities. While a single activity may itself result in an insignificant impact, it may, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

14.1.2 Transboundary Effects

Transboundary environmental effects can arise where a project in one state has significant impacts on the environment in one or more other states. Examples of commonly evaluated transboundary impacts include emissions of airborne pollutants from industrial facilities that affect the air quality downwind in another jurisdiction, waste water discharges to rivers, lakes and at coastal locations that adversely affect water quality downstream in another state, or adverse visual impact caused by the construction of large structures that are visible in another jurisdiction.

In operation, the EWI will connect Ireland to the UK electricity grid, allowing electricity to flow in both directions depending on system surpluses and demands. Given the anticipated wide diversity in sources of electricity generation in Ireland, UK and Europe, it is not possible to predict the equivalent emissions of carbon dioxide or polluting emissions associated with electricity imported or the net balance between electricity imports and exports. However, the cost associated with carbon dioxide emissions is assumed to be included in the price paid for electricity.

It is widely accepted that interconnectivity between states provides an effective way of promoting renewable energy providing overall positive environmental benefits. This is borne out by current EU and national energy policies.

14.2 Assessment Methodology

Cumulative impacts and transboundary effects are assessed in this chapter. The principal legislation and international agreements relevant to transboundary environmental effects are identified and summarised. The requirement of the legislation is compared with the procedures being followed in Ireland and the UK to obtain planning approvals and consents for elements of the EWI project.

The potential environmental impacts due to the project that have been identified in preceding chapters of the ER are examined in the context of cumulative and transboundary effects.

14.3 Legislative Background

Applicable EU, national and international legislation on transboundary environmental effects is summarised below.

(a) Directive 85/337/EEC (As amended by Directive by Directive 97/11/EC) on the assessment of the effects of certain public and private projects on the environment. Article 7 of the Directive provides for transboundary environmental effects between Member States. Where a project proposal in a Member State is likely to significantly affect the environment in another, it is required to send information to the potentially affected state at the same time as it informs the public in its own jurisdiction.

The information should describe the project and the possible transboundary impacts. It must also allow the potentially affected state to engage in the EIA process for the project.

(b) Article 31 of the Planning & Development Regulations 2006 (SI No 685 of 2006) replaces Chapter 5 of Part 10 of the regulations on Transboundary Environmental Effects. Under the regulations, planning authorities are required to inform the Minister where a proposed development is likely to have significant environmental effects on a Member State. The planning authority provides information to the transboundary state, except in the case of strategic infrastructure development, where/when the applicant has already done so.

The information provided to the transboundary state for consultation includes a description of the project and its possible impacts, the EIA procedure and possible decisions that may be taken and an invitation to make submissions as part of the EIA process.

(c) The Espoo Convention on Environmental Impact Assessment in a Transboundary Context stipulates the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across borders.

Potentially affected countries are notified and information is supplied on the planned activity as well as all available information on its possible transboundary impact, on the type of possible decision and indication of a reasonable deadline within which a reply should be made. Potentially affected countries can choose to be involved in the EIA procedure. The Convention has been ratified in Ireland and the UK.

The legislation described above applies in particular where a project proposed in one country has the potential to produce transboundary environmental effects in another. The EWI infrastructure, by its nature, has to cross the national boundary of the UK and Ireland but its direct and indirect effects are likely to be localised, minor and confined to the jurisdiction in which relevant elements of the infrastructure are installed.

14.4 Planning Approval and Consents Procedure

14.4.1 Permitting Procedure

Ireland

Planning approval is required under the Planning and Development (Strategic Infrastructure) Act 2006. An Bord Pleanála (ABP) is the planning authority for strategic infrastructure development (SID). The initial stage of the application process involves consultation with ABP. As the planning authority for the application, ABP consults the appropriate statutory bodies.

A screening/scoping report was submitted following which ABP has determined that the EWI and its scope, for planning purposes, includes the converter station at Woodland, the onshore underground cable and the marine cable to the 12 nautical mile limit of Irish territorial waters. ABP also determined that a statutory EIA is not required but that an environmental report should be prepared for that part of the development within Irish jurisdiction. Extensive consultation has been undertaken with statutory agencies and the public by EirGrid. This is planned to continue through all stages of project implementation.

Foreshore licensing is required under The Foreshore Acts, 1933 to 1998. Foreshore and seabed works in Ireland require either a licence or lease, or permission from the

Department of Agriculture, Fisheries and Food (DAFF) for all installations between the high water mark and the 12 nautical mile limit.

Applications for foreshore licences or leases involve an application process similar to that for planning approval with the preparation of an environmental report and public consultation.

UK

Planning permission under the Town and Country Planning Act, 1990, will be required for the converter station at Deeside. An application for permission will be submitted to the local council, including an environmental report. The planning application will be available to public scrutiny and submissions can be made to the planning authority.

Installation of electricity cables below the mean high water mark (MHWM) is subject to consent under Section 34 of the Coast Protection Act 1949, as amended. The purpose of the control is primarily to ensure that works do not endanger the safety of navigation and fisheries, and to limit any impacts on existing sea defences at the landfall location.

14.4.2 Relevance to Transboundary Legislation

Elements of the EWI in each jurisdiction (Ireland and UK) are subject to planning approval/consent. The approval process in both countries provides for extensive consultation with statutory organisations and the public.

Furthermore, EirGrid has committed to providing environmental reports for EWI project elements in both jurisdictions, even though the development is a sub-threshold development within the meaning of the EU EIA Directives and Part 10 of the Planning and Development Regulations in Ireland. Extensive consultation took place with environmental organisations through the preparation of these reports, all of which will be available to view on the project's website during the planning evaluation process.

It can be seen therefore, that the planning/consent process followed fully satisfies the requirements to inform affected jurisdictions (Ireland and UK). The requirements for consultation, information exchange and involvement in the evaluation of transboundary effects is also fully satisfied, since both jurisdictions are engaged in the consents process.

14.5 Cumulative and Transboundary Effects

14.5.1 Introduction

It is very unlikely that during the installation, operation or decommissioning phases of the EWI cable project impacts will combine with other known projects to create cumulative impacts to the landscape or visual amenity. The following sections have been compiled following review of the various impacts chapters (6-13).

14.5.2 Landscape

Temporary impacts to the landscape of Rush Bay during construction work will not result in transboundary effects. There will also be temporary landscape impacts at the Welsh landfall, however, these are dealt with in a separate environmental report. Temporary impacts on the landscape at Barkby Beach will not be perceived in Ireland. Cumulative impacts are not anticipated.

14.5.3 Ecology

14.5.3.1 Construction

During the installation of the cable, there will be some inevitable localised sediment disturbance. In terms of cumulative impacts at the time of construction, the only other activity that is likely to be carried out at the same time, that could result in similar sediment disturbances is from fishing boats engaged in demersal fishing.

A number of demersal fishing methods are employed in the vicinity of the cable route, which are covered in greater detail in Chapter 13. However, in summary, in inshore waters there is dredging for cockles, razor clams and other bivalves using gear that can penetrate seabed sediments by up to 38cm. Fishing activity can be intensive, particularly during summer months, when fishing for razor clams is underway. The use of water jetting and suction dredging generates relatively high, albeit localised sediment disturbance.

In the waters further offshore in the vicinity of the cable route the majority of fishing effort is by trawlers primarily targeting *Nephrops*. Other offshore demersal fishing takes place for scallops by dredge and whitefish using a beam trawl.

Fishing activities, in combination with the installation operations for the EWI cable, may provide a localised additive affect on benthos resulting from sediment disturbance. However, by comparison with existing fishing operations, installation of the EWI cables will present a negligible increase over ongoing effects.

14.5.3.2 Operation

Cumulative impacts during operation may result from other HVDC cables, such as that proposed for construction by Imera Power. HVDC cables have been shown to produce magnetic fields that have the potential to impact on certain species of fish, such as eels. However, given the distances between the EirGrid EWI cables and the proposed route for the Imera Project, additive impacts are not anticipated.

During operation, monitoring of cable burial will take place using geophysical survey techniques. These survey techniques will present additional sound sources into the Irish Sea that may be additive to other ongoing sources of noise. The geophysical survey techniques are not expected to present a significant increase over background noise levels in general, and cumulative impacts are expected to be negligible.

No transboundary effects on ecological features are anticipated as a result of operation of the EWI cable.

14.5.4 Archaeology

Based on the information presented in chapter 7, cumulative and transboundary effects to the archaeological interest are predicted to be negligible.

14.5.5 Noise

In the event that the construction of the onshore cable occurs at the same time as the TJP and intertidal work, the maximum increase in LAeq level over the noise levels discussed in section 8.4 at any receiver at equal distance from the two activities is predicted to be 3dBA. At receivers at different distances to the two activities, the overall increase above those above would be between 0 and 3dBA. The plant and equipment used for the onshore construction work will be very similar to that for construction of the TJP, however, construction of the onshore cable will not be planned to occur at the same time as intertidal work.

It is likely that at the closest and therefore most noise-affected residence there would be no increase in noise level over that predicted in section 8.4 as noise levels would be dominated by the closest activity.

No transboundary effects related to noise are expected.

14.5.6 Air

If construction of the TJP and beach trenching take place at the same time as other land-based construction operations for the onshore elements of the EWI project, there may be an increase in local air emissions. However, even in such a case, air emissions are not expected to approach the standards that have been set for human health. Hence, cumulative effects during construction are not predicted.

Transboundary effects will not arise from the construction, operation or decommissioning of the EWI project.

14.5.7 Navigation and Traffic

The temporary minor impacts that may be caused to normal navigation in the Irish Sea, should they occur at the same time as construction of another HVDC cable proposed for the Irish Sea, could combine with impacts from that project to produce a cumulative effect. The projects are well spaced apart (more than 60km) and any such combined effect is expected to be negligible. No cumulative impacts to navigation are expected during the operational phase of the EWI project.

The onshore traffic management plan will be used to ensure that traffic associated with the installation of the onshore elements of the EWI project does not combine with that associated with the landfall works to provide a cumulative impact in terms of traffic associated with both elements of the project occurring together. However, by keeping the periods separate for both projects, the slight impacts to normal traffic flow created by each project will be extended in time. No cumulative impacts to normal traffic flow are expected during operation of the project.

No transboundary effects to navigation or traffic are anticipated from the construction, operation or decommissioning of the EWI project.

14.5.8 Water

It is understood that there is a plan to install a similar HVDC interconnector cable between Dinas Dinlle, close to Caernarfon in North Wales and Wicklow, Ireland. At their closest point, adjacent to the western coasts of Anglesey, the cables will be approximately 60km apart. As such, due to the localised nature of any potential impacts it is unlikely that any cumulative impacts on water quality will arise. No cumulative effects are anticipated from operation of the EWI project.

No transboundary effects on water quality are anticipated from the construction, operation or decommissioning of the EWI project.

14.5.9 Geology

From the Irish landfall site up to the median line into British waters in St George’s Channel, the EWI cable will cross two existing cables (Hibernia ‘C’ and ESAT 2). Use of concrete mattressing or rock armouring at these crossings may provide a localised cumulative impact to seabed sediments. However, these are expected to be very limited in extent. No cumulative effects are anticipated from operation of the EWI project.

No transboundary effects to geology are anticipated from either construction, operation or decommissioning of the EWI project.

14.5.10 Socio economics

In terms of transboundary effects, operation of the EWI project will be a benefit to both Ireland and Britain. It will allow both countries to import and export electricity when there is a requirement for this, and capacity is available. It may encourage the increase in construction of renewable energy projects, such as wind farms, where there may be additional power generated above which could be used locally.

No transboundary environmental effects to socio-economic conditions in are anticipated from the construction, operation or decommissioning of the EWI project.

14.5.10.1 Fisheries

With respect to cumulative impacts with other developments, consultation with commercial fishermen from both Ireland and Wales raised potential concerns about the cumulative impacts of developments within the Irish Sea. These include:

- Marine conservation areas (e.g. around Dundalk Bay/Waterford estuary);

- UK offshore wind farm developments (Gwynt Y Mor, North Hoyle and Rhyl Flats); and
- Harbour developments (Bremore, Ireland).

However, fishermen also stated that the several existing cables and pipelines in the area do not interfere or adversely affect fisheries activity. Therefore, following appropriate mitigation, it is not anticipated that there will be any significant cumulative impacts as a result of the development.

No transboundary effects on fisheries interests are anticipated from either construction, operation or decommissioning of the EWI project.

14.5.10.2 Employment, Tourism and Recreation

Effects on local tourism and recreation will arise from the landfall construction work, and together with construction of the onshore elements of the cable, this may form an additional impact. EirGrid will ensure, by liaison with its contractors and the local council, that such impacts are minimised as far as possible.

No transboundary effects on employment, tourism or recreation interests are anticipated from the construction, operation or decommissioning of the EWI project.

15 ENVIRONMENTAL MANAGEMENT

15.1 Introduction

This chapter sets out the potential management/mitigation required for the environmental effects of the construction, operation and decommissioning of the marine section of the EWI in terms of its potential effects on the human, biological and physical environment.

It should be noted that a realistic worst-case approach has been adopted throughout the ER to define the most substantial likely effects on the environment. In this way, it is clear that the environmental impact of the EWI will be no greater than that set out in this environmental report and may indeed be notably less.

The formalised structures set down in ISO 14000/EMAS will be followed as far as possible. High-level mitigation measures were identified during the initial scoping stage and implemented during the preliminary design process to form the basis of the project, as described in this environmental report. These are discussed in 'Chapter 4: Description of the Development and the Alternatives Considered'. One of the key mitigation measures was finding a route that would minimise the impacts of the project (with particular regard to shipping and navigation and impacts upon the environment).

During the environmental assessment process, as each aspect of the environment has been assessed, a more detailed set of mitigation measures has evolved that will need to be implemented during the particular phases of the project in order to avoid exceeding the predicted residual impacts identified in this environmental report.

The mitigation measures likely to arise from the decommissioning aspects of the work will be subject to further assessment at the end of the operational life of the EWI and will be agreed with the relevant licensing authorities at that time.

Tables 13.2–13.4 outline the mitigation and control measures that that have been proposed for the construction, operational and decommissioning phases of the project. Against each measure, an initial responsibility has been assigned to form a preliminary EMP. Once installation methods have been finalised, a construction management plan will be produced, and the preliminary EMP will be used to build the plan into its forward planning.

15.2 Monitoring, Auditing and Reporting

This section considers the processes that are to be put in place to ensure that the mitigation measures identified in this environmental report are carried out, and that the engineers responsible for detailed design, the contractors and subcontractors, the maintenance contractors and the operators are aware of the importance of the measures proposed to ensure that any effects on the environment are as low as reasonably practicable.

Monitoring and auditing of the organisations responsible for design, construction and operation will enable EirGrid to demonstrate that they are complying with the requirements of the consent conditions and that the development of the project is carried out in a safe and environmentally responsible manner.

The key features of environmental management that have been considered during the assessment process, and will continue to be reviewed through the life of the project, include:

- A process of developing the most appropriate alternatives for the site, including site location, cable route, landfall design and construction methodology to minimise the environmental impact of the development;

- The requirement for the contractor and subcontractors to demonstrate that they have a project-specific environmental management plan and that they adhere to it; and

- Procedures for the selection, management and auditing of contractors, including the requirement for the contractor to produce its own environmental management plan encompassing a description of environmental constraints and the procedures and method statements used to prevent or minimise and mitigate environmental impact.

This ER is the product of the overall environmental assessment process. Environmental management will continue through the construction, operation and decommissioning phases of the project. This will help to ensure that the environment is protected appropriately during all stages of the development.

15.3 Environmental Management during Detailed Design and Construction

EirGrid is committed to the development of the proposed EWI in an environmentally responsible way.

15.3.1 The Contractor

The contractor will be required to produce and maintain their own project-specific health, safety and environmental management plan (HSE plan), which will need to be agreed by all the relevant statutory authorities. The HSE plan must identify site responsibilities for environmental management and describe how the various environmental management activities required will be undertaken, including consultations, licence and consent applications, communication, training, selection and management of subcontractors and monitoring and auditing during construction.

In addition, the contractor will be required to develop project-specific environmental management procedures and method statements, detailing how they will prevent or mitigate the environmental impacts identified in the ER, taking into account all aftercare requirements and information from subsequent investigations and surveys. The procedures will include:

- A pollution control plan;
- A waste management plan;
- A oil spill contingency plan;
- A navigation management plan;
- A traffic management plan;
- A contingency and emergency response plan;
- A reinstatement and aftercare plan;
- Environmental training plans;
- Toolbox talks;
- Monitoring plan;
- Audit schedule and procedures;
- Liaison plan; and
- Project/site-specific method statements.

The contractor will be required to develop and agree these in consultation with EirGrid's project management team and relevant authorities.

15.3.2 Environmental Awareness

Site briefings (onshore and offshore) will be given to all contractors' staff through induction talks before the start of construction, and through tool-box talks setting out key procedures during construction. This will help ensure that site personnel are fully aware of the key environmental issues and management procedures, which have been set in place to mitigate impacts. Appropriate aids, such as videos and leaflets will be used.

15.3.3 Environmental Monitoring

The identification of monitoring requirements is included in this environmental report. Monitoring will be carried out during and after construction in accordance with the agreed measures.

The consenting authority may determine that there are specific aspects of the work undertaken in this ER that have a requirement for monitoring both during and following construction. These may be incorporated into the consent conditions for the development and will be integrated into the ongoing management, monitoring and maintenance plans. These are summarised in Table 15.1.

Table 15.1: Monitoring proposals

Aspect	Monitoring Proposed	Responsibility
During Construction		
Marine geology and coastal processes	The cables will be buried deep enough to minimise the prospect of uncovering. However, post-installation monitoring may be necessary to check that the cable is buried to the target depth to help avoid the effects of bed changes or damage by fishing practices. Re-burial will be required if exposure occurs at any point	Construction Contractor
During Operation		
Offshore cable	Cable burial surveys to ensure the cable remains at a safe depth and poses no threat to the environment will be carried out periodically	EirGrid

15.3.4 Environmental Inspection and Auditing

The contractor will be required to carry out regular inspections and audits during the construction phase to demonstrate that procedures are being followed and remedial action has been taken, as necessary, to ensure that works comply with statutory and contract requirements.

Audits will be carried out before, during and after construction to verify the contractor's environmental performance.

15.3.5 Consultation

Continued liaison with statutory consultees, landowners, commercial fisheries and recreational users of the area will be undertaken during construction. The contractor's fisheries liaison officer will also have certain responsibilities for notifying local fishermen of activities.

15.4 Environmental Management during Operation

Operation of the cable will be in accordance with industry best practice, which requires contingency plans to be in place to demonstrate that:

1. All hazards relating to the operation of the cable with the potential to cause a major accident have been identified;
2. The risks arising from those hazards have been identified;
3. The safety management system is adequate; and
4. Adequate arrangements have been established for auditing and reporting.

Operating procedures will be developed to include the risk assessment and contingency requirements identified for the proposed cable development.

The contingency plan will cover health, safety and environmental aspects of accidents arising from the cable, by ensuring through safe design, and construction, that the operational risks to the environment are reduced.

15.5 Environmental Management during Decommissioning

All decommissioning activities will be managed according to best existing health and safety practice, and will follow a similar procedure to that set out for construction above. In addition to any legal obligations, the contractors will also operate a health, safety and environmental policy (HSE), which will be imposed on all parties working on the decommissioning project.

It is currently considered that, given the relatively inert nature of cables, leaving them in place once they are defunct is less environmentally damaging than removing them. The final decision on decommissioning will depend largely on the legislative requirements at the time, in addition to environmental and economic factors, and may indeed include recovery and/or dismantling.

Table 15.2: Construction impacts and mitigation measures

Activity/Impact	Mitigation	Responsibility
Landscape and Visual		
Landscape and Visual	As landscape and visual impacts are only expected to arise at construction stage, the most important mitigation measure is to keep this period as short as possible; further measures involve reinstatement such as: • restoring the car park surface to match the existing surface; • reforming the stone breakwater and bank to its present condition using the retained boulders; and • restoring the sand beach to existing profiles.	EirGrid / Contractor
Ecology		
Marine birds	All vessels will avoid surface aggregations of seabirds where possible (and safe) to do so, to minimise the amount of incidents where seabirds are displaced or have cause to take flight.	EirGrid / Contractor
Intertidal birds	Construction activity will only be limited to the sub-optimal feeding environment of the sandy beach, and will not take place on the adjacent rocky platform, where waders (e.g. oystercatchers) may be present. Landfall works will be timed where possible so as to be completed prior to the arrival of waders in the autumn.	EirGrid / Contractor
Seals	No construction activity or related vessel activity will take place close to Lambay Island in the period from September to December, to avoid potential disturbance to pupping seals.	EirGrid / Contractor
Subsea noise	In the event that cable lay through rock is required all necessary precautions will be undertaken to minimise the potential for disturbance to marine mammals, particularly cetaceans. A marine mammal observer (MMO) will be appointed for any such works, and will operate according to NPWS guidelines.	EirGrid / Contractor
Vessel-derived pollution	All construction vessels will operate within strict IMO regulations for pollution prevention, and will operate waste management plans. Any waste discharged at sea (such as treated black and grey water or macerated food waste) will be according to MARPOL regulations. Construction vessels will carry an oil spill response plan that crews will be fully trained to operate in the event of it being required. Vessels will also be equipped with facilities to deal with onboard minor spills (e.g. spill kits).	EirGrid / Contractor

Activity/Impact	Mitigation	Responsibility
Sediment disturbance	Techniques (such as ploughing) to minimise the suspended sediment load generated will be used as far as possible, with jetting kept to a minimum, particularly in deeper areas of fine sediment. The minimum amount of mattressing required to fulfil engineering and safety considerations will be used to reduce the areal extent of habitat alteration. Chemically inert materials approved for use in the marine environment will be used. EirGrid will inform scientists involved in monitoring work on the rocky platform at Rush Bay North Beach of the proposed construction schedule well in advance of any beach works to allow data to be collected.	EirGrid / Contractor
Archaeology		
Archaeology	In the absence of any further survey data pertaining to known wreck sites, each site will be subject to archaeological exclusion zones. Each exclusion zone will take the form of a 100-metre buffer, based on the cardinal extents of the wreck site, rather than on the centre point for which the position is given. In order to mitigate against negative impacts on previously unknown archaeological sites and features, the data and logs obtained during the course of future geophysical surveys will also be reviewed by a suitably qualified geoarchaeologist and any relevant data arising from the review process will be incorporated into the design and assessment process at the earliest opportunity. All archaeological mitigation works will be presented within a written scheme of investigation produced after discussion with the relevant authorities.	EirGrid / Contractor
Noise		
Landfall	The EMP for construction will specifically cover noise mitigation measures proposed. The construction activities onshore will be carried out in accordance with the requirements of BS 5228 with activities generally taking place between 07:00 and 19:00 hours. Efficient working practices will keep noise to a minimum during the construction of the project. Local residents onshore likely to be affected by the onshore works will be given prior notice (at least one week) of any specific activities or processes likely to generate unusually high noise levels or if extended working hours are required (i.e. for cable pull-in work, or cable jointing). Agreement will also be sought from the relevant statutory authorities prior to commencement of such work. Works in close proximity to residential housing will also be determined in consultation with the relevant authorities. The timing of works near residential housing will also be determined in consultation with the relevant authorities. Additional noise attenuation measures, e.g. noise barriers will be employed if necessary, in close proximity to sensitive locations, or if overnight work is needed. Contact details for the person responsible for day-to-day management of the site will also be made freely available.	EirGrid / Contractor
Offshore	See ecological mitigation measures	

Activity/Impact	Mitigation	Responsibility
Air		
Landfall Air	Air quality impacts will be minimised by ensuring all equipment is well serviced and engines switched off when not in use.	EirGrid / Contractor
Landfall Dust	Water will be used to dampen any stockpiles to reduce dust production in areas where dust or sand is problematic.	EirGrid / Contractor
Offshore	The cable-lay operation will be performed on a 24-hour basis to ensure minimal navigational impact on other users, and to maximise efficient use of suitable weather conditions and to minimise vessel emissions.	EirGrid / Contractor
Navigation and Traffic		
Marine navigation	Vehicle/vessel movements will be strictly controlled onshore and offshore. The cable-lay operation will be performed on a 24-hour basis to ensure minimal navigational impact on other users, and to maximise efficient use of suitable weather conditions. Notice of potential for disruption and/or accidents during cable-laying operations will be given to shipping in the area via Navtex and NAVAREA warnings. Procedures to minimise disruption near those shipping traffic hotspots identified will be considered and applied. Collision avoidance procedures will be developed and applied.	EirGrid / Contractor
Onshore traffic	A traffic management plan will be produced prior to construction to control and minimise the impacts of construction traffic on roads and other road users. The traffic management plan will be discussed with Fingal County Council and the necessary procedures will be followed to receive their approval.	EirGrid / Contractor
Water		
Water quality - intertidal	The specific mitigation measures to be employed to prevent contamination of water during construction will include: • refuelling or vehicle/plant maintenance will be avoided in the intertidal area; • plant will be regularly checked for leaks and well maintained; • drip trays will be used when refuelling at all locations; and • adequate spill kits will be maintained in working areas, and staff carrying out refuelling will be trained in their use.	EirGrid / Contractor

Activity/Impact	Mitigation	Responsibility
Water quality - offshore	The cable-lay operation will be performed on a 24-hour basis to ensure minimal navigational impact on other users, and to maximise efficient use of suitable weather conditions and to minimise vessel emissions. All vessels will operate under international standards (MARPOL) with respect to black and grey water and food waste discharges, which are designed to eliminate impacts to coastal waters, and to reduce the levels of discharge in offshore waters. The offshore contractor will have method statements and plans in place to minimise the risk of spillages. All bunkering and replenishment of oils and greases will be undertaken in compliance with MARPOL 73/78 (amended). Oil spill contingency plans will be put in place and adhered to, to prevent the release of fuel and other chemicals from vessels through collisions and ruptures.	EirGrid / Contractor
Physical Environment		
Superficial sediments - Intertidal	Material excavated from the beach trench will be sorted so that the top sandy layers are replaced at the surface during backfilling.	EirGrid / Contractor
Construction – excavated material	Excavated material will be used for backfilling where suitable. Any beach sand not backfilled as a result will be distributed evenly over the adjacent beach by excavators for gradual dispersion by natural sedimentary processes. Any other material excavated from onshore trenches will be stockpiled for removal to a licensed landfill site with prior approval of the relevant authorities.	EirGrid / Contractor
Superficial sediments - Subtidal	The offshore electrical cables will be buried at a depth to suit the local ground conditions and the third party risk profile. It is likely that scour protection material will not be required. However, future maintenance of the cables may require some element of scour protection where sediment movements are found to be high. Any crossing of existing pipelines/cables is likely to involve protective mattresses/rock armouring since around the crossing point the cable cannot be buried to sufficient depth. The mattresses will be kept as low as possible and hence reduce the potential for scour or deposition around them. Only chemically inert materials approved for use in the marine environment will be used.	EirGrid / Contractor

Activity/Impact	Mitigation	Responsibility
Socio-economic		
Fisheries	Clear channels of communication between EirGrid and commercial fishing interestss will be established through the appointment of a fisheries liaison officer on construction vessels and the publication of official construction schedule notices. EirGrid will inform local fishermen in advance (at least 48 hours) of operations, to ensure that fishermen using static gear can lift and redeploy it to avoid damage or loss. In-line with standard offshore practice, contractors will be required to remove all construction-related debris that could constitute obstacles to fishing. Accidentally dropped objects will be recorded and recovered. The cable will be buried as a safety measure to avoid damage and entanglement with respect to third parties (with, for example, trawling gear). The proposed burial depth for the majority of the route is 1.5m, with target depths of 3m in intertidal and nearshore areas, and 2m out to a distance of 8.5km from the coast; local changes to this depth will be based on seabed conditions and risk of third party interference (i.e. particular types of fishing, or fishing gear).	EirGrid / Contractor
Tourism and recreation	With respect to pedestrian access to the beach, temporary diversions will be placed around the onshore works during the short term of construction to allow continued access. Access to the beach for pedestrians will only be limited while plant is active on the road down to the beach (during deliveries).	Contractor/ EirGrid
Safety	All necessary measures will be in place at the landfall construction site to ensure public safety. The car park and beach trenches will be fenced off to exclude public access during construction work.	EirGrid / Contractor

Table 15.3: Operational impacts and mitigation measures

Activity/Impact	Mitigation	Responsibility
Project Description		
Survey and repair of cable.	Occasional cable burial surveys to ensure the cable remains at a safe depth are likely to entail the use of a survey vessel.	
Offshore development and infrastructure	EirGrid will continue to consult with relevant organisations to resolve any identified potential effects.	
Ecology		
Ecology Sediment disturbance	This design depth will minimise any potential negative impacts on re-colonisation of sediment over the cable by benthic infauna, given that the majority is found within the top 30cm of sediment, with little fauna found below this. The potential impacts from electromagnetic fields will be mitigated by the use of a HVDC cable system (as opposed to conventional AC systems), which generates minimal, magnetic fields, using sufficiently insulated cable and burying the cable to a target depth of at least 1.5m.	
Navigation		
Navigation	Once constructed, "as built" co-ordinates of the cable will be charted (e.g. on Admiralty Charts) and circulated to the maritime community, which will minimise the potential for accidental damage to the cable caused through e.g. anchoring or towed fishing gear. Should maintenance or repair of the cable be required during its lifetime, details of the activity to take place will be circulated to the appropriate authorities and maritime community.	
Socio-economic		
Fisheries	EirGrid will issue as-laid co-ordinates of the cable, and inform fishermen of any specific areas where complete burial was not possible to prevent any damage or loss to fishing equipment. The schedule of any maintenance, survey or repair activities will be well publicised to fishermen in advance, and the duration of these activities will be kept to a minimum to reduce the duration of any exclusions.	

Table 15.4: Decommissioning impacts and mitigation

Activity/Impact	Mitigation	Responsibility
Project Description		
Decommissioning cable	Decommissioning of the offshore cables will be subject to agreement between EirGrid plc, the Minister of Communications, Energy and Natural Resources, DEFRA (MFA) and other appropriate authorities, and be in line with relevant legislation and industry best practice at the time, but it is anticipated that all buried structures will be left *in situ*, as this is less environmentally damaging than removing them, whilst all above seabed structures will be removed. Decommissioning cannot therefore be finalised until immediately prior to decommissioning is due to take place.	
Navigation		
Marine navigation	See mitigation for construction marine navigation. It would be envisaged that the same measures would be applied as for construction. However, it is likely that such methods will have to be revised in order to ensure that activities at that time are accounted for appropriately.	

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