

NON-TECHNICAL SUMMARY

Introduction

Shell E&P Ireland Ltd (SEPIL) is developing the Corrib natural gas field off the coast of County Mayo. Discovered by Enterprise Energy Ireland Ltd in 1996, the gas field is the first significant natural gas source and processing development in Ireland for over 30 years.

The Corrib natural gas field development is divided into five distinct but inter-related and independent elements as follows:

1. Offshore seabed installation (subsea wellheads and manifold at the gas field);
2. Offshore gas pipeline (between well heads and landfall);
3. Onshore gas pipeline (between a landfall and gas terminal at Bellanaboy Bridge);
4. Bellanaboy Bridge gas terminal; and
5. Onshore Mayo to Galway pipeline.

All elements of the proposed development have received full regulatory approval. The majority of the offshore and onshore works have been now completed including construction of the gas terminal and associated peat removal since 2004, and laying of the offshore pipeline and associated landfall works at Glengad completed in 2009.

In addition, Bord Gáis Éireann, in recent years, has extended its transmission network from Galway to the terminal at Bellanaboy to facilitate the distribution of Corrib gas into the national grid (see Figure 1).

The gas terminal is near mechanical completion as of May 2009. Final works associated with the installation of the offshore pipeline will commence in spring 2010, with installation of the offshore umbilical scheduled for 2011. It is anticipated that works for the construction of the onshore pipeline, including associated peat disposal will begin in 2011 and will continue to 2013.



Figure 1: Gas Transmission Network in Ireland

In 2002, Shell acquired Enterprise Oil plc and Enterprise Energy Ireland, which was the operator of the Corrib field. The new company was named Shell E & P Ireland Limited and integrated into the Shell Group. Shell E&P Ireland Limited (SEPI) is part of Shell's European Exploration & Production organisation, which has extensive experience in operating gas plants and gas pipelines, subsea developments and offshore oil and gas fields in Europe since the 1960s.

Following public concerns raised about the pipeline between the landfall and the terminal, and following independent reports commissioned by the Minister for Communications, Marine and Natural Resources from both Advantica and Peter Cassells, SEPI agreed in 2006 to limit the pressure in the onshore section to less than 144 bar and to modify "the route of the pipeline in the vicinity of Rosspoint to address community concerns regarding proximity to housing".

The modification of the onshore route affected a number of regulatory consents already granted. This necessitated the preparation of new EIS documents, including a new EIS (by RPS) for the onshore section of the pipeline. A Supplementary Update Report (Rev 02, February 2009) as an addendum to the 2001 Corrib Field Development Offshore Field to Terminal Environmental Impact Statement (the '2001 Offshore EIS'), prepared by RSK Environment Limited, in respect of the offshore section of the pipeline was also produced.

Applications for consent for the onshore pipeline under the Strategic Infrastructure Act, the Gas Act and the Foreshore Act were submitted to An Bord Pleanála, the Department of Communications Energy and Natural Resources, and the Department of Agriculture Fisheries and Food (respectively) in February 2009.

Following statutory periods of public consultation, An Bord Pleanála in November 2009 requested further information on the proposed development including:

- Alterations to the proposed development such that the route between Gleann an Ghad (Glengad) and na hEachú (Aghoos) would be generally in accordance with that indicated as Route Corridor C in the route selection process detailed in the 2009 Onshore EIS (that is within Sruwaddacon Bay).
- A complete, transparent and adequate demonstration that the proposed pipeline does not pose an unacceptable risk to the public.

In order to provide the requested information, a revised EIS for the onshore section of the pipeline, including information required for an Appropriate Assessment (now known as a Natura Impact Statement) of the impact of the development on Natura 2000 sites has been prepared.

This document is the non-technical summary of the Supplementary Update Report (Rev 03, May 2010) for the 2001 Offshore EIS providing an update in respect of the offshore pipeline elements of 2001 Offshore EIS. The Supplementary Update Report provides updates, taking into account new baseline information that has become available since 2001 including additional environmental monitoring data that was collated during 2008 and 2009, as well as modifications to the project description, construction activities (taking into account works that have taken place) and construction schedule that have evolved since 2001.

Table 1: Existing Consents and Approvals for the Corrib Gas Field Development

Licence/Consent	Status
Petroleum Lease by the Minister of Communications, Marine and Natural Resources.	Granted 2001
Plan of Development for the Corrib Field by the Minister of Communications Marine and Natural Resources.	Approved 2002
Consent under Continental Shelf Act 1968 from the Minister of Communications, Marine and Natural Resources.	Granted 2002
Foreshore Licence for pipeline, umbilical and outfall from the Minister of the Marine and Natural Resources.	Granted 2002
Consent to Construct a Pipeline (S40 of the Gas Act) from the Minister of the Marine and Natural Resources.	Granted 2002
Planning Permission (An Bord Pleanála) - Bellanaboy Bridge terminal and associated peat deposition site.	Granted 2004
Waste licence from EPA for peat deposition at Srahmore (Bord na Mona)	Granted 2004
Integrated Pollution Prevention and Control licence from EPA for Bellanaboy Bridge Gas Terminal	Granted 2007
Green House Gas Emission Permit from Environmental Protection Agency, Bellanaboy Bridge Gas Terminal	Granted 2009

The Project

Since the submission of the 2001 Offshore EIS, the majority of the offshore works have been completed, with the remaining offshore elements yet to be undertaken comprising completion of rock placement works over the offshore pipeline, the installation of the offshore umbilical from the landfall site to the offshore gas field, the tie-in of the

offshore pipeline and umbilical to the subsea manifold at the Corrib field and associated commissioning works.

Construction

Final works associated with the installation of the offshore pipeline will commence in spring 2010 and will involve the deposition of additional rock on top of the area that has already been subject to rock placement, and possibly beyond. The rock placed over the installed pipeline in 2009 was a relatively fine grade material, and this will be covered by a heavier coarse grade in 2010, which will provide greater stability against sediment movement. Rock placement is likely to take around 3 months to complete.

Installation of the offshore umbilical is currently scheduled for 2011. An overall schedule is presented in Table 3-1. The umbilical will be placed in a pre-prepared trench, relatively close to the offshore pipeline route and may require further protection in the form of rock placement or matting to aid stability.

Alternatives

As a result of the modification of the onshore pipeline route, a review of new potential landfall locations was carried out in 2007. The new landfalls were:

- Inver Bay;
- Inver Point;
- Portacloy;
- Glinsk; and
- Garter Hill.

A number of factors were considered for each landfall (geohazards, shore approach, offshore routing, access, constructability, safety, environmental and schedule). Each of the other landfalls were found to be less favourable than Glengad for at least three of the factors considered. The study therefore concluded that the landfall at Glengad was the best option.

The location of outfall diffuser for the treated water discharge pipeline – as a result of the conditions attached to the approval of the Plan of Development for the Corrib field and the Foreshore Licence for the pipeline – was moved outside of Broadhaven Bay cSAC, from the position within the bay proposed in the 2001 Offshore EIS. This discharge pipe will now carry treated surface water run-off only. Treated produced water will be discharged via a multipurpose umbilical that runs from the terminal to the Corrib field.

Planning and Development

The consents for the project are listed in Table 1 above. The offshore elements of the project will be constructed under the existing consents. The revised RPS Onshore Pipeline EIS (2010) non-technical summary covers the planning and development context for all onshore elements of the pipeline, including the landfall valve installation.

Human Beings

Construction of the offshore seabed installation to date has involved a workforce of approximately 200 to 300 people over the construction period. However, this was mainly an international specialist workforce with limited local benefits. Construction of the landfall and the subsequent laying of the offshore pipeline in 2009 involved a workforce of approximately 300 to 400 with a positive impact on the local economy, with enhanced opportunities for local service providers.

The remaining offshore works which are limited to the installation of the umbilical and any remaining rock placement work are expected to continue to result in a positive impact on the local economy, with enhanced opportunities for local service providers.

Community liaison officers will be available to discuss aspects of the project during the construction and operational phases.

In terms of the whole development, the Goodbody Report provides an updated assessment of the economic benefits of the Corrib project, reconfirming that overall there will be economic benefits from project. The social investment programme funded by the Corrib partners will also provide indirect economic benefits to the area.

Flora and Fauna

A number of baseline surveys have been carried out since 2001 to provide more information on the area in which the project will be installed and operated. These include benthic invertebrate surveys of the Corrib field and pipeline route out to the Corrib field, in the vicinity of the outfall locations, within Broadhaven Bay and in the intertidal area around the landfall site. The results of these surveys have confirmed that the exposed nature of the bay influences the intertidal and near-shore communities, and that they are relatively species poor because of this. The coarse sand of the seabed is not stable in the long-term and, as such, the communities do not have time to develop before the seabed is moved around by tides and currents. In the area of the outfall for the treated surface water run-off, although deeper at approx 65 metres water depth, the seabed sediments are still relatively coarse in nature, although the communities are more diverse and stable. This situation progresses out towards the Corrib field where the communities in deeper water are more stable and diverse, as they are influenced less by the movement of the surface waters. The results of these surveys support the findings of the baseline surveys carried out for the 2001 EIS, and the predictions made on the basis of these.

The results of the latest fish surveys carried out by the Marine Institute in the area along the pipeline route were reviewed, and the major species caught were found to be the same as those that were reported in the 2001 Offshore EIS.

An updated literature review of the bird species present in the area of the offshore pipeline route was also carried out, revealing that very little further information is available on the area. The little tern colony that was observed using the sand bar to the north of the landfall site is no longer present.

SEPIL has commissioned several extensive marine mammal monitoring surveys in Broadhaven Bay since 2001, all of which have been carried out by the Coastal and Marine Resources Centre of University College Cork. These surveys were undertaken between August 2001 and October 2002, June to September 2005, and the current study, which commenced in June 2008 and is ongoing. Marine mammal observers have also been present during marine works in Broadhaven Bay in 2008 and 2009.

The results of the marine mammal surveys show that Broadhaven Bay and neighbouring waters are nationally important in terms of diversity and abundance of cetaceans, that there may be a resident population of bottlenose dolphins and that the area may be used as a breeding and rearing area by some dolphin species.

Other species of conservation interest noted in the above surveys included grey and common seals, basking sharks and sunfish.

Impacts from the installation of the pipeline in the offshore areas of the pipeline route have been assessed to be similar to those predicted in the 2001 Offshore EIS, these being temporary in nature and negligible in magnitude. While the importance of the area for cetaceans has been established since 2001, no blasting has been required in Broadhaven Bay, an operation that would potentially have been the greatest source of impact to marine mammals. Consequently, the predicted impacts of pipeline construction on marine mammals have been re-assessed and found to be minor.

The footprint of the rock berm placed in Broadhaven Bay in 2009 may increase as result of further rock placement activities in 2010 and 2011. The sandy sediments and rock outcrop seabed habitat within this footprint will be directly impacted in that it will be

smothered by rock. This will result in a slight increase in the permanent loss of the existing habitat.

Geology

During the benthic sampling surveys described above, the surface sediments were analysed for grain size. The results from these analyses were generally in agreement with the information presented in the 2001 Offshore EIS. It is acknowledged that the area of impact in terms of seabed geology will increase slightly as a result of rock placement works in Broadhaven Bay, however there is no change to the residual impacts as predicted in the 2001 Offshore EIS

Water

Three surveys have been carried out in the vicinity of the treated surface water run-off discharge location, one in 2005, the second in 2007 and the third in 2008. These surveys were undertaken in the summer months and recorded very little evidence of thermal stratification, and no salinity stratification. Water quality results indicate that the area is pristine. Whilst updated modelling of the dispersion of discharged water predicted that concentrations of metals and other elements in the discharged water would decrease rapidly from Environmental Quality Standard to background, and the Environmental Protection Agency (EPA) granted the IPPC licence for the terminal, based on these predictions, treated produced water will now be discharged via a multipurpose umbilical to the Corrib Field. Modelling indicates that the discharge is predicted to have a negligible biological impact.

As the construction period has extended over a number of seasons there will be more than one period where construction activities result in raised levels of suspended solids. However, given that the mobile sediments in Broadhaven Bay are naturally raised into suspension by the wave and current regime, raised suspended solids levels from construction operations will not create a cumulative impact above that created naturally.

Given the wide area and long period over which black and grey wastewater discharged from vessels have been, and will be made the magnitude of the impact is classified as negligible. Such discharges are quickly dispersed by wave and tide action, and discharges during future installation operations will not be "additive".

Air Quality

Emissions arising from future construction activities include those resulting from the transit of the umbilical laying vessel and other construction/support vessels to and from the area and pre-commissioning activities. It is acknowledged that the duration of impacts will be greater than initially anticipated, resulting in increased air emissions as compared with the 2001 predicted emissions. However, while they are higher overall, the duration and area over which they will be emitted means that the negligible impact to air quality predicted in the 2001 Offshore EIS is unchanged.

Noise

Underwater blasting was not undertaken as part of the proposed works and therefore no underwater noise impacts resulted. The remaining underwater excavation work required will involve trenching of the umbilical, which is not predicted to result in significant underwater noise impacts. The noise levels from dredging works were higher than those predicted in the 2001 Offshore EIS, however the distances from the vessels at which high noise levels were felt by the most common species was still small. Noise impacts of a similar, and slightly elevated, level are predicted from the rock-placement works, although this activity is anticipated to be of short duration and will have a negligible and temporary noise impact on the receiving environment.

In terms of mitigation against the noise generated by the marine construction vessels, a code of practice for dredging works was implemented in 2008 and 2009 (in

agreement with the NPWS), and will be implemented during all subsequent construction.

For the land-based operations at Glengad, working hours will normally be restricted to 07:00–19:00 Monday to Friday, 07:00–16:00 on Saturday and there will be no activity on Sundays. During the umbilical pull-in operation, it will be necessary to work on a 24-hour basis.

Certain commissioning activities for the offshore pipeline may require 24-hour working. However, current information in respect of the pre-commissioning of the offshore pipeline indicates that this activity would need to be restricted due to elevated noise levels arising from the nitrogen generating plant and associated compressors. If, however, further noise attenuation measures can be identified and proven to reduce noise levels to an acceptable target, it is proposed to carry out this work on a 24-hr basis. Should further noise attenuation not be available, this activity will be curtailed, and not carried out during the period 22:00 – 07:00.

Recognising that noise will be of concern, SEPIL will ensure that local residents are informed of the programme of work proposed, and the dates when 24-hour working may occur.

Landscape

Remaining offshore installation activities in the Corrib Field will be located beyond the horizon; therefore, there will be no landscape or visual impact associated with the remaining field activities.

Some construction-related visual impacts associated with the presence of construction vessels in Broadhaven Bay and landfall facilities at Glengad took place during 2008 and 2009, and will be expected over a further season. Whilst it is acknowledged that the landfall construction works have a greater duration than that originally envisaged, there is no change to the level of overall predicted impact associated with the near-shore and landfall works to the level predicted in 2001. The impact remains one of short term, but significant impacts to the 'Highly Scenic Views' across Broadhaven Bay.

Sustainable Development

Greenhouse gas emissions will be generated as a result of construction and operation of the project. However, the supply of gas to Ireland's gas network will support a strategic fuel switch from solid fuel and oil to natural gas and renewables, and so contribute to a reduction in national greenhouse gas emissions.

Cultural Heritage

Archaeologists were present during the construction work that took place around the landfall and in the near-shore area in 2002, 2005, 2008 and 2009. During the work, nothing of archaeological interest was recorded. Given that no finds or features of interest have been recorded from any survey work in the area to date, it is anticipated that there will be no impact upon archaeology. However, there is always the possibility that previously unknown archaeological remains could be encountered during construction. A monitoring licence will be obtained for any new marine trenches or onshore topsoil stripping in areas not stripped previously. Given the previous monitoring that has been carried out in the area, the Underwater Archaeology Unit of the DOEHLG have confirmed that no further archaeological monitoring will be required for the umbilical installation works.

Material Assets

The 2001 Offshore EIS predicted that there would be no impact on the local environment from the production of solid waste associated with installation and operation of the offshore works. New legislation concerning the management of waste will further serve to ensure that there are no impacts associated with the remaining works.

In terms of impacts to marine and onshore traffic, there is likely to be some disruption caused to the local road networks during the remaining construction works. For remaining offshore works, a fisheries liaison officer (FLO) will be responsible for communicating the construction schedule to the relevant fisheries and maritime organisations to enable their members to plan their activities accordingly, while for the remaining near-shore/landfall works a Traffic Management Plan will be in place to reduce the impacts to local traffic movements as far as possible. Following completion of the construction works, a survey of the roads used by construction traffic in the area will be carried out, and damage attributed to the project traffic will be repaired.

Cumulative Impacts

There are a number of elements to the overall Corrib development with the potential to create cumulative impacts if several of them were constructed at the same time or were located in the same area. The phasing of the overall project has, and will, restrict the possibility of cumulative impacts occurring to traffic, landscape, noise, tourism and air quality. The geographical separation of the different elements will reduce the potential for cumulative impacts to archaeology, ecology, geology, hydrology and hydrogeology. In terms of employment and the local economy, the sequential phasing of the project is expected to be more beneficial than a more restricted and intense construction period.

Environmental Management

From the outset, the project has been designed to limit its environmental impact as far as possible, indeed SEPIL's contractors (and their subcontractors) have been, and will be, expected to conduct their activities in such a way that any impact on the environment during construction is minimised. The remaining offshore related construction activities will be undertaken in accordance with the Project's existing Environmental Management Plan. The EMP will outline procedures to meet the environmental management requirements for the remaining works.

SEPIL staff on site will act primarily in an overseeing role, observing the contractors' performance against their own management plans, and by raising issues or intervening where appropriate.

Monitoring

A number of environmental monitoring surveys associated with construction activities undertaken to date have already been completed. These surveys include a pre-construction survey of subtidal and intertidal (landfall) sediments in Broadhaven Bay prior to pipeline installation, the monitoring of marine mammal activity during the construction and pipe-laying phases, post-construction monitoring of subtidal and intertidal (landfall) sediments in Broadhaven Bay, and post-drilling survey in Corrib Field to monitor impact of drilling operations. Monitoring will continue to take place in accordance with agreed monitoring commitments.

PREAMBLE

INTRODUCTION

Shell E&P Ireland Ltd. (SEPIL) on behalf of the Corrib Gas Partners (SEPIL, Statoil Exploration (Ireland) Ltd. and Vermilion Energy Ireland Limited) is developing the Corrib Gas Field off the coast of County Mayo. The development of the Corrib Gas Field represents the largest natural gas development in Ireland for over 30 years.

The Corrib Gas Field Development is divided into five distinct but inter-related and inter-dependent elements (see Figure 1) as follows:

1. Offshore seabed installation (subsea wellheads and manifold at the Gas Field);
2. Offshore gas pipeline (between wellheads and landfall);
3. Onshore gas pipeline (between landfall and gas terminal at Béal an Átha Buí (Bellanaboy));
4. Bellanaboy Bridge Gas Terminal; and
5. Onshore 150km Mayo to Galway pipeline.

All elements of the proposed development have received regulatory approval

Following local concerns raised in 2005 about the proximity of the approved pipeline to houses, and the subsequent reviews undertaken on behalf of the Minister for Communications, Energy and Natural Resources, SEPIL undertook to modify the route of the onshore pipeline in the vicinity of Ros Dumhach (Rosspart).

SEPIL applied for consents for a modified route for the onshore pipeline in February 2009 in applications to An Bord Pleanála, the Department of Communications, Energy and Natural Resources (DCENR) and to the Foreshore Unit of the Department of Agriculture, Fisheries and Food (DAFF) under the relevant statutory processes.

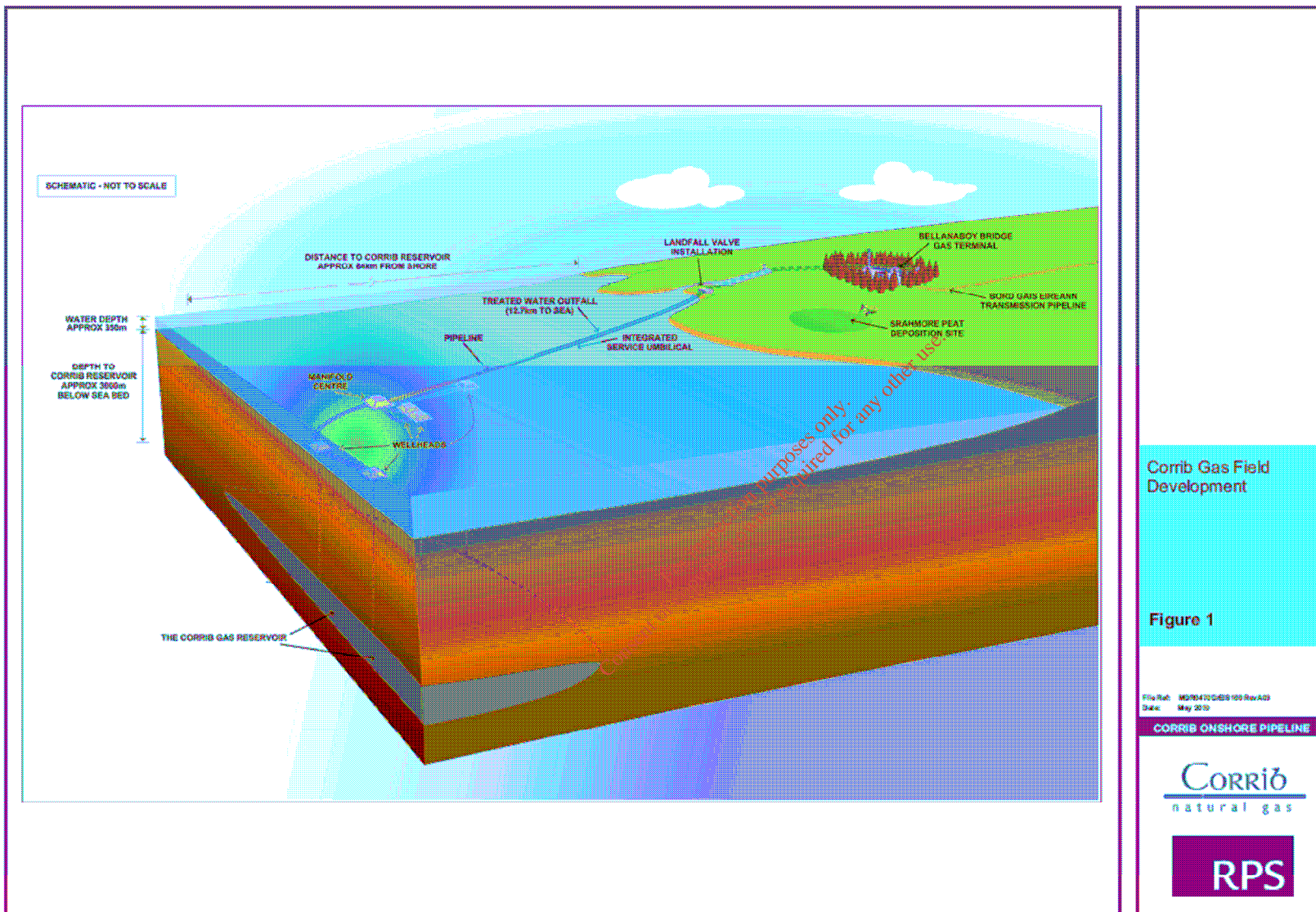
Following an Oral Hearing hosted by An Bord Pleanála in 2009, An Bord Pleanála in a letter dated 2nd November, 2009 requested that alterations be made to the proposed development as follows:-

“Modify the pipeline route between chainages 83+910 and 89+550 so that the route at this location would generally be in accordance with that indicated as Corridor C (that is, within Sruwaddacon Bay) in the route selection process which formed part of the Environmental Impact Statement (E.I.S.) and planning application”.

This revised Corrib Onshore Pipeline EIS describes the modified onshore pipeline route in accordance with An Bord Pleanála's request.

The modifications to the proposed onshore pipeline development requested by An Bord Pleanála has affected the applications made in February, 2009, and has necessitated the preparation of new/revised applications to the relevant statutory authorities, including a revised Environmental Impact Statement (EIS) for the onshore pipeline and other documentation as outlined below:

- This Preamble, which is common to the revised Corrib Onshore Pipeline EIS and the revised Supplementary Update Report to the 2001 Corrib Field Development Offshore Field to Terminal EIS (the 'Offshore EIS'), outlines the background to the Corrib project and presents a profile of the developer, SEPIL. In addition, it summarises the regulatory approvals required for the proposed pipeline development and outlines the consents and processes associated with these.



- The 2001 Offshore EIS (prepared by RSK Environment Ltd) described the pipeline system from the field to the Gas Terminal, with Section 19 covering the onshore pipeline. The new (revised) Corrib Onshore Pipeline EIS (prepared by RPS) for the development of the onshore pipeline between the landfall and the Gas Terminal replaces Section 19 of the 2001 Offshore EIS.
- As the consents processes under the Gas Act and the Foreshore Act apply to the pipeline in its entirety (both onshore and offshore), a revised (2010) supplementary update report in respect of the offshore section of the pipeline for the 2001 Offshore EIS has also been prepared (by RSK Environment Ltd).

BACKGROUND

The Corrib Gas Field is a small - to medium - sized offshore gas field, estimated to contain approximately 1 trillion cubic feet (tcf) of gas. It is equivalent to approximately two thirds the amount of gas originally contained in the Kinsale Head Gas Field. It is currently predicted that the Corrib Gas Field will supply up to 60% of Ireland's gas needs during peak supply and it is estimated to have a field life of between 15 and 20 years. The gas in the Corrib Gas Field is a pure form of natural gas, consisting of approximately 97% methane/ethane and small amounts of water and hydrocarbon condensate.

The Corrib Gas Field will be developed using subsea technology tied back to an onshore gas terminal. This means that once the wells are drilled, there will be no need for a permanent offshore platform structure, as the wells will be remotely controlled from land. This is best practice for a gas field of this type and size and is similar in design to some of the most modern gas field developments such as the Ormen Lange Field, Norway, the Snøhvit Field (Liquefied Natural Gas (LNG)), Norway, the Casino Field, south east Australia and the Scarab Saffron Gas Fields, East Mediterranean, Egypt.

THE DEVELOPER

SEPIL is a wholly-owned company within the global group of energy and petrochemical companies ("Shell Group"), operating in more than 140 countries and territories owned by Royal Dutch Shell plc. The Shell Group explores for, produces and trades in a range of energy resources.

The Shell Group is the largest international gas producer in Western Europe and one of the largest in the world. Currently, the Group operates in over 90 countries, employs approximately 100,000 staff, and operates more than 100 gas plants.

SEPIL is part of the Group's European organisation, which has extensive experience in operating gas plants and gas pipelines as well as subsea developments and offshore oil and gas fields in Europe since the 1960's (see Appendix D).

The Corrib Gas Field is being developed by three co-venture partners. These are SEPIL (the Operator) (45%), Statoil Exploration (Ireland) Limited (36.5%) and Vermilion Energy Ireland Limited (18.5%).

NEED FOR THE DEVELOPMENT

Since the application was submitted in 2001 to the then Department of the Marine & Natural Resources for approval of the Plan of Development for the Corrib Field, gas consumption in Ireland has continued to increase.

This rising demand for energy has outstripped Ireland's domestic production and infrastructure capacity. Consequently, Ireland has required additional imports of gas from abroad since the mid-

1990's (gas inter-connector pipelines with Scotland were constructed in 1993 and 2002) and currently more than 90% of the gas used in Ireland is imported. In 2009, approval was granted to Shannon LNG for the construction of a Liquefied Natural Gas (LNG) terminal at Foynes and a high pressure pipeline connecting to the gas network by An Bord Pleanála under the Strategic Infrastructure Act. This facility will receive LNG (transported by ocean-going tankers) and will be connected to the Irish natural gas network. In addition, a new 'East–West electrical inter-connector' to facilitate greater exchange of electricity between Ireland and the UK will begin construction in 2010 (in addition to the existing Moyle (North–South) Inter-connector with Northern Ireland and electrical connections between Scotland and Northern Ireland).

This, combined with Ireland's peripheral location in Europe and its small market scale, leaves the country vulnerable to supply disruption and imported price volatility.

In 1999 Bord Gáis Éireann (BGE) commissioned consultants (Sofregaz, MCOS (now RPS) and JP Kenny) to evaluate the required strategic investment in gas transmission infrastructure throughout Ireland until the year 2025. The resulting expansion of the Irish Natural Gas Transmission Network has included:

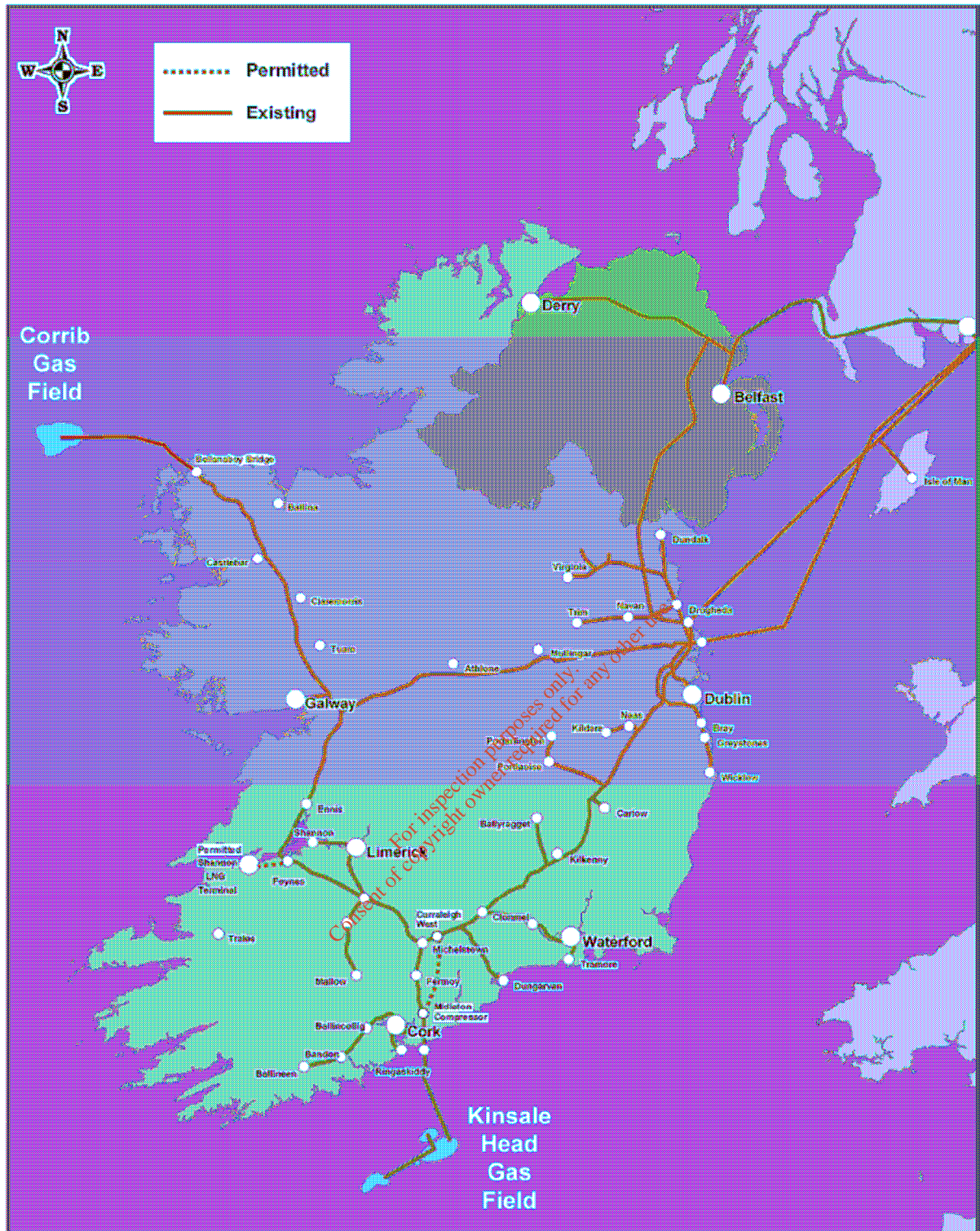
- Gas Pipeline to the West (Dublin – Galway – Limerick), constructed 2002;
- Second Gas Interconnector (Ireland – Scotland), constructed 2002;
- South – North Pipeline (Dublin – Belfast), constructed 2006; and
- Mayo – Galway Pipeline, constructed 2005 – 2006 specifically for Corrib gas.

BGE also constructed the Belfast-Derry pipeline in Northern Ireland in 2005. The full extent of the Irish Natural Gas Network, including each of these recent developments and the proposed Corrib Pipeline, is shown on Figure 2 overleaf.

Declining gas reserves in the Kinsale Head and Ballycotton gas fields, and the lower-than-expected contributions from the Seven Heads field, means that indigenous gas forms a decreasing proportion of the gas used in the Irish market, supplying approximately 5% of the demand from domestic sources. Furthermore, the UK, from where Ireland imports over 90% of its gas, has itself become a net importer of gas. The development of the Corrib Gas Field will facilitate greater indigenous security of gas supply that will be available throughout the entire network. It has already stimulated expansion of the onshore gas transmission system which in turn will result in increased possibilities for economic growth in the Mayo / Galway region.

Bord Gáis Éireann has been spending €40 million over three years on the Gaswest Project, under which the natural gas network from the Mayo-Galway Gas Pipeline is being expanded. Eleven towns in Co. Mayo and Co. Galway have been identified for this investment. The towns in Co. Mayo included in the Gaswest Project are Ballina, Ballinrobe, Ballyhaunis, Castlebar, Claremorris, Crossmolina, Knock and Westport. Progress for this expansion is already well under way, and Ballyhaunis and Knock are the only remaining towns in Mayo scheduled to receive gas (expected to be in 2010). Electricity generation and transport are the key sectors influencing energy demand in Ireland. In 2009 annual growth to 2020 was forecasted to be 1.7% (Energy Forecasts for Ireland 2020, *Sustainable Energy Ireland, 2009*).

Gas is also predicted to become a greater source of energy in Ireland due to its positive environmental profile compared with traditional energy sources such as peat and the Government's Kyoto Protocol commitments, which include targets for reduction of greenhouse gas emissions to no more than 13% above 1990 levels in 2008-2012. Ireland generates 55% of its electricity from natural gas. Natural gas thus facilitates reduced carbon emissions in Ireland while meeting increasing demands for energy at a time when renewable sources of energy are being developed but will only be capable of meeting a relatively small proportion of overall demand.



Gas Transmission Network in Ireland	CORRIB ONSHORE PIPELINE	
	File Ref: MDR04700/09/040 Rev A03	Date: May 2010
Figure 2		

EXISTING CONSENTS

The Corrib Gas Field Development has been subject to a long and complex regulatory approval process. The statutory approvals / licences / consents that are associated with the development and that have been granted are listed in Table 1 below.

Table 1: Existing Consents and Approvals for the Corrib Gas Field Development.

Licence/Consent	Status
Petroleum Lease by the Minister for the Marine and Natural Resources.	Granted 2001
Plan of Development for the Corrib Field by the Minister for the Marine and Natural Resources.	Approved 2002
Consent under Continental Shelf Act 1968 from the Minister for the Marine and Natural Resources.	Granted 2002
Foreshore Licence for pipeline, umbilical and outfall from the Minister for the Marine and Natural Resources.	Granted 2002
Consent to Construct a Pipeline (Section 40 of the Gas Act) from the Minister for the Marine and Natural Resources.	Granted 2002
Planning Permission – Bellanaboy Bridge Gas Terminal and associated peat deposition site from An Bord Pleanála.	Granted 2004
Waste licence from Environmental Protection Agency for peat deposition at An Srath Mór (Srahmore) (Bord na Móna).	Granted 2004
Integrated Pollution Prevention and Control Licence from the Environmental Protection Agency for Bellanaboy Bridge Gas Terminal.	Granted 2007
Green House Gas Emission Permit from Environmental Protection Agency, Bellanaboy Bridge Gas Terminal	Granted 2009

PROJECT HISTORY

The following provides an overview of the planning and development history of the Corrib Gas Field Development and rationale for the proposed modification of the route of the onshore section of the pipeline.

The Corrib Field was discovered in 1996 by Enterprise Energy Ireland Ltd, which was subsequently acquired by SEPIL in 2002. Application for planning permission for Bellanaboy Bridge Gas Terminal with associated Environmental Impact Statement (EIS) was lodged with Mayo County Council by Enterprise Energy Ireland Ltd in April 2001. Planning permission for the Terminal was received in August 2001 and subsequently appealed to An Bord Pleanála. Consent to Construct a Pipeline (under Section 40 of the Gas Act) from the Minister for the Marine and Natural Resources was granted in 2002. Enterprise Energy Ireland Ltd was acquired by Shell in May 2002.

In October 2004 An Bord Pleanála granted planning permission for the Gas Terminal and associated peat deposition site. Planning and construction of the Gas Terminal commenced in December 2004. Haulage of peat from Béal an Átha Buí (Bellanaboy) to An Srath Mór Srahmore (the peat deposition site) commenced under EPA Waste Licence in April 2005.

During preparation work for the onshore section of the pipeline in the summer of 2005 local concerns were raised about the proximity of the approved pipeline to houses between the landfall and the Gas Terminal. After opposition to these onshore works resulted in the imprisonment of five men for contempt of court, all onshore construction work associated with the Corrib Gas Field development was halted in July 2005.

The (then) Minister for Communications Marine and Natural Resources appointed international pipeline consultants, Advantica, to conduct an independent safety review of the onshore pipeline. They subsequently issued a report on their findings (Independent Safety Review of the Onshore Section of

the Proposed Corrib Gas Pipeline, 2006). Offshore installation work was ongoing at this time. The Corrib Gas Partners accepted the recommendations arising from this review, which included limiting the pressure in the onshore section of the pipeline to 144 barg - less than half the original design pressure of the pipeline. Advantica concluded that, provided it could be demonstrated that the pressure in the onshore pipeline would be limited effectively and the recommendations of the report were followed, there would be a substantial safety margin in the pipeline design, and that the pipeline design and proposed route (originally proposed route) should be accepted as meeting or exceeding international standards in terms of the acceptability of risk and international best practice for high pressure pipelines. SEPIL and their engineering consultants carried out engineering and safety studies to ensure that all the recommendations made by Advantica in their Safety Review had been addressed and implemented in the design for the 2009 proposed development. Advantica's main findings and recommendations are detailed in Appendix Q8.

In 2006, a Government-appointed mediator (Peter Cassells) met with local residents from the Ros Dumhach (Rosspart) area, including those who were opposed to the development, and with SEPIL in an attempt to resolve difficulties that arose there during 2005. Offshore subsea installation work at the Corrib Field was ongoing at this time and construction on the Gas Terminal recommenced in October 2006. In his report, Mr. Cassells recommended that the route of the onshore pipeline be modified in the vicinity of Ros Dumhach (Rosspart). SEPIL took this recommendation and appointed consultants (RPS) in 2007 to identify and develop this modified route in consultation with the local community and other relevant stakeholders. Work on this began in January 2007 which also necessitated the preparation of a new Environmental Impact Statement for this section of pipeline. The outcome of the route selection process, which took place during 2007 and 2008 culminated in the various applications for consent for a modified onshore pipeline being submitted in February 2009.

As of May 2010, the offshore production facilities have been installed, the 83km offshore section of the Corrib pipeline has been laid, and the Gas Terminal is more than 90% complete. To allow the connection of the Corrib gas development with the national gas distribution network the 150km Galway to Mayo pipeline was completed in 2006 and is now connected to the Terminal. The onshore section of the Corrib Pipeline is the last major element of the project.

Following the application to An Bord Pleanála in February 2009 for consent for the onshore pipeline under the Strategic Infrastructure Act, the An Bord Pleanála requested further information in November 2009. This request included an invitation to SEPIL to modify the route of the onshore pipeline so that it would be generally in accordance with that indicated as 'Corridor C' in the February 2009 application (that is, within Sruwaddacon Bay). The revised Corrib Onshore Pipeline EIS reflects the requested route change.

STATUTORY APPROVALS ASSOCIATED WITH ONSHORE PIPELINE ROUTE MODIFICATION

The Planning and Development (Strategic Infrastructure) Act 2006 - the 'Strategic Infrastructure Act', was enacted on 6th July, 2006 and became fully operational on 31st January, 2007. This inserted a number of significant provisions into the Planning and Development Act, 2000 (the 'PDA'). In essence, these provide a streamlined procedure for planning applications for prescribed classes of infrastructure development, and require that applications for such development be made directly to An Bord Pleanála. The onshore pipeline development is declared under the 2006 Act to comprise strategic infrastructure. As such, the pipeline, which had previously constituted exempted development under the Planning Acts, is subject to an application for Approval for this development to An Bord Pleanála under the Strategic Infrastructure Act as a result of the route modification. This does not alter the requirement to submit separate applications under the Gas Act and Foreshore Act.

The entire pipeline between the Corrib Gas Field and the Gas Terminal received Ministerial Consent under Section 40 of the Gas Act in April 2002. However, a new consent will be required under the Gas Act for the entire pipeline in order to implement the proposed modifications to the onshore pipeline route. This is because there is no mechanism under the Gas Act to amend an existing consent.

The Foreshore Licence dated 17th May, 2002 to construct/install, operate and maintain the pipeline in the foreshore (from the high water mark to 12 nautical miles offshore), under the Foreshore Act, is specific to the exact route of the pipeline in the foreshore; therefore modifications to the route alignment in the areas of Sruwaddacon Bay below High Water Mark require additional consent.

Key consents for the revised route are therefore being sought as follows:

- Approval of the onshore pipeline and associated development within the functional area of the Planning Authority, by An Bord Pleanála under the provisions of the Planning and Development (Strategic Infrastructure) Act 2006;
- Consent for the overall pipeline development from the Minister of the Department of Communications Energy and Natural Resources (DCENR) under Section 40 of the Gas Act 1976 to 2002 (as amended); and
- A Foreshore Licence in respect of the works in the foreshore from the Department of Environment, Heritage and Local Government (DEHLG) under the Foreshore Acts 1933-2009 (as amended).

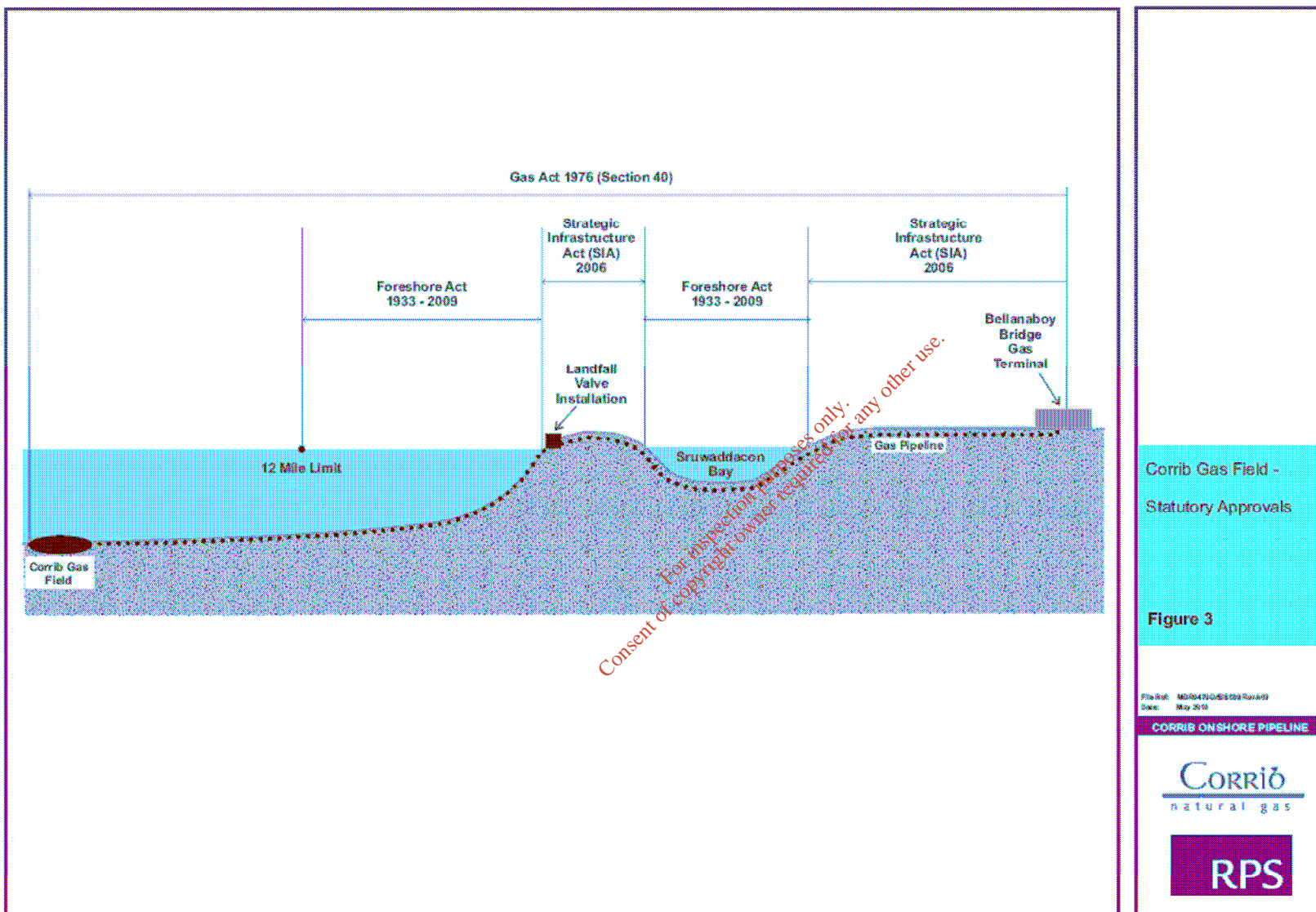
The inter-relationship of these three pieces of legislation is illustrated in Figure 3

The following revised EIS documentation has been prepared:

- A revised Supplementary Update Report (by RSK) to the 2001 Offshore EIS, reflecting the current status of the offshore development; and
- A revised Environmental Impact Statement (EIS) for the proposed Corrib Onshore Pipeline (by RPS), which has been revised to reflect request for further information from An Bord Pleanála.

OFFSHORE EIS

The details of the development of the offshore section of the pipeline have not been materially altered since the publication of the 2001 Offshore EIS, nor indeed from that which has the benefit of previous regulatory consent. The Corrib Offshore Pipeline between the gas field and the landfall at Gleann an Ghad (Glengad) was installed in 2009 in accordance with the existing consents under the Gas Act and the Foreshore Act. The Supplementary Update Report for the 2001 Offshore EIS has been updated to reflect the current status of the offshore development, as well as up-to-date baseline survey data that have been acquired and the findings of monitoring carried out since the February 2009 applications were submitted.



CORRIB ONSHORE PIPELINE EIS

The revised EIS for the modified onshore section of the pipeline has been prepared to meet the requirements of the European Communities (Environmental Impact Assessment) Regulations 1989-2001. The EIS includes:

- A summary of the route selection process and details on alternatives considered, including alternative construction methodologies;
- A detailed description of the proposed development;
- Pipeline design documentation presented in (revised) Appendix Q, in response to recommendations made by the DCENR, and to An Bord Pleanála's request (November 2009) for further information;
- An assessment of the environmental impacts associated with the revised route of the onshore section of the pipeline, including
 - An assessment of the potential environmental impacts associated with constructing a 4.9 km tunnel, most of which is underneath Sruwaddacon Bay;
 - An assessment of the potential impacts resulting from the deposition at the Srahmore Peat Deposition Site of up to 75,000m³ of peat arising from the construction of the onshore pipeline. This assessment is provided in Volume 3 of the Corrib Onshore Pipeline EIS.

THE PLANNING AND DEVELOPMENT (STRATEGIC INFRASTRUCTURE) ACT 2006

Section 4 of the Strategic Infrastructure Act (SIA) relates to Provision of Electricity Transmission and Gas Infrastructure. Specifically Section 4 of the SIA inserts a new Section 182C into the Planning and Development Act 2000 (the 'PDA'), which now requires an application for approval of all strategic gas infrastructure projects to be made to An Bord Pleanála. Therefore the provisions of the SIA as inserted into the PDA apply to the proposed development. A "Strategic Gas Infrastructure Development" is defined in Section 2 of the PDA as amended by Section 6 of the SIA as:

"any proposed development comprising or for the purposes of a strategic downstream gas pipeline or a strategic upstream gas pipeline, and associated terminals, buildings and installations, whether above or below ground, including any associated discharge pipe".

The Act further defines a strategic upstream gas pipeline as:

"so much of any gas pipeline proposed to be operated or constructed – (a) as part of a gas production project, or (b) for the purposes of conveying unprocessed natural gas from one or more than one such project to a processing plant or terminal or final coastal landing terminal, as will be situate in the functional area or areas of a planning authority or planning authorities".

These definitions clearly incorporate all development within the functional area of Mayo County Council associated with the proposed upstream pipeline development, including the LVI and other associated infrastructure.

The SIA and PDA, as amended, provide that where the "undertaker" intends to carry out a Strategic Gas Infrastructure Development, the undertaker shall prepare an application and an Environmental Impact Statement, and shall apply to An Bord Pleanála for approval of the development. The powers to grant compulsory acquisition orders for land under the Gas Act have been transferred under the SIA to An Bord Pleanála.

Application

An application for consent under the PDA, as amended by the SIA and elsewhere, for the Corrib Onshore Pipeline was made to An Bord Pleanála in February 2009. The application consisted of:

- A cover letter, copy of draft statutory notices and other relevant particulars;
- Application drawings; and
- Environmental Impact Statement for the Corrib Onshore Pipeline.

Following a request for further information in November 2009, the application drawings and the Corrib Onshore Pipeline EIS have been revised. The changes to the EIS include the modification of the route, as well as a change of construction methodology for the modified route section. The EIS also includes further information on the design documentation for the pipeline (contained in a revised Appendix Q).

Copies of the response to An Bord Pleanála's request, including the revised application drawings and revised EIS will be provided to the prescribed bodies.

The additional information is likely to become available for public inspection during a statutory period for public consultation to be prescribed by An Bord Pleanála (some time after it has received the additional information). During this period any person may make a submission to An Bord Pleanála in relation to the additional information. The prescribed bodies would also be invited to provide submissions to An Bord Pleanála within this period.

An Bord Pleanála may reopen the oral hearing in respect of the additional information submitted.

An Bord Pleanála can approve applications made to it in whole or in part; it can require modifications to the proposal (as is the case with this application to An Bord Pleanála); or it may refuse approval. It may also attach conditions relating to the construction or financing of the project.

In making its decision, An Bord Pleanála must have regard to proper planning and sustainable development, environmental effects, national policies, the national interest, and relevant local development plans.

With the implementation of the SIA and the amendments of the PDA, no conventional Planning Permission is required under the Planning and Development Act 2000, i.e. from Mayo County Council, for any part of this proposed development.

THE GAS ACTS 1976 TO 2000 (AS AMENDED)

The Gas Act sets out in detail the powers and duties of the gas undertaker. Section 40 of the Gas Act applies to the proposed overall gas pipeline development. Section 40A requires that where relevant, an Environmental Impact Statement be included as part of an application to the Minister under Section 40 of the Act. Applications for Section 40 Approval must therefore be accompanied by comprehensive appraisal of possible environmental and other impacts, which may be brought about by the construction of the upstream pipeline.

The Gas Act as amended requires that when selecting a route for a pipeline that the developer have regard to any comments raised by any local authority within whose functional area the proposed pipeline route, or part of the route is situated, or any of the following on, in or over whose land such a route or part of the route would be situated, namely; a harbour authority, the Electricity Supply Board (ESB) or any other electricity undertaker, and Córas Iompair Éireann (CIE) or any other railway undertaker.

Consequently, SEPIL and their consultants, RPS, have consulted with the relevant prescribed bodies as well as with the DCENR prior to submitting the revised application for the proposed development. This has included pre-application consultation meetings with the DCENR, Mayo County Council, National Parks and Wildlife Service (NPWS) of DEHLG and North Western Regional Fisheries Board (NWRFB). Particulars of the concerns raised, and how these have been addressed are included in Chapter 2 of the Onshore Pipeline EIS.

Application

An application for Consent to Construct a Pipeline under Section 40 of the Gas Act, 1976, as amended, was made to the Minister of the DCENR in February 2009. As a result of the invitation from An Bord Pleanála for SEPIL to modify the onshore pipeline route, the February 2009 application to DCENR will be withdrawn and a revised (new) application will be resubmitted in parallel with the response to An Bord Pleanála. It will comprise:

- Application (Scope, Drawings and Design Premise)
- Offshore EIS comprising:
 - Corrib Field Development Offshore (Field to Terminal) Environmental Impact Statement, 2001 re-printed 2008.
 - Supplementary Update Report (Rev 03), 2010
- Corrib Onshore Pipeline EIS (Revised).

There is no statutory mechanism for making amendments to a Section 40 application. Therefore, in light of modifications requested by An Bord Pleanála under the Strategic Infrastructure Act, it is necessary for an entirely new Section 40 application to be made for the modified pipeline route now proposed.

THE FORESHORE ACTS 1933-2009 (AS AMENDED)

The Foreshore Acts 1933 to 2009 (as amended) provides for the protection and preservation of the Foreshore and the seashore.

The foreshore extends to the twelve-mile limit. Section 3(1) of the Act, as amended by the Foreshore (Amendment) Act 1992, and the Foreshore and Dumping At Sea Amendment Act 2009 provides that any works or placing structures or material on, or for the occupation of, or removal of material from the

foreshore requires a lease or licence to be obtained from the Minister for Environment, Heritage and Local Government.

This type of development requires the preparation of an Environmental Impact Statement, which must be provided to the prescribed bodies specified in the Foreshore (Environmental Impact Assessment) Regulations, 1990 (S.I. No. 220).

SEPIL and their consultants, RPS, have consulted with the Foreshore Unit of the DEHLG and with relevant prescribed bodies prior to finalising the revised application for the proposed development.

Application

An application for a Foreshore Licence associated with the modifications to the Corrib Onshore Pipeline was submitted to the Coastal Zone Management Division of the DAFF in February 2009. As a result of the invitation from An Bord Pleanála for SEPIL to modify the onshore pipeline route, the February 2009 Foreshore Licence application will be withdrawn and a revised (new) application will be submitted to the Foreshore Unit of the DEHLG¹ in parallel with the response to An Bord Pleanála and the revised Gas Act application referenced above. It will comprise:

- Application Form;
- Offshore EIS comprising:
 - Corrib Field Development Offshore (Field to Terminal) Environmental Impact Statement, 2001 (re-printed 2008).
 - Supplementary Update Report (Rev 03), 2010.
- Corrib Onshore Pipeline EIS (revised).

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¹ Under the *Foreshore and Dumping at Sea (Amendment) Act 2009*, responsibility for all foreshore energy-related developments (including oil, gas, wind, wave and tidal energy) was transferred to the Minister for the Environment, Heritage and Local Government with effect from 15th January, 2010

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1 INTRODUCTION

1.1 Purpose of this Report

In 2001, the Corrib Field Development (Offshore Field to Terminal) Environmental Impact Statement (EIS) ("the 2001 Offshore EIS") was prepared for the offshore and onshore elements of the pipeline between the Corrib gas field and the terminal. The EIS accompanied an application for the entire upstream pipeline submitted to the Department of Communications, Energy and Natural Resources (DCENR) (at that time the Department of Marine and Natural Resources). The upstream pipeline received ministerial consent under Section 40 of the Gas Act 1976 (as amended) in April 2002.

New approvals are now required following re-evaluation of the routing of the onshore section of the upstream pipeline as addressed in the Onshore Pipeline EIS (RPS, 2010) and as such this document aims to update the information provided in the 2001 Offshore EIS.

This Supplementary Update Report (Rev 03) provides these updates, taking into account new baseline information that has become available since 2001 including additional environmental monitoring data that was collated during 2008 and 2009 as well as modifications to the project description, construction activities (taking into account works that have taken place) and construction schedule that have evolved since 2001.

It is noted that the offshore facilities associated within the Corrib field are not changing and will be constructed in accordance with the existing consents granted.

1.2 Report Structure

This Supplementary Update Report generally follows the same section structure as adopted in the 2001 Offshore EIS. However, it focuses specifically on the offshore components of the development including the rock placement works associated with the offshore pipeline and the installation of the umbilical. The section of pipeline between the landfall (including a new landfall valve installation (LVI)) and the terminal are described in the RPS Onshore Pipeline EIS 2010. Information that was presented in the 2001 Offshore EIS and that remains unchanged has not been repeated in this Supplementary Update Report.

It is acknowledged that the 2001 Offshore EIS was written prior to the release of the EPA "Guidelines on the information to be contained in Environmental Impact Statements" published in March 2002.

1.3 Summary of Updates

1.3.1 Remaining Project Elements

The primary remaining elements of offshore pipeline construction that are yet to be completed are limited to completion of rock placement works over the offshore pipeline (and potentially the umbilical) the installation of the umbilical from the landfall to the offshore gas field, the tie-in of the offshore pipeline and umbilical to the subsea manifold at the Corrib field and associated commissioning works. The construction methods for these remaining project components are discussed in detail in Sections 2 and 3.

Table 1-1 provides a summary of the updates that are presented in this report.

Table 1-1: Summary of Updates

Updated Information Presented	Section
<p>Project Description</p> <ul style="list-style-type: none"> • Description of construction activities undertaken to date. • Minor design changes, including: <ul style="list-style-type: none"> ○ The section of the offshore pipeline between KP 80 and KP 81.5 will have a berm of rock armour protection deposited to prevent scour, avoid potential free-spanning caused by the presence of a bedrock outcrop along the route and aid stability of the pipeline bundle ○ Wall thickness of the gas pipeline will vary from 21 to 27mm (compared with 25mm as stated in the 2001 Offshore EIS) ○ From the LVI to the terminal, the design pressure has been limited to 144 bar ○ Control umbilical will be approximately 5 inches in diameter (compared with 6 inches as stated in the 2001 Offshore EIS) ○ Discharge point of the water discharge pipeline is located approximately 12.7km from the pipeline landfall (compared with 7km as stated in the 2001 Offshore EIS) and will be used for discharge of treated surface water run-off only ○ Treated produced water will be discharged via the umbilical, with the discharge point located within the Corrib Field 	2
<p>Construction Activities</p> <ul style="list-style-type: none"> • Construction schedule – updated indicative schedule provided • Installation methods – additional details of typical methods provided on: <ul style="list-style-type: none"> ○ Rock replacement ○ Umbilical installation ○ Completion of the pipeline tie –in to the Corrib Field Manifold ○ Offshore pipeline commissioning activities • Additional mitigation measures if required 	3
<p>Alternatives</p> <ul style="list-style-type: none"> • In 2006, a review of the options for landfalls was commenced by SEPIL – details of that review are summarised 	4
<p>Planning</p> <ul style="list-style-type: none"> • Reference made to RPS Onshore Pipeline EIS 2010 for updates to relevant planning policy and impacts of the overall development on planning policy • Reassessment of impacts on land use 	5
<p>Human Beings</p> <ul style="list-style-type: none"> • Reference made to RPS Onshore Pipeline EIS 2010 for updates on current status of human receiving environment • Reassessment of impacts on human beings due to increased duration of construction works • Reference to social investment programme included in mitigation 	6

Updated Information Presented	Section
<p>Flora & Fauna</p> <ul style="list-style-type: none"> • Description of new survey data including: <ul style="list-style-type: none"> ○ Benthic communities: grab sampling and photography in Broadhaven Bay in 2002 and 2008, intertidal sampling at the landfall in 2005 and 2008, benthic sampling and seabed photographic survey performed in 2007 along the offshore pipeline route (nearshore sections in 2002 and 2008), and benthic sampling and seabed photographic survey performed in 2007 and during 2008 at the offshore well locations ○ Note: Whilst post construction monitoring commenced in 2009 these results are not yet available but will be reported in due course ○ Fisheries and aquaculture: survey data from the Central and North Western Regional Fisheries Board, and Marine Institute, Galway; fish landings data from the Sea Fisheries Protection Authority; aquaculture site information from Aquaculture licensing team, Department of Agriculture, Fisheries and Food (DAFF) ○ Seabirds: a desktop literature review to update information regarding seabird diversity and abundance along the proposed pipeline route including 2008 bird survey results ○ Cetaceans: monitoring data from Broadhaven Bay surveys carried out by the Coastal and Marine Resources Centre (CMRC) in 2001–2002, summer 2005, continuous monitoring since 2008, including the periods of construction during 2008 and 2009; sightings and strandings data from the Irish Whale and Dolphin Group; marine mammal observer data from 2007, 2008, and 2009 and data from offshore surveys reported in the literature • Reassessment of impacts on flora and fauna: <ul style="list-style-type: none"> ○ Impacts from blasting no longer relevant ○ Impacts to fish in Broadhaven Bay reduced from minor to negligible because of the change in trench construction methods ○ Impacts to Little Terns reduced from minor to negligible as these birds no longer breed in the area due to loss of habitat due to natural wave erosion ○ Impacts of increased construction duration on Sand Martins and Brent Geese ○ Impacts resulting from increased size of project footprint due to the rock-placed berm in Broadhaven Bay ○ Overall impact assessment on marine and terrestrial flora and fauna due to increased duration of construction programme • Requirements for ongoing mitigation and monitoring measures updated 	7
<p>Geology & Sediments</p> <ul style="list-style-type: none"> • Description of new survey data including: <ul style="list-style-type: none"> ○ Grab sampling of soft surface sediment (for grain size and chemical analysis), and photography along the proposed offshore pipeline route in 2002, 2007 and 2008 ○ Core sampling along the route of the pipeline through the intertidal and on an adjacent transect in 2005 and 2008 • Reassessment of impacts on geology – taking into account rock placement works as well as the fact that blasting has not been required 	8
<p>Water</p> <ul style="list-style-type: none"> • Description of new survey data including: 	9

Updated Information Presented	Section
<ul style="list-style-type: none"> ○ Vertical profiles of temperature and salinity in the vicinity of the surface water run-off discharge pipe diffuser in 2005, 2007 and 2008 ○ Analysis of various organic and inorganic substances in water samples collected in the vicinity of the surface water run-off discharge pipe diffuser in 2007 and 2008 ○ Analysis of various organic and inorganic substances in water samples collected in the vicinity of the produced water discharge pipe diffuser in 2008 ○ Review of impacts associated with new discharge location at the offshore manifold location ● Reassessment of impacts on water quality due to increased disturbance and duration of works ● Monitoring – reference made to the IPPC licence for terminal operations 	
<p>Air Quality</p> <ul style="list-style-type: none"> ● Reassessment of impacts of emissions to the atmosphere due to increased duration of construction 	10
<p>Noise</p> <ul style="list-style-type: none"> ● Requirements for ongoing mitigation and monitoring ● Reassessment of noise impacts reflecting the increased duration of construction works, the fact that no blasting was required, and the additional placement of rock protection on the pipeline in the near shore waters of Broadhaven Bay ● Noise impacts associated with pre-commissioning activities of the offshore pipeline 	11
<p>Landscape & Visual</p> <ul style="list-style-type: none"> ● Reassessment of landscape and visual impacts reflecting increased duration of construction 	12
<p>Climate Change and Sustainable Development</p> <ul style="list-style-type: none"> ● Reassessment of impacts on climate change due to the increased duration of construction ● The addition of a section on sustainable development 	13
<p>Cultural Heritage</p> <ul style="list-style-type: none"> ● Legislation updated ● Results of archaeological monitoring undertaken during 2002, 2005, 2008, and 2009 presented (nothing of any archaeological significance found) ● Requirements for ongoing monitoring and mitigation 	14
<p>Material Assets</p> <ul style="list-style-type: none"> ● Waste legislation updated ● Reassessment of impacts on the local environment from solid wastes ● Description of fishing activity in offshore and near shore areas updated ● Description of local road network updated based on the Traffic Management Plan for landfall activities produced by TOBIN Consulting Engineers ● Additional mitigation details presented ● Reassessment of traffic impacts 	15

Updated Information Presented	Section
Environmental Effects <ul style="list-style-type: none">• Summary of the potential environmental effects, proposed mitigation measures or residual impacts that differ from 2001	16
Cumulative <ul style="list-style-type: none">• Updated assessment of the cumulative impacts that may arise during construction and operation of the development as a whole	17
Environmental Management <ul style="list-style-type: none">• Updated environmental management arrangements	18

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2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Site Context

The Corrib development consists of a series of gas wells and seabed infrastructure in the Corrib field, a manifold that gathers the flow of gas from each of the wells, and a pipeline leading from the manifold to the onshore terminal located at Bellanaboy Bridge. There will also be a multipurpose umbilical that runs from the terminal to the Corrib field. The multipurpose umbilical contains the following services:

- 5 electrical power cables and signal cables;
- 5 hydraulic fluid lines;
- 5 chemical lines; and
- 2 treated produced water cores.

An outfall pipeline for the discharge of treated surface water run-off from the terminal site runs along the route of the pipeline between the terminal and a point offshore approximately 12.7km from the landfall. The treated surface water run-off discharge pipeline will terminate vertically on the seabed in around 65m water depth.

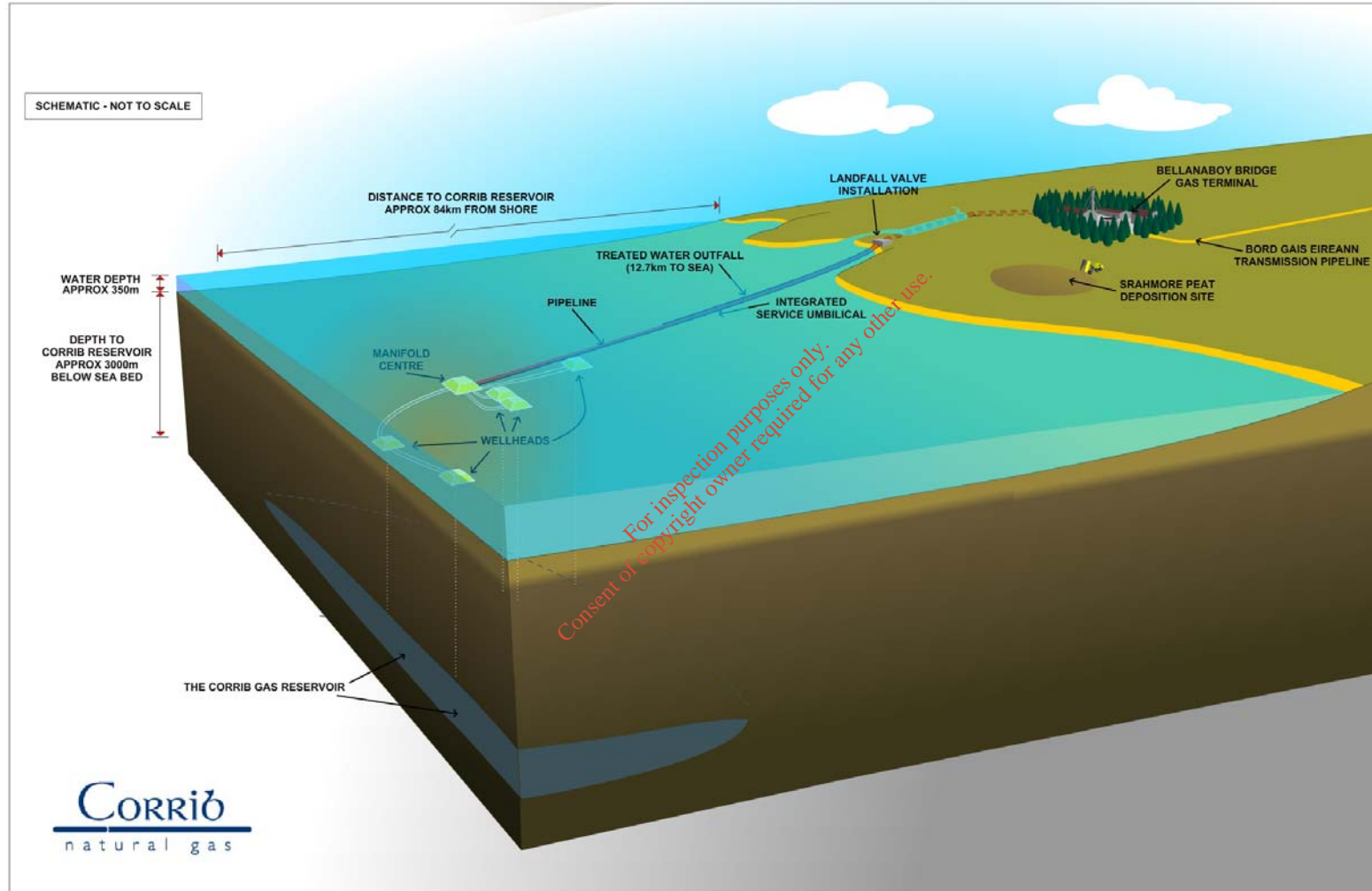
A schematic of the Corrib Development is shown in Figure 2-1.

This Supplementary Update Report focuses on the offshore components of the development, the section of pipeline between the landfall (including a new landfall valve installation (LVI)) and the terminal itself are discussed in the RPS Onshore Pipeline EIS 2010.

The description of the proposed development remains very much as described originally in the 2001 Offshore EIS. However, there have been some construction activities on the project, which are described in the following paragraphs.

Aspects of the development that are yet to be installed, and have undergone minor design changes, are detailed in Section 2.2.

Figure 2-1: Schematic of the Corrib development



2.1.1 Corrib Field

At the time of submission of the 2001 Offshore EIS, five exploration and appraisal wells had been drilled in the field (P1 to P5). These had been suspended (i.e. made safe but enabling later conversion to production wells).

In 2006, wells P3 and P4 were completed using the Sedco 711 drilling rig. Christmas trees (arrays of valves at the top of a well that control the production rate from the well) were installed at both of these wells. Wellhead protection structures were installed over each of the five wellheads (P1 to P5).

In 2007, the Sedco 711 returned to the field to drill a new well P6 (which is located close to the manifold), and it also drilled well P101 as a replacement for P1 (again close to the manifold). Christmas trees were installed at both wells and also at well P5 to the south-west of the main cluster of wells. Wellhead protection structures were installed over the two new wells (P101 & P6). In addition, the foundation and protection cover for the manifold and the concrete foundation for the Pipeline End Manifold (PLEM) were installed.

In 2008, wells P5, P6 and P101 were completed, and the manifold module was installed inside its protection structure.

The final completion of well P2 including the installation of a Christmas tree will, if required, be carried out at a later stage in accordance with a detailed schedule to be agreed with the DCENR.

2.1.2 Pipeline Route

The offshore pipeline was installed in 2009, this included burial wherever necessary. There remains one short section within Broadhaven Bay where additional works on the pipeline are required to provide full stabilisation. In 2009 some finer grade rocks were deposited on the pipeline between KP80 and KP81.5, and it is intended that coarser grade rocks are placed over these in 2010 to complete the stabilisation. Poor weather at the end of the 2009 construction season precluded the completion of this operation at that time.

2.2 Proposed Development

This section describes any changes to the specification of project components since the submission of the Offshore EIS in 2001.

2.2.1 Pipeline

The wall thickness of the offshore gas pipeline varies from 21 to 27mm (compared with 25mm as stated in the 2001 Offshore EIS).

The gas pipeline was constructed of high-strength carbon steel specified in accordance with the requirements of Det Norske Veritas (DNV) code OS-F101 and is at least equivalent to the American Petroleum Industry's standard API 5L grade X70.

The wall thickness and material grade of the steel pipe gives the pipeline its strength to resist the internal pressure of the gas.

Sections of the pipeline have been provided with a concrete coating where required to assist with protection and to increase the overall weight. Pipeline stability has been designed in accordance with DNV code RP E305.

Due to the presence of an area of bedrock outcrop in Broadhaven Bay a section of the offshore pipeline was identified as requiring additional protection to prevent scour and potential free-spanning of the pipeline. In September and October 2009 a filter layer of

rock was placed over the pipeline between KP 80 and KP81.5, including a section west of the outcrop that was left untrenched as a result of the boulder-rich sub soil.

In 2010 it is envisaged that remedial work to the existing rock berm may be required (to be ascertained following a survey) followed by the placement of an over coat of rock armour of heavier grade to ensure long term stability of the rock berm. The berm will be approximately 13-17m in width and rising to a height of around 1.5-2m above the surrounding seabed when completed. Additional protection may be required in the event that the planned survey of the trenched section identifies areas of insufficient backfill or insufficient cover.

Similar rock placement or alternative methods of stabilisation e.g. matting may be required in specific locations following the installation and burial of the umbilical in 2011 (see below).

2.2.2 Umbilical

The control umbilical will be approximately 5 inches in diameter. Two cores within the umbilical previously identified as spare will be used to carry treated produced water to the Corrib field manifold where it will be discharged in approximately 350m water depth. The two cores will be 19mm in diameter and 25.4mm in diameter respectively. Discharge from the cores will take place approximately 2m above the seabed, within the manifold, where seven access apertures/windows will effectively provide a multi-port outfall.

2.2.3 Discharge Pipeline

The discharge pipe (outfall pipe) described in the 2001 Offshore EIS as being laid from the terminal to a discharge point in Broadhaven Bay was installed at the same time as the gas pipeline. It was "piggy-backed" onto the larger gas pipe, and now terminates approximately 2.5km north of Erris Head, in water depths of around 65m in the open Atlantic Ocean, outside Broadhaven Bay cSAC. The discharge point is located approximately 12.7km from the pipeline landfall (compared with 7km as stated in the 2001 Offshore EIS). The assembly terminates approximately 0.5m above the sea bed and is protected by a steel cover. This assembly has been partially trenched to minimise trawl interference. This discharge pipe will carry treated surface water run-off only. The outfall pipeline is 10 inches in diameter and constructed of high density polyethylene.

2.2.4 Landfall Facilities

As detailed in the 2001 Offshore EIS, there will be a requirement for valves in the pipeline from the landfall to the terminal, and a termination unit for the umbilical. These will be contained within an underground enclosure at the landfall known as the landfall valve installation (LVI). The LVI is discussed in further detail in the RPS Onshore Pipeline EIS 2010.

3 CONSTRUCTION

3.1 Construction Methods and Sequence

The Construction Strategy for the offshore field and pipeline is described in the 2001 Offshore EIS. Some construction activities have taken place since 2001, including the installation of the export pipeline from the Corrib Field to the landfall at Glengad, however there are still a number of outstanding activities to be completed. Installation of the pipeline commenced in 2008 using methods described in the 2001 Offshore EIS. Further details of installation methods for a number of components yet to be installed are now available and are described below, along with an updated schedule.

3.2 Construction Sequence

Activities carried out since 2001 on the offshore pipeline route, including the landfall, include the following:

- 2002:

Glengad Headland landfall site: Most of the topsoil stripping (approximately 80%) undertaken, to a distance of 50m landward of the cliff. A section of the cliff was cut to access the beach and intertidal zone. Following suspension of construction work, the landfall site and the cliff were reinstated.

Nearshore and intertidal trench Broadhaven Bay: Intertidal causeway was constructed. Part of the trench was excavated and subsequently reinstated using the extracted rock and sand. Causeway was removed.

- 2005:

Glengad Headland: Temporary construction site established. Following suspension of works the area was reinstated.

Nearshore Trench: The outer reinstated section of the near-shore trench was excavated and later backfilled.

- 2006 – 2008:

Corrib Field: Wells completed and Christmas trees installed, new wells drilled, well protection structures and infield flowlines installed, pipeline manifold protection structure installed.

- 2008:

Glengad Headland landfall site: Topsoil stripped. Temporary construction site established. Cliff cut and site prepared for pipe pull. Following suspension of construction work in October due to worsening weather conditions, the landfall site and the cliff were partly reinstated (topsoil remained in storage area to protect seed bank in preparation for 2009 activities).

Nearshore and intertidal trench Broadhaven Bay – intertidal causeway was constructed. The intertidal and nearshore trench was excavated and subsequently reinstated. Causeway was removed.

P5 and P101 wells completed, work carried out on P6, in the in-field area the Manifold module was installed.

- 2009:

Glengad Headland landfall site: Temporary construction site re-established. Cliff cut and the pipeline bundle pulled in from a pipelay vessel through the cliff to the proposed landfall valve installation site. Cliff fully reinstated. A hydrostatic strength test was conducted on the gas pipeline and the water outfall pipeline.

Nearshore and intertidal trench Broadhaven Bay: Intertidal and nearshore causeway was constructed, trench was excavated with sediment being temporarily deposited elsewhere in the Bay. Pipeline was pulled from a pipelay vessel, through the trench and on to the landfall site. The causeway was removed, and the trench backfilled with the stored material. The section up to approximately 13 kilometres from shore was trenched post-lay. On a part of this section where trenching was not possible, graded rock was placed on top of the pipeline to aid stability.

During the installation of the offshore pipeline, the treated surface water discharge pipeline was also laid (it was attached to the gas pipeline) as far as the discharge location to the North of Erris Head. In addition, a conduit was 'piggy-backed' on the pipeline from the landfall out to around 2.2km from shore. The umbilical will be pulled through this conduit to the landfall site during the installation operation for the umbilical.

Final works associated with the installation of the offshore pipeline will commence in spring 2010 and will involve the deposition of more rock on top of the area that has already been subject to rock placement, and possibly beyond. The rock placed over the installed pipeline in 2009 was a relatively fine grade material, and this will be covered by a heavier coarse grade in 2010, which will provide greater stability against sediment movement. Rock placement is likely to take place during a 3 month period in the summer.

Installation of the offshore umbilical is currently scheduled for 2011. An overall schedule is presented in Table 3-1. The umbilical will be placed in a pre-prepared trench, relatively close to the offshore pipeline route and may require further stabilisation, should trenching not be possible in certain locations.

The schedule could be subject to change as it depends on a number of contracts being agreed, and suitable plant and equipment being available during the summer season of 2010 and 2011.

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Table 3-1: Indicative Construction Schedule

Activity	Q1	Q2	Q3	Q4	No. Weeks
2010					
Near-shore Pipeline Survey					2
Offshore Pipeline Protection-Rock Placement					12
Pipeline tie-in to Manifold					2
Rock Placement at Manifold					5
2011					
Umbilical Installation and protection					5
Umbilical tie-in to Manifold					6
2012					
Offshore Pipeline Pre-commissioning					2

Note: Indicative periods where activities may occur have been provided above. Indicative durations are indicated in the right hand column.

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3.3 Typical Installation Methods

The installation methods for all project activities have been undertaken in accordance with the methods described in the 2001 Offshore EIS. However, further details on the proposed installation methods of the project elements yet to be installed are now available and are described below.

Additional information is also provided on the tie-in of the offshore pipeline with the Corrib Field Manifold.

3.3.1 Rock Placement

The pipeline will be protected by 'rock placement' where required comprising 2 distinct layers:

- A base/filter layer of rock;
- Rock armour

The base layer or filter layer rock comprises washed and graded material ranging between 25 mm and 200 mm (grade will depend on location). Installation of this layer commenced during Autumn 2009 and it is possible that some remedial rock may be required during the 2010 to take into consideration any movement / washout of rock as a result of the winter conditions in Broadhaven Bay. Any remedial works will be determined by a survey, which is scheduled to take place during Spring 2010.

Placement of the base layer will be undertaken by a fall-pipe vessel that can operate in water depths covering the full length of the offshore pipeline and umbilical route.

The rock armour will comprise washed and graded material of approximately 350mm, sourced from a suitable quarry. As installation of the base layer took place at the end of the offshore construction season it was not possible to install the armoured over layer of rock in 2009.

Placement of the rock armour will be undertaken using one or more side stone casting vessel(s) supported by a bulk carrier, which will tranship rock to the side stone casting vessel(s). This work is scheduled to take place during the 2010 construction season and may further be required in 2011 after installation of the umbilical.

All rock will be of granite /gneiss type, and will be inert in the marine environment.

3.3.2 Umbilical Installation

An umbilical lay vessel will carry (on a reel) the complete length of pre-manufactured control umbilical to lay from the landfall to the manifold in the Corrib field. A smaller survey vessel will also accompany the vessel.

At the landfall end, with the support of a diving vessel, the end of the wire cable currently inside the umbilical conduit will be attached to a new wire and an internal check will be conducted of the umbilical conduit. Subsequently the new wire will be attached to the end of the umbilical on the umbilical lay vessel. A winch will be set up on the landfall site, and will be used to pull the umbilical through the conduit to its termination. Once that operation has been completed, the umbilical lay vessel will move offshore, trenching and laying the umbilical as she moves. The umbilical will be laid parallel to the pipeline, at a distance of around 20-30m from the pipeline. It is expected that the operation, from arrival in Broadhaven Bay to laying the final part of the umbilical in the Corrib field, will take around 15 days –20 days. The survey vessel will then complete a final route survey to record burial of the umbilical.

During the period between the laying of the umbilical on the seabed and the completion of the trenching operations, guard vessels may be used along the route of the umbilical to ensure that the umbilical is not disturbed by any fishing activities.

As per the schedule presented in Table 3-1, it is envisaged that umbilical installation will take place during the 2011 offshore construction season.

3.3.3 Completion of Pipeline tie-in to Corrib Field Manifold

A subsea construction vessel equipped with remotely operated vehicles (ROVs) will complete the tie-in of both the pipeline and the umbilical into the Corrib manifold. The tie-in of the pipeline is planned to take place in summer 2010, the umbilical tie-in after installation of the umbilical in 2011. ROVs will be used to connect a spoolpiece to the end of the pipeline, which then connects into the manifold. The inclusion of the spoolpiece will allow for any thermal expansion in the offshore end of the pipeline during operation. ROVs will then connect the umbilical directly into the manifold control system. Protection will be applied following the respective completion of the umbilical and pipeline tie-in.

3.3.4 Offshore Pipeline (Pre-) Commissioning Activities

A similar vessel will provide pipeline and umbilical pre-commissioning support.

The offshore pipeline is currently filled with inhibited sea-water and will need to be tied into the completed landfall valve installation at Glengad.

During the commissioning phase, a mobile nitrogen generation plant will be established adjacent to the LVI compound at Glengad for a period of one to two weeks.

This station will include a series of mobile diesel generator units, which will generate emissions of combustion gases. Soundproofing will be provided to ensure that noise levels will be within acceptable limits.

The offshore pipeline will then be dewatered over a period of approximately 14 days. Using pipeline integrity gauges (pigs) propelled by nitrogen, the pigs will move from onshore to offshore, pushing the water out of the offshore pipeline to be disposed of at the manifold. The total quantity of hydrotest water to be discharged from the offshore pipeline will be approximately 14,000 m³.

It is currently proposed that the offshore pipeline will be pre-commissioned in the summer of 2012, to coincide with suitable weather conditions required for the associated offshore operations.

Details on the pre-commissioning of the onshore pipeline can be found in the RPS Onshore Pipeline EIS 2010. The umbilical will be tested from the terminal to prove its integrity and that full communication with the subsea facilities has been established.

3.4 The Onshore Pipeline

The section of the pipeline from the landfall to the terminal is addressed in the RPS Onshore Pipeline EIS 2010.

3.5 Onshore Valves and Termination Unit

The offshore pipeline and umbilical will terminate in a special facility a short distance behind the landfall. This facility, known as the landfall valve installation (LVI), will be constructed in a low-profile arrangement with much of the system buried below ground. The onshore pipeline and onshore section of the umbilical will join with the offshore elements in the LVI. The LVI is addressed in the RPS Onshore Pipeline EIS 2010. The offshore pipeline currently terminates within the boundary of the construction compound at Glengad. The pipeline has been capped and buried, and will be re-excavated during the construction of the onshore pipeline, at which time the LVI will also be fully constructed.

3.6 Mitigation Measures during Construction

A number of mitigation measures will be implemented during the construction phase to minimise as far as possible the impacts to local residents and the environment. These are contained within the Environmental Management Plans for the offshore works. Method Statements for all construction activities within the candidate Special Area of Conservation (cSAC) will be prepared and be subject to approval of National Parks and Wildlife Service (NPWS) prior to commencement.

3.6.1 Noise

For marine based work in the intertidal and subtidal zones, activities will run on a 24-hour basis. For the land-based operations at Glengad, working hours will in general be restricted to 07:00–19:00 Monday to Friday, 07:00–16:00 on Saturday and there will be no activity on Sundays. During the umbilical pull-in operation, it will be necessary to work on a 24-hour basis.

Noise will be minimised by the screening of stationary machinery (generators), use of noise attenuation barriers and turning off such equipment when not in use. Silenced machinery will be used as much as possible to mitigate noise.

Certain commissioning activities for the offshore pipeline may require 24-hour working. However, current information in respect of the pre-commissioning of the offshore pipeline indicates that this activity would need to be restricted due to elevated noise levels arising from the nitrogen generating plant and associated compressors. If, however, further noise attenuation measures can be identified and proven to reduce noise levels to an acceptable target, it is proposed to carry out this work on a 24-hr basis. Should further noise attenuation not be available, this activity will be curtailed, and not carried out during the period 22:00–07:00.

Recognising that noise will be of concern, SEPIL will ensure that local residents are informed of the programme of work proposed, and the dates when 24-hour working may occur.

3.6.2 Light

When night time work is necessary, lights will be directed away from residences and roads as much as practicable. However, as the safety of the crew is paramount, some disturbance may be unavoidable.

3.6.3 Oil Spill

Onshore re-fuelling will be restricted to allocated re-fuelling areas. Offshore re-fuelling will be carried out using procedures designed in accordance with industry best practice. In the event of an oil/diesel spill, offshore and onshore emergency procedures will be implemented as necessary. Oil spill response containers are stationed at each site and each machine driver is equipped with and trained to use an oil spill kit in the cabin of the machine.

3.6.4 Archaeology

Offshore archaeological monitoring has taken place in Broadhaven Bay in all previous construction periods.

Whilst the marine pipe trench was archaeologically monitored in 2002, 2005, 2008, and 2009 and nothing was found during this work, there still may be potential for archaeological remains to be uncovered during the remaining works, if any deviation from the original routes occurs.

The Department of Environment, Heritage and Local Government (DoEHLG) will require a monitoring licence for any new marine trenches or onshore topsoil stripping in areas not stripped previously.

Contingency plans to deal with such an eventuality will be put in place for the remaining construction phases.

Given the previous monitoring which has been carried out in the area, the Underwater Archaeology Unit of the DOEHLG have confirmed that no further archaeological monitoring will be required for the umbilical installation works.

3.6.5 Ecology

During construction, a working area will be fenced off at the landfall to prevent encroachment by personnel and machinery outside of the allowable work area and to protect the adjacent habitats. There will be adequate signage to further delineate this boundary.

Ecological surveys will be carried out during the construction period to monitor the activity of species of particular conservation interest in the vicinity of the construction operations. These surveys are part of the ongoing environmental monitoring programme put in place by SEPIL to ensure that any impacts are minimised as far as possible.

Marine mammal observers will be present during marine construction operations in Broadhaven Bay and adjoining coastal waters. They will make a visual search of the area before any marine works are due to commence and any noisy operations will be delayed until 20 minutes after the last sighting of marine mammals within 1000m of the construction spread. A code of conduct developed and agreed with NPWS to minimise disturbance to marine mammals from construction activities will be implemented.

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4 ALTERNATIVES

4.1 Need for Scheme

4.1.1 Energy Sources in Ireland

Since the compilation of the 2001 Offshore EIS, the need to address climate change through reduced CO₂ emissions has come to the forefront of the political agenda. Ireland currently uses coal, oil, gas, wind, peat and hydroelectric power as sources of energy. However, since 1990, Ireland has become increasingly dependent on oil and natural gas, most of which is imported.

The use of coal and indigenous peat has declined over this period. In the absence of significant additional hydro resources and provided the statutory nuclear prohibition in the country remains, it is expected that gas will assume increasing importance because of the efficiency of energy use in combined cycle gas turbine (CCGT) generators and the resulting relatively benign environmental impact of the emissions. (The dependence of Ireland on natural gas for power generation will be 70% by 2020, without policy intervention, or 50% if the renewable target of 40% penetration by 2020 is met, see below.)

Substitution of other fossil fuels by natural gas in power generation has the potential to assist in achieving Ireland's targets for reduction of greenhouse gas emissions under the Kyoto Protocol. The level of carbon dioxide (CO₂) emissions per kilowatt-hour (kWh) of electricity supplied has improved considerably, mainly due to the increased use of gas for electricity generation in recent years.

Renewable energy will also continue to play a central role in the energy sector's contribution to meeting the Kyoto target, reducing the carbon intensity of electricity production. A new interim 2012 target of 12% of electricity consumption to be met by renewable energy was set by the Government, with a further target of 40% penetration by 2020, subject to technical considerations.

It is therefore clear that for Ireland to sustain its economic growth and provide energy for its people, the use of natural gas will be required to meet future energy demand.

4.2 Alternatives Considered

The 2001 Offshore EIS identified a number of alternative development concepts. Screening exercises were conducted to select and define the preferred development strategy. The rationale behind the selection of the preferred option and the reasons for the elimination of the alternative concepts have not changed. Where alternatives have been further developed, they are addressed below.

Following concerns raised about the routing of a section of the pipeline between the landfall and the terminal, the routing of the onshore pipeline was re-evaluated in 2006, with various alternatives considered. As these new alternatives are related to the onshore pipeline and landfall locations, they have been addressed in the RPS Onshore Pipeline EIS 2010 and are not repeated here.

4.2.1 Offshore Pipeline Route and Associated Landfall

In terms of the offshore pipeline, the 2001 Offshore EIS showed two optional routes into Broadhaven Bay: a proposed pipeline route and an alternative 'northern route'. The proposed route was later confirmed as the route that would be used, and the pipeline was laid according to this route in 2009.

In the 2001 Offshore EIS various offshore routes were considered to link the Corrib Gas field to the landfall options that had been identified during the EIA process.

The routes themselves offered a number of options to avoid potential geohazards on the seabed. Glengad was the selected landfall point based on the assessment of the options in the 2001 Offshore EIS.

The route of the onshore section of the pipeline between the landfall and the terminal has been the subject of concern from sections of the local community. In January 2007, SEPIL appointed RPS to implement a recommendation by the independent mediator, Peter Cassells (appointed by the (then) Minister for Communications, Marine & Natural Resources), that SEPIL modify the route of the pipeline 'in the vicinity of Rosspoint to address community concerns regarding proximity to housing'.

In order to examine fully the alternative onshore route options, RPS considered that it was necessary to examine alternative landfall locations. SEPIL's pipeline engineers then carried out a review of the identified landfall options, in association with RSK. The main conclusions of this evaluation are summarised below.

Six options for pipeline landfalls were considered, these being:

- Glengad
- Inver Bay;
- Inver Point;
- Portacloy;
- Glinsk; and
- Garter Hill.

All six potential landfall locations (including Glengad') are shown in Figure 4-1, together with their associated offshore pipeline routes.

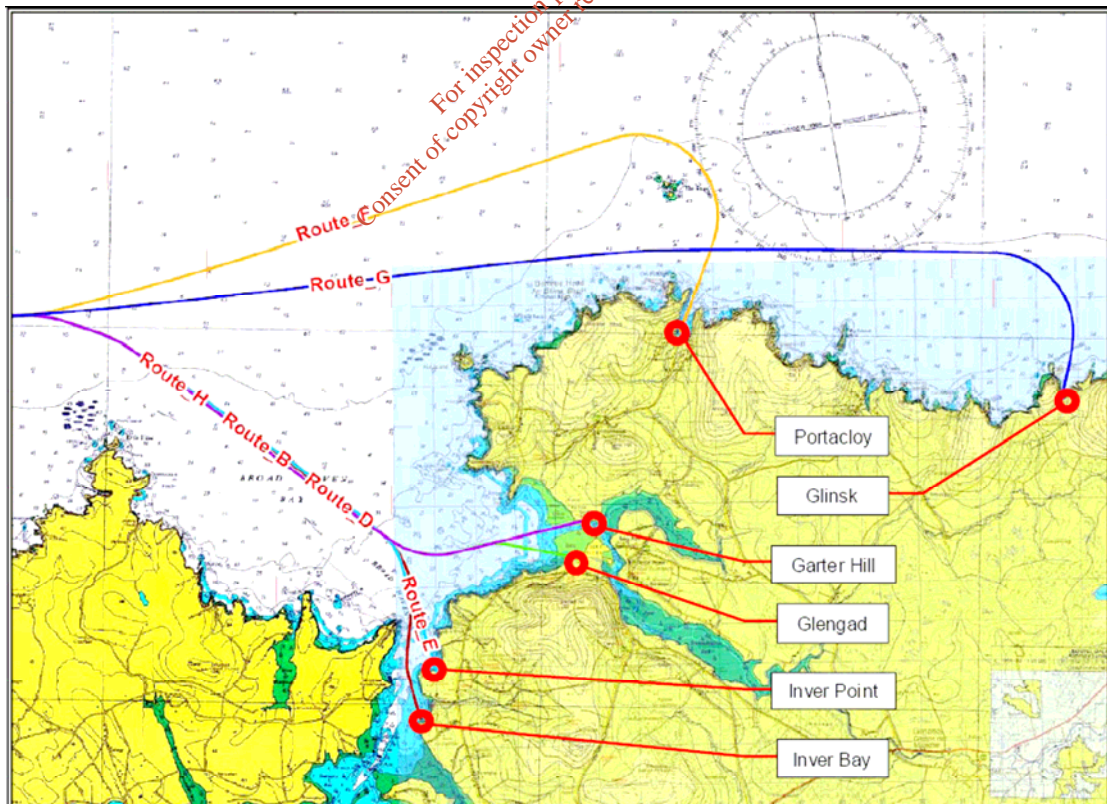


Figure 4-1: Alternative Landfalls and offshore pipeline routes

These alternatives were proposed in combination with an independent assessment of alternative onshore corridors. All six landfall options were re-evaluated. Note that these landfalls were evaluated without reference to the merits or otherwise of the associated onshore corridors that are dealt with in the RPS Onshore Pipeline EIS 2010.

The six landfall options were reviewed using the following criteria:

- Geohazards –Bathymetry & Geology;
- Shore Approach;
- Access;
- Offshore Pipeline;
- Constructability;
- Safety;
- Environmental; and
- Schedule.

4.2.1.1 Geohazards

The principal geohazards at Portacloy, Inver Point and Inver Bay related to the potential volume of rock that was present beneath the beach and in the near-shore zone. This would have required excavation, possibly using blasting, to prepare a trench for pipeline stability and protection.

More serious geohazards were present at Glinsk, with the requirement to tunnel through the marine cliff, as well as to produce a suitable seabed profile in the near-shore region and onto the beach.

Garter Hill and Glengad presented the least concerns with regard to rock or other geohazards and whilst the seabed in the approaches to Garter Hill would have needed to be proven, the shore approach and landfall at Glengad was well understood.

4.2.1.2 Shore Approach

The beach and the near shore approach at Glinsk were very steep, and provision of a suitable seabed profile to pull the pipeline ashore by both dredging and rock dumping would have had a potentially significant environmental and schedule impact.

At both Portacloy and Inver Bay, the landfall approach was complicated by the fact that there was no easy direct pull ashore. At Portacloy, the inlet was narrow and water depths further restricted the use of a shallow draft lay vessel as an option. This would have required complicated construction techniques. Given the importance of safety and design concerns, this was considered an extremely difficult option.

The Inver Bay landfall was also complicated by the fact that it was not a direct pull ashore and a second shallow draft vessel would have needed to be used to lay the pipe out of the inlet and into deeper water.

At Inver Point, a direct pull ashore was deemed possible, but this would have needed to be proven by a detailed marine survey.

Garter Hill and Glengad had the least concerns with regard to shore approach, although the nature of the seabed in the final approaches to Garter Hill would have needed to be proven.

4.2.1.3 Site Access

Site access was deemed very difficult at both Glinsk and Garter Hill, as it would have been necessary to build a permanent access road over some distance to

each of these landfalls. Portacloy had the complication of a narrow road access through the settlement to the landfall that would have had to be upgraded to take heavy plant and machinery unless it could have been brought in by sea.

Inver Point and Inver Bay would both have required some access road upgrading and road extension to reach the landfall, but although this was greater than that required at Glengad, it was not thought to be critical.

Site access at Glengad had the least impact.

4.2.1.4 Offshore Pipeline

One of the major influences on the assessment for each option was the overall route length, with Glinsk and Portacloy both involving a considerable additional distance offshore. The other options were all fairly similar in length. There were also variations in the associated onshore length, but these are not addressed here.

Offshore lengths are summarised in Table 4-1, showing the difference in length from the base case, Glengad.

Table 4-1: Offshore Route Lengths

Landfall Option	Additional Length (m)
Glengad	0
Inver Point	- 1200
Glinsk	+ 13455
Inver Bay	- 155
Portacloy	+ 4727
Garter Hill	+ 325

The pipeline route to Glinsk would have required an additional 13.5km in both linepipe and umbilical, and procurement of these would have presented the most critical schedule issue associated with the offshore pipeline.

Similarly, the pipeline route to Portacloy would have required a 4.7km increase in linepipe and umbilical with the associated schedule issue again.

The offshore pipeline route to Inver Bay and Inver Point would have allowed a reduction in pipeline and umbilical length, and so would not pose any problem of procurement associated with extra materials. However, a detailed survey of the new routes would have been required to ascertain the full extent of rock outcrops and any other adverse seabed features.

The offshore route to Garter Hill was virtually the same length as the base case route to Glengad. There was therefore no issue related to additional linepipe or umbilical. However, a detailed survey of the new route would have been required to ascertain if there were any rock outcrops or other adverse seabed features.

4.2.1.5 Constructability

With specific regard to constructability, Glinsk was deemed the worst choice of landfall due to the options for constructing through the high, fissured cliffs being limited to a shaft and tunnel.

At Portacloy, additional potential environmental impact resulting from increased time to construct may have occurred due to the installation method and the requirement to mobilise an additional work barge. In addition, schedule delay would also have been incurred due to the volume of rock excavation across the landfall itself and through the near-shore.

At Inver Bay, construction would have been based on a standard pull ashore; however, the location at which the offshore lay barge would need to anchor could have been an obstruction for the passage of other vessels during the construction period (including the lifeboat), which would not be acceptable.

Inver Point construction would have been based on a standard pull ashore from a deep-water lay vessel. Alignment was difficult due to the rocky foreshore and the shallow section at the approach to the inlet (possibly a rock outcrop), so this would have needed to be confirmed by detailed marine survey.

At Garter Hill, the seabed conditions in the final landfall approaches were unknown, although they are likely to be similar to the existing landfall close by at Glengad. Previous work at Glengad has shown that a near-shore trench could be dredged without the use of blasting, even though some rock was encountered. Maintenance of a trench across the entrance to Sruwaddacon Bay would also need to be addressed.

Glengad had the least concerns, as construction uses conventional techniques using a deepwater lay vessel, and the pipeline trench has been proven previously.

4.2.1.6 Safety

As conventional landfall construction techniques would be adopted at Glengad and Garter Hill, each would only require normal safety standards and precautions for marine works to be enforced.

Tunnel construction and landfall installation on the steep and exposed beaches such as at Glinsk would have been very high-risk operations. If marine blasting was necessary, the supply, transport, storage and use of explosives would require permitting, detailed procedures and a high level of control.

The main channel through the Broadhaven inlet is the route through which commercial and leisure craft will access Ballyglass and Belmullet. Due to the narrow waterway at this location, there could be an increased risk of vessel collision or anchoring incident. As such, access needed to be restricted during landfall and construction activities. This therefore affected the two Inver options.

Similarly, access to Portacloy Bay is narrow and would have needed to be restricted during landfall construction.

4.2.1.7 Environmental

Due to the large areas of rock present on the foreshore at Portacloy, Inver Point and Inver Bay, landfalls at these locations would have required excavation and possibly blasting, with the associated negative environmental impacts (e.g. to marine mammals).

At Glinsk, significant construction works would have been required to tunnel through the marine cliff, in addition to environmental impacts from producing a suitable seabed profile. In addition, construction of new access roads to both Glinsk and Garter Hill would have had an associated negative environmental impact.

At Glengad, construction works in the form of trench excavation and pipeline installation were undertaken without the requirement for blasting or rock breaking.

4.2.1.8 Schedule

In quantifying the relative environmental impact of any project, one of the key factors is the duration of the activity. For example, for two projects involving similar activities in the same area, the impact will generally be greater in the project with a significantly longer duration than that of a shorter project.

Although the length of new routes at the Inver Bay, Inver Point and Garter Hill landfalls was relatively small, there would have been a requirement for an additional marine survey. Both geophysical and geotechnical surveys would be required to confirm the existence or otherwise of bedrock within the trenched areas, and this could have added around 5–6 months to the project schedule excluding the time taken to obtain foreshore licences for the surveys.

The revised landfall construction would have had little effect on the overall project schedule, although it would have delayed the planned commencement of the pipelay. Any problems with rock at either landfall that required blasting or specialist mechanical excavation would have led to further delays.

Both Portacloy and Glinsk landfalls required substantial additional marine surveys, which would have added 7–8 months to the project schedule. Offshore construction durations could have increased pro rata, depending on the additional route length.

At Glinsk, the construction of a tunnel and shaft through the cliff would have been a major undertaking, with the inherent schedule risks associated with adverse ground conditions. This work would have been likely to have a significant impact on landfall construction.

4.2.1.9 Conclusions

All the proposed landfall locations would have been technically feasible for landfall construction, subject to detailed surveys and design, although it was clear that some were considerably more suitable than others.

A high-level, qualitative comparison between the options was made, and is presented in Table 4-2. A slightly worse than the base case condition (Glengad) is shown by a '–' and much worse by '– –'. Better would be shown by '+', although there are no landfall locations that achieve this position.

Table 4–2: Comparative Scores

Subject	Glengad	Inver Bay	Inver Point	Portacloy	Glinsk	Garter Hill
Geohazard	0	–	–	– –	– –	0
Shore Approach	0	0	–	–	–	0
Offshore Routing	0	0	0	– –	– –	0
Access	0	–	–	0	– –	– –
Constructability	0	–	0	0	– –	0
Safety	0	0	0	–	– –	0
Environmental	0	–	–	–	–	–
Schedule	0	–	–	– –	– –	–

0= no difference/insignificant difference

It is obvious from Table 4–2 that Glengad represented the best option and Glinsk the worst option. As a result, pipeline installation at Glengad was completed during 2009.

Based on the high-level assessment of landfall options, the following general conclusions could be drawn:

- Problems with rock excavation were considered possible for all options except Glengad, where the rock has already been excavated and subsequently backfilled. At Garter Hill, the extent and type of rock would likely to be similar, so it was assumed that mechanical excavation would be sufficient. The two Inver landfalls would almost certainly have involved more rock (particularly Inver Point), but without detailed site investigation including bathymetric, geophysical and geotechnical (boreholes and trial pits) surveys, it was not possible to determine whether it would prove to be of a similar nature to Glengad or require blasting. Portacloy and Glinsk were unknown quantities, but considerable difficulties with both onshore and near-shore rock excavation were expected, with a certain extended construction period at Glinsk.
- Procurement lead-time posed a major schedule constraint for both Portacloy and Glinsk, due to the additional length of pipe and umbilical required for both

options. The additional length of the route would have increased the potential environmental impact.

- Although access road extensions were required at most landfall options, major new access roads would have to be constructed at Glinsk or Garter Hill for landfall construction and for permanent access. This road would have been longer at Garter Hill, but either would have significant impacts on the sensitive local environment.

Specific conclusions for each landfall are as follows:

- Glinsk would pose some significant technical, commercial and schedule challenges. Tunnel construction and landfall installation on the steep and exposed beach at Glinsk are very high-risk operations and would have involved significant technical difficulties. The near-shore approach, beach profile and tunnel through the high sea cliff would have involved significant technical difficulties and created the potential for increased environmental impact. Compared with the alternatives, it would have required a substantially longer construction period to deal with the tunnel construction. The significant extra offshore length posed a critical schedule issue due to the procurement lead-time for additional linepipe and umbilical.
- Portacloy was slightly less of a commercial and schedule challenge, but with a more complex marine construction methodology that would include a pull ashore into the middle of the bay and the installation of spool pieces and bends to complete the landfall. This would have increased the risk of there being impacts on the delicate marine environment of this inlet. This would also have included the use of an additional work barge and the associated risks. Additional environmental impacts would also have been incurred due to the potential volume of rock excavation across the beach and through the near-shore.
- All the Broadhaven Bay landfalls (Glengad, Inver Bay, Inver Point & Garter Hill) appeared viable, although the Inver landfalls may have involved extensive marine rock excavation (which could have required rock blasting) and the associated environmental impact. In addition, Inver Bay would have required the mobilisation of an additional shallow draft lay vessel in order to exit the narrow Broadhaven inlet.
- The Glengad landfall has the advantage of having been studied in much more detail and from this work, it is known that there were no requirements for rock blasting. Since the landfall had effectively already been constructed (the trench was fully excavated and subsequently backfilled in 2005 and 2008), this would therefore represent the quickest option for construction with the least schedule impact.

4.2.2 Discharge Pipeline

The 2001 Offshore EIS investigated four alternative locations for the outlet point of the water discharge pipeline (on the 10m, 20m, 30m and 40m bathymetric contours along the gas pipeline route through Broadhaven Bay). The modelling results indicated that all locations would provide sufficient dilution for the proposed discharge. The location of the outfall pipe was subsequently moved outside the boundary of Broadhaven Bay Special Area of Conservation. The results from modelling close to this location generally did not indicate a change in impact when compared to the equivalent data for the 40m water depth at which depth negligible impacts were predicted. This location was approved by the Environmental Protection Agency (EPA) in its granting of the IPPC licence for the terminal in

November 2007. Since then however, a decision has been taken by SEPIL to discharge only treated surface water run-off at this discharge point. The treated surface water run-off pipeline was constructed at the same time as the offshore gas pipeline during 2009. Treated produced water is now proposed to be discharged via two cores in the umbilical at the manifold location in the Corrib Field. Water quality modelling has been undertaken for the proposed discharge point and the modelling indicates that the combination of very low concentrations in the discharge together with available dilution give rise to no anticipated environmental impacts.

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5 PLANNING AND DEVELOPMENT CONTEXT

5.1 Introduction

Information on planning and development, including updated information since publication of the 2001 Offshore EIS, is contained within the Preamble. In addition, the RPS Onshore Pipeline EIS 2010 provides updated information on national, regional and local planning policy relevant to the Corrib development.

5.2 Existing and Future Natural Gas Network

Since 2001, gas consumption in Ireland has continued to increase to approximately 5.217 billion cu m (2008 est.), with demand outstripping domestic production (http://www.indexmundi.com/ireland/natural_gas_consumption.html). Gas imports have been required and the import of electricity through additional interconnector facilities is planned. Further details of the existing energy network and its future development is also contained within the Preamble.

5.3 National, Regional and Local Planning Context

An updated review of the national, regional and local planning policy relevant to the Corrib development is provided in the Preamble and the RPS Onshore Pipeline EIS 2010.

5.4 Impacts of the Development on Strategic National Planning and Regional Development

Impacts of the overall Corrib development on current strategic national and regional development are addressed in the RPS Onshore Pipeline EIS 2010.

5.5 Impacts on Land Use

Potential impacts on use of the Sruwaddacon Bay are addressed in the RPS Onshore Pipeline EIS 2010. In terms of the landfall, it is acknowledged, that the duration of disturbance is greater than initially anticipated as some works, commenced during 2008, continued in the summer of 2009 and will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

There will also be a permanent land take in which the LVI will be constructed. Impacts from this land take are addressed in the RPS Onshore Pipeline EIS 2010.

As stated in the 2001 Offshore EIS, as the landfall is located in an area where there is a low population density, impacts on land use and human activities will be minimal.

6 HUMAN BEINGS

6.1 Introduction

The 2001 Offshore EIS considered the potential impacts of the proposed offshore development on human beings. It also discussed the landfall and the two crossings of Sruwaddacon Bay. The assessment was based on data supplied by the Central Statistics Office as well as government, local and county publications. Since 2001, the characteristics of the receiving human environment have changed. The RPS Onshore Pipeline EIS 2010 provides updated information on the receiving human environment (based on census data from 1996, 2002 and 2006) including demography, employment and community aspects. In addition, in November 2007, Goodbody Economic Consultants investigated the economic benefits of the overall Corrib development in further detail.

6.2 Study Methodology

Based on the updated information, a re-assessment of the potential impacts of the offshore development on human beings has been undertaken. Potential impacts associated with crossing the Sruwaddacon Bay are addressed in the RPS Onshore Pipeline EIS 2010.

6.3 Receiving Environment

An updated review of the receiving environment including population, employment, tourism, and language and culture is provided in the RPS Onshore Pipeline EIS 2010.

6.4 Characteristics of the Proposed Development

Following installation of the offshore pipeline and subsea infrastructure at the Corrib Field in 2009, remaining offshore works are limited to the installation of the umbilical and any remaining rock placement works. The characteristics of the proposed development are detailed in Sections 2 and 3. Most of the activity will be based from offshore vessels and will therefore have little interaction with local activities. Supporting vessels for works in Broadhaven Bay will operate out of Ballyglass Pier. The installation of the umbilical through Broadhaven Bay, and on to the landfall will result in limited onshore activities in the local area, as described in Section 3.

6.5 Predicted Impacts of the Proposed Development

6.5.1 During Construction

Taking the updated information on the receiving human environment into account (as presented in the RPS Onshore Pipeline EIS 2010), there are no changes to the predicted impacts arising during the construction phase described in the 2001 Offshore EIS. There may be financial benefits in terms of employment during construction, although the influx of non-local workers may have a short-term, insignificant effect on the local culture and language.

However, it is acknowledged that the duration of impacts is greater than initially anticipated as some construction activity commenced during 2008, continued in the summer of 2009, and will require works over a further season. Some construction-related impacts will therefore have a greater duration than that originally envisaged.

6.5.2 During Operation

Taking the updated information on the receiving human environment into account (as presented in the RPS Onshore Pipeline EIS 2010), there are no changes to the predicted impacts arising during the operation phase described in the 2001 Offshore EIS. Operationally, the offshore elements of the development are unlikely to have any impacts on the local population.

At a macro level, the Goodbody report (Goodbody Economic Consultants, 2007) provides an updated assessment of the economic benefits of the Corrib project. The findings of this report confirm the benefits of the overall project as presented in Section 6.5.2 of the 2001 Offshore EIS.

6.6 Do-Nothing Scenario

No change from 2001 offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

6.7 Mitigation Measures

6.7.1 Employment and Economic Impacts

As presented in further detail in the RPS Onshore Pipeline EIS 2010, the Corrib Gas Partners have implemented a social investment programme to facilitate development opportunities within the Erris region. The social investment programme is a voluntary contribution by the Corrib Gas Partners to the local and wider communities in the vicinity of the Corrib project, and involves working in collaboration with these communities to achieve local social and economic objectives. Funding is available during both the construction and operational phases of the overall development.

Priority is given to those projects in the settlements most affected by the Corrib natural gas field development, i.e. those in close proximity to the terminal site and pipeline.

The social investment programme focuses on financial assistance, although in-kind donations, such as equipment, or volunteers' time and expertise, also play a part. In addition to the direct positive economic and employment impact of the Corrib project, the social investment programme provides indirect economic benefits.

As detailed in the RPS Onshore Pipeline EIS 2010, community liaison officers are available during both the construction and operational phases of the proposed development to meet with the public, and provide any information necessary to answer any questions or issues in order to disseminate and circulate information to the community. Regular community update newsletters are circulated and freely available in the community and feature accurate information about the progress of the proposed development. These are also freely available online.

6.8 Monitoring

There has been ongoing liaison between SEPIL, and government and community bodies, which will continue throughout the construction and operational phases of the development to ensure that mitigation measures for the whole project are implemented as appropriate.

6.9 Reinstatement and Residual Impacts

There is no change to the reinstatement and residual impacts as described in the 2001 Offshore EIS.

7 FLORA AND FAUNA

7.1 Introduction

Following submission of the 2001 Offshore EIS, a number of field surveys have taken place in and around Broadhaven Bay and along the offshore pipeline route to the Corrib Field. The following sections provide a summary of the additional information that has been gathered which directly relates to the offshore pipeline route. A re-assessment of the potential impacts of the installation and operation of the export pipeline and the umbilical is provided.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

7.2 Study Methodology

7.2.1 Study Methods

New information has been collected for a number of different ecological receptors within the potential footprint of the project. Sources of the information include both surveys specifically commissioned by SEPIL and those carried out by other organisations.

7.2.1.1 Benthos

- 2000 – baseline surveys of Corrib Field and pipeline route (for 2001 Offshore EIS purposes);
- 2002 – pre-construction survey in Broadhaven Bay (to establish baseline for planned pipeline installation in 2002);
- 2005 – pre-construction survey (intertidal) in Broadhaven Bay (and Sruwaddacon Bay) (to establish baseline for planned pipeline works in 2005);
- 2005 – baseline survey around permitted outfall location off Erris Head (to begin development of baseline data set);
- 2007 – repeat of 2000 survey along pipeline route, to update baseline information (to support Offshore EIS Supplementary Update Report);
- 2007 – additional baseline survey around permitted outfall location off Erris Head (providing baseline information against which any future impacts from proposed discharge could be measured);
- 2008 – pre-construction survey of subtidal and intertidal (landfall) sediments in Broadhaven Bay (repeat of 2002 survey, to establish baseline for planned pipeline installation in 2008);
- 2008 – post-drilling survey in and around the Corrib Field;
- 2008 – additional baseline survey off Erris Head to comply with requirements of IPPC licence, further establishing baseline against which any future impacts could be measured; and
- 2009 – post construction monitoring programme of subtidal and intertidal (landfall) sediments in Broadhaven Bay commenced. Whilst these results are not yet available, they will be reported in due course.

7.2.1.2 Fisheries and aquaculture

- Survey data from the Central and North Western Regional Fisheries Board, and Marine Institute, Galway;

- Fish landings data from the Sea Fisheries Protection Authority; and
- Aquaculture site information from Aquaculture licensing team, DCENR.

7.2.1.3 Seabirds

- A desktop literature review was commissioned to view and update information regarding seabird diversity and abundance along the proposed pipeline route.

7.2.1.4 Marine Mammals

- Monitoring data from Broadhaven Bay surveys carried out by CMRC in 2001–2002, Summer 2005, Summer/Autumn 2008 and onwards;
- Sightings and strandings data from the Irish Whale and Dolphin Group;
- Marine mammal observer (MMO) data from Sruwaddacon geophysical survey, 2007;
- Data from offshore surveys reported in the literature (in Ó Cadhla *et al.*, 2004; Wall, 2004; Wall, 2008); and
- MMO data from 2008 and 2009 (MMOs monitoring during construction work in Broadhaven Bay).

This assessment also draws on the results of the landfall vegetation surveys 2008; overwintering bird survey 2007/2008; preliminary results from the Brent Goose surveys at the start of 2008/2009; Sand Martin monitoring during the 2008 breeding season; and the land based otter surveys in 2010.

7.3 Receiving Environment

7.3.1 Benthic Surveys

A number of surveys have been undertaken along the route of the offshore pipeline since 2001 to improve the knowledge of the environment into which the pipeline was laid. These include: 1) a series of transects across the subtidal pipeline route through Broadhaven Bay in 2002, 2008 and 2009; 2) intertidal sampling at the landfall in 2005, 2008 and 2009) a benthic survey along the proposed pipeline route in July/August 2007 from the R/V *Prince Madog*. Sampling was also undertaken around the treated surface water run-off outfall diffuser location during the 2007 survey. In addition, SEPIL commissioned a benthic survey in the Corrib offshore field and around the permitted outfall location off Erris Head in July/August 2008 from the M/V *Deepworker*.

7.3.1.1 Offshore

The benthic surveys in 2007 and 2008 comprised sediment sampling by grab sampler, and photographic surveying of the seabed. In 2007, twelve locations of varying depth were identified for both sediment sampling and photography along the offshore pipeline route; these are presented in Figure 7-1. In 2008, a total of twenty nine locations were visited in the Corrib offshore field for sediment sampling and photography; these are presented in Figure 7-2.

Sampling was carried out primarily using a double van-veen grab of 0.2m² (2x0.1m²) where the seabed sediment was suitable, although a 0.1m² Day grab was used where sediments were coarser. At each station, attempts were made to collect four replicate samples; three were retained for macrofaunal analysis while the fourth was used for physico-chemical analysis (results for physico-chemistry are discussed in Section 8).

All macrofaunal samples were sieved over a 0.5mm mesh; all organisms were identified to the lowest possible taxon, enumerated and subject to standard statistical analysis.

In 2007 seabed photography was performed at 12 stations along the offshore pipeline route using a combination of vertical and sediment profile imagery (SPI) cameras on a

frame. In 2008 seabed photography was performed at 18 stations at the Corrib offshore field. Surface images were used to document general sediment type and bioturbation, to record epifaunal species not easily sampled using the grab, and to screen for any protected habitats (e.g. biogenic reefs). Cross-sectional SPI photographs show a vertical profile of the sediment, recorded by equipment that penetrates a few inches below the sediment surface.

Benthic infauna

Offshore Pipeline Route

Univariate indices of diversity and abundance, and percentages of constituent phyla for each station (replicates pooled) for the 2007 survey along the offshore pipeline route are presented in Table 7-1. The full benthic infauna report can be found in Appendix 7-1.

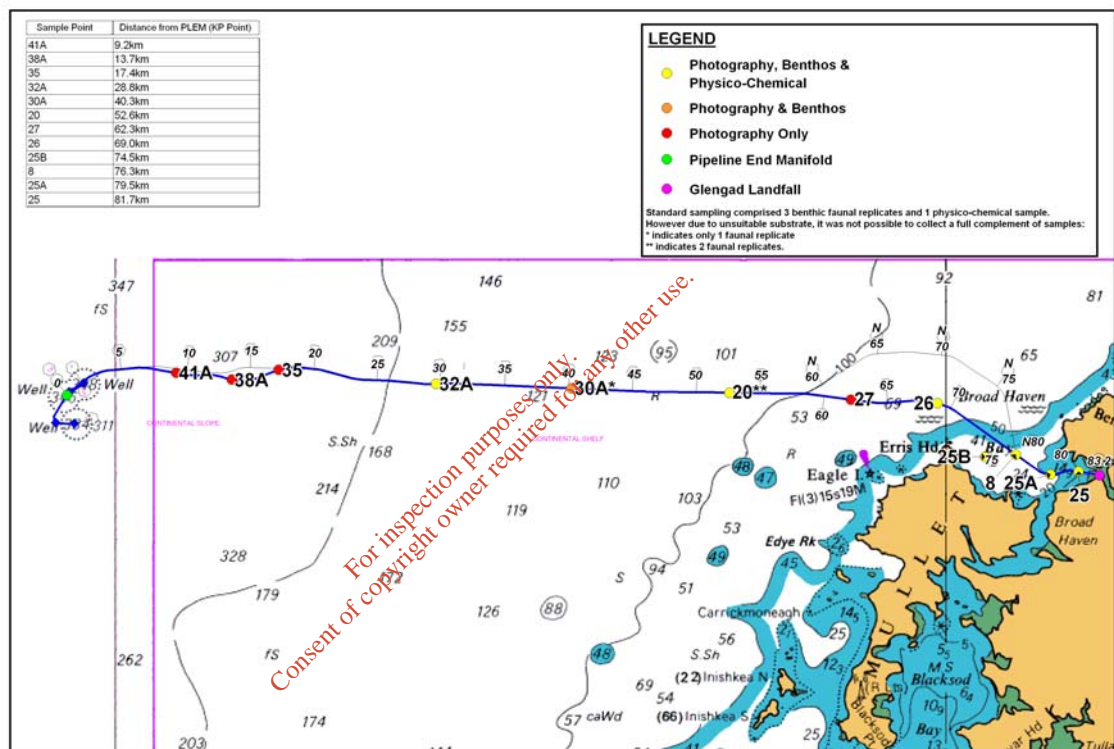


Figure 7-1: Location of Summer 2007 Benthic and Photographic Sampling Points along the Proposed Pipeline Route (RV *Prince Madog*).

Table 7-1: Univariate Indices for Sample Sites on the Proposed Offshore Pipeline Route (2007)

Station	Depth (m)	Diversity					% of each phyla*				
		S	N	J'	H'	λ	Annelida	Crust.	Mollusca	Echino.	Other
25	13	44	257	0.57	2.16	0.18	34.29	62.99	0.65	1.30	0.78
25a	26	61	545	0.50	2.05	0.33	10.27	84.60	1.83	1.90	1.41
8	41	84	396	0.75	3.32	0.06	32.18	29.65	14.91	4.97	18.28
25b	43	84	314	0.80	3.53	0.05	33.62	33.83	13.68	8.06	10.82
26	78	103	703	0.61	2.82	0.16	53.11	4.74	2.70	2.70	36.75
20	115	83	204	0.86	3.78	0.04	64.95	21.32	4.66	3.92	5.15
30a	142	31	28	0.92	2.56	0.06	19.35	9.68	16.13	3.23	51.61
32	173	148	1732	0.31	1.55	0.58	91.09	3.21	1.31	2.46	1.92

S = Number of species (including encrusting species); N = Number of individuals; J' = Pielou's Evenness

H' = Shannon-Weiner Diversity (\log_e); λ = Simpson's Dominance index

*Abundances were used to calculate the percentage of each phyla at each site except for site 30a, where species numbers were used (as epifaunal species dominated the sample at this site).

The data indicate that annelid worms or crustaceans generally dominate the communities at the sampling sites along the offshore pipeline route. Site 30a was an exception in that bryozoans (an encrusting epifaunal group, found on the coarser seabed substrates at this site) were a dominant component of the community.

Most organisms recorded were characteristic of sandy environments. Common to these environments and recorded throughout the data set were the polychaetes *Chaetozone christiei* and taxa from the family Spionidae, particularly the genus *Spiophanes*, crustaceans from the order Cumacea, particularly *Pseudocuma longicornis* and *Bodotria sp.* and the amphipods *Bathyporeia sp.* and *Siphonocetes sp.* Echinoidea (sea urchins) were also present at all sites except 30a.

Diversity along the route was typically moderate to high at all sites; it was relatively low at site 32a due to the high numerical dominance of the polychaete *Galathowenia oculata*. However, dominance by a single or small group of species was low throughout the rest of the data set, indicating established communities.

Offshore Gas Field

Table 7-2 shows univariate indices of diversity and abundance, and percentage for constituent phyla at each station (replicates pooled) for those stations in the offshore field sampled during the 2008 offshore survey from the M/V *Deepworker*. The full survey report is presented as Appendix 7-2.

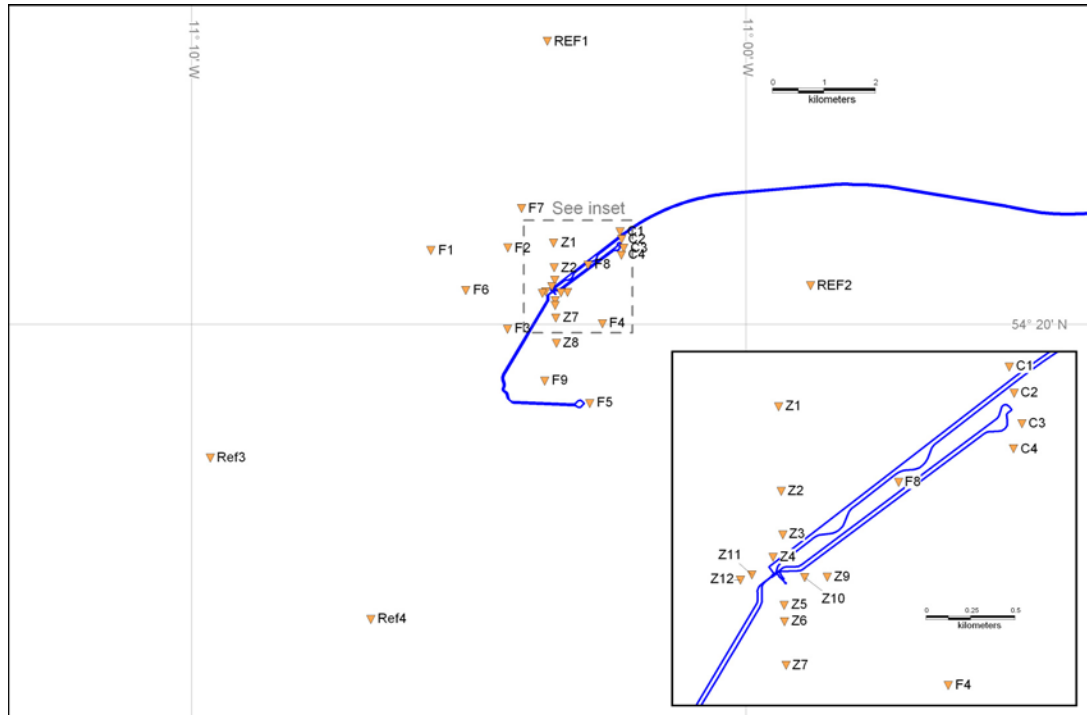


Figure 7-2: Location of Summer 2008 Benthic and Photographic Sampling Points in the Corrib Offshore Gas Field (MV Deepworker).

Table 7-2: Univariate Indices for Sample Sites in the Corrib Offshore Gas Field (2008)

Station	Diversity					% of each phyla*				
	S	N	J'	H'	λ	Annelida	Crust.	Mollusca	Echino.	Other
C1	82	270	0.64	2.83	0.20	76.89	3.09	13.10	4.08	2.84
C2	104	284	0.74	3.44	0.10	70.81	3.87	17.94	2.58	4.81
C3	104	267	0.57	2.67	0.27	81.90	4.99	7.24	2.87	3.00
C4	76	195	0.60	2.60	0.26	71.75	4.97	15.41	6.16	1.71
F1	95	308	0.59	2.71	0.24	82.14	2.71	9.96	1.62	3.57
F2	92	319	0.52	2.33	0.34	83.80	3.55	8.36	3.03	1.25
F3	84	256	0.51	2.26	0.36	79.56	3.52	9.77	4.95	2.21
F4	82	255	0.52	2.28	0.33	71.99	3.66	18.46	4.58	1.31
F5	94	331	0.54	2.46	0.29	75.75	3.22	15.79	3.12	2.11
F6	55	150	0.50	2.01	0.38	70.95	8.43	14.86	5.10	0.67
F7	69	259	0.47	1.98	0.41	81.85	5.92	4.25	6.69	1.29
F8	83	298	0.48	2.11	0.39	80.76	2.46	9.17	5.48	2.13
F9	74	213	0.54	2.33	0.32	76.84	4.07	12.68	3.60	2.82
Z1	89	239	0.61	2.73	0.24	82.73	2.79	8.64	3.20	2.65
Z2	77	193	0.57	2.46	0.30	82.56	5.01	6.22	5.01	1.21
Z3	89	229	0.57	2.54	0.29	75.58	4.07	14.24	4.07	2.03
Z4	60	162	0.54	2.22	0.33	75.51	2.06	16.26	5.56	0.62
Z5	100	240	0.69	3.17	0.15	73.57	2.50	14.88	6.95	2.09
Z6	90	239	0.54	2.42	0.31	75.31	3.35	16.60	3.77	0.98
Z7	85	390	0.42	1.86	0.45	83.49	1.63	10.86	2.91	1.11
Z8	79	212	0.57	2.48	0.29	74.73	5.34	12.72	5.34	1.88
Z9	72	274	0.55	2.34	0.30	76.64	5.60	13.75	2.55	1.46

Station	Diversity					% of each phyla*				
	S	N	J'	H'	Λ	Annelida	Crust.	Mollusca	Echino.	Other
Z10	70	167	0.65	2.76	0.21	69.20	2.80	18.40	7.00	2.60
Z11	78	300	0.43	1.89	0.45	78.22	4.78	11.11	5.22	0.67
Z12	84	209	0.59	2.62	0.25	74.16	2.87	15.47	5.58	1.91
REF1	86	174	0.63	2.83	0.22	68.71	8.45	11.71	8.06	3.07
REF2	75	180	0.56	2.43	0.30	81.15	6.65	6.10	4.25	1.85
REF3	78	225	0.58	2.52	0.27	83.14	6.36	6.66	2.81	1.04
REF4	86	276	0.53	2.34	0.32	84.76	3.26	8.95	1.81	1.21

S = Number of species (including encrusting species); N = Number of individuals; J' = Pielou's Evenness

H' = Shannon-Weiner Diversity (\log_e); Λ = Simpson's Dominance index

Within site variability was found to be low at all of the sites, replicates of each site having 40% or more similarity with each other. However, there was also a high degree of similarity throughout the whole sampling area such that similarities between replicates from different sites were also high.

The faunal communities observed in the 2008 survey showed a high degree of homogeneity and were typical of those found in muddy sand sediment sampled from the continental slope. They had moderate to high diversity and were dominated by the tube-dwelling polychaete *Galathowenia oculata*, which at all but seven of the sites made up at least 50% of the animals present.

Also common to communities in the survey area were sponid, terebellid and sabellid polychaetes, amphipod and isopod crustacea, opisthobranch molluscs, bivalves and juvenile echinoderms.

Treated Surface Water Outfall Location

In 2007, in addition to the survey completed specifically to sample the pipeline route, a benthic survey of the area around the permitted outfall location off Erris Head was also performed from the R/V *Prince Madog* using the same grab sampling methods (photography was not performed). This area (Figure 7-3), encompassing stations varying between 48m and 90m water depth, is effectively the border between the "nearshore" and "offshore" environments. Details of this survey are reported fully in Appendix 7-3 and summarised below.

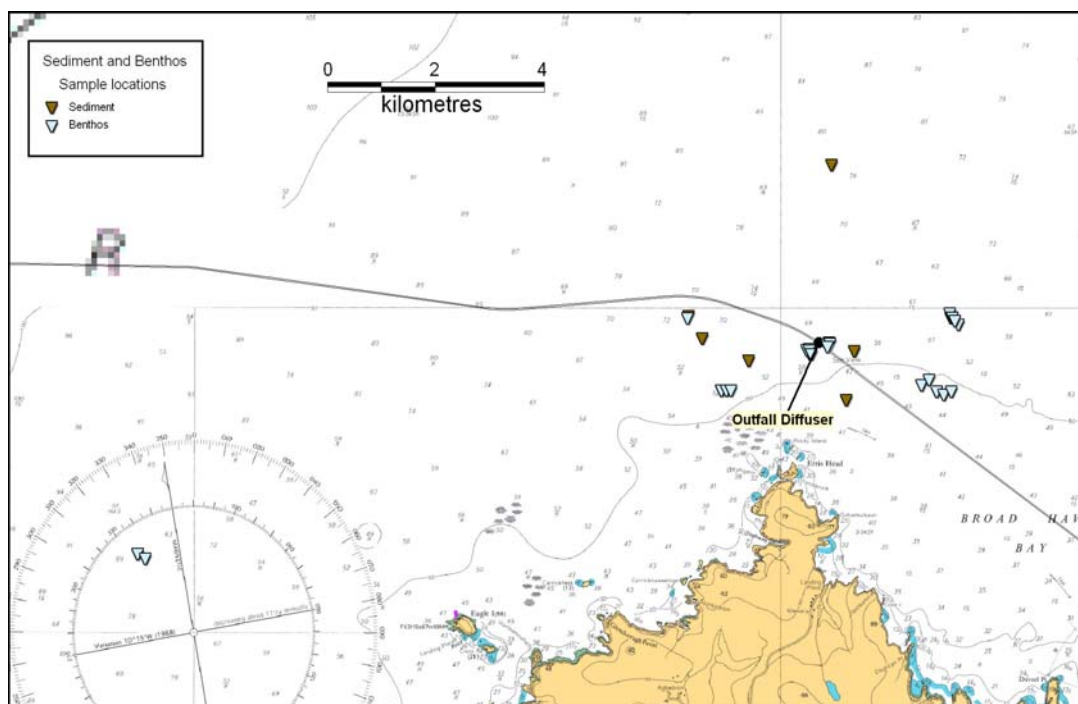


Figure 7-3: Location of Summer 2007 Benthic Sampling Points at the Corrib treated surface water outfall location off Erris Head (R/V *Prince Madog*).

Fauna communities recorded were of moderate to high diversity, and mostly displayed low dominance, although there were some stations where a single species dominated. Polychaete worms, molluscs and crustaceans were all key groups, with nematode and nemertean worms also important in some places.

While there were some noticeable differences in communities, there was also a relatively high degree of similarity over the sampling area, indicating a reasonably homogenous environment. Within-site variability between replicate samples was generally low.

Throughout the outfall sampling area, communities were found to be typical of subtidal sands, ranging from species generally found in stable, fine sand to those found in more exposed coarse sand with gravel, and are generally similar to those recorded from the area in the 2000 survey.

Seabed sampling was also undertaken at the permitted outfall location off Erris Head in 2008 as part of the M/V *Deepworker* survey programme. A total of 12 stations were sampled around the outfall location, and a number of stations were also sampled to cover a wider area in the vicinity of the outfall.

Figure 7-4 shows the 12 locations in the vicinity of Erris Head where benthic sampling took place during the summer 2008 M/V *Deepworker* survey programme. The full report from the 2008 survey at the Erris Head outfall is presented as Appendix 7-4.

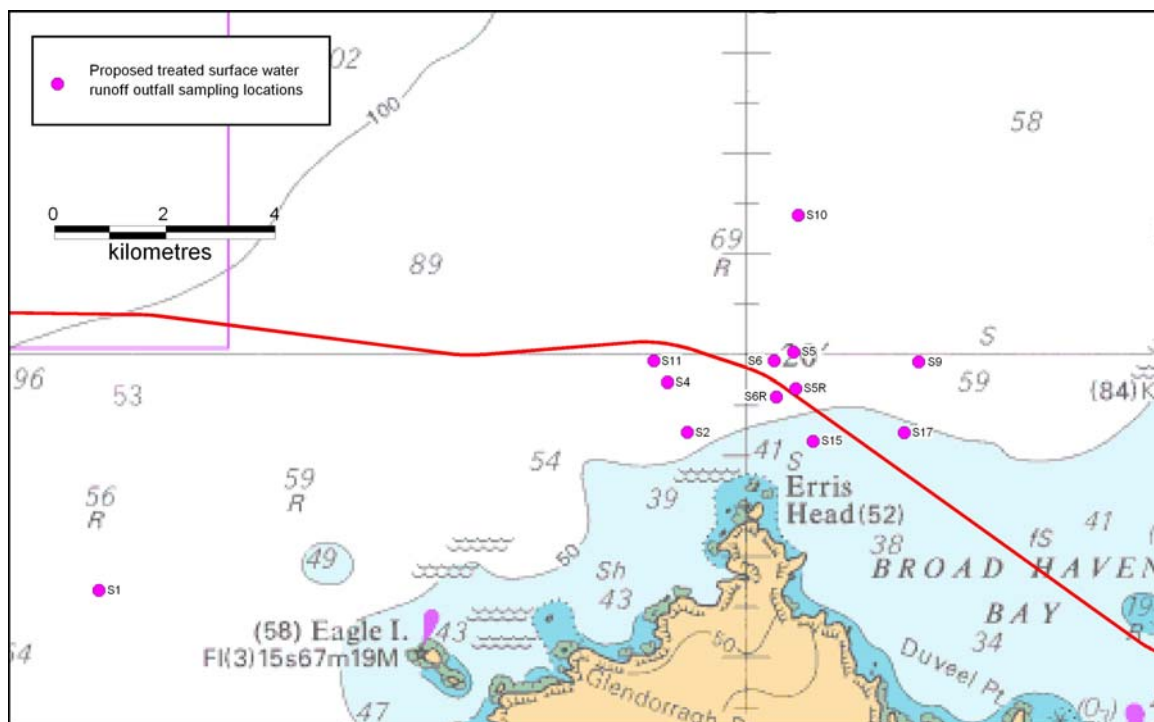


Figure 7-4: Location of Summer 2008 Benthic Sampling Points at the Corrib treated surface water outfall location off Erris Head (M/V *Deepworker*). Sample locations are the same as the 2007 R/V *Prince Madog* summer programme.

Photography

Offshore Pipeline Route

Examples of seabed surface photography (from 2007) at representative shallow and deep stations on the proposed offshore pipeline route are presented in Figure 7-5. The full SPI and surface sediment photographic survey report can be found in Appendix 7-1.



Figure 7-5: Examples of Surface Seabed Photography along the Proposed Pipeline Route, Summer 2007 (Left: rippled sand in Broadhaven Bay at station 25a in 26m water depth; Right: Sediment showing evidence of bioturbation at station 41 (329m), approaching the offshore gas field).

Overall, the photographic surveys found that all pipeline stations surveyed showed evidence of healthy conditions based on the presence of a characteristically deep oxidised layer, fauna and prominent biogenic features such as burrows, tubes and feeding casts. No evidence of impact or habitat quality degradation was recorded; and no sensitive or Annex 1 habitats were found.

Offshore Gas Field

Examples of seabed surface photography at stations in the offshore gas field (from 2008) are presented in Figure 7-6. The full SPI report is included in Appendix 7-2.



Figure 7-6: Examples of Surface Seabed Photography from the offshore field (Summer 2008) (Left: Intensive reworking of sediments by fauna at Corrib Field Reference Station 4. Also shown are anemones, mounds and decapod burrows. An anemone (*Actinuaige richardi*) can be seen on the surface; Right: The typical sediment habitat at the central areas of the Corrib offshore field (Station Z1). Sediments here show intensive reworking by benthic fauna. An urchin can be seen on the sediment surface.).

All offshore field stations surveyed were characterised by the presence of very fine sands and showed evidence of faunal activity. Biological features observed across the site are broadly similar, with the majority of stations showing intensive reworking of sediments by infauna; sediments were observed to have been fluidised to a degree,

through the activities of burrowing fauna (bioturbation). This biological activity has resulted in an apparent oxidised layer that is characteristically quite deep.

The photographic survey results from 2007 and 2008 were in general accord with those obtained along the pipeline route and in the offshore gas field in 2000.

7.3.1.2 Nearshore

In accordance with the construction monitoring programme agreed for the Corrib pipeline, sediments were sampled in Broadhaven Bay in the following surveys:

- 2002 (by EcoServe), intended as a pre-construction survey to installation works that were subsequently delayed;
- Summer 2008 (by RSK), immediately prior to the scheduled installation of the offshore pipeline (subsequently delayed),

In all surveys, sediment was sampled along six transects (A–F), which were positioned across the route of the pipeline through Broadhaven Bay. There were six stations on each transect at 10m, 50m and 500m either side of the route. In addition to the 36 stations on the 6 transects, 2 further stations were sampled as reference stations (it should be noted that the location of these reference stations were changed in 2008 due to sampling difficulties).

Samples were collected from each station for analysis of benthic infauna, grain size and total organic carbon. Seabed photography was also undertaken using an ROV (2002) or by analysing still captured images from a drop-down video camera system (2008).

Figure 7-7 shows the sampling locations along transects across the nearshore pipeline route for the 2008 RSK survey.

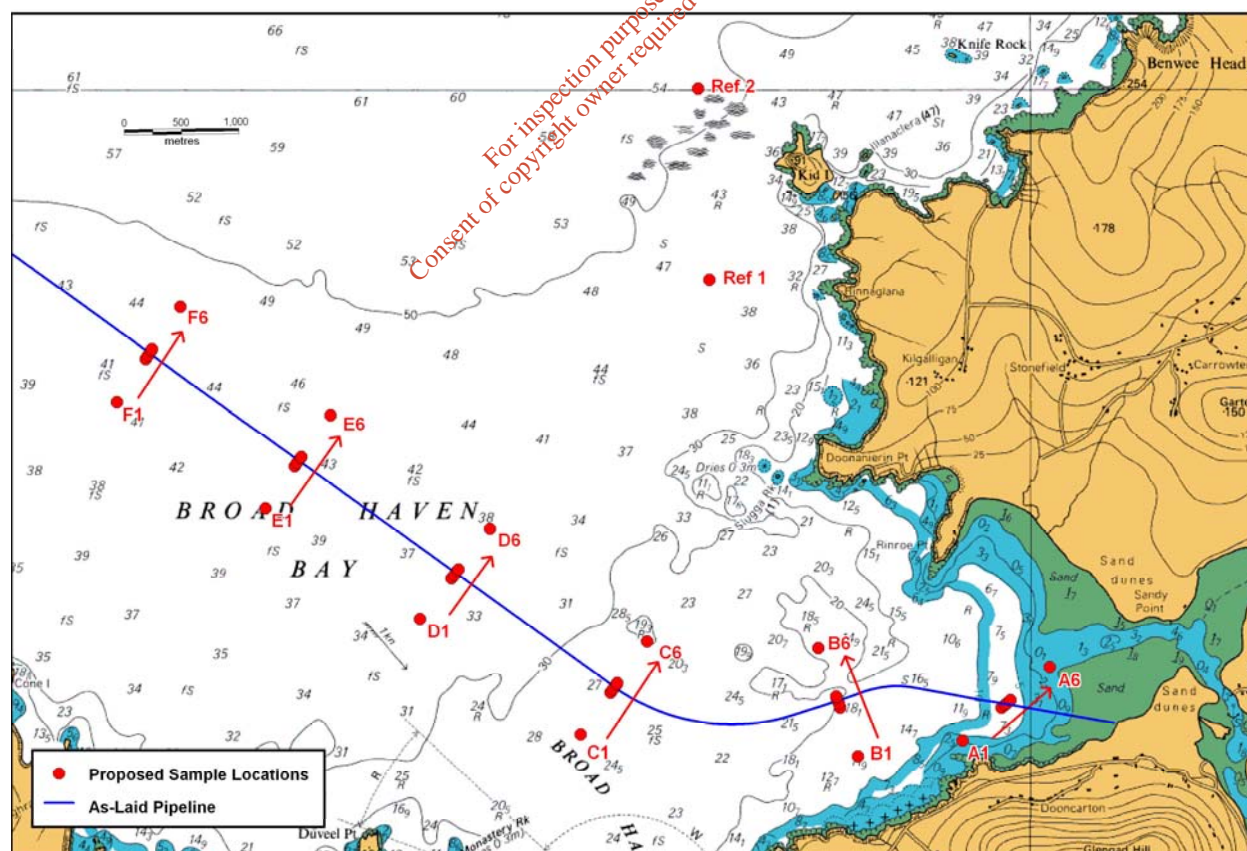


Figure 7-7: Locations of planned sampling stations in Broadhaven Bay during the 2008 RSK survey.

The reports of the 2002 and 2008 nearshore surveys are provided as Appendices 7-5 and 7-6 to this Supplementary Report respectively.

Infauna

The following briefly summarises the results of the 2002 Ecoserve nearshore pipeline survey:

Grab samples were taken from each station identified from the video to consist of relatively soft sediments. A total of 79 species or higher taxa were identified from the grab sampling, including annelids, crustaceans, molluscs, echinoderms, anthozoans, platyhelminthes, nemertean, and a sipunculid

The number of taxa appears to increase with distance from the shore (Appendix 7-5) reaching a peak at Transects D and E, with a slight decrease at Transect F.

The number of taxa at station Ref 1 is comparable to stations along transects D and E. Broadhaven Bay is uniformly sandy and this is reflected in the faunal taxa recorded in the grab samples. None of the species identified are of specific nature conservation importance and are widespread in Ireland (Picton and Costello, 1999).

The overall species abundance and diversity reflect the nature of the bay, being unimpacted and of moderate wave exposure, with a predominantly sandy seabed, with bedrock and boulders at the margins. In addition the species recorded are consistent with the findings of the benthic sampling along the offshore pipeline route carried out in 2000 and reported in the 2001 Offshore EIS.

The benthic macrofaunal communities observed during the 2008 survey were of moderate to high diversity and generally exhibited high evenness and low dominance. These communities showed a high degree of homogeneity and species were typical of those found in sandy sediments, with high contributions to community composition from spionid polychaetes, the amphipods (*Bathyporeia* sp.) and cumaceans.

The community at site A1 proved to be the exception as the species found here were more typical of a shallow water, coarse sediment, encrusting community in the presence of significant macroalgal growth. Such species included the amphipod *Jassa falcata* and a number of colonial encrusting organisms.

It was observed that with increasing depth there was an increasing diversity and abundance of echinoids and *Abra* bivalves, with the highest diversity and number of these species found at transect F sites and the lowest at A sites (except A1).

Although not designed to sample invertebrates, further information on the epifauna within Broadhaven Bay is available from the Irish Groundfish trawl survey (station 25) in October 2009. In addition to fish species hermit crabs (Paguridae) and asteroid seastars (*Asterias rubens*, *Marthasterias glacialis*, *Astropecten irregularis*) were amongst the invertebrates recorded.

Photography

The 2002 results showed that rock habitats varied from sand influenced infralittoral bedrock and boulders at the shallower stations (A1, B1, B5, B6 and C6) to deep circalittoral bedrock at Ref 2. Shallower stations supported kelp with a sparse understory of red algae; however, it was observed that at deeper stations that greater sediment movement was restrictive to the growth of foliose red algae on hard sediment. At site B6 and C6, the water was deeper and the rock was most likely subject to less scour except during stormy conditions. At these stations attached fauna included tunicates *Aplidium punctum*, dead mans fingers (*Alcyonium digitatum*) and the sponges *Cliona celata* and *Polymastia* sp. Mobile fauna such as the sea urchin *Echinus esculentus*, the sea cucumber *Holothuria forskali*, starfish *Asterias rubens* and *Marthasterias glacialis* were found on all areas of the rock but would be likely to avoid areas of high scour when such conditions prevailed. At these sites, the bedrock

supported a kelp park with a more established understory of brown and red algae. At station Ref 2, the water was in excess of 70m deep where it was unlikely for algae to occur due to the reduced light penetration through the water column. The ROV was unable to access the site completely, although it was possible to identify a number of echinoderm species including the sea urchin *Echinus esculentus*, the sea cucumber *Holothuria forskali* and starfish *Luidia ciliaris*. In addition the sponge *Cliona celata* was observed.

None of the species identified from the seabed imagery were of specific nature conservation importance and are widespread in nearshore waters of Ireland (Picton and Costello, 1999).

The 2008 video footage of the seabed produced results that were not wholly in agreement with sediment infauna data produced from macrofaunal analysis. From the video transects, it was observed that increased epifaunal and floral species were encountered at stations adjacent to the shoreline and in shallower waters (Transect A) (particularly off the mouth of the Sruwaddacon). These results were in contrast to the deeper water stations, such as those on Transect F.

It should be noted however, that the two survey methods targeted species with different habits: the grab sampling collects species that live in the seabed, while the photographic work records those that live on it.

7.3.1.3 Landfall

Baseline surveys were undertaken in the intertidal area at the landfall as follows:

- June 2005 (by EcoServe), pre-construction survey; and
- June 2008 (by RSK) pre-construction survey

Sampling locations are presented in Figure 7-8. In the 2005 pre-construction survey, two transects were surveyed: one corresponding to the route of the pipeline and the second representing a control. For the 2008 survey, an additional transect (ZX) was inserted between the control and landfall transects in order to provide further information on the general landfall environment. Three stations were surveyed on each transect corresponding to upper, middle and lower shore. At each station, sediment samples were taken using a core sampler of 10.5cm diameter, to a depth of 20cm. The 2005 survey used a sieve of 1mm to retain fauna, while the 2008 survey used two sieves (1mm and 0.5mm) in order to provide both comparative and additional information. Full survey reports for the 2005 and 2008 surveys are presented as Appendix 7-7 and 7-8 respectively; a summary of results is provided below.

Fine and medium sands dominated the substratum at all stations on both transects, with some coarser material at the lower shore stations. The coarse material is indicative of a disturbed environment and it is the relative instability, which is probably the main reason for the low diversity and abundances recorded.

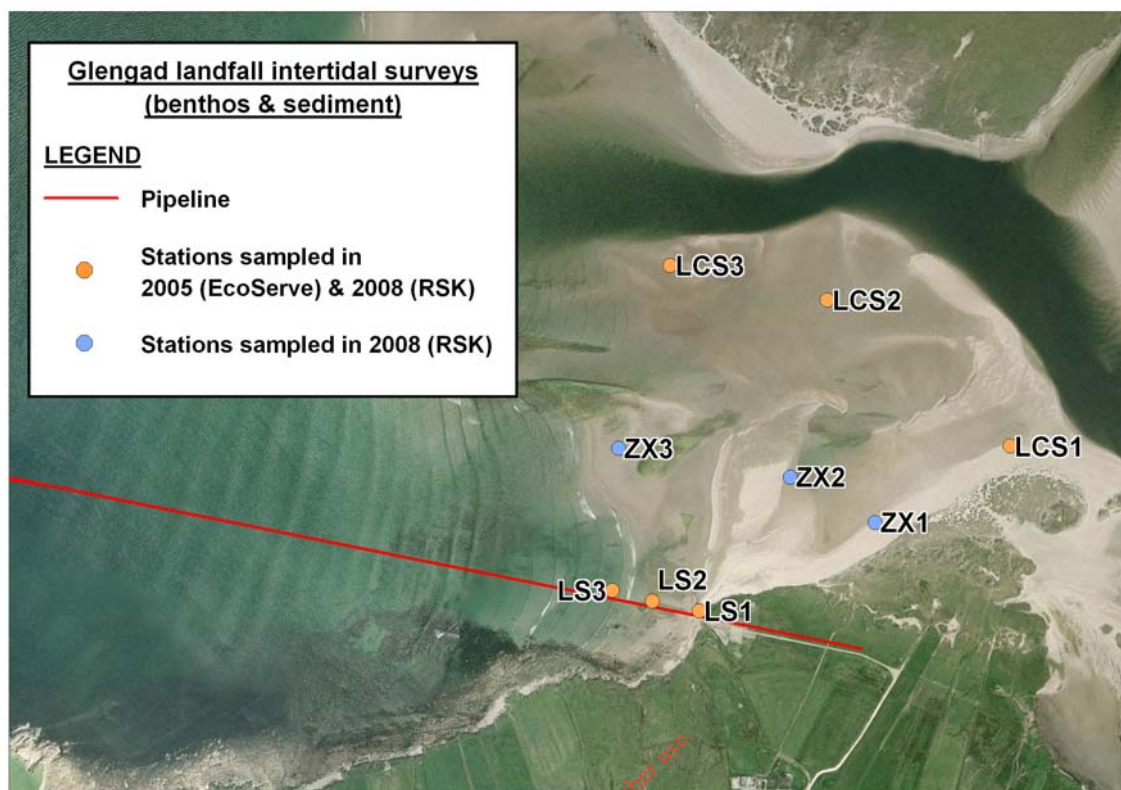


Figure 7-8: Locations of Landfall Sampling Stations in 2005 (EcoServe) and 2008 (RSK).

For all surveys, the following general points can be made:

- Upper shore stations were often entirely devoid of infauna, and usually had the lowest diversity and abundance. Occasionally (June 2008, LCS1), relatively high abundances of talitrid amphipods and oligochaete worms were recorded, associated with dead algae on the highly mobile strandline;
- A fauna characteristic of exposed, high-energy sand beaches was recorded, naturally low in both abundance and diversity. Amphipods and polychaetes comprised the majority of all fauna, with the amphipods *Bathyporeia pelagica* and *Pontocrates arenarius*, and the polychaetes *Ophelia rathkei*, *Microphthalmus*, and *Scolelepis squamata* occurring frequently;
- Other fauna recorded in low abundances included nemerteans (flatworms), nematodes (roundworms) and mysids (opossum shrimps). Molluscs and echinoderms were absent, as expected for a high-energy mobile intertidal sand community.

The 2008 survey recorded the capitellid polychaete *Baldia johnstoni* from the landfall transect, a species only described relatively recently; this is likely to represent a noteworthy first record for Ireland, as it has previously only been recorded on the western North Sea coast of Scotland and northern England (R. Bamber, Associate, Natural History Museum, London, pers. comm.).

Offshore Fisheries

Unpublished data on fish landings by Irish and foreign vessels for 2003–2007 were collected from the Sea Fisheries Protection Authority for the three ICES administrative rectangles along the offshore pipeline route, which is presented in Table 7-3. (NB 37D8=offshore, 37E0=inshore).

Pelagic fish (i.e. living in the water column) are by far the most important in terms of weight, comprising the majority of the catch weight in each of the triangles. Mackerel, horse mackerel, blue whiting and herring are all important.

Demersal (i.e. found on or near the seabed) finfish species such as hake, monkfish, haddock and some flatfish (e.g. megrim, witch) are also caught, along with some elasmobranch fish (dogfish and skates). Deep-sea red crab is caught on the outermost rectangle and edible crab is important in the two inshore rectangles.

All of these data are consistent with those presented in the 2001 Offshore EIS, in both the species present and that pelagic landings were far greater than demersal and/or shellfish landings. However, it is reiterated that the latter two usually command higher prices compared to pelagic fish.

Research surveys

Irish Groundfish Survey weight data for the top ten species for Station 22 (ICES VIIIb, 37D9), West of the Belmullet peninsula and approximately halfway along the length of the pipeline) were collated from the Marine Institute for the two recent surveys (2006 and 2007), and are presented in Table 7-4. It is noted that this station was not sampled in October 2008. These data complement the commercial species data; pelagics were most important with mackerel (and, to a lesser extent, horse mackerel), dominating catches in terms of weight. Commercial demersal species were relatively unimportant by comparison, although haddock was relatively important in 2007. Low-value (gurnard, dab) or non-commercial species (poor cod, dragonet) also comprised some of the catch, providing further information on the fish communities present.

Unpublished data from a Groundfish Survey conducted in 2004 by the Marine Institute allow comparison of relative abundance of species all around Ireland. Unlike usual groundfish surveys, this survey was conducted in spring with the purpose of identifying maturity status of commercial species. None of the important commercial species (haddock, whiting, cod, megrim, hake, monkfish, blue whiting, horse mackerel and herring) were recorded from stations in the vicinity of the pipeline route, suggesting that either these species were not abundant in the area in the spring, and/or the gear being used was not suited to collection of these species. Mackerel, however, was recorded in the pipeline area at its highest abundance throughout Irish waters, and a relatively high number of rays were recorded in this area.

In addition to Groundfish Surveys (conducted using trawling only), Clarke *et al.* (2005) conducted longlining and trawling surveys of eight areas along the shelf edge to the west and north-west of Ireland and, in particular, examined the presence of deepwater elasmobranchs (sharks and skates) in these catches. One of the survey areas was just to the north of the proposed pipeline route (on the slope to the Rockall Trough) and recorded the deepwater shark species *Deania calceus* as a significant component of longline catches here, as well as the commercial teleost fish ling (*Molva* sp.) and tusk (*Brosme brosme*).

Table 7-3: Commercial Fish Landings (Ten most Common Species) for 2008 by ICES Rectangle Along the Export Pipeline Route (NB 37D8=offshore, 37E0=inshore)

37D8			37D9			37E0		
Species	Scientific name	Tonnes	Species	Scientific name	Tonnes	Species	Scientific name	Tonnes
Blue whiting	<i>Micromesistius poutassou</i>	812.6	Horse mackerel	<i>Trachurus</i> spp.	3,353.1	Horse mackerel	<i>Trachurus</i> spp.	321.0
Horse mackerel	<i>Trachurus</i> spp.	468.1	Mackerel	<i>Scomber scombrus</i>	174.3	Edible crab	<i>Cancer pagurus</i>	190.9
Hake	<i>Merluccius merluccius</i>	401.6	Edible crab	<i>Cancer pagurus</i>	160.9	Mackerel	<i>Scomber scombrus</i>	146.6
Monkfish	<i>Lophius</i> spp.	107.9	Hake	<i>Merluccius merluccius</i>	145.5	Herring	<i>Clupea harengus</i>	90.5
Atlantic Pomfret	Bramidae	71.2	Blue whiting	<i>Micromesistius poutassou</i>	135.0	Monkfish	<i>Lophius</i> spp.	14.8
Ling	<i>Molva molva</i>	56.5	Haddock	<i>Melanogrammus aeglefinus</i>	37.8	Lobster	<i>Homarus gammarus</i>	11.7
Megrim spp.	<i>Lepidorhombus</i> spp.	43.1	Monkfish	<i>Lophius</i> spp.	33.6	Haddock	<i>Melanogrammus aeglefinus</i>	11.0
Edible crab	<i>Cancer pagurus</i>	18.0	Ling	<i>Molva molva</i>	11.3	Pollack	<i>Pollachius pollachius</i>	6.4
Greater forkbeard	<i>Phycis blennoides</i>	15.5	Saithe	<i>Pollachius virens</i>	9.4	Cod	<i>Gadus morhua</i>	4.1
Squid various	<i>Loliginidae</i>	11.5	Lobster	<i>Homarus gammarus</i>	7.6	Rays and skates	Rajidae	3.5
Top 10 species total		2005.9	Top 10 species total		4068.5	Top 10 species total		800.6
All species total		2064.3	All species total		4112.3	All species total		818.4

Key to colours: Pelagic teleost fish; demersal teleost fish; shellfish; elasmobranchs. NB 37D8 and 37D9 data: Irish and foreign vessels; 37E0: Irish vessels only.

Table 7-4: Ten most abundant species from Irish Groundfish Survey for 2009 for Station 22 (ICES VIIIb, 37D9, offshore W of Belmullet peninsula, approximately halfway along pipeline route)

Species	Scientific name	Catch (kg)	% weight (% cumulative weight)
Boar fish*	<i>Capros aper</i>	1525.5	73.3 (73.3)
Mackerel	<i>Scomber scombrus</i>	281.3	13.5 (86.8)
Grey gurnard*	<i>Eutrigla gurnardus</i>	104.7	5.0 (91.9)
Haddock	<i>Melanogrammus aeglefinus</i>	93.3	4.5 (96.4)
Lesser spotted dogfish	<i>Scyliorhinus canicula</i>	13.4	0.6 (97.0)
Argentine*	<i>Argentina sphyraena</i>	12.8	0.6 (97.6)
Thornback ray	<i>Raja clavata</i>	7.5	0.4 (98.0)
Horse mackerel	<i>Trachurus trachurus</i>	4.8	0.2 (98.2)
Tub gurnard*	<i>Trigla lucerna</i>	4.7	0.2 (98.4)
Lemon sole	<i>Microstomus kitt</i>	3.4	0.2 (98.6)

%=percentage of total catch weight; cum%=cumulative percentage of total catch weight.

Key to colours: Pelagic teleost fish; demersal teleost fish; elasmobranch

*=Lower value or trash fish, often discarded

7.3.2 Nearshore Fisheries

The Marine Institute at Galway performs the Irish Groundfish Survey during the fourth quarter of each year at a number of fixed stations around the Irish coast for the express purpose of providing scientific advice on commercial fish stock management at a national scale. These research surveys provide important additional data to that of the commercial landings, as fishing vessels only retain, and therefore report, commercially important fish. The surveys are carried out using demersal otter trawling gear similar to that which would be used by commercial trawlers, although for a half-hour towing period (commercial vessels usually for 4-5 hours).

One of the Irish Groundfish Survey stations (Station 25) is located within Broadhaven Bay. Data from the 2006 and 2007 surveys at this station show the greatest catches to be of the shoaling pelagic fish mackerel *Scomber scombrus* and, to a lesser extent, horse mackerel *Trachurus trachurus*. However, these species are likely to be transitory through the bay. Demersal species caught in smaller more consistent quantities, but likely to be much more representative of the fish community in the bay, are dab *Limanda limanda*, grey gurnard *Eutrigla gurnardus*, plaice *Pleuronectes platessa*, thornback ray *Raja clavata*, whiting *Merlangius merlangus*, lesser spotted dogfish *Scyliorhinus canicula* and other species (Table 7-5). These results show a different dominance from those presented in the 2001 Offshore EIS, where the dominant species at this site was whiting. However, overall species composition remains much the same as in the 2000 survey, although percentage composition shows considerable variation based on the opportunistic sampling of shoaling pelagic fish such as mackerel. The 2008 survey data indicates that catches are mostly demersal species and likely to be present year-round; there were relatively small catches of the shoaling and transitory pelagic fish (mackerel and horse mackerel) that have previously both been opportunistically sampled and made up a large percentage of catches.

Table 7-5: Ten Most Abundant Species from Irish Groundfish Survey for 2009 for Station 25 (ICES VIIb, 37E0, within Broadhaven Bay)

Species	Scientific name	Kg	% weight (% cumulative weight)
Plaice	<i>Pleuronectes platessa</i>	42.2	37.1 (37.1)
Dab*	<i>Limanda limanda</i>	28.1	24.7 (61.8)
Thornback ray	<i>Raja clavata</i>	11.9	10.5 (72.3)
Grey gurnard*	<i>Eutrigla gurnardus</i>	10.1	8.9 (81.1)
Squid	<i>Loligo forbesi</i>	6.1	5.4 (86.5)
Sole	<i>Solea solea</i>	3.2	2.8 (89.3)
Tub gurnard*	<i>Chelidonichthys lucernus</i>	1.8	1.6 (90.8)
Mackerel	<i>Scomber scombrus</i>	1.3	1.2 (92.0)
Edible crab	<i>Cancer pagurus</i>	1.3	1.2 (93.2)
Lesser spotted dogfish	<i>Scyliorhinus canicula</i>	0.98	0.9 (94.1)

%=percentage of total catch weight; cum%=cumulative percentage of total catch weight.

Key to colours: Pelagic teleost fish; demersal teleost fish; shellfish; elasmobranch

*=Low value or trash fish, often discarded

N/A=Not a "top 10" species in this year. NR=not recorded.

In addition, in 2006 the Central Fisheries Board conducted a series of fish investigations in a number of estuaries and lagoons around the Irish coast in an EPA-funded study. These surveys used several sampling methods (such as beach-seine netting, fyke netting and beam trawling) to accurately record diversity and relative abundance of fish species from a range of habitats. Sruwaddacon Bay was sampled in October 2006 as part of this programme (CFB, 2006). The survey included performing beam trawls at stations just seaward of the entrance to Sruwaddacon Bay (i.e. SE of Rinroe Point). A list of species recorded in these beam trawl samples from the area is presented in Table 7-6.

Table 7-6: List of Fish Species Recorded SE of Rinroe Point by Beam Trawl in CFB October 2006 Survey

Scientific name	Common name
<i>Entelurus aequoreus</i>	Snake pipefish
<i>Gaidropsarus vulgaris</i>	Three-bearded rockling
<i>Gobiusculus flavescens</i>	2-spot goby
<i>Labrus bimaculatus</i>	Cuckoo wrasse
<i>Liparis liparis</i>	Sea snail
<i>Spinachia spinachia</i>	15-spined stickleback

Trawls in the Sruwaddacon Bay area were characterised by a relatively low catch per unit effort and the lowest diversity of any trawl samples taken under the project (CFB, 2006), which included Newport and Tullaghan Bay, both in County Mayo. None of the species are of particular commercial or conservation interest.

Additional information on fish species found within inner Broadhaven Bay is provided by the Central Fisheries Board's literature on sea angling (CFB, undated). This notes mackerel, flatfish (plaice, flounder, small turbot), rocky-ground associated species (pollack, coalfish, conger, wrasse), elasmobranchs (dogfish and rays) and the high-value sporting fish bass and sea-trout (CFB, undated).

7.3.3 Aquaculture/Shellfishery Activities

There are two licensed aquaculture sites within the Broadhaven Bay area as of January 2009 (presented in Table 7-7); this has fallen from the five sites listed in the 2001 Offshore EIS. As detailed in the RPS Onshore Gas Pipeline EIS 2010, a licence for oyster culture exists at Pollatomish pier within Sruwaddacon Bay. At the current time, this site remains the only licensed aquaculture area in Sruwaddacon Bay.

Table 7-7: Aquaculture Sites within the Broadhaven Bay Area

Code	Location	Species	Method
T10/275A*	Moyrahan Point Area	Pacific oysters	Not stated
T10/81	Pollatomish Pier, Sruwaddacon	Oysters	Bags and trestles
T10/164	Off Moyrahan Point, Belmullet	Oysters and clams	Not stated

Source: A. O'Keeffe, Shellfish Licensing team DCENR 12 October 2007; confirmation as correct K. Gill, Coastal Zone Management Division, 23 January 2009; *Application, updated by K.Gill CZMD 22.2.10.

7.3.4 Seabirds

A desktop study drawing together information available on the bird communities found along the offshore portion of the pipeline route has been completed to provide an up to date understanding. Data have been compiled from several reports and publications. The study focuses primarily on data published since the 2001 Offshore EIS, but also provides a new assessment of results from previously reviewed reports. These sources are described in the full report by Fehily Timoney & Company, attached as Appendix 7-9. The report also acknowledges that data are limited in their capacity to confidently establish overall seabird utilisation over the area over time.

The coastal and offshore waters of Ireland are essential feeding grounds for many seabirds, including non-breeders and passage migrants, throughout the year. Species that have been recorded as present year-round included Fulmar (*Fulmarus glacialis*), Northern Gannet (*Morus bassanus*) and European Shag (*Phalacrocorax aristotelis*), although the Shag was only recorded from the offshore section of the pipeline route. Fulmar and gannet, as well as Atlantic Puffin (*Fratercula arctica*) were recorded throughout the length of the offshore pipeline route. Seasonal migrants present included Manx Shearwater (*Puffinus puffinus*), Storm Petrel (*Hydrobates pelagicus*) and passage migrants include Great, Cory's and Sooty Shearwaters (*Puffinus gravis*, *Calonectris diomedea* and *P. griseus*), Great, Arctic and Pomarine Skuas (*Catharacta skua*, *Stercorarius parasiticus* and *S. pomarinus*). Most of these species are summer migrants, occurring in higher abundance between July and August, however some species such as Great-Northern Diver (*Gavia immer*) occur mainly in winter.

Other notable species recorded are Wilson's and Leach's Petrels (*Oceanites oceanicus* and *Oceanodroma leucorhoa*) and Sabine's Gull (*Larus sabini*). It is likely that other migrant species, e.g. Glaucous Gull (*Larus hyperboreus*), may also occur in the area. Due to increasing conservation concerns, some seabird species present in the area have been "upgraded" in status since the original Offshore 2001 EIS, such as the herring gull (*Larus argentatus*), which was formerly on the Amber list (medium concern) but is now on the Red List (high concern).

Based on July 1999–September 2001 data (Appendix 7-9), seabird species richness on the eastern half of the proposed pipeline route was low (1–4 species) and increased to moderate (5–9 species) in the western half and to 10+ species near the field. Seabird abundance was also shown to be low over the pipeline route with the exception of an area in the western half of the route. While density offshore is generally low, dense concentrations may be encountered occasionally, often in association with changes in oceanographic conditions. During passage migrations (spring and autumn)

and foraging during the breeding season, very large numbers of seabirds (up 10,000 per hour) can pass within 5km of the coast in the area.

Seabird breeding colonies are identified and mapped in the full report (Appendix 7-9); the nearest colony (Danish Cellar) is located approximately 3km from the offshore pipeline route in Broadhaven Bay. There are large colonies of Annex 1 European Storm-petrels close to the pipeline route on Inishglora, Inishkeeragh and the Duvillaun Islands (all off the Mullet Peninsula) and on the Stags of Broadhaven and Illanmaster off the north Mayo coast. The Annex 1 Leach's Storm Petrel has its only Irish breeding colony (310 pairs) on the Stags of Broadhaven.

While the 2001 Offshore EIS did not list the closest breeding colonies to the pipeline route, the other information in the review is broadly in line with the findings of the baseline information presented in 2001.

Little Tern and other tern species

In the 2001 Offshore EIS potential "Minor" impacts to a little tern colony on a shingle/sandpit area to the north of the proposed landfall were discussed. Since 2001, the area on which the colony was situated has been subject to natural wave erosion and no longer exists.

Inishderry is a known breeding colony for a number of species including Sandwich, Common and Arctic Terns. Little Tern have bred there in the past. It is a small island at the southern end of Broadhaven Bay, near Belmullet. It is located over 7 km from the nearest point of the offshore pipeline. In the past, birds commuted between Inishderry and Derreens Island (Carrowmore Lake) via Barnatra, nesting in alternate years on either one or the other of these islands.

The four Annex 1 tern species – Sandwich, Common, Arctic and Little Terns – have nested in the past at various sites in north-west Mayo. Quite large colonies (up to 200 pairs) of Sandwich Terns have nested on Inishderry and on islands in Carrowmore Lake, but none was recorded during the *Seabird 2000* survey in 1998-2002 (Mitchell *et al.*, 2004). Little Terns now seem to be confined mainly to the Inishkea Islands, where there are also colonies of Common and Arctic Terns (Mitchell *et al.*, 2004).

It is considered that there will be no likely significant short term or long term impact on tern species. There will be no impacts on Inishderry from the remaining construction activities associated with the offshore pipeline, neither can it be considered to be within the zone of influence. This was confirmed in consultations with NPWS in August 2008.

7.3.5 Landfall and Onshore Birds

The landfall is on the westerly shore at Glengad where the low cliff is of glacial till. Part of the west-facing cliff comprises the section, which was reinstated in autumn 2002, 2008 and 2009 as part of the offshore pipeline works.

In 2008 surveys were undertaken in order to establish the status of cliff vegetation (if present) at Glengad. The west facing section within, and on either side of, the zone of impact (reinstated cliff) was subsequently surveyed prior to construction and was found not to be ascribable to the Annex I habitat vegetated sea cliffs of the Atlantic and Baltic Coasts.

Prior to excavation in 2002, the cliff was a vertical stony cliff more or less devoid of vegetation, topped by improved agricultural grassland. At that time it would also not have been ascribable to the Annex I habitat Vegetated sea cliffs of the Atlantic and Baltic Coasts.

Further details are provided in the RPS Onshore Gas Pipeline EIS 2010, Appendix J.

Two discrete 'sub-colonies' of Sand Martins were identified during the survey visits to the cliff in 2008 – Colony A (the "original colony") is located 30 m north of the proposed

pipeline landfall while Colony B is located several hundred metres to the south west of the landfall. These two sub-colonies were again found to be active in the 2009 breeding season and a new Sand Martin colony (Colony C) was recorded across the bay at Rinroe Strand.

Sand martins are summer visitors, usually arriving at Glengad in and around the first week in May. Construction activities on the cliff and causeway during the breeding season in 2002 did not appear to interfere with their breeding success or normal feeding activity.

Additionally, there was no evidence to suggest that the construction activities in the vicinity of the colonies in 2008 and 2009 had any impact on Sand Martin breeding activity. This was confirmed by monitoring throughout the breeding season in 2008 and 2009, and also by NPWS Conservation Rangers who visited the site on a number of occasions during the 2008 landfall construction period. Further details are provided in the RPS Onshore Gas Pipeline EIS 2010, Appendix J.

In addition to general high and low water surveys, the Light-bellied Brent Goose (Amber listed, Lynas, *et al.*, 2007) has been surveyed as a target species during overwintering seasons from 2002/2003. The main feeding grounds for this species are at Rinroe and to the west and north of the landfall at Glengad.

Prior to the 2007/08 winter season, the arrival of Light-bellied Brent Geese into the Broadhaven Bay sites was typically recorded in mid-November. However, a much earlier return, by several weeks (typically mid-October), of this species has been recorded in the last three consecutive winter seasons (2007/08, 2008/09 and 2009/10). It should be noted that, despite the early return of the geese, their distribution and behaviour within the bay remains largely unchanged.

The intertidal zone around Glengad is a dynamic system, being subject to continuous erosion and deposition. The Light-bellied Brent Geese are quick to exploit new feeding and roosting opportunities such as the formation of pools or the growth of algae on newly deposited sand and gravel beds. In the most recent season (2009/2010) Light-bellied Brent Geese have been more regularly recorded in North Rossport Bay, particularly at high tide and during heavy swells. In all survey years the number of Light-bellied Brent Geese increased towards the end of the overwintering period, with peak counts typically recorded in March or April. The maximum number of Light-bellied Brent Geese recorded in the Broadhaven Bay/Sruwaddacon area since the 2002/03 peak was 426 on 14th April 2010.

Further details of bird survey results are given in the RPS Onshore Gas Pipeline EIS 2010 Appendix J1.

7.3.6 Marine Mammals

Since the submission of the Offshore ES in 2001, a number of additional studies, commissioned by SEPIL, have been performed in the Broadhaven Bay area. These are discussed below.

Offshore

No project-specific dedicated survey data are available for the pipeline route and field area. However, there have been several studies in the area offshore of Mayo since 2001 that provide updated information on cetaceans:

- 1999–2001: offshore data on records from observers on several “vessels of opportunity”, between July 1999 and October 2001 (reported in Ó Cadhla *et al.*, 2004);
- Summer 2000: a dedicated three-week survey between 30th July–22nd August 2000 (Surveys in Western Irish Waters and the Rockall Trough-SIAR), 2000; also reported in Ó Cadhla *et al.*, 2004); and

- Summer 2004: during May to September 2004, Wall *et al.* (2006) conducted offshore surveys; although no dedicated survey effort took place in the project area, some incidental observations were recorded.
- September 2008: opportunistic offshore data from two-week dedicated Irish Whale and Dolphin Group MMO placed on a vessel of opportunity (RV *Celtic Explorer*, conducting deepwater survey program) (reported in Wall, 2008).

Table 7-8 presents records of cetaceans recorded within 50km of the pipeline and Corrib field. All were previously listed as occurring off north-west Mayo in the 2001 Offshore EIS.

Table 7-8: Cetacean species reported within approximately 50km of the Corrib Offshore Pipeline Route and Field since 2001

Common name	Scientific name	Survey			
		SIAR 2000	1999 - 2001	2004	2008
Humpback whale	<i>Megaptera novaeangliae</i>	NR	•	NR	NR
Northern Bottlenose whale	<i>Hyperoodon ampullatus</i>	•	NR	NR	NR
Bottlenose dolphin	<i>Tursiops truncatus</i>	•	NR	NR	NR
White-sided dolphin	<i>Lagenorhynchus acutus</i>	•	NR	NR	NR
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	•	•	NR	NR
Common dolphin	<i>Delphinus delphis</i>	•	•	•	•
Striped dolphin	<i>Stenella coeruleoalba</i>	•	NR	NR	NR
Harbour porpoise	<i>Phocoena phocoena</i>	•	NR	NR	NR

NR=Not recorded. Sources: SIAR 2000: Ó Cadhla *et al.*, 2003 (Appendix 7-10); 1999-2001: Ó Cadhla *et al.*, 2004; Wall *et al.*, 2006; 2008: Wall, 2008.

Based on the results of the offshore studies, the following conclusions can be made:

- Although no specific pipeline or field surveys have been carried out, the offshore environment of the west coast of Ireland is confirmed as being of European importance for cetaceans; and
- Common and white-sided dolphins were the most frequently occurring cetacean species in the offshore environment in the vicinity of the field and pipeline.

Inshore

Data used in the 2001 Offshore EIS were largely from desk-based sources and SEPIL therefore made a commitment to commission monitoring work as part of the Corrib development. Since then the following surveys have been undertaken by staff from the Coastal and Marine Centre (CMRC), part of University College, Cork and from dedicated MMO's aboard vessels involved in the offshore pipeline construction works through Broadhaven Bay:

- 2001–2002: marine mammal monitoring in Broadhaven Bay. This comprised cliff- and boat-based surveys (both visual monitoring and photo-identification) between August 2001 and October 2002, and acoustic monitoring (Ó Cadhla *et al.*, 2003) (see Appendix 7-10);
- Summer 2005: marine mammal monitoring in Broadhaven Bay, comprising dedicated survey using both visual and acoustic survey methods. Visual monitoring (cliff-based only) comprised 281 hours on 46 separate days between 12th June and 30th September 2005. Acoustic monitoring took place

over a total of 99 days from 24th June to 30th September 2005 (CMRC, 2006) (see Appendix 7-11);

- Summer 2007: during a geophysical survey of the Sruwaddacon undertaken from 19th June to 1st August 2007, a qualified marine mammal observer (MMO) was aboard one of the survey vessels at all times to ensure compliance with best practice. This comprised a total of 20 days observer effort. All sightings of marine mammals were recorded (Collins, 2007) (see Appendix 7-12);
- Summer 2008 onwards: ongoing dedicated marine mammal monitoring in Broadhaven Bay; this comprised dedicated cliff-top visual survey (336 hours total active survey on 45 days in the period May 15th-November 1st), acoustic monitoring (7,852 hours in 2008) and boat-based transect surveys on July 29th and September 25th, the latter of which allowed for photo-identification of bottlenose dolphins (CMRC, 2009) (see Appendix 7-13);
- Summer and Autumn 2008: MMO data from aboard construction vessels within Broadhaven Bay (from July to October);
- 2009: continuation of ongoing dedicated marine mammal monitoring in Broadhaven Bay, comprising cliff-top visual survey from primary monitoring locations (541 hours total active survey over 68 days in the period January 1st – December 31st), cliff-top visual survey from secondary monitoring locations (69 hours over 139 days commencing in May, over a period of 139 days), acoustic monitoring (13,687 hours total during 2009) and boat-based visual transect surveys (55 hours, over a period of 14 days) (see Appendix 7-14); and
- 2009: MMO data from aboard construction vessels within Broadhaven Bay (from April to October) (see Appendix 7-15);

In addition to this dedicated survey effort, validated records of incidental sightings and strandings are available from the database maintained by the Irish Whale and Dolphin Group (www.iwdg.ie). Searches were performed for the period since the submission of the original EIS (October 2001). Table 7-9 summarises the records of marine megafauna (including cetaceans (whales and dolphins), pinnipeds (seals), otter, turtles, basking shark and sunfish) made within Broadhaven Bay.

Table 7-9: Species List of Marine Megafauna Recorded within Broadhaven Bay during Marine Mammal Surveys and Monitoring since October 2001 (NB: does not include cetacean records not identified to species level)

Common name	Scientific name	Survey							
		2001-2002	2005	2007	IWDC 2001-2008	CMRC 2008	MMO 2008	CMRC 2009	MMO 2009
Cetaceans									
Minke whale	<i>Balaenoptera acutorostrata</i>	•	•	NR	NR	•	NR	•	•
Killer whale	<i>Orcinus orca</i>	NR	•	NR	NR	•	NR	•	•
Pilot whale	<i>Globicephala melas</i>	NR	NR	NR	•	NR	NR	NR	NR
Sei whale	<i>Balaenoptera borealis</i>	NR	NR	NR	NR	NR	NR	•	NR
Risso's dolphin	<i>Grampus griseus</i>	•	•	NR	•	•	NR	•	NR
Bottlenose dolphin	<i>Tursiops truncatus</i>	•	•	NR	NR	•	•	•	•
White-sided dolphin	<i>Lagenorhynchus acutus</i>	•	NR	NR	NR	NR	NR	•	NR

Common name	Scientific name	Survey							
		2001-2002	2005	2007	IWDC 2001-2008	CMRC 2008	MMO 2008	CMRC 2009	MMO 2009
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	•	NR	NR	NR	NR	NR	NR	NR
Common dolphin	<i>Delphinus delphis</i>	•	•	NR	•	•	NR	•	•
Harbour porpoise	<i>Phocoena phocoena</i>	•	•	NR	•	•	NR	•	•
Pinnipeds									
Common seal	<i>Phoca vitulina</i>	•	•	•	NR	NR	•	•	•
Grey seal	<i>Halichoerus grypus</i>	•	•	•	NR	•	•	•	•
Unidentified seal	Phocidae	•	•	•	NR	•	•	•	•
Other species of conservation interest									
Otter	<i>Lutra lutra</i>	•	NR	NR	NR	•	NR	NR	NR
Basking shark	<i>Cetorhinus maximus</i>	•	•	NR	NR	•	NR	•	•
Sunfish	<i>Mola mola</i>	•	•	•*	NR	•	•	•	•
Turtle (unidentified)	Chelonioidae	•	NR	NR	NR	NR	NR	•	NR

NR=Not recorded. *Observed in Broadhaven Bay during RSK inshore benthic survey, July 2007

Sources: 2001–2002: Ó Cadhla *et al.*, 2003 (Appendix 7-10); 2005: CMRC, 2005 (Appendix 7-11); CMRC 2007 (Appendix 7-12); Collins, 2007; IWDC 2001–2008: IWDC database records; CMRC – Monitoring Study 2008 (Appendix 7-13); RSK MMO Report, 2009 (Appendix 7-15) and Visser *et al.*, 2010 (Appendix 7-14)

The site-specific surveys above have allowed for a much more accurate assessment of the existing populations in the inshore environment. Based on the results of these studies, the following conclusions can be made:

- Broadhaven Bay and its neighbouring waters are nationally important in terms of both diversity and abundance of cetaceans;
- Photo-identification studies suggested a level of residency of bottlenose dolphins;
- Records of newborn and young calves of dolphins in Broadhaven Bay (common, bottlenose and Risso's) suggest possible importance as a nursery area; and
- Broadhaven Bay is also of importance to other species of conservation importance such as grey and common seals, basking sharks and sunfish.

CMRC monitoring results on cetacean diversity and abundance from 2009 are similar to pre-construction (i.e. 2001-2 and 2005) results. There is a general trend which shows reduced sighting rates in all subsequent monitoring seasons since 2002, however cetacean sightings rates during 2009 are comparable with 2008, with the exception of bottlenose dolphins, which were sighted more frequently in 2009. A similar trend since 2002 is observed with pinnipeds, although the increase in sighting rates was stronger in 2009 compared to 2008.

Although overall sighting numbers for marine mammals are reduced compared to the initial pre-construction monitoring in 2002, numbers of individual animals have

remained relatively consistent throughout the monitoring. The obvious exception to this is bottlenose dolphin, which showed a marked increase in numbers between 2008 and 2009

Acoustic monitoring data shows similar trends in bottlenose dolphin and harbour porpoise detections during 2009 compared to 2008; suggesting similar habitat usage throughout the year

In 2009, the sei whale was observed in Broadhaven Bay. This is the first recorded sighting in Irish coastal waters since the early 1900's (Oudejans and Visser *in press*), and means that a total of 11 species of marine mammals have been observed within Broadhaven Bay cSAC. This is the highest marine mammal diversity found to date in a concentrated area in Irish inshore waters (e.g. Ingram *et al.*, 2003, 2005a, 2005b).

Otters

Otters were recorded in Broadhaven Bay during the marine mammal monitoring survey in both 2001-2002 and 2010 (see Table 7-9). Shore-based otter surveys have been carried out from 2002 to 2008, both as part of general faunal surveys and as targeted species-specific surveys throughout the Sruwaddacon Bay area. Details of these are given in the RPS Onshore Pipeline EIS 2010, Appendix J1. Spraints have been reported from the coastal fringe throughout the Sruwaddacon and Broadhaven Bay areas. Proposed mitigation measures to reduce impacts during construction and the assessment of impacts to this species are also covered in the RPS Onshore Pipeline EIS 2010.

While the surveys carried out since 2001 have greatly added to the baseline information available for the Broadhaven Bay and offshore pipeline route areas, with the exception of the recorded increased usage of the bay by several species of dolphin, the baseline information provided in the 2001 Offshore EIS is broadly accurate.

7.3.7 Designated Conservation Areas along the Subsea Pipeline Route

Broadhaven Bay cSAC

At the time the 2001 Offshore EIS was submitted, Broadhaven Bay was a candidate SAC, this is understood to still be the case, with the same features of interest as proposed in 2001.

Blacksod Bay / Broadhaven pSPA

This site is of high ornithological importance for its excellent diversity of wintering waterfowl and for the nationally important populations of five species that it supports. Of particular note is the usage of the site by over 3% of the national Ringed Plover population. It is also of importance as a breeding site for terns and gulls, especially the Sandwich Tern. It is of note that seven of the species that occur regularly are listed on Annex I of the EU Birds Directive, i.e. Great Northern Diver, Red-throated Diver, Golden Plover, Bar-tailed Godwit, Sandwich Tern, Common Tern and Arctic Tern. Sruwaddacon Bay is part of this large pSPA.

Unlike more recently designated SPAs there is no formal site citation – i.e. the “Intention to designate” notice which lists the species for which the site was designated. However the site synopsis lists species for the site as a whole and includes numbers of birds of international and national importance.

From information received from NPWS in 2008 and subsequently, it is understood that this site is to be re-designated “As part of this process the special conservation interests of the site have been provisionally identified using (a) the 4-year mean peak counts from the period 1995/96 - 1998/99 for wintering water-birds and (b) the 1995 all-Ireland tern survey along with the Seabird 2000 census for breeding seabird interests”(NPWS, 2008). In addition, it is understood that, as a result of recently

recorded numbers of Light-bellied Brent Goose (i.e. from Corrib Brent Goose surveys) that it “should be regarded as a special conservation interest for this site”.

7.4 Characteristics of the Proposed Development

The characteristics of the proposed development are the same as presented in the 2001 Offshore EIS, with minor exceptions. The changes to the original specification are presented in Sections 2 and 3.

Perhaps the most significant change from an ecological impacts perspective is the avoidance of proposed blasting works to construct the pipeline trench through Broadhaven Bay.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and it will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

The pipeline was placed on the seabed, and impacted no more than the surface sediments with the exception of the route in Broadhaven Bay. The pipeline was buried along the route through Broadhaven Bay by constructing a trench in the harder sediments into which it was placed, then covered using the material extracted from the trench. In other areas of the bay, the pipeline was buried using a trenching device.

The placement of rock to protect the pipeline from scour and potential free-spanning and aid pipeline stability in the near shore sections of Broadhaven Bay will be continued (from the works undertaken in 2009) during 2010 and 2011 when the umbilical is planned to be installed.

The umbilical will be trenched throughout its route from the landfall to the field, with the exception of sections with high concentrations of (sub) surface boulders. The umbilical will pass through a conduit at the shore crossing at Glengad. As detailed in Section 2, treated surface water run-off will be discharged through a HDPE pipeline co-located with the offshore pipeline between the terminal and a point approximately 12.5km from the landfall. The umbilical will be used to carry treated produced water to the Corrib field manifold where it will be discharged.

7.5 Potential Impacts of the Proposed Development

Installation of the Pipeline and Umbilical

Impacts from the installation of the pipeline in the offshore areas of the pipeline route were the same as those predicted in the 2001 Offshore EIS, these being temporary in nature and negligible in magnitude. More detailed information on the techniques to be used in the nearshore and landfall areas of the pipeline are now available, and the potential impacts to the ecological interest in the area have been re-assessed based on this new information (provided in Section 3).

At the time when the 2001 Offshore EIS was written, it was expected that blasting of bedrock in the nearshore area would be required to allow for pipeline burial, and the associated potential impacts to fauna in the area were discussed at some length. However, during pre-construction work performed in 2002 in advance of the full installation programme, it became clear that it would be possible to construct the nearshore trench using only mechanical rock breaking techniques, and that there would be no need for blasting. Therefore, there have been no impacts from blasting, and any noise impacts from the excavation of the trench in the nearshore area, and associated vessel activity will be temporary. Given the increased level of information now available on marine mammal activity in the bay, a reassessment of the level of impacts was carried out. It concluded that these impacts would be minor, as the source of greatest potential impact had been removed. Further discussion of noise levels is provided in Section 11.

The footprint of the rock berm placed in Broadhaven Bay in 2009 may increase as result of further rock placement activities in 2010 and 2011. The sandy sediments and rock outcrop seabed habitat within this footprint will be directly impacted in that it will be smothered by rock. This will result in permanent loss of the existing habitat.

During Operation

During operation of the pipeline, there is the potential for leaching of trace metals from the sacrificial anodes placed throughout the length of the pipeline. The potential impact on benthos, plankton and fish will be negligible because of the small volumes involved. The tonnage of anode planned has also been revised downwards since 2001, reducing the possible impact further. Further information is provided in Section 9.

Potential Impacts of the Water Discharges

Emissions of treated surface water run-off and treated produced water will arise from the terminal operations. The treated surface water run-off from hard surfaces around the terminal will be discharged through a pipeline that terminates around 12.5km from the landfall. The produced water will be subject to three stages of treatment before it is discharged via the umbilical to the Corrib Field. The contaminants likely to be present in the produced water discharge have been identified on the basis of the fluids analysed from well testing operations. These contaminants will be treated to their respective Environmental Quality Standards (EQS) (Water Framework Directive (2000/60/EC)). The dispersion of the discharge has been modelled, and the results of that modelling are presented in Appendix 9.1 of this Supplementary Update Report. Initial dilution of the discharge will be significant in the immediate vicinity of the outfall, and as it rises through the water column (because it is less dense than seawater), it will be subject to considerable further dilution. It is anticipated that the dilution of the discharge will be around 100 fold within 5m of the discharge. The discharge of the treated water is therefore predicted to have a negligible impact. The EPA has granted an IPPC licence for the terminal operations. In granting this licence, the potential for environmental damage from the discharge was fully considered by experts in the field of ecotoxicology, with the conclusion that the discharge would not cause detrimental effects to the fauna and flora of the area. While the discharge location for treated produced water is now subject to change (moving from off Erris Head to the Corrib Field), the dilution available will not be reduced, hence there will be no predicted detrimental effects to the fauna in that area.

7.6 Do-Nothing Scenario

No change from 2001 offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

7.7 Mitigation Measures

Mitigation measures have been developed to prevent, control and minimise potential impacts from the offshore components of the development. All works within the cSAC will be subject to detailed consultations with NPWS.

Landfall

Pre-entry ecological surveys were carried out in 2002, 2005, 2008 and 2009 to identify any particular constraints. Construction operations were managed to avoid any impacts to the sand martins that nest in the cliff face adjacent to the work area. Details of mitigation measures to protect this species are given in the RPS Onshore Pipeline EIS 2010, together with more baseline information. It should be noted that there has not been, neither will there be, direct impact on the Sand Martin colony, which is located to the north and northeast of the landfall. There was no evidence to suggest that the construction activities in the vicinity of the colonies in 2008 and 2009 had any

impact on Sand Martin breeding activity. This was confirmed by monitoring throughout the breeding season in 2008 and 2009.

The temporary working area will again be fenced off during construction to prevent encroachment by personnel and machinery outside of the allowable work area and to protect the adjacent habitats. There will be signage to further delineate this exclusion zone.

Observations in October 2008 during the Winter Bird Survey of 2008/9 confirmed that the feeding behaviour of the Brent geese was not affected by onshore or intertidal works associated with the dismantling the causeway, hence no impacts are anticipated to this population.

The algal beds on which the over wintering Light-bellied Brent geese feed are located to the west and north of the landfall at Glengad. These are the main Brent Goose feeding grounds at Glengad and Rinroe and are far enough away from the landfall to be unaffected by construction activities.

The algal beds were observed prior to, and throughout the 2008 and 2009 construction periods at Glengad. It was very noticeable that there was an almost immediate "greening" of the area after the Brent geese left on migration in April.

There was no noticeable reduction in the extent of the algal beds during the 2008 and 2009 construction periods. Indeed, the extent and obvious growth in the algal beds continued throughout and there is no question that the amount of available food crop at Glengad appeared greater in autumn 2008, and subsequently, than it did previously. The area of algal bed also appears to be extending even further eastwards - along the southern edge of the channel edge.

Further information on Brent geese is contained in the RPS Onshore Gas Pipeline EIS 2010, Appendix J.

Broadhaven Bay

Marine Mammals

Vessels and personnel operating within the Broadhaven Bay cSAC do so according to a Code of Conduct that has been developed, and which will be reviewed with any recent information and discussed and agreed with NPWS for all future works. The Code (Appendix 7-16) is based on a risk assessment (Appendix 7-17), which considers the potential for impacts to marine mammals (and other large vertebrates) and is designed to ensure that impacts to marine mammals are minimised. A marine mammal monitoring programme is in place during the construction works through Broadhaven Bay.

The mitigation measures proposed in the 2001 Offshore EIS to minimise impacts to marine mammals from blasting works are no longer necessary as the trench will be constructed using conventional dredging.

Rock-placement works will be undertaken using a fall pipe vessel and for the nearshore works a side stone casting vessel, resupplied with material from a bulk-carrier. It is envisaged that this approach to the rock-placement works will keep the number of vessels involved to a minimum, thus minimising the potential for disturbance. MMO's will be present during rock-placement works, and work will be undertaken during on-going cliff based marine mammal monitoring.

Seabed Habitats

The design of the rock berm to protect a section of the pipeline in Broadhaven Bay is such that the footprint is of minimum dimensions, but sufficient to prevent seabed scour.

The rock berm will provide stable seabed habitat for colonisation by epibenthic species. In addition the rock will be graded and washed prior to placement and is of a type that will remain inert in the marine environment, with no leaching of contaminants.

Water Discharge Pipe and Umbilical

While the impacts of the discharge were assessed as being negligible in 2001, relocation of the discharge to two locations in deeper water will increase the levels of dispersion further such that any impacts will be reduced even further.

7.8 Predicted Impacts of the Proposed Development

Landfall

The mitigation measures that will be employed during construction will ensure that any impacts to the species present in the area will be minimised as far as possible. The assessment of the impacts to onshore species such as nesting birds is discussed further in the RPS Onshore Pipeline EIS 2010.

Broadhaven Bay

The presence of vessels and machinery in the bay during the construction period is likely to result in a temporary disturbance to marine fauna in Broadhaven Bay. However, the extent of activity, and thus potential impact, will be limited in terms of area and duration. Adherence by the vessels involved to the agreed Code of Conduct will further ensure that any impacts to marine mammals are minimised. Since the 2001 Offshore EIS was submitted, the importance of Broadhaven Bay to cetaceans has been established by lengthy field surveys, which have concluded that the area may be used by some species of cetaceans throughout the year, and that it may also be used as a nursery area. In assessing the impacts to marine mammals, it should be noted that the cetacean species recorded in Broadhaven Bay are wide ranging, and Broadhaven is likely to form only a small part of their range.

In the 2001 Offshore EIS, the impacts of pipeline construction on marine mammals were predicted to be minor. While further studies have established the importance of the area for marine mammals, the construction methods to be used in Broadhaven Bay are environmentally more benign. Consequently, the predicted impacts of pipeline construction on marine mammals have been re-assessed and found to be minor.

The predicted impacts to fish from construction in Broadhaven Bay have been reduced from minor to negligible due to the change in trench construction methodology.

The 2001 impact assessment classified the potential impacts to Little Terns as "Minor"; however, these birds do not breed in the area now, and the impact classification should therefore be revised down to negligible.

The sandy sediments and rock outcrop seabed habitat within the footprint off the rockberm will be directly impacted in that it will be smothered by rock. This will result in permanent loss of the existing habitat.

7.9 Monitoring

Offshore Pipeline Route

Marine mammal activity has been monitored closely during the construction and pipe-laying phases.

In the years following construction, the pipeline route will be surveyed periodically using a combination of ship deployed ROV and sidescan sonar surveys. Duration of the surveys will be a few weeks in each case and the survey spread will be continually moving along the pipeline route.

Broadhaven Bay

During the 2002 and 2005, construction operations in Broadhaven Bay, marine mammal surveys were carried out. Since 2008, continuous monitoring has been undertaken reflecting the requirement to monitor both during construction activities and for a 12 month period post construction.

Surveys with a similar scope will be established for future construction work and the protocol will be agreed with the National Parks and Wildlife Service (NPWS).

Future marine mammal observations will be compared with those previous recorded in 2002, 2005, 2008 and 2009. During and post-construction land based otter monitoring surveys will also be carried out.

Monitoring of Brent geese and sand martins will continue throughout the construction period and post-construction.

Seabed sediments and biota

A series of seabed surveys will continue to be carried out in Broadhaven Bay to monitor the sediments following the completion of the construction of the offshore pipeline. The specification of these surveys has been agreed with the DCMNR (now the DCENR) in consultation with the Marine Institute, and pre-construction surveys were carried out in 2002 and 2008 in both cases before pipeline installation was suspended. Post-installation surveys will be scheduled for approximately one and six months post-installation and the final survey scheduled for approximately 12 months after construction and at the same time of year as the pre-construction survey to reduce seasonal influences on the comparison of results between the surveys.

The first of the baseline monitoring surveys for the area around the treated surface water outfall location was undertaken in 2005 (and repeated in 2007 and 2008). This has established a robust baseline against which any future changes can be measured.

7.10 Reinstatement and Residual Impacts

Taking the new data detailed above into consideration, there is no change to the nature of the residual impacts as described in the 2001 Offshore EIS.

8 GEOLOGY AND SEDIMENTS

8.1 Introduction

The 2001 Offshore EIS considered the impacts on the geology and surface sediments associated with the drilling of offshore wells, construction of an offshore pipeline and associated landfall terminating in an underground chamber. It also covered the issues surrounding the two crossings of Sruwaddacon Bay.

As detailed in Section 3, since 2001 much of the construction work has been undertaken on the pipeline route. This includes work in Broadhaven Bay undertaken during the summers of 2002 and 2005, which involved the construction and subsequent reinstatement of a marine trench leading to the proposed landfall site. During 2008 the landfall and nearshore areas were prepared for the installation of the offshore pipeline. This included the excavation by land-based and marine equipment of a trench extending approximately 2km into the bay from the landfall. In 2009 the trench in Broadhaven Bay was re-excavated using dredging vessels and the offshore pipeline and treated surface water discharge pipeline were fully installed. Also in 2009, construction works commenced for scour protection/stability measures for the offshore pipeline in Broadhaven Bay. These works were subsequently suspended. An initial filter layer of protected rock was placed over the offshore pipeline between KP 80 and 81.5, where an outcrop of rock had resulted in free spanning. Trenching was suspended in this area.

This section presents new data that has been acquired since 2001 as a result of further survey work that has been carried out during the development of the project. This includes information generated from surveys at the landfall, in the intertidal and nearshore area of the pipeline route through Broadhaven Bay, and in the area of the Corrib field. The potential impacts to the geology from installation and operation of the section of pipeline between the landfall (including the landfall valve installation (LVI)) and the terminal itself are discussed in the RPS Onshore Pipeline EIS 2010.

It is noted that nearshore construction activity was undertaken in Summer 2008 and subsequently suspended, and that works continued in 2009, when the majority of offshore works, including installation of the pipeline occurred. The remaining offshore construction work is planned for the forthcoming summer period (2010), and the umbilical installation between the field and the landfall is scheduled for 2011. It is therefore acknowledged that some construction-related impacts will have a greater duration than originally envisaged.

8.2 Study Methodology

A number of surveys have been undertaken during the development of the project including:

- 2000 – baseline surveys of Corrib Field and pipeline route (for 2001 Offshore EIS purposes);
- 2002 – pre-construction survey in Broadhaven Bay (to establish baseline for planned pipeline installation in 2002);
- 2005 - pre-construction survey (intertidal) in Broadhaven Bay and Sruwaddacon Bay;
- 2005 – baseline survey around permitted outfall location off Erris Head (to begin development of baseline data set);
- 2007 – repeat of 2000 survey along pipeline route, verifying to update baseline information (to support 2008 Onshore Pipeline and Section 40 Application);

- 2007 - additional baseline survey off Erris Head (providing further baseline information against which any future impacts from proposed discharge could be measured);
- 2008 – pre-construction survey of subtidal and intertidal (landfall) sediments in Broadhaven Bay (repeat of 2002 survey, to establish baseline for planned pipeline installation in 2008);
- 2008 – post-drilling survey in Corrib Field to monitor impact of operations;
- 2008 - additional baseline survey off Erris Head, establishing baseline against which any future impacts could be measured;
- 2009 – construction-related geophysical surveys of pipeline route; and
- 2009 – programme of post-construction monitoring of subtidal and intertidal (landfall) sediments in Broadhaven Bay. Whilst post construction monitoring commenced in 2009 these results are not yet available but will be reported in due course.

In 2000, baseline surveys were conducted along the proposed pipeline route and in the area of the offshore gas field as part of the 2001 Offshore EIS. Further pre-construction surveys were conducted in Broadhaven Bay in 2002 in advance of proposed pipelaying operations.

During 2007 and 2008, many of the sites along the proposed pipeline route, at the treated surface water outfall location, and in the area of the offshore gas field that were previously sampled in 2000 and 2002 were revisited using various vessels including the research vessel R/V *Prince Madog*, the M/V *Nomad* and the M/V *Deepworker* and additional samples were taken. The 2007 surveys were undertaken to verify the findings of the 2000 baseline surveys to support the 2008 Onshore Pipeline and Section 40 application. The 2008 surveys were undertaken to verify the findings of the 2002 baseline surveys as agreed with the Marine Institute and DCMNR in 2002. A number of additional surveys were undertaken in 2008 in order to supplement the baseline data previously collected.

Sampling in 2007 and 2008 consisted of grab sampling, the collection of soft surface sediment (for grain size and chemical analysis), and photography. Photography consisted of images of the intact seabed surface and sediment profile imagery (SPI), whereby an image of a vertical cross-section through the surface sediment is taken. The results of the survey work from 2007 along the offshore pipeline route and 2008 at the offshore gas field are presented in Appendix 7-1 and 7-2 respectively. Section 8.3 below, which describes the superficial sediments in the area of the Corrib offshore field, along the pipeline route, and at the treated surface water outfall location, has been updated to reflect the new information which has been collected. The sediment descriptions as defined by their class size are based on the Udden-Wentworth classification system, which is the preferred method for describing particle size distributions.

8.3 Receiving Environment

8.3.1 Quaternary Geology and Superficial Sediments

Figure 8.3 of the 2001 Offshore EIS presents the full overview of the superficial geology as it relates to the pipeline route. In 2007, an updated offshore pipeline route survey was carried out, the results of which are discussed below.

8.3.1.1 The Offshore Gas Field

Figure 8-1 shows the locations at the offshore field at which seabed sediment samples were taken for physico-chemical analysis in 2008.

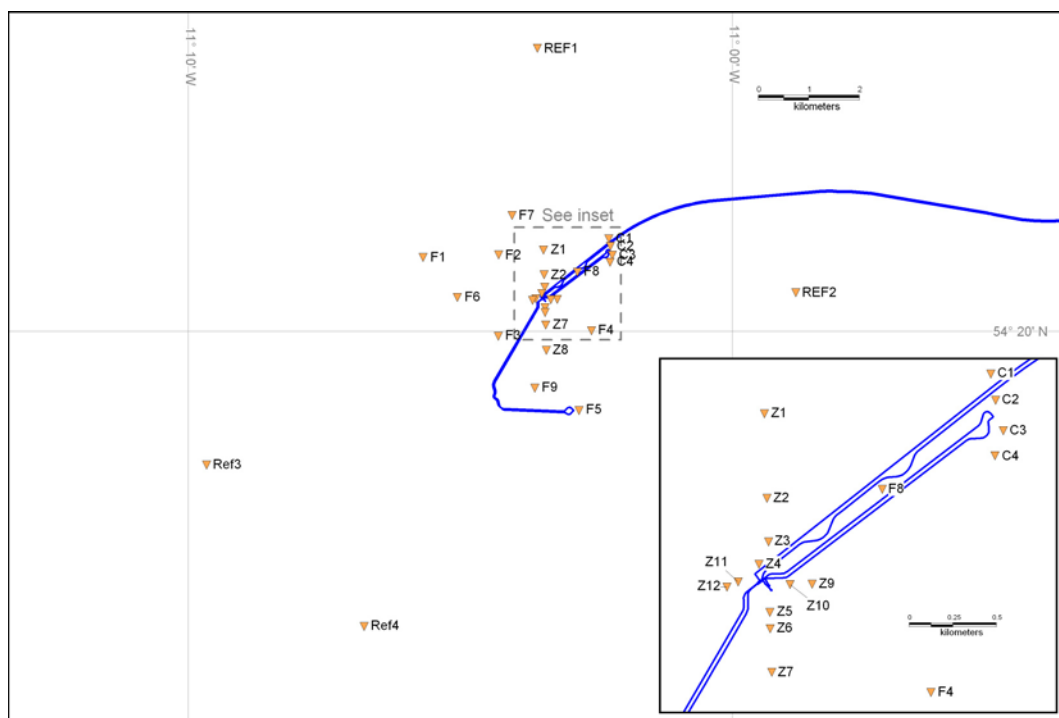


Figure 8-1: Seabed sediment sampling locations at the offshore gas field

As mentioned in Section 7, the benthic survey in 2008 comprised sediment sampling by grab sampler, and photographic sampling of the seabed primarily using a double Van-Veen grab of 0.2m² (2x0.1m²) and a surface and sediment profile imagery (SPI) camera system. A total of twenty-nine locations were visited.

At each station, four replicate samples were obtained; sediment for physico-chemical analysis was subsampled from the 4th replicate.

Subsamples were taken for the following physico-chemical analyses:

- Particle Size Analysis;
- Organic Chemistry; and
- Inorganic Chemistry.

The predominant component of the sediment at the offshore gas field is sand (approximately two thirds in the majority of cases) while the remaining third is predominantly mud. Gravel was only recorded in small quantities at sample site F1.

The SPI photography tended to confirm the results of the particle size analysis in that all of the stations that were investigated at the offshore gas field were characterised by the presence of very fine sands.

Total organic carbon levels are generally low, as would be expected in sediments where there are low levels of fine material (mud).

Total organic extracts (TOE) were analysed to detect any saturated hydrocarbons (including anthropogenic hydrocarbons such as drilling related base-oils) that may be present in the sediment. Concentrations of TOE in the samples are considered consistent with 'background' levels as previously seen at the offshore gas field (Benthic Solutions Limited 2006, RSK 2007 and 2009 (Appendix 7-1 and 7-2).

TOE concentrations were higher than those found at inshore sites. All sites had values in excess of 0.005mg/kg (typically ca. 0.01mg/kg) whereas around the treated surface water outfall to the north of Erris Head, the concentrations, with the exception of site S10 (0.014mg/kg), were <0.005mg/kg and in one case <0.001 mg/kg.

Ecomul was only detected at two sites (Z4 and Z10) and Ecosol only at site F1; albeit all in low concentrations.

Most of the sites at the Corrib offshore field had metal concentrations very similar to those observed closer inshore, near Erris Head, with no readily discernable distribution pattern, which further reflects the pristine nature of the location. The marked exception however, was the significantly elevated concentrations of barium found at several sites: in some cases up to 200-fold greater than background values. These values are the consequence of local drilling activities. This is discussed in more detail in Section 8.3.1.5.

The data sets for metals and hydrocarbons reflect a pristine environment. With the limitations of differing pre-treatment and subsequent analytical methods, the data are in accordance with other published work. With the exception of barium (and possibly some PAHs) in the vicinity of the Corrib offshore field, there is little evidence of significant variations from typical background levels. The elevated concentrations are almost certainly a consequence of local drilling activities.

No determinants were found at concentrations that would give rise to concern regarding potential biological impacts.

8.3.1.2 The Offshore Pipeline Route

The 2007 verification survey locations along the pipeline route, and their positions relative to the pipeline end manifold (PLEM) in the Corrib offshore field (kilometre points – KPs) are presented in Figure 8.2. The 2007 offshore pipeline route verification survey was a repeat of the original survey undertaken in 2000, for the 2001 Offshore EIS.

The 2002 and 2008 nearshore surveys provided additional information regarding the benthic environment to that obtained from previous surveys. Both surveys were undertaken as pre-construction baseline surveys, scheduled to take place immediately prior to the summer 2002 and 2008 Broadhaven Bay construction periods. These surveys relate only to the section of the offshore pipeline route through Broadhaven Bay, which is described in the 2001 Offshore EIS between KP 77.0 – KP83.2. Figure 8.3 shows the sampling locations and transects sampled during the 2008 Broadhaven Bay survey, which revisits the same transects on the nearshore pipeline route that were sampled in 2002.

Descriptive text from the 2001 Offshore EIS is only presented where the section of the pipeline route to which it relates has been sampled more recently. The sedimentological descriptions follow the methodology used in the 2001 Offshore EIS.

It should be noted that the 2001 Offshore EIS also provided a baseline description for the “northern route”, an optional pipeline route that was investigated to provide an alternative route around what was considered a difficult area of seabed off Erris Head. The northern route has since been discounted as an option, as it has been possible to route the pipeline through the area off Erris Head, which is a more direct approach. The route shown in Figure 8.2 is the one along which the pipeline has been constructed.

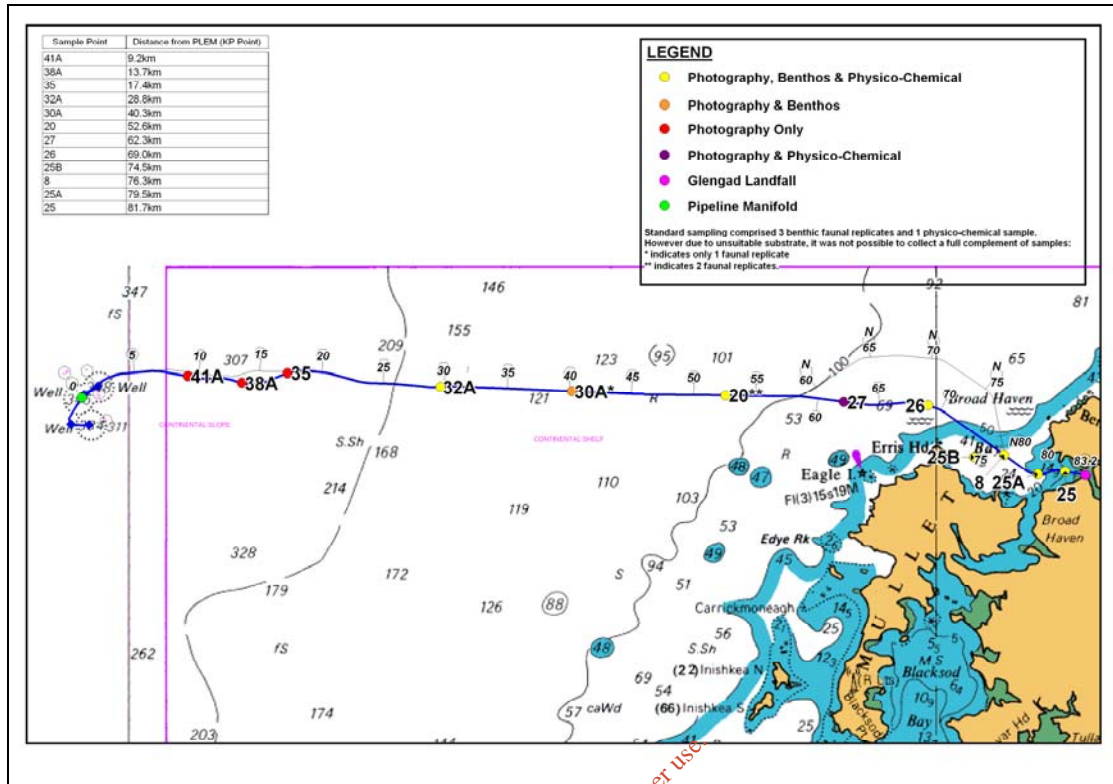


Figure 8.2: Offshore Pipeline Route Seabed Sample Locations - 2007

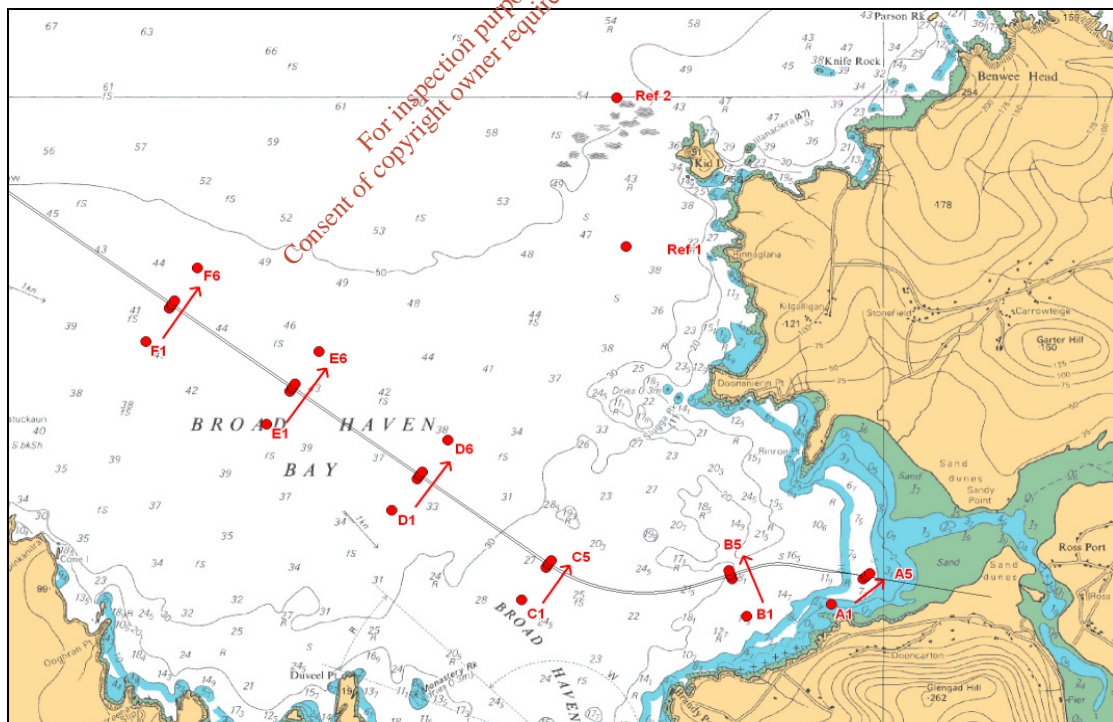


Figure 8.3: Locations of the Drop-Down Video and Grab Sample Sites in Broadhaven Bay from the 2008 nearshore pipeline survey

KP4.5–KP 28.0

Sampling was attempted at three locations (41A, 38A and 35, at KPs 9.2, 13.7 and 17.4 respectively) within this section of the pipeline route. Attempts at all three locations, even using two different types of grab, were relatively unsuccessful. This was due to small stones becoming trapped in the jaws of the grab, which allowed much of the finer material to be washed out during retrieval through the water column. At all three locations, however, photographs of the surface of the seabed were successfully taken (see Appendix 7-1). It can be seen from those photographs and SPI images (in the same Appendix) that the sediments are generally muddy, but also contained many small stones, sand and shell fragments.

These results compliment those from 2000, where the sediments are described in this area as muddy with gravel and occasional boulders.

KP28.0–KP45.1

In 2007, a grab sample was taken from station 32A, at KP 28.8. Data from that sample indicates that the sediment was classed as very coarse sand with some gravel. The seabed photography shows the sediment to comprise coarse sand, with many small stones and shell fragments. Repeated attempts to collect a sample at station 30A (KP 40.3) failed, with pebbles being trapped in the jaws of the grab. The seabed photographs from 30A recorded occasional cobbles (likely to be glacial erratics with the overall seabed sediment similar in nature to that at site 32A).

These observations correspond with those recorded in 2000 (for the area between KP 40.5–45.1), which were stated as coarse gravel, cobbles and small boulders with only an occasional sandy veneer and thicker sand patches in places.

KP50.45–KP58.0

In 2007, repeated sampling using two types of grab was attempted at station 20, at KP (52.6). No successful samples were obtained, with grabs invariably returning only pebbles; many grabs were returned empty, indicating a compact impenetrable seabed. One of the surface photographs taken shows gravelly sediment, while the remaining two record sandier sediment with shell fragments.

The 2007 results in this area generally concur with the 2000 assessment of the seabed, which was stated to be a weathered till material comprising a hard, gravelly sandy clay with coarse gravels/cobbles.

KP58.0–KP65.35

Small samples of surface sediment were collected at station 27 (KP62.3) in 2007, possibly indicating well-packed sediment. Samples were classified as medium sand. Imaging at this site indicated sandy sediments and some shelly gravel. Rippling indicated sediment transport in this area, which concurs with 2000 data. Overall, sediment data also agrees with the 2000 conditions of gravelly sand covered by a rippled veneer of sand.

KP66.7–KP70.55

Station 26 (at KP69) was successfully sampled in 2007, being classified as very coarse sand with some shells. Surface photography at this site clearly shows a coarse shelly sand and abundant intact shell material, with patchy finer sand.

2007 data therefore agree with 2000 data of sandy gravels covered by a slightly rippled sandy veneer, suggesting active sediment transport.

KP70.55–KP77.0

At station 8 (KP76.3), sediment was successfully sampled in 2007 and classified as fine sand. Waveforms of around 8cm were recorded photographically here, indicating significant sediment movement. Occasional shell material in the sand was also observed.

These results are in general agreement with 2000 data.

KP77.0–KP83.2 Broadhaven Bay

Sediment at stations 25A (KP79.5) and 25 (KP81.7, the most inshore of stations) within inner Broadhaven Bay were sampled successfully in 2007 and can be classified as sand (Folk) or medium sand (Udden-Wentworth). Photography at station 25a supported this data and also recorded some rippling of surface sediment; no apparent bedforms could be discerned from images at station 25.

2002 Broadhaven Bay – Baseline survey

In 2002, EcoServe was commissioned to sample seabed sediment along six transects (A-F), which were positioned across the route of the pipeline through Broadhaven Bay. There were 6 stations on each transect, positioned 10, 50 and 500m either side of the route. In addition to the 36 stations on the 6 transects, 2 further stations were sampled as reference stations.

Sediment grab samples & granulometric analysis

A sub-sample of sediment was taken from the first successful grab sample at each station, labelled and sent for further analysis in the laboratory. The results were then compared with standard sediment scales (Wentworth, 1922).

Analysis of the sediment grain size showed that the seabed of Broadhaven Bay is generally comprised of sand. When using the scale developed by Wentworth (1922), the seabed varies from very coarse sand to medium sand with very low or no 'silt' or 'mud' present. The majority of the sites towards the inner bay (Transects A – D) are medium sand apart from site A1, which is very coarse sand; at this station, the number of taxa recorded was also low. This A1 site is shallow (11.2m BSL) and adjacent to bedrock outcrops on the south side of the bay. It is likely that the close proximity of the hard substratum locally intensifies the water movement as a result of wave action causing an increase in mobility of the sediments and the consequent winnowing out of the finer fraction.

The granulometric analysis shows that there is a very slight gradient from medium sand to coarse sand towards the head of the bay, which is a common situation due to the higher energy regimes closer to the shoreline. An increase in sediment movement may result in the loss of the finer sediment particles resulting in generally coarser sediment than the rest of the bay.

The results of the granulometric analysis are given in full in Appendix 7-5. No sediment samples were analysed from stations B1, B6, D6, F6 and Ref 2, as the seabed comprised bedrock and boulders.

2008 Broadhaven Bay – Baseline survey

As described in Section 7, the 2008 survey of the nearshore seabed along the offshore pipeline route through Broadhaven Bay, involved seabed-sampling techniques using a 0.1m² day grab, and the analysis of still images taken from a drop-down video camera system. This survey was a repeat of the 2002 nearshore pre-construction survey undertaken by EcoServe. The survey was scheduled to take place immediately prior to construction works in Broadhaven Bay in summer 2008.

Limited physico-chemical analyses comprising particle size analysis (PSA) and Total Organic Carbon (TOC), were undertaken on the sediment samples.

With the exception of site A1 (Figure 8.3), sites throughout the sampling area were predominantly comprised of sandy sediments, with over 70% of the sediment at each site being recorded as medium to fine sand. There was very little mud component, and where mud was encountered in samples, it was in extremely low proportions.

TOC levels were typically low, as would be expected in such sediments where only low levels of finer grained materials (the sediment fraction that tends to bind organic components) were encountered.

Analysis of the video footage tends to support the laboratory analysis of PSA in that the large majority of the seabed sediments observed along the pipeline transects appear to comprise fine sands with some shell fragments visible. Reference stations 1 and 2 both showed evidence of rocky outcrops with boulders and more gravelly sediments.

The results of the 2008 nearshore survey are appended to this report as Appendix 7-6.

In summary, the 2007 and 2008 sediment survey data along the route of the nearshore pipeline corresponds with the 2001 description of mainly featureless sand with intermittent gravels and also concurs with the results of the 2002 nearshore survey.

Rock Placement Works

In August 2008, a previously uncharted outcrop of exposed bedrock was identified in around 19m water depth, approximately SSE of Rinroe Point. This was subsequently confirmed by a geophysical survey of the nearshore area during summer 2009.

In order to reduce the risk of the pipeline free-spanning, approximately 10,000 m³ of graded rock with a specific density of approximately 2.7 tonnes/m³ has been deposited onto the seabed over the pipe area to form a protective rock berm. The rock placed in 2009 forms a filter layer. Washed and graded rock material was deposited by the rock placement vessel *Tertnes*, which has a flexible fall pipe, in September and October 2009. Details of the rock placement are presented in Table 8-1 below. The overall extent of rock placement over the identified section of the nearshore pipeline in Broadhaven Bay is shown in Figure 8-4. This also covered the section west of the rock outcrop where trenching was suspended as result of boulder-rich sediment, inclement weather and mechanical wear and tear of the subsea trenching machine.

Table 8-1 Details of protective rock berm placed during 2009

Parameter	
Berm KP start/end	80.00/81.5
Berm length	1500m
Total Installed volume of rock berm	10,226 m ³
Rock origin	Quarry, Sløvag (Norway)
Rock type	Granite/gneiss
Rock particle diameter	25 mm and 200 mm

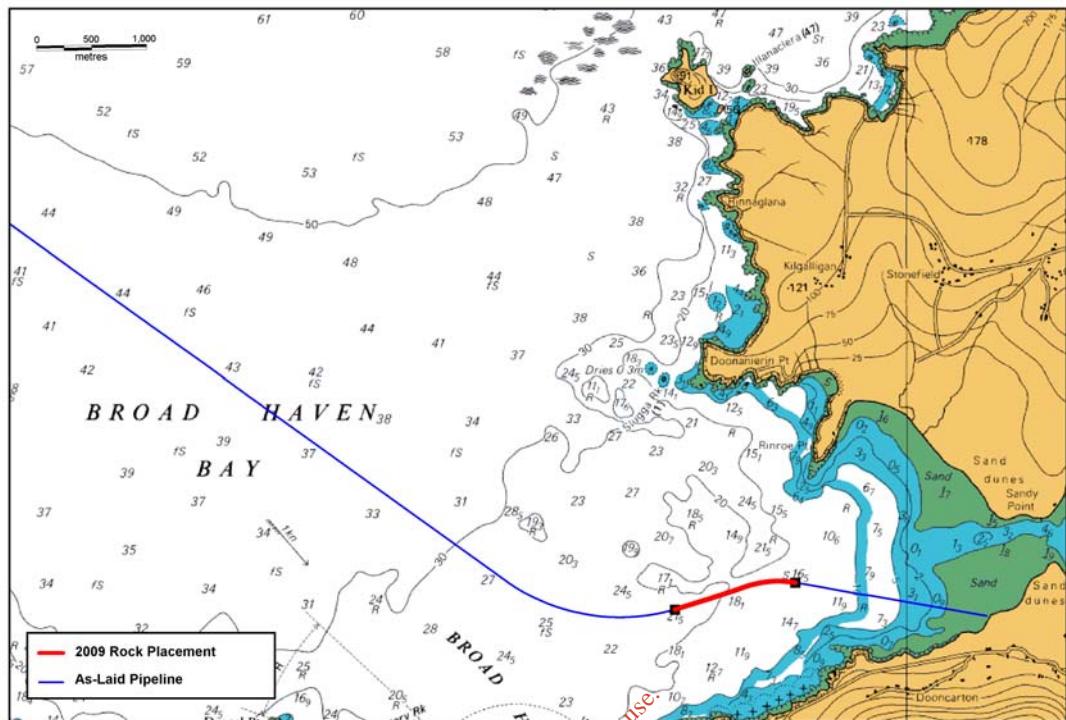


Figure 8-4: Extent of rock placement in Broadhaven Bay during 2009.

Further rock placement works, scheduled to take place during 2010/2011, are detailed in Section 8.4 and Section 3.

Intertidal

In 2005, Ecoserve undertook core sampling of surface sediments (see Appendix 7-7) along the route of the pipeline through the intertidal and on an adjacent transect on Glengad, which is intended to act as a control site. In 2008, RSK undertook repeat sampling at the landfall along these two transects, and at an additional transect between these two (Figure 8-5).

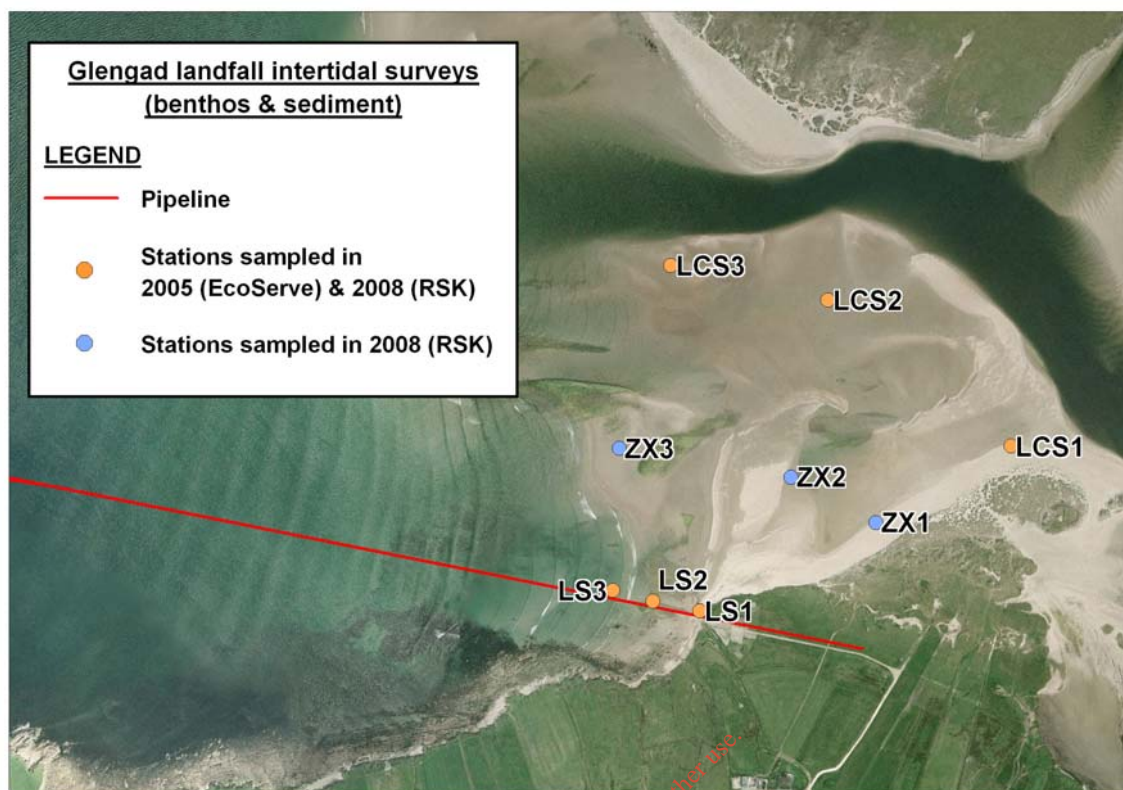


Figure 8-5: EcoServe 2005 and RSK 2008 offshore pipeline landfall sampling locations

In the 2005 survey, fine and medium sands dominated the substratum at all stations on both transects, with some coarser material at the lower shore stations (Figure 8-6). No Total Organic Carbon (TOC) data were collected in 2005.

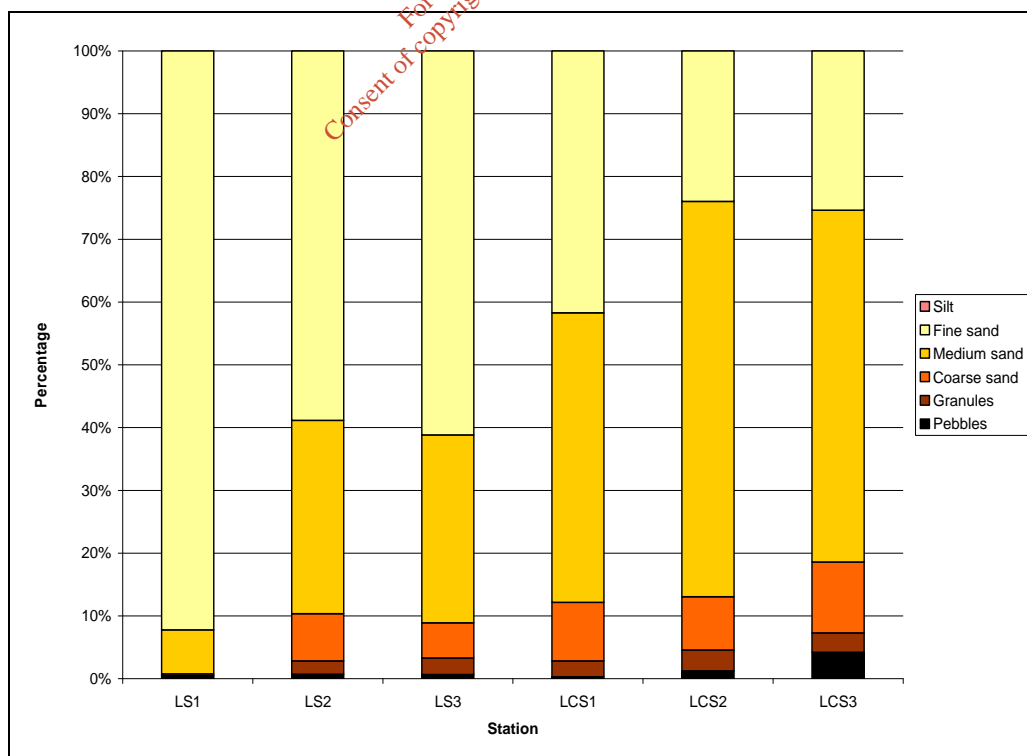


Figure 8-6: Grain Size Distribution at Intertidal Stations (2005)

In 2008, the results were broadly consistent with those from 2005. All sediment samples consisted entirely of medium sand, with no gravel (>2mm) or mud (<63µm) recorded. This reflects the high-energy environment and its high degree of sorting. Levels of TOC were below the detection limit of 0.1% at all stations (except at LCS1), reflecting the absence of fine sediment with which TOC is usually correlated. The higher levels of TOC observed at LCS1 are likely to be due to the presence of dead algal matter on the strandline.

As mentioned in Section 8.2, post construction monitoring surveys of the intertidal sediments at the landfall have commenced, and the results will be reported in 2010, following completion of the survey programme.

8.3.1.3 Treated Surface Water Outfall Location

Figure 8-7 shows seabed sediment sampling locations at the treated surface water outfall off Erris Head.

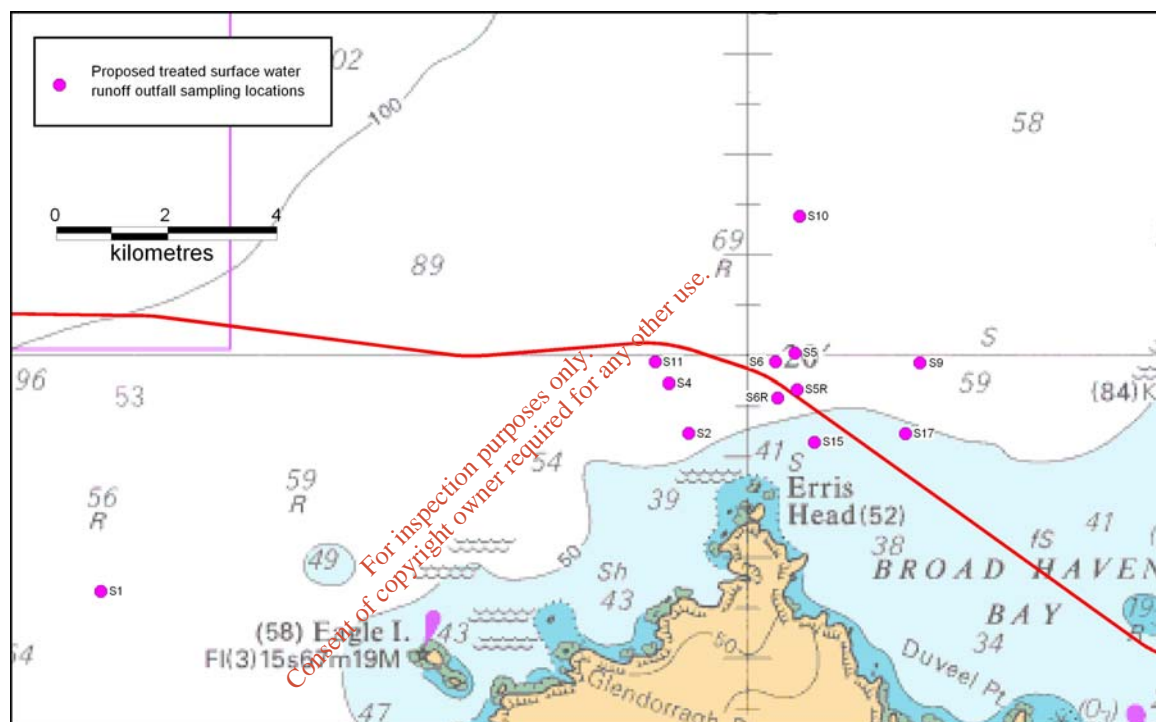


Figure 8-7: Location of Summer 2008 MV Deepworker Benthic Sampling Points at the treated surface water outfall off Erris Head

The techniques employed for seabed sample collection at these stations were the same as those used in the area of the Corrib offshore field, with the exception that no seabed photography was employed. The 2008 survey (Appendix 7-4) was a repeat of the 2007 survey undertaken at the treated surface water outfall (see Appendix 7-3), and the sampling methods undertaken were consistent between the two surveys.

Seabed sediments are characterised by sand as the predominant fraction present, with low levels of gravel, particularly at three sites (S1, S5 and S6R). Minimal levels of mud were recorded in several of the samples. Overall, sediments were coarser in nature at the sampling locations off Erris Head and rocks and cobbles were encountered much more frequently, compared with those at the Corrib offshore field. Sediment grain size results are broadly as expected given the previous sampling in the area. The sediment tends to be coarse in the nearshore areas and with reduced median grain size offshore, though no fine material was collected at any station.

TOC levels are low, in line with the predominance of coarse sediment material; there are no appreciable differences in the TOC levels at the treated surface water outfall stations compared with those at the Corrib offshore field.

The concentrations of TOE in the samples are considered consistent with 'background' levels as previously seen along the pipeline route and around the treated surface water outfall (Benthic Solutions Limited 2006, RSK 2007 (Appendix 7-1)). As expected, there was no evidence of anthropogenically-derived hydrocarbons in the sediments in the vicinity of the offshore sampling stations.

8.3.1.4 Landfall Topography and Geology

Information obtained from Borehole 1-02, located approximately 50m inland from the high water mark and drilled in September 2001, suggests that solid rock (quartzite and psammite) occurs at 4.40m below seabed, overlain by approximately 1m of weathered rock, which is in turn overlain by approximately 3m of sands and gravels.

8.3.1.5 Existing Pollutant Levels

In the 2001 Offshore EIS, sediment pollutant levels were only discussed in relation to the Corrib field itself, particularly with reference to the drilling activities that had taken place and the discharge of cuttings in the area. As discussed in Section 8.2, sediment samples were collected during 2007 and 2008 from a number of locations along the pipeline route, in the area of the Corrib field, and in the vicinity of the treated surface water outfall. These were analysed to determine the content of a number of metals and organic chemicals. Table 8-2 presents a summary of the range of metal concentration data in comparison with OSPAR and Environment Canada Guidelines. The full set of results for the 2007 pipeline and treated surface water outfall surveys are presented in Appendices 7-1 and 7-3 respectively, which also contains the results of the organic analyses.

As noted above, the sediments collected along the pipeline route were fairly coarse, and none of the sites contained material <63µm - the sediment fraction that is chosen frequently in studies to determine the extent of anthropogenic impact, as metals tend to be bound to the finer, predominantly clayey material in marine sediments. Under these circumstances, it is expected that the concentrations would be quite low, and this was generally found to be the case.

Appendix 7-1 also provides a comparison of the metal results with those from a number of other European areas. It can be seen from Table 8-2 and Appendix 7-1 that the levels of trace metals in the sediments along the pipeline route, at the field and treated surface water outfall locations are low, as would be expected for a site with little or no anthropogenic impact. The exception to this is certain sites in the Corrib Field (see Appendix 7-1 and 7-2), where localised elevated concentrations of barium are observed in the seabed sediments. These concentrations are observed up to 200 times background levels and are certainly due to drilling activities. Barium is the metal found in highest concentrations in drilling muds, in the form of barite (BaSO₄). Due to its low solubility and the fact that it is not toxic as a sulphate, the elevated barium concentrations in this location are not considered to be of toxicological concern.

Table 8-2: Observed Range of Metals in Sediments Along the Proposed Pipeline Route, at the Offshore Gas Field and at the proposed Treated Surface Water Outfall Location and Guideline Concentrations

Metal mg/kg	Corrib Pipeline range	Corrib Offshore Gas Field & Treated Surface Water Outfall	OSPAR BC*	OSPAR EAC lower limit	OSPAR EAC upper limit	Environment Canada TEL	Environment Canada PEL
Hg	<0.10	<0.001 - 0.0325	0.05	0.05	0.50	0.13	0.70
Cd	0.094-0.32	0.031- 0.285	0.2	0.10	1.00	0.676	4.21
Cr	11.2-39.2	3.84- 49.1	60	5.00	50.00	52.3	160
Pb	7.9-11.9	3.47-32.4	25	5.00	50.00	30.3	112
As	<1.0-12.7	0.43-17.1	15	1.00	10.00	7.24	41.6
Zn	10.2-38.6	5.3-66.1	90	10.00	100.00	124	271
Ba	0.67-11.0	2.59-1880	-	-	-	-	-
Ni	1.51-4.43	0.785- 9.75	30	5.00	50.00	15.9	42.8
Cu	0.54-1.87	1.52-16.5	20	5.00	50.00	18.7	108

Note: *BC background concentration, formerly termed background reference concentration (BRC). From OSPAR (2005).

Concentrations of all metals were within the OSPAR EAC limits, with the exception of arsenic levels at site S26, in the vicinity of Broadhaven Bay and at a number of locations off Erris Head. It is understood that concentrations of arsenic in the wider Donegal Bay area are elevated owing to the concentrations of this element in the natural geological strata in the area.

Organic material and hydrocarbons

Total Organic Carbon (TOC) levels in the sediments along the pipeline route, in the Corrib field, and at the treated surface water outfall location were generally very low (<0.5%), though at site 26 (KP69) a level of 5.9% TOC was recorded, which was greater than expected given the sediment material present. The low concentrations are to be expected because of the coarse nature of the seabed sediments. In general, there is a relationship between the percentage of fine sediments and the percentage of TOC, the number of binding sites for contaminants that fine material and TOC provide also usually correlates with the concentrations of metals and organic contaminants in sediments.

Hydrocarbon concentrations in the sediments analysed were typically very low. Polynuclear aromatic hydrocarbons (PAH) and their alkyl derivatives have been recorded in a wide range of marine sediments (Laflamme and Hites, 1978) with the majority of compounds produced from what is thought to be pyrolytic sources. These are the combustion of organic material such as forest fires (Youngblood and Blumer, 1975), the burning of fossil fuels and, in the case of offshore oilfields, flare stacks, etc. Concentrations of the 16 US EPA major PAHs in the sediments at all locations sampled are very low, all being less than relevant OSPAR designated background concentrations, further highlighting the overall pristine nature of the marine environment.

8.4 Characteristics of the Proposed Development

The characteristics of the proposed development in the context of this section are detailed in Section 8 of the 2001 Offshore EIS, except that it was since established that no requirement for blasting in Broadhaven Bay was required. The pipeline was placed on the seabed, and the resulting impact was just to the surface sediments beneath the invert of the pipeline, with the exception of the route in Broadhaven Bay. The pipeline was buried along the route through Broadhaven Bay by constructing a trench in the sediments onto which it was placed. It was then covered using the material extracted

from the trench. In other areas of the bay, the pipeline was buried using a trenching device.

The placement of rock to protect the pipeline from scour and potential free-spanning and aid pipeline stability in the near shore sections of Broadhaven Bay will be continued (from the works undertaken in 2009) during 2010 and 2011 when the umbilical is planned to be installed.

The rock placed in September and October 2009 comprised finer grades, forming a filter layer, which will be supplemented by heavier grades that will provide a protective armour and make the berm up to its design dimensions. Following a multibeam echosounder and visual survey of the berm in Spring 2010, continued rock placement will take place. Any remedial or additional rock placement of the filter layer, that may be required as a result of erosion during the 2009/2010 winter season will take place before placement of the heavier grade layer.

The section of the offshore pipeline in Broadhaven Bay that is highlighted above for rock placement is the main known section identified as requiring additional protection. There is the potential for further areas where rock placement may be required along the pipeline/umbilical route as mitigation, depending on the degree of scour that is experienced and the overall success of trenching works.

The umbilical will be trenched throughout its route from the landfall to the field, with the exception of sections with high concentrations of (sub) surface boulders and the umbilical will pass through a conduit at the shore crossing at Glengad. As detailed in Section 2, treated surface water run-off will be discharged through a HDPE pipeline co-located with the export pipeline between the terminal and a point approximately 12.5km from the landfall. The umbilical will be used to carry treated produced water to the Corrib field manifold where it will be discharged.

8.5 Potential Impacts of the Proposed Development

Taking the new data detailed above into consideration, the rock placement in Broadhaven Bay will disturb an area of seabed equivalent to the design footprint of the rock berm. Seabed geology over the berm footprint will be entirely covered. An estimate assuming worst case scenario calculates the footprint to range from 15000m² to 30,000m² in addition to the existing project footprint associated with the offshore pipeline/umbilical and seabed infrastructure at the offshore gas field. The total project footprint can only be verified after completion of the umbilical installation. With the exception of the additional impacts resulting from the rock placement there are no significant changes to the nature of the potential impacts as described in the 2001 Offshore EIS.

8.6 Do-Nothing Scenario

No change from 2001 offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

8.7 Mitigation Measures

The rock placement works during 2009 were undertaken using a fallpipe rock placement vessel. This allows for very precise placement of material, guided by the vessels own Remotely Operated Vehicle (ROV). Such accurate rock placement is not possible for the 2010 rock armour to be placed onto the protective berm, as the size grade of the material used necessitates the use of a side casting rock placement vessel. The number of vessels used in offshore works will be kept to a minimum, and an appropriate weather window to undertake the works utilised to minimise the duration of time needed for vessels to be present in the Bay.

All of the rock material that is to be deposited to protect the pipeline in the Bay will be inert hard rock that has been washed following quarrying and grading. As such, the potential for rock dust to be introduced into the water column is considered extremely low.

The majority of the seabed of the Bay is sandy in nature, and as such the rock berm will introduce hard substrate for colonisation by epibenthic species. This introduced hard geology will be consistent with the exposed bedrock that necessitates the rock placement, as well as the subtidal cliffs at the peripheries of the Bay.

Hard rock substrates are characterised by increased species richness compared with the sandy seabed.

There are no significant changes to the mitigation measures proposed in the 2001 Offshore EIS.

8.8 Predicted Impact of the Proposed Development

Taking into consideration the rock placement works in Broadhaven Bay programmed for 2010 the affected area of impact in terms of seabed geology has increased slightly. The area affected represents 0.017 to 0.033% of the area of Broadhaven Bay cSAC.

For the operation of the pipeline (including the piggy-backed discharge pipeline) and installation and operation of the umbilical, impacts to the geology of the area are expected to be influenced only by the placement of rock.

8.9 Monitoring

Monitoring will continue to be undertaken to document any impacts on the sediment in Broadhaven Bay, through the collection of sediment from a number of transects centred on the route through Broadhaven Bay. Samples will be analysed to determine the extent of the redistribution of sediment from disturbance to the seabed caused by pipeline installation. This monitoring programme includes a pre-construction survey (completed), as well as a programme of post construction surveys in compliance with the conditions associated with pipeline consents granted in 2002.

8.10 Reinstatement and Residual Impacts

Taking into consideration the rock placement works in Broadhaven Bay programmed for 2010, it is acknowledged that the area of impact in terms of seabed geology has increased slightly, although there is no change to the residual impacts as predicted in the 2001 Offshore EIS.

9 WATER

9.1 Introduction

The 2001 Offshore EIS considered the potential impacts to water associated with the construction and operation of the offshore facilities. Since the submission of the Offshore EIS, additional data have been acquired that supplement those provided in 2001. This section presents the new data or refers the reader to information that has been submitted by SEPIL under separate cover, which has been available in the public domain.

In addition, SEPIL now propose to discharge the treated produced water through cores in the umbilical, which terminates in the Corrib Field manifold. The produced water was originally intended to be mixed with treated surface water runoff from the terminal and discharged through an outfall north of Erris Head (constructed in 2009). The treated surface water (rain water collected from areas in the terminal where there is potential for hydrocarbon spills) will still be discharged at this location.

A re-assessment of the potential and predicted residual impact on water from the offshore, near shore and landfall works as well as the operation of the facilities has been undertaken on the basis of the new information.

9.2 Study Methodology

Further to the 2001 Offshore EIS, additional field data have been collected in the marine environment. In summer 2005, Ecological Consultancy Services Ltd (EcoServe) was engaged by SEPIL to conduct a baseline survey around the permitted outfall location off Erris Head. Vertical profiles of temperature and salinity were taken at 17 stations in the vicinity of the outfall location. Similar data were also collected in summer 2007 and 2008 (Appendix 7-3 and 7-4) from the same sample locations. In addition, further water samples were analysed for content of various organic and inorganic substances during these surveys in 2007 and 2008.

The 2007 and 2008 sampling locations at the outfall location are shown in Figure 9-1.

The 2001 Offshore EIS presented the results of dispersion modelling undertaken by Kirk McClure Morton. Additional modelling, presented as Appendix 10.1 in the Terminal EIS (2003), was conducted to consider an outfall location in around 60m water depth, outside Broadhaven Bay. This was the outfall location described in the December 2004 IPPC licence application to the Environmental Protection Agency for the Bellanaboy Bridge Terminal.

The Bellanaboy Bridge gas terminal was granted an IPPC licence by the Environmental Protection Agency (EPA) in November 2007. This licence includes limits on the offshore discharge in terms of its volume and quality. SEPIL's application documents and the licence itself are in the public domain and can be obtained via the EPA website (<http://www.epa.ie/terminalfour/ippcApril/index.jsp>).

The subject received detailed scrutiny by the EPA and its Inspectors, and the EPA concluded that given the consent limits and monitoring regime proposed, the quality of the environment would not be impacted.

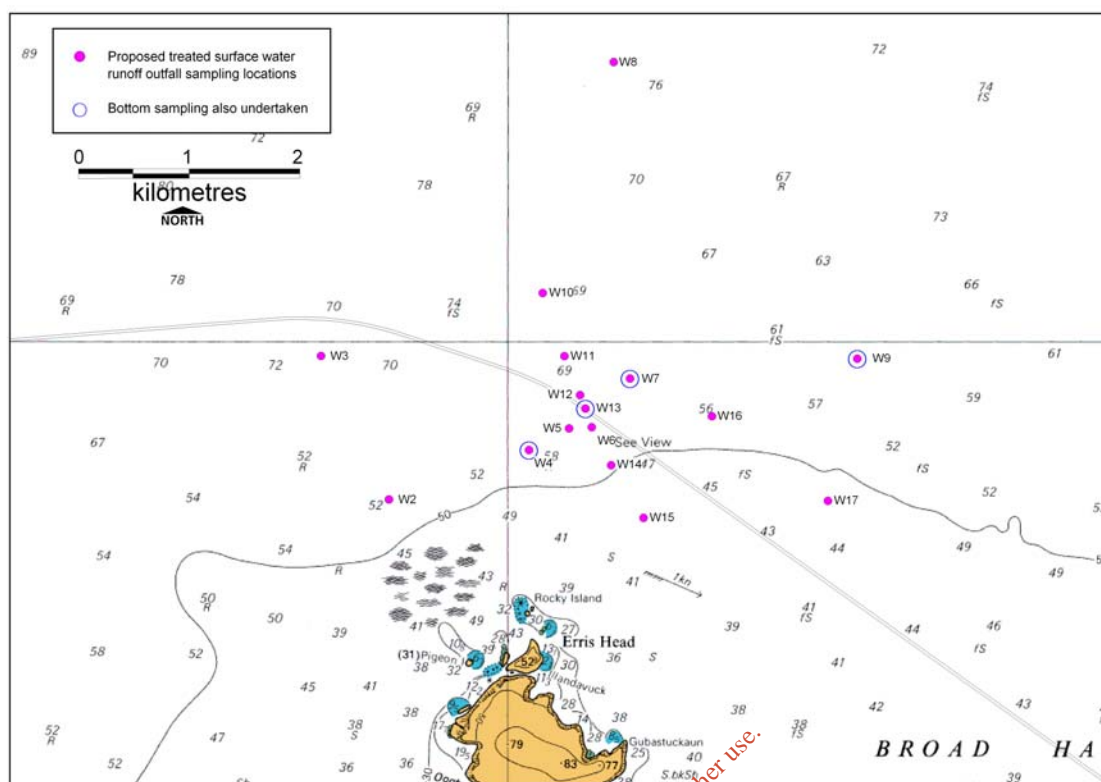


Figure 9-1: Surface and bottom water seawater sampling stations off Erris Head.

Since the licence was issued, and as a result of further discussions with local fishermen, SEPIL now plan to discharge only the treated surface run-off water from the Terminal footprint at the licenced Erris Head outfall location. This discharge will now consist of only treated rainwater run-off and therefore, with the exception of the introduction of fresh water into the marine water at the outfall location, there will be no effects.

The treated produced water will now be transported to the manifold in the Corrib Field through two spare cores in the umbilical. There it will be released at a depth of approximately 350m.

Bacteria and nutrients present in the treated produced water within the cores create the potential for the build-up of a biofilm on the inner walls, which could result in a reduced discharge capacity and in a worst case cause a blockage. Therefore, biocide will be used to prevent biofouling of the umbilical cores.

The chosen biocide will be optimised to target bacteria in the treated produced water with this potential. The produced water will be treated with biocide on a batch basis prior to the water being injected into the umbilical cores. Typical biocides for this application will rapidly degrade due to hydrolysis. Consequently, the toxicity of the water will reduce whilst treating the produced water discharge system i.e. sumps, discharge pumps and umbilical cores. The toxicity-to-bacteria half life of the biocide is expected to be in the order of several hours. By the time the produced water is discharged at the subsea location of the Corrib Field, the active concentration of the biocide will have reduced to approximately 100 to 200 ppm, with the degradation of the biocide to carbon dioxide, bromide and ammonia. These components, and the remainder of the active biocide will rapidly disperse with the produced water in the area of the Corrib field and will not present a threat to the marine environment.

9.3 Receiving Environment

Much of the background data for the seas around Ireland as presented in 2001 remains valid in that new studies have not changed the significance of the data. Where new data have been acquired that expand the knowledge of the marine receiving environment, these are presented in the following sections.

9.3.1 Stratification and Water Quality

9.3.1.1 Stratification

The findings of the 2005 summer survey off Erris Head indicated that sea surface temperatures ranged between 13.5–14.5°C, whilst at depth (approximately 5m above the seabed) the temperature ranged from approximately 11.5–13.25°C (these data were recorded in July 2005). In general, the temperature of the top layer (25–30m) was relatively constant, after which there was a marked but steady decrease in temperature with depth. The salinity at 5m below the surface ranged between 34.5 ppt and 35 ppt. The bottom salinity ranged from 34 ppt to 35.5 ppt. The change in salinity from surface to bottom did not show any marked halocline. The results from the CTD profiles suggest that the water around the proposed outfall location is relatively well mixed with no strong thermoclines or haloclines present.

The findings from the survey carried out in August 2007 off Erris Head and at a reference station 14 miles to the west were wholly in accordance with these general observations. Temperatures at the surface were just over 15°C with a marked thermocline at approximately 40m. Below this depth, there was little change through the water column with a temperature of c. 12°C extending to the seabed at 90m. Again, there was no evidence of any significant salinity differences in the surface waters and through the water column at each station.

The findings from the survey carried out in July/August 2008 off Erris Head indicate sea surface temperatures ranging between 13.8 and 14.3°C. In most cases the water was well-mixed to approximately 20m with evidence of a thermocline developing below this depth. The coolest water (11.4°C) was observed at a depth of just over 90m. The minimum differences in temperature through the water column (13.8 – 13.0°C) were observed at the shallowest site (60m) that was fairly well-mixed to about 30m. In general, the findings are similar to those recorded during the 2007 survey. As would be expected in a coastal area with little freshwater input, only small differences in the salinities of the surface waters were observed, with small increases through the water column to the seabed. Certain stations displayed slightly erratic salinity measurements that were not in common with the general trend, however these were not evident in the corresponding temperature profiles.

9.3.1.2 Seawater Chemistry

Metals

A single seawater sample was collected from Broadhaven Bay in 2000, and another in 2001, these samples were analysed and the results presented in the 2001 Offshore EIS. Discussions have since been held with the Marine Institute on the metals that should be recorded as part of the baseline and ongoing monitoring around the outfall location to the north of Erris Head. In summer 2007 and summer 2008, twenty-two water samples were collected from around the outfall location located 2.5km off Erris Head, 17 of these from close to the surface each year, and the remainder from close to the seabed. In addition, surface and bottom water was sampled at a number of other sampling locations north of Erris Head (in the general vicinity of the proposed outfall), during summer 2008. The samples were analysed at the UK's Environment Agency laboratories. Results for these analyses are presented in Table 9-1, which also presents the comparable data from the 2001 Offshore EIS for the samples collected in 2000 and 2001.

Table 9-1: Measured Background Metal Concentrations in Broadhaven Bay

Metal	2000	2001	2007	2008	Oceanic concentrations*	Marine Institute#
	mg/l	mg/l	mg/l	mg/l	mg/l	
Arsenic	0.008	0.006	0.00109– 0.00156	<0.001 – 0.00145		0.00115
Barium	<0.01	0.00761	<0.1	<0.1		
Cadmium	<0.0001	<0.00004	<0.00004	<0.00004	0.00005	0.000055
Chromium	0.001	0.003	<0.0005	<0.0005		0.000168
Copper	0.011	0.018	<0.0002– 0.00245	<0.0002 – 0.00121	0.0005	0.000659
Lead	<0.001	0.000864	<0.00004– 0.000545	0.000056 – 0.0408	0.00003	0.00084
Mercury	<0.0001	0.000041	<0.00001– 0.00001	<0.00001– 0.000019	0.0001–0.0004	<0.000008
Nickel	0.005	0.005	<0.00025– 0.0011	<0.0003– 0.00035		0.0012
Silver	<0.001	<0.001	<0.001	<0.001		<0.001
Zinc	0.005	0.032	0.00097– 0.00842	0.00139 – 0.0295	0.005	0.011

* - concentrations taken from OSPAR Region III QSR, 2000

- lowest concentrations measured for each metal during Marine Institute surveys of Shellfish waters around Ireland between winter 2004 and winter 2005

The results from the samples collected in the vicinity of the treated surface water run-off outfall location in 2007 and 2008 tie in well with published data for oceanic waters. In addition, the data recorded by the Marine Institute in surveys of shellfish waters around the Irish coast over the period between winter 2004 and winter 2005 are also in general accord with Broadhaven data from 2007 and 2008. Sample results for 2000 and 2001 tend to show higher concentrations of metals in the water. While this increase may be because samples were collected closer to the coast (within Broadhaven Bay), it is more likely that the laboratory analyses were not as sensitive as those used in 2007 and 2008, where particularly low detection limits were specified. In addition, more rigorous QA procedures were employed in the sampling carried out in 2007 and 2008. It should be noted that analytical techniques are being developed continually and the earlier findings should be treated with some caution.

The results collected in 2007 and 2008 show that the waters off Erris Head have low concentrations of metals – which is to be anticipated given the open nature of the marine environment – and low levels of anthropogenic input in the area. The full reports on the 2007 and 2008 sampling are provided as Appendices 7-3 and 7-4.

Suspended Particulate Matter

Results from 2007 and 2008 indicate that most of the sites had suspended particulate matter concentrations in the surface waters of less than the MRV (minimum reporting value – 3mg/l) indicative of the high clarity of these coastal waters. The quoted MRVs reflect the current analytical methods typically utilised by the regulatory bodies.

Ammoniacal Nitrogen

In 2008, with the exception of two sites, all ammoniacal nitrogen results were less than the MRV (0.01mg/l) in general somewhat lower than had been the case in the 2007 survey. These concentrations are very low and it seems unlikely that ammoniacal nitrogen is influenced by land run-off but is more likely to be generated in-situ as excretion products from grazing zooplankton.

Trace Organics

For the majority of sites around the permitted surface water run-off outfall, concentrations of organics were reported as less than their relevant detection limit (or MRV). However in the case of phenol and dimethyl benzenes positive values were observed at several sites, albeit still at very low concentrations – typically < 0.5 µg/l. In

2007, 5 sites also had reported values for phenol marginally above the detection limit. With the exception of acenaphthene (1 site) and naphthalene (1 site), no PAHs were reported at concentrations greater than their respective detection limits – both positive results were very close to the limit of detection. In 2007 a small number of sites had PAH results marginally greater than the detection limits.

Whilst some persistent organic compounds have been detected in 2007 and 2008, at such very low concentrations they reflect the pristine nature of the environment.

9.4 Characteristics of the Proposed Development

A decision has since been made to limit water discharges at the Erris Head outfall location to treated surface water run-off only. This outfall was installed in 2009 “piggy-backed” to the larger gas pipeline. Treated produced water from the terminal site is now proposed to be discharged via the umbilical at the manifold in the Corrib Field, where the end of two umbilical cores will be modified to terminate within the manifold cover.

Water quality modelling has been undertaken to investigate the impact of discharging produced water at a depth of approximately 350m in the area of the Corrib Field and is included as Appendix 9-1 of this report.

9.5 Potential Impacts of the Proposed Development

The potential impacts assessed for the offshore operations, remain as described in 2001. In the sections that follow, changes from the 2001 Offshore EIS are described.

9.5.1 Remaining Facilities Installation

Estimates of the volume of black and grey wastewaters, discharged from vessels during the remaining offshore and nearshore works, are provided in Table 9-2. Estimates have also been provided for galley wastes from the installation vessels.

The following works requiring offshore installation vessels have been considered in terms of discharges to the marine environment:

- Rock placement works will require a fallpipe vessel to undertake (remedial) works to aid the stability of the flowlines and jumpers, pipeline, and water outfall pipe. In the nearshore waters a side stone casting vessel will be utilised (supported by a bulk carrier for supply of rock) in order to place an armour layer of heavier grade material.
- At the Corrib field itself, a construction vessel will be required for installation of the tie-in spool between the central manifold and the pipeline.
- Umbilical laying will be carried out by a reel-lay vessel supported by a survey vessel and a trenching support vessel, potentially followed by stabilisation works should trenching not be successful in all areas

Table 9-2: Black and Grey Water and Galley Waste Production Estimate during Pipeline and Umbilical Installation from Remaining Offshore Construction Works Associated with the Pipeline and Umbilical Installation

	Total man days	Black and grey water (m ³)	Putrescible galley waste (tonnes)
Remaining nearshore and offshore construction activities	10094	2524	3
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			

Given the wide area and long period over which the discharges will be made, the magnitude of the impact is classified as negligible. The discharges shown above are in addition to those from the 2008 and 2009 pipeline construction periods. Such discharges will be quickly dispersed by wave and tide action, and discharges during future installation operations will not be “additive”.

9.5.2 Umbilical and remaining pipeline rock placement works

During Installation

Installation of the umbilical will involve the use of a umbilical laying vessel, a trenching vessel and an ROV/Survey support vessel. A diving support vessel will also be used to expose the end of the umbilical conduit in Broadhaven Bay.

The rock placement works nearshore (outer armour layer) will involve the use of a side stone casting vessel supported by a bulk carrier. Any further works in the Corrib field, along the pipeline and umbilical as well as nearshore (remedial work to the filter rock layer placed in 2009) requires the use of a flexible fall-pipe rock placement vessel.

The construction period has now become extended over a number of seasons, and there will therefore be more than one period where construction operations result in raised levels of suspended solids. However, given that the mobile sediments in Broadhaven Bay are naturally raised into suspension by the wave and current regime, raised suspended solids levels from construction operations will not create a cumulative impact above that created naturally.

9.5.3 Operation

Sacrificial Anodes

Sacrificial anodes are designed to lose material to the surrounding water to maintain an electrical potential across the pipework, which helps to prevent corrosion. The anodes will be made from an aluminium-zinc-indium based alloy. For the Corrib subsea development, more detailed engineering calculations now estimate that 85 tonnes of anode will be required for the pipeline, a reduction from the 105 tonnes estimated in 2001. The anodes are positioned as collars around pipelines.

The typical percentage composition of these anodes is presented in Table 9-3.

Table 9-3: Typical Composition of Sacrificial Anodes

Element	Composition (%)	Total tonnage for Corrib export pipeline
Zinc	4.0 (approx)	3.4 (approx)
Indium	0.015 (approx)	0.0128 (approx)
Iron	0.09 (max)	0.077 (max)
Silicon	0.20 (max)	0.17 (max)
Copper	0.004 (max)	0.0034 (max)
Others (each)	0.01 (max)	0.0085 (max)
Others (total)	0.05 (max)	0.0425 (max)
Aluminium	Balance	81.3 (min)

The tonnages of anode given above have been calculated in accordance with a DNV standard (DNV RP B 401), based on a long-term test programme. The anodes will dissolve if an electrical reaction is able to occur between them and other parts of the pipework. Such a reaction (current) will only be able to take place if there are other parts of the pipework exposed to seawater. Normally, the epoxy pipe coatings prevent the metalwork encountering seawater. However, it is possible that in some places the coatings could become damaged, and therefore the anodes could partially dissolve. The tonnages of anode to be used in the development are based on 2% of the pipework being exposed to seawater over a period of 30 years.

9.5.4 Discharge Pipeline (Outfall Pipe) and Umbilical Discharge

The design of the surface and produced water treatment systems have been updated since 2001, and it is now planned that the discharges are made on a continuous basis, rather than the batched discharge that was previously proposed. The IPPC licence issued in November 2007 for the terminal was based on the continuous discharge, with maximum daily volumes as follows:

- Treated Produced water – $6\text{m}^3/\text{hour}$ or daily maximum of 144m^3 (allowing for additional capacity in the event of recycling of water from the treatment)
- Treated Surface water run-off – $30\text{m}^3/\text{hour}$ or daily maximum of 720m^3 (allowing for moderate - high rainfall events).

The volumes quoted are those upon which the design of the water treatment systems in the terminal have been based.

It should be noted that the maximum anticipated produced water flow rate is $3.3\text{m}^3/\text{hour}$ (in the early years of production, falling to less than $1\text{m}^3/\text{hour}$ after year 10). It is currently estimated that there is a limit of approximately $2.7\text{m}^3/\text{hour}$ on the capacity of water discharge through the cores in the umbilical. When the production of produced water is at its estimated highest level ($3.3\text{m}^3/\text{hour}$), there will be an excess $0.6\text{m}^3/\text{hour}$ which cannot be discharged. This volume will be stored on site and removed periodically by road tanker to an appropriately licensed waste water treatment plant.

The average surface water run-off rates are calculated to be around $2.1\text{m}^3/\text{hr}$. In the event of extreme rainfall events with surface water run-off rate in excess of $30\text{m}^3/\text{hr}$, the excess volume will be retained in the open drains system and sump until it can be treated and discharged.

The treated produced water will normally have a lower salinity than the surrounding seawater and is thus less dense than the receiving water. Consequently, once it is discharged it will rise through the water column, mixing as it ascends. The initial velocity will be relatively small and the processes giving rise to the attenuation of the contaminant concentrations will be due to the effluent's inherent buoyancy and subsequent advective dispersion as it moves away under the influence of the local current field. This will result in the entrainment of contaminants into the surrounding water body, ensuring that they are diluted to background levels within a short distance.

Modelling of the discharge at the subsea manifold has been carried out by HR Wallingford (Appendix 9.1). The results show that concentrations of contaminants are expected to be diluted by approximately 100 times within 5m of the discharge point. Thereafter, these very low concentrations are further diluted to within 10% of background level within the next 350m. Whilst the modelling has demonstrated that the effluent plume disperses less rapidly at the highest expected ambient currents (i.e. 0.35 m/s), for 90% of the time currents are significantly weaker (i.e. $<0.2\text{ m/s}$) reducing the distance to within 10% of background to under 200m. Local currents appear not to have a significant directional bias as would be expected if they were predominantly tidal in origin. However there is evidence that northeastward flows dominate. It is therefore unlikely that there will be a build up of discharged constituents around the site.

The dispersion studies are not capable of simulating accurately the situation with the manifold protection cover in place. The modelled jet velocity of ca. 1m/s with a single riser is very much larger than the velocities at which the effluent would flow from seven access ports. This will reduce the initial-dilution due the reduction in the momentum-induced jet mixing. However, this may be offset as the effluent will effectively be emerging from a multi-port outfall.

During the Oral Hearing for the IPPC licence application, conducted by the EPA in in Belmullet in April 2007, Professor Peter Matthieson commenting on the discharge which was proposed off Erris Head at the time, stated that...

In view of the high level of treatment to be provided, there will be no damage to whitefish, crab or lobster fisheries in the vicinity of Broadhaven Bay. Similarly there will be no predicted impacts on other marine organisms.

The same levels of treatment will be used for the water to be discharge through the umbilical and it is therefore concluded that there will be no impacts to marine organisms in the area of the Corrib Field resulting from the discharge.

9.6 Do-Nothing Scenario

No change from 2001 Offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

9.7 Mitigation Measures

For all offshore aspects of the project other than the pipeline installation in Broadhaven Bay, and the discharge off Erris Head and in the Corrib Field, the mitigation measures as proposed in 2001 Offshore EIS remain valid.

9.7.1 Discharge Pipeline (Outfall Pipe) and Umbilical

9.7.1.1 Environmental Quality Standards

In considering the design of the water treatment plant for the terminal and given the outcome of the original (2001) assessment of alternatives (treated water would be discharged in Broadhaven Bay), the Environmental Quality Standards (EPA, 1997) were used as discharge limits. While the outfall location for the produced water is now in the Corrib Field itself, it is still proposed that the water will be treated to such stringent levels.

Treatment of produced water discharge to this degree is unusual, as the EQS is typically a measure of background concentrations rather than a limit applied to an undiluted discharge. The dilution and dispersal afforded by the location of the discharge (in 350m water) will serve to further reduce the concentrations of contaminants in the discharge rapidly.

9.8 Predicted Impact of the Proposed Development

The predicted impact of all aspects of the proposed development remains as stated in the 2001 Offshore EIS. In the case of the pipeline rock placement works and umbilical installation, where some changes have occurred as a result of modified installation methods and more data becoming available on the background water quality, the predicted impacts are restated for completeness. The predicted impacts of treated water discharge from the two water outfall locations are addressed below.

9.8.1 Rock placement and Umbilical

Placement of rock over the pipeline section in Broadhaven Bay, and the burying of the umbilical using a subsea plough/jetting tool, will have a minor, short-term, localised impact (see Table 3-1 for installation period), creating increased turbidity. Given that the installation period has been extended, the impacts will be perceived over a longer time period, though they will effectively be negligible.

9.8.2 Discharge pipe (outfall pipe) and Umbilical

During operation, the discharge from the outfall location north of Erris Head will consist of treated surface water run-off from hard surfaces around the terminal, effectively treated rain water and therefore no impacts are predicted. The discharge on the seabed in the Corrib field will consist of produced water, which has been treated to reduce contaminant concentrations to those required by the existing IPPC licence. The concentrations specified in that licence were such that there would not be damage to marine organisms. No effects are therefore predicted.

9.9 Monitoring

The terminal operations have received an IPPC licence from the EPA. Several conditions in that consent relate to the monitoring of the treated produced water to be discharged off Erris Head, including water quality, sediment quality, biomonitoring, and biological effects monitoring. While the relevant baseline work has already been completed for the Erris Head discharge, given that now only treated surface water run-off is proposed for discharge at that location, and that the treated produced water is to be discharged in the Corrib Field, a change to the IPPC licence is required. A licence review application has been submitted to the Environmental Protection Agency in this regard. While revised monitoring plans would be subject to such a revised licence, it is anticipated that in the case of the treated surface water discharge, data already collected will be sufficient as a baseline.

In order to ensure that the produced water discharge does not present a risk to the marine environment, a programme of toxicity testing of the treated produced water effluent is proposed. The details of this programme will be subject to the revised IPPC licence conditions.

9.10 Reinstatement and Residual Impacts

Based on the assessments made in the 2001 Offshore EIS and further consideration of the potential impacts carried out by the EPA in granting the IPPC licence, the reinstatement and residual impacts are still considered negligible.

10 AIR EMISSIONS

10.1 Introduction

The 2001 Offshore EIS considered the potential impacts of emissions to the atmosphere arising as a result of drilling, construction, installation, commissioning, operation and decommissioning activities. As detailed in Section 3, some construction activities have been completed and others rescheduled. An updated schedule and further details on construction methodologies are now available for components of work yet to be completed. A re-assessment of the potential impacts of emissions to the atmosphere associated with the offshore, near-shore and landfall works has been undertaken based on up-to-date information.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and it will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

10.2 Study Methodology

The 2001 Offshore EIS used standard oil and gas industry factors from the United Kingdom Offshore Operators Association (UKOOA)¹ to calculate the air emissions from the project, from the tonnages/volumes of fuel used, or estimated, or well test gas flared.

10.3 Receiving Environment

The state of the receiving environment has not changed significantly since the 2001 Offshore EIS. Ambient air quality monitoring is generally not undertaken offshore and whilst additional onshore air quality data is available, it is unlikely to be representative of the offshore environment.

10.4 Characteristics of the Proposed Development

The characteristics of the proposed development are as detailed in Sections 2 and 3.

10.4.1 Offshore Pipeline (Pre-) Commissioning Activities

The offshore pipeline is currently filled with inhibited sea-water and will need to be tied into the completed landfall valve installation at Glengad.

During the commissioning phase, a nitrogen generation plant will be established adjacent to the LVI compound at Glengad for a period of one to two weeks.

This station will include a series of mobile diesel generator units which generate emissions of combustion gases.

The offshore pipeline will then be dewatered over a period of approximately 14 days. It is currently proposed that the offshore pipeline will be pre-commissioned in the summer of 2012, to coincide with suitable weather required for the associated offshore operations.

¹ In 2007, the United Kingdom Offshore Operators Association (UKOOA) changed its name to Oil and Gas UK.

10.5 Potential Impacts of the Proposed Development

Emissions arising from future construction activities, include those resulting from the transit of the umbilical laying vessel and other construction/support vessels to and from the area and pre-commissioning activities. It is acknowledged that the duration of impacts is greater than initially anticipated.

10.5.1 Remaining Facilities Installation

Offshore Work

There is a requirement for a rock placement vessel to undertake (remedial) works in 2010 and 2011 to aid the stability of the flowlines and jumpers on the seabed into the Corrib Field, as well as the offshore pipeline and water outfall pipe. This work will be predominantly carried out by a fall-pipe vessel. A side stone casting vessel and bulk carrier will be present, as well as attending support vessels such as an ROV and dive support vessels.

In the Corrib field itself, a construction vessel will also be required for installation of the tie-in spool between the central manifold and the pipeline. These vessels will emit engine exhaust gases, according to the size of the engine concerned.

Umbilical laying in 2011 will be carried out by a reel-lay vessel supported by a survey vessel and a trenching support vessel. Although the offshore umbilical will be trenched throughout its length it may be necessary to stabilise certain section with rock or matting.

Total estimated emissions as a result of rock placement over the sections of the offshore infrastructure and umbilical installation, based on typical construction vessels are presented in Table 10-1.

Table 10-1: Estimated Emissions from Remaining Offshore Construction Works Associated with the Pipeline and Umbilical Installation

Emissions	Offshore Construction Works for the Pipeline and Umbilical (tonnes)
CO ₂	5773
NO _x	106
CO	14
SO ₂	36
VOC	4
CH ₄	0

Assumptions:

- umbilical installation takes place over three weeks (umbilical vessel mobilised for two weeks, one week in Broadhaven Bay);
- sulphur content of fuel is 0.1% (wt); and
- emissions have been calculated using emission factors from the UKOOA EEMS Guidelines for the Compilation of an Atmospheric Emissions Inventory.

Near-shore Work

In the nearshore waters remedial rock-placement works is planned to be undertaken in Broadhaven Bay in the area where the rock berm was placed on the offshore pipeline in 2009. The detailed requirements for this work will be determined following a survey in second quarter 2010. If remedial works are required to the filter layer of rock, a fallpipe vessel will undertake these works. Following this rock placement, a side stone-casting vessel will be utilised (supported by a bulk carrier for supply of rock) to place a armour layer of rock of heavier grade on top of the already installed filter layer.

The estimated emissions resulting from nearshore rock placement works are included in Table 10-2 below.

Table 10-2: Estimated Emissions from Remaining Nearshore Construction Works Associated with the Pipeline and Umbilical Installation

Emissions	Nearshore Construction Works for the Pipeline and Umbilical (tonnes)
CO ₂	2034
NO _x	38
CO	5
SO ₂	13
VOC	2
CH ₄	0

Landfall

The installation of the umbilical will be carried out by pulling the umbilical from a ship located approximately 2km from the landfall through a pre-installed conduit to the landfall site at Glengad. The umbilical pull will be done from a temporary winch to be installed at the landfall site in Glengad.

The estimated emissions arising from typical plant associated with the landfall activities are included in Table 10-3.

Table 10-3: Estimated Emissions from Remaining Onshore Construction / Commissioning Works Associated with the Pipeline and Umbilical

Emissions	Onshore Construction Works for the Pipeline and Umbilical (tonnes)
CO ₂	498
NO _x	13
CO	3
SO ₂	1
VOC	1
CH ₄	0

Assumptions:

- In order to account for activities undertaken during 2008 and 2009, emissions have been doubled and therefore represent a conservative estimate.

Offshore Pipeline (Pre-) Commissioning Activities

During the commissioning phase a nitrogen generating plant and associated compressors will be located adjacent to the Landfall Valve Installation compound at Glengad for a period of 1-2 weeks. The equipment will be powered by three 200 kW diesel generators. The nitrogen itself will not result in any impact on air quality as nitrogen makes up approximately 78% of the air in the atmosphere and does not pose a risk to human health.

The AERMOD air dispersion model was employed to simulate the emissions arising from the pre-commissioning and the potential impact on sensitive receptors close to this site. It was assumed that all three generators will operate on an average 50% capacity throughout the pre-commissioning period. All results presented have been compared to the statutory limits for the protection of human health (S.I. 271 of 2002).

The results of the modelling, incorporating background concentrations, are presented in Table 10-4. Only pollutants that have the potential to cause an acute effect (short term) and the associated short term statutory limits have been assessed as the operation period of the plant is planned for one to two weeks.

Onshore Pipeline The emissions associated with the construction of the onshore pipeline via the Sruwaddacon Estuary are addressed in the RPS Onshore Pipeline EIS 2010.

Table 10-4: Predicted impact of generator emissions associated with the nitrogen generation equipment at Gleann an Ghad (Glengad)

Parameter	Averaging Period	Background	Predicted Impact from Generators	Total Predicted Impact	Limit for the Protection of Human Health
Nitrogen Dioxide (NO ₂)	Hourly Maximum	6 µg/m ³	78 µg/m ³	84 µg/m ³	200µg/m ³
Particulate Matter PM ₁₀	24-hour Average	10 µg/m ³	1.82 µg/m ³	11.82 µg/m ³	50µg/m ³
Carbon Monoxide	8-hour limit	0.4 mg/m ³	0.03 mg/m ³	0.43 mg/m ³	10 mg/m ³

The results indicate that the predicted impact to air quality arising from generators powering the nitrogen plant on the nearest residential dwellings will be a slight adverse impact of a temporary nature. However, the results will remain well below the limits for the protection of human health at all times. The nearest residential receptors affected are those approximately 200 metres south of the compound. Based on the EPA air quality index, the air quality in this area will remain in the range of “good” to “very good” with the generators in operation.

10.6 Do-Nothing Scenario

No change from 2001 offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

10.7 Mitigation Measures

Taking the new data detailed above into consideration, there is no change to the nature of the mitigation measures as described in the 2001 Offshore EIS.

10.8 Predicted Impact of the Proposed Development

Estimated emissions from the project were summarised in Table 10.6 in the 2001 Offshore EIS. Whilst the primary activities that could generate impacts to air quality remain almost unchanged the greater definition in vessel and equipment to be used, and the increased duration of the works have resulted in an increase compared with the 2001 predicted emissions. Although this does not affect the overall conclusions of the assessment or the justifications for those conclusions.

10.9 Monitoring

There is no change to the monitoring as proposed in the 2001 Offshore EIS.

10.10 Reinstatement and Residual Impacts

Taking the new data detailed above into consideration, there is no change to the nature or scale of the residual impacts predicted in the 2001 Offshore EIS.

11 NOISE

11.1 Introduction

The 2001 Offshore EIS assessed the potential impact of noise on the receiving environment during the construction and operation of the various elements of the project. Underwater noise was also considered in the context of marine species that inhabit the area from the offshore gas field to the landfall.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and it will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

11.2 Study Methodology

There have been some scientific developments since 2001 in the understanding of the impacts of underwater noise on marine species as a result of academic research into this issue, supported by developers and non-governmental organisation (NGOs). The offshore wind farm industry has added to the work traditionally carried out by the oil and gas exploration companies and their geophysical contractors. The National Parks and Wildlife Service (NPWS) has published a Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters (August 2007). The Code of Practice identifies measures to mitigate potential impacts on marine mammals resulting from acoustic seafloor surveys that rely on the generation and analysis of sound to map the profile of the seafloor including side-scan sonar and multibeam bathymetric echo-sounders. Mitigation for underwater noise from construction activity is not addressed in the Code of Practice.

11.3 Receiving Environment

The receiving noise environment remains as described in the 2001 Offshore EIS. However, work undertaken since 2001 provides additional information on conditions relevant to the noise assessment as detailed below. Further work on the cetacean usage of Broadhaven Bay carried out since 2001 has also been considered.

11.4 Characteristics of the Proposed Development

11.4.1 Near-Shore and Landfall

In the 2001 Offshore EIS, an assessment was provided for the impacts, which could have resulted from the construction of a near-shore trench in Broadhaven Bay, including the use of explosives. On the basis of further detailed studies and site investigations in 2002, Shell concluded that blasting would not be required and that the pipeline trench would be excavated by conventional means. This was confirmed in summer 2005 when the trench was successfully excavated to the depth required by conventional dredging equipment. The trench was re-excavated using dredging techniques and landbased equipment (intertidal zone) before the pipeline was installed in Broadhaven Bay.

The majority of offshore construction works was undertaken in 2009, including the installation of the offshore pipeline. Rock was placed over a near-shore section of the pipeline to protect against scour due to the presence of a bedrock outcrop. Small grade rock was then placed from a fall-pipe rock placement vessel. Further rock placement works will be required during 2010, before placing heavier grade rock armour from a side-stone casting vessel. In addition, installation works will continue at

the offshore field. It is anticipated that the umbilical will be installed in the summer of 2011.

11.4.2 Offshore Pipeline (Pre-) Commissioning Activities

The offshore pipeline is currently filled with inhibited sea-water and will need to be tied into the completed LVI at Glengad.

During the commissioning phase, a nitrogen generation plant will be established adjacent to the LVI compound at Glengad for a period of one to two weeks.

This station will include a series of mobile diesel generator units. Soundproofing will be provided to ensure that noise levels will be within acceptable limits.

The offshore pipeline will then be dewatered over a period of approximately 14 days. It is currently proposed that the offshore pipeline will be pre-commissioned in the summer of 2012, to coincide with suitable weather required for the associated offshore operations.

11.5 Potential Impacts of the Proposed Development

11.5.1 Near-Shore

As noted, construction-related noise emissions occurred during 2008 and 2009. These emissions included those resulting from the excavation of the pipeline trench, installation of the offshore pipeline and placement of the first layer of rock protection. Further rock placement works will be required and overall it is acknowledged that the duration of works is greater than initially anticipated.

In addition, further review of available literature since 2001 indicates that noise levels from dredging activities may be slightly higher than those quoted in the 2001 EIS, with a maximum of 180 dB re. 1 μ Pa at 1m now anticipated rather than the 162 dB re. 1 μ Pa at 1m estimated in 2001.

Such noise levels would indicate that the maximum distance over which a strong impact could be observed would be less than 18m, while mild avoidance and low likelihood of disturbance would be predicted over distances of 100m and 1800m respectively. Together, these impacts are not considered to present significant disruption or displacement to cetaceans within Broadhaven Bay.

The 2001 Offshore EIS identified that the most significant noise impacts in Broadhaven Bay were likely to be due to underwater noise events related to possible blasting. As detailed above, blasting did not take place and hence the aspect of the project that represents the most significant noise impacts in Broadhaven Bay is the rock placement works due to be undertaken in 2010. It has been estimated that noise levels from this activity will be in the order of that of the pipeline installation (in the order of 180 dB re. 1 μ Pa at 1 m) (Subacoustech, 2009).

11.5.2 Offshore Pipeline (Pre-) Commissioning Activities

Noise from the nitrogen compressors and associated generators will occur for approximately 1 to 2 weeks and on the basis of current information is likely to result in a significant increase in noise levels in the local area.

11.6 Do-Nothing Scenario

No change from 2001 offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

11.7 Mitigation Measures

In terms of mitigation against the noise generated by the marine construction vessels, a code of practice for dredging works was implemented in 2008 and 2009 (in agreement with the NPWS), and will be implemented during the next construction period. The code includes requirements such as a qualified and experienced Marine Mammal Observer (MMO) to be on board near shore construction vessels. The MMO is responsible for ensuring, through visual observations, that an exclusion zone of 1000m around the vessel is free of marine mammals for 30 minutes before operations commence. In September and October 2009, the same code-of-practice was implemented for the rock-placement works, and will be implemented for the continued rock-placement works in 2010 as well as all other remaining near-shore construction works.

For marine based work in the intertidal and subtidal zones, activities will run on a 24-hour basis.

Onshore noise will be reduced by screening stationary machinery (generators), use of noise attenuation barriers and turning off such equipment when not in use. Silenced machinery will be used as much as possible to mitigate noise.

For the land-based operations at Glengad which are deemed to be noisy working hours will in general be restricted to 07:00–19:00 Monday to Friday, 07:00–16:00 on Saturday and there will be no activity on Sundays. During the umbilical pull-in operation, it will be necessary to work on a 24-hour basis.

Certain commissioning activities for the offshore pipeline may require 24-hour working. However, current information in respect of the pre-commissioning of the offshore pipeline indicates that this activity would need to be restricted due to elevated noise levels arising from the nitrogen generating plant and associated compressors (See Section 11.8.2 below). If, however, further noise attenuation measures can be identified and proven to reduce noise levels to an acceptable target, it is proposed to carry out this work on a 24-hr basis. Should further noise attenuation not be available, this activity will be curtailed, and not carried out during the period 22:00 – 07:00.

Recognising that noise will be of concern, SEPIL will ensure that local residents are informed of the programme of work proposed, and the dates when 24-hour working may occur.

11.8 Predicted Impact of the Proposed Development

11.8.1 Near- Shore

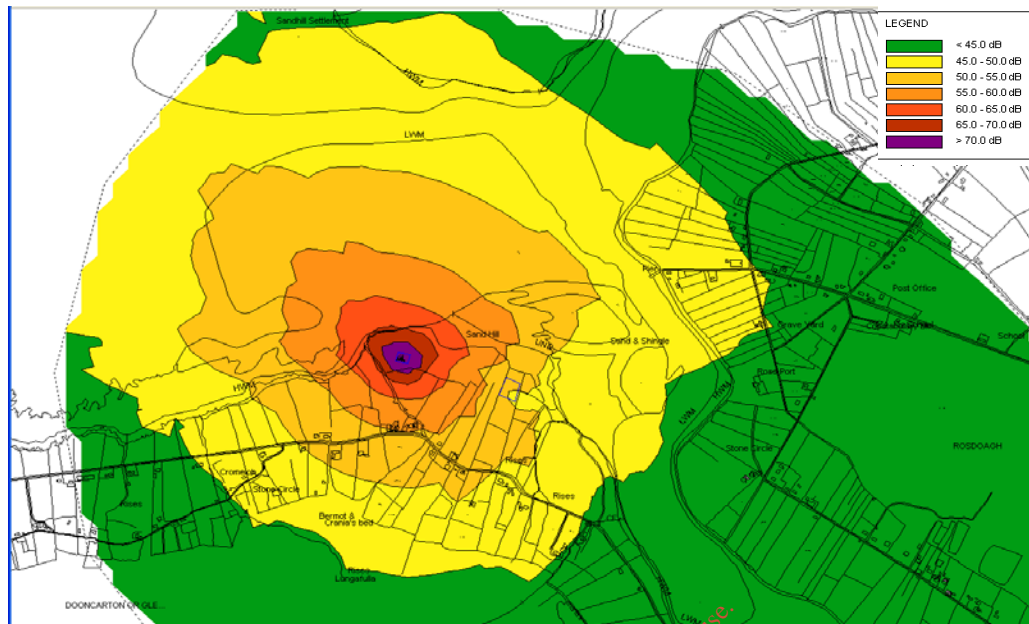
Underwater blasting was not undertaken as part of the proposed works, and as a consequence, no underwater noise impacts resulted. The remaining underwater excavation work required will involve trenching of the umbilical, which is not predicted to result in significant underwater noise impacts. The noise levels from dredging works were higher than predicted in the 2001 Offshore EIS, however the distances from the vessels at which high noise levels were felt by the most common species was still small. Noise impacts of a similar, and slightly elevated level are predicted from the rock-placement works, although this activity is anticipated to be of short duration. It is therefore concluded that this activity will have a negligible and temporary noise impact on the receiving environment.

11.8.2 Offshore Pipeline (Pre-) Commissioning Activities

As can be seen from the noise plot below (Figure 11-1), noise levels associated with the pre-commissioning activities are predicted to be within the Environmental Protection Agency (EPA) and the World Health Organisation (WHO) Guidelines assessment criterion for daytime noise levels of 55dB(A), at the noise sensitive receptors in the Glengad area,

with the exception of 1 property where the predicted noise level associated with the commissioning works is 55.8dB(A).

Figure 11-1. Plot of L_{day} (Pre-) Commissioning Noise Levels.



11.9 Monitoring

Noise monitoring during marine works will be the same as proposed in the 2001 Offshore EIS, with the addition of MMOs being present on some construction vessels monitoring cetacean presence to reduce the potential for impacts to marine mammals from noise.

Onshore, a noise survey will be carried out before and during works on the site and near local residences to measure/assess the level and impact of construction activities.

11.10 Reinstatement and Residual Impacts

Taking the new data detailed above into consideration, there is no change to the residual impacts predicted in the 2001 Offshore EIS.

12 LANDSCAPE AND VISUAL IMPACT

12.1 Introduction

The 2001 Offshore EIS considered the landscape and visual impacts associated with the construction of the Corrib offshore pipeline and associated landfall terminating in an underground chamber. It also covered the issues surrounding the two crossings of the Sruwaddacon Bay (no longer under consideration due to revisions to the route of the onshore section of the upstream pipeline). As detailed in Section 3, an updated construction schedule and more detailed information on construction methodologies are now available for works yet to be completed.

12.2 Study Methodology

Based on this additional information, a re-assessment of the potential landscape and visual impact of the offshore, near-shore and landfall works has been undertaken. The potential visual and landscape impacts associated with the landfall valve installation (LVI) are addressed in the RPS Onshore Pipeline EIS 2010.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and it will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

12.3 Receiving Environment

The landscape character of Broadhaven Bay is one of wild, exposed, windswept shoreline, with a small number of sandy bays separated and contained by steeply rising cliffs. Views across the area have been designated as 'Highly Scenic Views' within the Mayo County Council Development Plan 2008-2014.

12.4 Characteristics of the Proposed Development

The characteristics of the proposed development are as detailed in Section 2 and Section 3. The only aspects of the offshore elements of the development that will create a visual impact are those from the presence of the construction vessels and rock placement vessels and the temporary landfall construction facilities required for the umbilical pull-in.

In addition, during the pre-commissioning phase, a temporary nitrogen plant will be located adjacent at the landfall site in Glengad for a period of one to two weeks. This will include mobile (container based) diesel generator units, which will generate emissions of combustion gases.

12.5 Potential Impacts of the Proposed Development

Construction-related visual impacts associated with the presence of construction vessels in Broadhaven Bay and landfall facilities at Glengad occurred during 2008 and 2009, and will be expected over a further season. It is therefore acknowledged that the duration of impacts is greater than initially anticipated.

12.5.1 Offshore

The continuation of subsea installation activities in the Corrib Field will be located beyond the horizon; therefore, there will be no landscape or visual impact associated with these ongoing activities.

During operations, there will be occasional remotely operated vehicle (ROV) surveys of the pipeline to monitor its status. The ROV will be deployed from a survey vessel, which will be visible from the shore while it remains in coastal waters, although the frequency and duration of such operations will be such that the impacts are negligible.

12.5.2 Near-shore/Landfall Works

During the period of construction, there has been a significant increase in marine activity in the nearshore areas within Broadhaven Bay.

Remaining offshore related construction activity will include rock placement works, pre-commissioning works, and umbilical pull-in. A near-shore survey vessel and crew change vessel will be present, as well as a rock placement vessel, side-stone casting vessel, and a bulk-carrier. These vessels are anticipated to be present in the near shore areas of Broadhaven Bay for a relatively short duration. Works associated with installation of the umbilical will involve a number of vessels operating for a short period (approximately two to three weeks) between the landfall and the Corrib field including an umbilical lay vessel (typically 123m length), a trenching vessel (typically 95m length) and survey vessel (typically 80m length).

In addition to the above, there will be various vessels that will access the construction spread from Ballyglass Pier. Some of this activity will continue for the duration of offshore construction works. The introduction of these vessels will result in short term, but significant, visual impacts on 'Highly Scenic Views' into the usually quiet bay.

At the landfall location, various plant including a winch will be present during the umbilical pull-in. A security fence, which will be erected around these and the onshore pipeline construction works, will pose a visual intrusion for the duration of the landfall activities. Impacts to the landscape at the landfall will be short term, during construction and for a short period afterwards. In the vicinity of the landfall, the principal landscape features that will be affected by the proposed development will be the beach itself, and the boulder clay 'cliff' to the rear of the beach. Any earthworks associated with the construction of the LVI and umbilical entrenchment will be minimal and only result in short-term landscape and visual impacts upon these principal landscape features and the associated 'Scenic Views' into and out of the area.

12.5.3 Offshore Pipeline (Pre-Commissioning Activities)

The nitrogen compressors and associated generators will be present on site for approximately 1 to 2 weeks in the Glengad area. Any visual impacts will be minimal and only result in short-term landscape and visual impacts.

12.6 Do-Nothing Scenario

No change from 2001 Offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

12.7 Mitigation Measures

12.7.1 Offshore

There will be no landscape or visual impacts associated with the ongoing installation activities at the wellheads, therefore no mitigation is proposed. No mitigation measures are proposed for the ROV inspection surveys either, given their predicted negligible visual impact.

12.7.2 Near-shore/Landfall Works

The remaining construction activities have been scheduled carefully to minimise the number of vessels required at any one time and to maximise efficiency on site, thereby keeping the construction schedule to a minimum. This in turn will help to minimise the duration and intensity of visual impact on the local area as a consequence of the presence of the vessels.

The reinstatement of the landfall has utilised state-of-the-art reinstatement techniques to return the visual integrity of the landscape, as closely as possible, to its previous condition. Armour rock material has been used to reinstate the base of the cliff where bedrock was broken out. Subsoil has been backfilled and compacted (with mechanical rollers) in layers to ensure adequate compaction. The cliff top layer has been reinstated using the stored topsoil taken from that location and cultivated. A geotextile has been laid at steep sections to prevent silt run-off. Vegetation has been allowed to regenerate naturally. No seed will be imported. It is not envisaged that the remaining construction works will have a significant impact on the integrity of the reinstatement works that have already taken place at the landfall following installation of the pipeline in 2009.

12.7.3 Offshore Pipeline (Pre-) Commissioning Activities

Upon completion of the pre-commissioning activities, all the mobile plant will be removed from site.

12.8 Predicted Impact of the Proposed Development

Whilst it is acknowledged that the landfall construction works have a greater duration than that originally envisaged, there is no change to the level of overall predicted impact associated with the offshore, near-shore and landfall works to the level predicted in 2001. The impact remains one of short term, but significant impacts to the 'Highly Scenic Views' across Broadhaven Bay.

12.9 Monitoring

Monitoring requirements for the landfall site reinstatement are detailed in the RPS Onshore Pipeline EIS 2010.

12.10 Reinstatement and Residual Impacts

There will be no residual landscape and visual impact associated with the offshore works.

There will be no anticipated residual impacts associated with the near-shore/landfall works as it is not envisaged that the remaining construction works will disturb the reinstatement measures that have already taken place.

13 SUSTAINABLE DEVELOPMENT

13.1 Introduction

Section 13 of the 2001 Offshore EIS identified and assessed the sources and potential impacts of substances affecting climatic change released from the offshore development. The assessment was based on emissions of greenhouse gases from the offshore development as calculated in the air quality assessment. The assessment has been updated below based on the updated information presented in Section 10 of this report.

In this section, climate change has also been addressed as part of the wider concept of sustainable development. Sustainable development is a global concept that requires a balance between economic prosperity, social development and environmental protection. Sustainable development was defined in 1987 by the Brundtland Commission report as:

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'

Agenda 21, as adopted at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, sets out a blueprint for sustainable development into the 21st century and sets out actions to be undertaken globally, nationally and locally by organisations of the United Nations System, governments and major groups in every area in which humans impact on the environment.

It is important that the principles of sustainable development are incorporated into new developments to ensure that they support long-term environmental, economic and social sustainability goals.

13.2 Climate Change

As stated in the 2001 Offshore EIS, the only greenhouse gases that are anticipated to be emitted from offshore operations in significant quantities are carbon dioxide and methane. Greenhouse gas emissions associated with the project are summarised in Table 13-1.

Table 13-1: Reflection of Greenhouse Gas Emissions (CO₂ Equivalents) based on one Years Worth of Construction and Installation Activity at Glengad

Source	Emission (tonnes)		GWP (tonne CO ₂ equivalent)
	CO ₂	CH ₄	
Drilling	43,396	4	43,480
Completion	25,698	2	25,740
Testing	49,688	592	62,120
Field installation	24,812	2	24,854
Offshore pipeline and umbilical installation	5773	0	5773
Near-shore pipeline and umbilical installation	2034	0	2034
Onshore works associated with pipeline and umbilical	498	0	498
Total	151,899	600	164,499

Note: CH₄ has 21x GWP of CO₂

To place the total greenhouse gas emissions (164 kilotonnes of CO₂ equivalent) into perspective, Table 13-2 compares the predicted greenhouse gas emissions with those of other industrial sources.

Table 13-2: Comparison of Greenhouse Gas Emissions with Other Industrial Sources

Source	Emission (tonnes)		GWP (tonne CO ₂ equivalent)	Time span of emissions data
	CO ₂	CH ₄		
Drilling, completion, installation and operations				
Corrib offshore activities¹	151,899 ²	600	164,499	Predicted total over 5-6 years
Operations				
Bellanaboy Bridge Gas Terminal	33,499 ³	210	37,912	1 year
Large gas terminal, UK	190,000	1000	211,000	1 year (2006)
240MW oil-fired power station, IRL	476,000	No data	>476,000	1 year (2004)
915MW coal-fired power station, IRL	5,550,000	No data	>5,550,000	1 year (2004)
360 MW CCGT power station, UK	369,074	41	369,935	1 year (2005)

¹The majority of emissions arise from the drilling and installation, not operation

² Equates to 25–30 kT/yr over 5-6 years

³ Reduced CO₂ emissions are due to the introduction of waste heat recovery and the cold venting of gas

Overall, as discussed in further detail below, the project will support a strategic fuel switch from solid fuel and oil to natural gas and renewables, and so contribute to a reduction in national greenhouse gas emissions.

13.3 Sustainable Development in Ireland

National

Ireland's approach towards the promotion and achievement of sustainable development and, in particular, towards the implementation of Agenda 21 is reflected in a range of national policy plans/statements and practical measures that together provide a framework for action across major areas of the economy and within both governmental and non-governmental sectors.

Ireland's National Sustainable Development Strategy (Sustainable Development: A Strategy for Ireland, 1997) aims to ensure that the economy and society in Ireland can develop to their full potential within a well protected environment, without compromising the quality of that environment and with responsibility towards present and future generations and the wider international community'. The Strategy provides a framework to allow sustainable development to be taken forward in a systematic manner in Ireland. It includes:

- an analysis of the relationship between economic activities and the environment, and an agenda to reinforce and deepen integration of environmental concerns;
- a strategic framework of priorities;
- action in strategic sectors (agriculture, forestry, marine resources, energy, industry, transport, tourism and trade);
- measures in supporting sectors (environmental quality, settlement and land use planning, the built environment, public action and awareness, and Ireland's international role); and
- arrangements for implementation and monitoring.

The Strategy is founded on the principles of precautionary action, integration of environmental considerations into other policies, and shared responsibility for the environment. It is focused primarily on policy issues that affect the environment to give appropriate weighting to such issues in the development process. It recognises that

economic growth and social development cannot be to the detriment of environmental quality.

Various strategic actions are identified in the Strategy. Those actions that are relevant to energy and industry include:

- Promotion of energy efficiency in industry;
- 14% of energy supply from renewables by 2010;
- Total national greenhouse gas emissions limited to 15% above 1990 levels by 2010 – measures introduced to reduce greenhouse gas emissions;
- Continued reduction of NO_x and SO_x emissions (e.g. through fuel substitution, energy conservation and installation of low-NO_x burners);
- Integrated Pollution Control licensing introduced;
- Increased focus on waste prevention and minimisation;
- Producer responsibility to encourage reuse and recycling of wastes; and
- Development of a materials and energy balance for industry to determine the full extent of industry's environmental/natural resource impacts and advise on targets for greater eco-efficiency.

In February 1999, the Minister for the Environment and Local Government officially launched Comhar, the National Sustainable Development Partnership, to promote consensus on sustainable development issues. Its terms of reference are to advance the national agenda for sustainable development, to evaluate progress in this regard, to assist in devising suitable mechanisms and advising on their implementation, and to contribute to the formation of a national consensus on these issues. Comhar's membership includes both State and non-governmental representation.

In 2002, a review of the National Sustainable Development Strategy was undertaken to assess progress made and to set out directions for future action. The findings of the review are reported in 'Making Ireland's Development Sustainable, 2002'. This document does not replace the National Sustainable Development Strategy but builds on the Strategy by placing it more fully in the context of recent environmental challenges.

Further enforcing the Government's commitment to sustainable development, the Government published the 'National Development Plan 2007–2013: Transforming Ireland – A Better Quality of Life for All', in 2007. The Plan sets out an investment plan for Ireland over the Plan period. The Plan focuses on five key areas: economic infrastructure; enterprise, science and innovation; human capital; social infrastructure; and social inclusion. In terms of sustainability, investment priorities include:

- Environment services and waste management investment;
- Climate change strategy – through investment in public transport, for example;
- Promotion of renewable energy, with a 15% commitment to use of renewables in electricity production by 2010;
- Agriculture;
- Built and natural heritage preservation; and
- Environmental research.

In terms of energy, in 2007 the Department of Communications Marine and Natural Resources published an Energy White Paper: Delivering a Sustainable Energy Future for Ireland: The Energy Policy Framework 2007–2020. The White Paper sets a clear path for meeting the Government's goals of ensuring safe and secure energy supplies, promoting a sustainable energy future and supporting competitiveness. The White

Paper enforces the Government's commitment to sustainable development as set out in the National Development Plan 2007–2013. Key actions and strategic goals identified in the White Paper are presented in Table 13-3.

Table 13-3: Energy White Paper – Key Actions and Strategic Goals

Action	Strategic Goal
Actions to ensure security of energy supply	<ul style="list-style-type: none"> Ensuring that electricity supply consistently meets demand Ensuring the physical security and reliability of gas supplies to Ireland Enhancing the diversity of fuels used for power generation Delivering electricity and gas to homes and businesses over efficient, reliable and secure networks Creating a stable attractive environment for hydrocarbon exploration and production Being prepared for energy supply disruptions
Actions to promote the sustainability of energy supply and use	<ul style="list-style-type: none"> Addressing climate change by reducing energy related greenhouse gas emissions Accelerating the growth of renewable energy sources Promoting the sustainable use of energy in transport Delivering an integrated approach to the sustainable development and use of bioenergy resources Maximising Energy Efficiency and energy savings across the economy Accelerating Energy Research Development and Innovation Programmes in support of sustainable energy goals
Actions to enhance the competitiveness of energy supply	<ul style="list-style-type: none"> Delivering competition and consumer choice in the energy market Delivering the All-Island Energy Market Framework Ensuring that the regulatory framework meets the evolving energy policy challenges Ensuring a sustainable future for Semi-State Energy Enterprises Ensuring affordable energy for everyone Creating jobs, growth and innovation in the energy sector

In terms of construction projects, the Department of Finance and Personnel (DFP) established a Sustainable Construction Group in December 2004 to issue guidance on sustainable construction for Government construction projects. A Sustainability Action Plan sets targets to be achieved to accomplish sustainable construction through procurement. The keys themes for which indicators are set include:

- Reuse Existing Building Assets;
- Design for Minimum Waste;
- Minimise Energy in Construction and Use;
- Do Not Pollute;
- Preserve and Enhance Biodiversity;
- Conserve Water Resources;
- Respect for People; and
- Set Targets (i.e. monitor and report to benchmark performance).

Local

The Local Government (Planning and Development) Act, 2000-2005 restricts a planning authority, when making a decision in relation to a planning application, to consideration of the proper planning and sustainable development of the area.

The Mayo County Development Plan, 2008-2014 has been prepared in accordance with the Local Government (Planning and Development) Act, 2000-2005 and will form the basis for the progressive and sustainable planning of the county for the next six years and beyond. The Mayo County Development Plan embraces the principles of sustainability in addressing future growth and development. In terms of economic and infrastructure development, key objectives of the Plan include:

- To promote development of all sections of the Mayo economy and optimise the contribution of the county's natural resource base to balanced, sustainable development and ensure that the availability of infrastructure facilities is not a limiting factor;
- To optimise the development of appropriate renewable energy sources, which make use of the natural resources of the area concerned in an environmentally acceptable and sustainable manner;
- To ensure the county's natural resources are managed and developed in a sustainable manner that will ensure they can be enjoyed by future generations; and
- To ensure that the energy supply and distribution throughout Mayo is expanded and upgraded sufficiently to enable economic, enterprise and other developments to locate in the County.

Key issues for natural resources include the sustainable development of valuable natural resources to their full potential in a manner that has due regard to environmental protection, biodiversity conservation and the preservation of visual, scenic and residential amenities.

13.4 Shell Group Sustainable Development Policy

As well as complying with national and local goals through the planning process, Shell aims to contribute to sustainable development in its activities in Ireland in full compliance with the requirements of the Shell Group Sustainable Development Principles (July 1999). These principles are as follows:

- Respect and safeguard people;
- Engage and work with stakeholders;
- Deliver value to customers;
- Minimise impact on the environment;
- Use resources effectively;
- Maximise profitability; and
- Maximise benefits to the community.

13.5 Contribution to National Sustainable Development Strategy Priorities

An assessment of the extent to which the project complies with strategic actions that are relevant to energy and industry as defined in the National Sustainable Development Strategy, has been carried out as follows:

Promotion of energy efficiency in industry

The availability of an alternative gas supply via the pipeline may encourage the development of combined cycle electrical generation plants and combined heat and power plants that are more energy efficient than conventional power plants and steam generation plants.

Total national greenhouse gas emissions limited to 15% above 1990 levels by 2010 – measures introduced to reduce greenhouse gas emissions

The overall project supports Ireland's proposed national strategic fuel switch from solid fuel and oil to natural gas and renewables, and so contributes to Ireland's target to limit national greenhouse gas emissions while ensuring security of energy supply.

Reduction in NO_x and SO_x emissions

As the overall project will serve to encourage a national fuel switch from oil and coal towards gas, this is likely to result in lower NO_x and SO_x levels nationally.

Increased focus on waste prevention and minimisation

A waste management plan has been developed for pipeline construction and operation phases, implementing Shell's waste hierarchy policy.

In terms of the overall project, the gas from Corrib provides the opportunity to displace the combustion of coal and peat, which produce solid residues requiring disposal.

Producer responsibility to encourage reuse and recycling of wastes

The project will reuse excavated peat to regenerate a cutover peat land where it will stabilise and integrate into new wetland habitats.

Maximum reuse of excavated material will be made on site as fill or for landscaping.

13.6 Contribution to Other National Priorities Related to Energy

An assessment of the extent to which the project complies with key actions and strategic goals as defined in the Energy White Paper has been carried out as follows:

Ensure security of energy supply

The overall project will help ensure security of gas supply for Ireland throughout the life of the field, as the project will provide an alternative supply of gas should the interconnector supply from the UK be interrupted.

By increasing competitiveness in the domestic energy market, this may serve to displace gas imports, further securing long-term energy supply.

Promote the sustainability of energy supply and use

The overall project will contribute to Ireland's target to limit national greenhouse gas emissions while ensuring security of energy supply.

Enhance the competitiveness of energy supply

The overall project will increase competitiveness in the domestic energy market. The overall project will also provide employment during construction and operation as well as providing a demand for local and regional services during construction and operation.

13.7 Assessment of Project vs. 'No Project' Scenario

An assessment of the extent to which the project and the 'no project' scenario complies with the following priorities has been carried out:

- Strategic actions relevant to energy and industry as defined in the National Sustainable Development Strategy;

- Key actions and strategic goals as defined in the Energy White Paper;
- Sustainable Construction Group themes; and
- Shell Group Sustainable Development Principles.

The findings of the assessment are presented in Table 13-4. The assessment indicates that the project complies more favourably with the sustainable development principles compared with the 'no project' scenario. Furthermore, the project contributes positively to Ireland's national sustainable development objectives.

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Table 13-4: Comparison of “Project” vs. “No Project” Scenarios against Sustainable Development Priorities

National Sustainable Development Strategy/Energy White Paper/Shell SD Priorities	Scenario 1 Project - Gas produced locally; local terminal.	Scenario 2 No Project - Gas imported via interconnector from UK. Gas produced either in UK, Europe or non-EU countries. The latter will involve LNG conversion.
Ensure security of energy supply	<p>The overall project will help ensure security of gas supply for Ireland throughout the life of the field, as the project will provide an alternative supply of gas should the interconnector supply from the UK be interrupted.</p> <p>By increasing competitiveness in the domestic energy market, this may serve to displace gas imports, further securing long-term energy supply.</p>	<p>Ireland is at the very end of the European gas grid, which is supplied to a large extent from Algeria and Siberia.</p> <p>There is risk of interruption of gas supply to Irish customers as Ireland is extremely dependent on imported gas.</p>
Promote the sustainability of energy supply and use/promotion of energy efficiency in industry/minimise energy in construction and use	<p>Although the overall project involves the exploitation of local finite gas resource, it will discourage the use of more carbon intensive fuels and is in line with the national energy switch from solid fuel to gas to renewables. The provision of gas infrastructure will discourage future investment in alternative coal or oil infrastructure. In terms of greenhouse gas emissions, the terminal has a lower global warming potential (GWP) than the average GWP for other terminals shown in Table 13-2. The overall project will therefore contribute to Ireland’s target to limit national greenhouse gas emissions.</p> <p>Use of gas close to its source rather than gas transported thousands of kilometres will be more energy-efficient.</p> <p>The availability of an alternative gas supply via the pipeline may encourage the development of combined cycle electrical generation plants and combined heat and power plants, which are more energy efficient than conventional power plants and steam generation plants.</p> <p>The gas pipeline from the Bellanaboy Bridge terminal created the opportunity for the Bord Gáis to build a distribution system to supply gas to towns and industries along the route of the pipeline. The availability of natural gas could serve to make these towns more attractive for inward investment and boost the economy of the region by</p>	<p>The “no project” option will still involve exploitation of a finite gas resource.</p> <p>Importation of gas from Europe and non-EU countries could lead to greater environmental impacts as follows:</p> <ul style="list-style-type: none"> • Some non-EU countries have less stringent environmental legislation compared to EU • Introduction of further processing through LNG conversion • Added energy loss impacts associated with long distance transport <p>Long-distance gas transport and LNG conversion/storage will involve added fossil fuel resource use.</p>

National Sustainable Development Strategy/Energy White Paper/Shell SD Priorities	Scenario 1 Project - Gas produced locally; local terminal.	Scenario 2 No Project - Gas imported via interconnector from UK. Gas produced either in UK, Europe or non-EU countries. The latter will involve LNG conversion.
	<p>providing a supply of clean, relatively cheap fuel. These towns and industries do not have sufficient demand to justify the cost of construction of a gas pipeline in the absence of the Corrib project.</p> <p>Where Bord Gáis Éireann decides to supply local towns with gas, this could result in a shift from peat/coal/oil/LPG to natural gas to meet energy needs in NW Ireland. Since gas is a cleaner fuel, this will result in lower environmental impacts.</p> <p>Overall, the local production of gas has a lower environmental impact compared to importation, due to lower transmission energy losses</p>	
Enhance the competitiveness of energy supply	<p>The overall project will also increase competitiveness in the domestic energy market, which may keep costs lower than they would be in the absence of such competition.</p> <p>The local community will realise both temporary and sustained benefits of increased employment during construction and operation of the overall project.</p> <p>The employment created during the operation of the project will provide the opportunity for some local people to remain in the area rather than have to move to other parts of Ireland or overseas for employment. It is possible that local people will not fill all of the jobs created. These jobs will be filled by people who will move into the area, augmenting the local communities and increasing the support for local schools, shops, other local businesses, sports clubs and other community activities. The influx of temporary workers during construction may have a negative impact on the Gaeltacht nature of the area.</p>	<p>If the project does not go ahead, there will be no opportunity to supply gas to local towns in N & NW Ireland and therefore no potential inward investment locally. Thus, lagging economic development will continue in the area.</p> <p>There will also be no temporary employment opportunities and no incoming families to augment the local community.</p> <p>All other localised social benefits and impacts will be avoided.</p> <p>Natural gas needs will rely solely on gas imports, with less security of supply. An interruption to supply would result in significant socio-economic impact both for customers and for Ireland.</p> <p>No impact on the Gaeltacht status.</p>

National Sustainable Development Strategy/Energy White Paper/Shell SD Priorities	Scenario 1 Project - Gas produced locally; local terminal.	Scenario 2 No Project - Gas imported via interconnector from UK. Gas produced either in UK, Europe or non-EU countries. The latter will involve LNG conversion.
Reduction in NO _x and SO _x emissions	As the overall project will serve to encourage a national fuel switch from oil and coal towards gas, this is likely to result in lower NO _x and SO _x levels nationally.	The "no project" option will still encourage a national fuel switch from oil and coal towards gas.
Increased focus on waste prevention and minimisation	<p>A Waste Management Plan has been developed for the pipeline construction and operation phases, implementing Shell's waste hierarchy policy.</p> <p>In terms of the overall project, the gas from Corrib provides the opportunity to displace the combustion of coal and peat, which produce solid residues requiring disposal.</p>	Importation of gas from Europe and non-EU countries could lead to greater environmental impacts as some non-EU countries have less stringent environmental legislation compared to EU.
Producer responsibility to encourage reuse and recycling of wastes/design for minimum waste/reuse existing building assets	<p>The project will reuse excavated peat to regenerate a cutover peat land, where it will stabilise and integrate into new wetland habitats.</p> <p>Maximum reuse of excavated material will be made on site as fill or for landscaping.</p>	Importation of gas from Europe and non-EU countries may not achieve the same levels of reuse and recycling.
Do not pollute/preserve and enhance biodiversity/conservate water resources	<p>Many potential environmental impacts have been avoided by sensitive routing and/or by commitment to the use of particular construction and restoration techniques and mitigation measures.</p> <p>An Environmental Management Plan has been developed for the offshore pipeline construction to ensure that legislative and contractual requirements and environmental best practice are implemented.</p> <p>Replanting of trees, including native species, will compensate for local habitats and ecosystems loss along the onshore pipeline route and on the terminal site.</p>	Importation of gas from Europe and non-EU countries could lead to greater environmental impacts as some non-EU countries have less stringent environmental legislation compared to EU.
Respect for people	<p>A risk-based approach will be applied to health and safety. In order to manage safety risks, a Major Accident Prevention Policy (MAPP) will be prepared for operation of the terminal.</p> <p>Use of local contractors: EU legislation requires large projects to be advertised across Europe, which restricts the</p>	<p>The safety risks associated with gas supplied via the interconnector from the UK will be similar to those associated with the project.</p> <p>Risks may be higher for gas imported from non-EU countries due to the possibility of less stringent H&S</p>

National Sustainable Development Strategy/Energy White Paper/Shell SD Priorities	Scenario 1 Project - Gas produced locally; local terminal.	Scenario 2 No Project - Gas imported via interconnector from UK. Gas produced either in UK, Europe or non-EU countries. The latter will involve LNG conversion.
	<p>sole use of Irish contractors.</p> <p>Community consultation: since the beginning of the project, the project team has carried out ongoing consultations with the local community in the form of public exhibitions, group meetings and individual consultations where local people were invited to express their views and key concerns relating to the project. Such concerns have been incorporated into the EIS. The project has gained widespread community support in the locality and the north-west region.</p> <p>An environmental monitoring group has been established to continue consultation during the construction and operation phases.</p> <p>Engaging the supply chain: the project team has made efforts to integrate HSE awareness into the supply chain by issuing HSE questionnaires as part of the supplier selection process.</p>	<p>legislation.</p>
Set Targets	The Environmental Management Plan for the project will include a requirement for monitoring of activities. Targets will be set for specific environmental parameters to check compliance and assess progress.	Not applicable

Key:

Better performance against SD principle or priority		Lower performance against SD principle or priority		Insufficient data to compare performance	
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14 CULTURAL HERITAGE

14.1 Introduction

The 2001 Offshore EIS considered the potential for archaeological impacts associated with the construction of an offshore pipeline and associated landfall terminating in an underground chamber. It also covered the two (previously proposed and permitted) crossings of the Sruwaddacon Bay (which are no longer under consideration due to changes in the proposed route of the onshore pipeline). The assessment was based on data in the public domain and geophysical and geotechnical data generated by the marine contractors at that time.

During 2002, a marine trench was partially excavated and subsequently backfilled under the archaeological supervision of Tideways archaeological subcontractors – Moore Group. The marine trench was excavated further in 2005, 2008 and 2009 under archaeological monitoring under licences for excavation, diving and use of a metal-detector from the Department of the Environment, Heritage and Local Government (DoEHLG). Nothing of any archaeological significance was recorded during these works.

In 2005, 2008 and 2009, the landfall and associated topsoil stripping associated with the Glengad Headland temporary site compound was monitored under archaeological supervision. An excavation licence was obtained from the DoEHLG for works associated with the landfall.

In 2004 and 2005, archaeological monitoring was also undertaken in association with the geotechnical test pits constructed to assess the crossing of the Sruwaddacon.

In 2008, excavation of pits for the winch and anchors to facilitate the pulling in of the pipeline into the landfall and topsoil stripping of the landfall site was also monitored.

Based on the findings of the post-2001 archaeological monitoring, a re-assessment of the potential archaeological impacts of the offshore, near-shore and landfall works has been undertaken.

14.2 Study Methodology

The National Monuments (Amendment) Act 2004:

- Clarified ministerial responsibilities in relation to matters affecting national monuments;
- Revised previous provisions in relation to consent required for works affecting national monuments;
- Made provision for archaeological works carried out in connection with road developments approved under the Roads Act 1993; and
- Introduced special provisions for dealing with national monuments discovered in the course of construction of such approved road developments.

As noted in the 2001 Offshore EIS, under the National Monuments Act, 1930-2004, all archaeological heritage is the property of the nation. The DoEHLG is the licensing authority for intrusive and non-intrusive archaeological investigations.

14.3 Receiving Environment

During the archaeological monitoring of the marine pipe trench undertaken in 2002, 2005, 2008 and 2009 nothing of any archaeological significance was found.

The archaeological monitoring of three geotechnical test pits located within the pipeline wayleave on the eastern shore of Glengad Headland, a walkover survey of the pipeline

wayleave on Glengad Headland, and archaeological monitoring of topsoil stripping activities at Glengad Headland also revealed nothing of archaeological significance.

Further archaeological monitoring associated with the geotechnical test pits constructed to assess the previously permitted lower crossing of the Sruwaddacon did not reveal any archaeological material.

Topsoil stripping of the landfall site and the excavation of pits for the winch and anchors, to facilitate the pulling in of the pipeline was monitored and no archaeological material was revealed.

Further archaeological monitoring was carried out during construction works in Summer 2009. This included:

- Dredging: round-the-lock cover on a trailer suction dredger (*Ham 311*) and back hoe dredgers (*Aberko Server* and *Razende Bol*), from 4th May-31 August; and
- Trenching: results from both pre- and post-lay ROV surveys of the section of the pipeline route to be trenched (in ~21-70m water depth) were subject to archaeological assessment.

In all cases, nothing of archaeological significance was recorded.

14.4 Characteristics of the Proposed Development

The characteristics of the proposed development are detailed in Sections 2 and 3.

14.5 Potential Impacts of the Proposed Development

To date, no archaeological deposits, finds or features have been revealed as a result of the archaeological desktop assessment, intertidal survey, previous geophysical investigations or previous archaeological monitoring. Based on these investigations, it is anticipated that there will be no impact upon archaeology. However, due to the buried and invisible nature of archaeological remains, there is always the possibility that previously unknown archaeological remains could be encountered during construction.

14.6 Do-Nothing Scenario

No change from 2001 Offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

14.7 Mitigation Measures

Whilst the marine pipe trench was archaeologically monitored in 2002, 2005, 2008, and 2009 and nothing was found during this work, there still may be potential for archaeological remains to be uncovered during remaining works, if any deviation from the original routes occurs.

The DoEHLG will require a monitoring licence for any new marine trenches or onshore topsoil stripping in areas not stripped previously.

Contingency plans to deal with such an eventuality will be put in place for the remaining construction phases.

Given the previous monitoring that has been carried out in the area, the Underwater Archaeology Unit of the DOEHLG have confirmed that no further archaeological monitoring will be required for the umbilical installation works.

14.8 Predicted Impact of the Proposed Development

To date, no archaeological deposits, finds or features have been revealed as a result of the archaeological desktop assessment, intertidal survey, previous geophysical investigations or previous archaeological monitoring. Based on these investigations, it is anticipated that there will be no impact upon the archaeology resource. However, due to the buried and invisible nature of archaeological remains, there is always the possibility that previously unknown archaeological remains could be encountered during the remaining construction works.

14.9 Monitoring

No further archaeological monitoring will be required once construction is completed.

14.10 Reinstatement and Residual Impacts

There will be no residual impacts in relation to archaeology.

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15 MATERIAL ASSETS

15.1 Introduction

The 2001 Offshore EIS assessed the potential impact of the project on resources that are available to the local community, specifically focusing in the 'Material Assets' section on waste treatment and the local road network. This section presents an update of relevant legislation on waste disposal, and more detailed information on the waste and transport aspects of the offshore pipeline and landfall construction and operation.

It is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and it will require works over a further season. It is therefore acknowledged that some construction-related impacts will have a greater duration than that originally envisaged.

15.2 Solid Waste

15.2.1 Introduction

This section considers the various solid waste materials and substances that will be generated during the installation, operation and decommissioning of the offshore development.

15.2.2 Study Methodology

Since the production of the 2001 Offshore EIS, the implementation of the Waste Management Act has set the category of hazardous waste. Other effects include a more rigorous system for the control and management of waste through licensing by the EPA or via permit at the local authorities.

Section 15.2 of the 2001 EIS refers to waste that has been categorised as general (controlled) waste or special waste. Reference to special waste in the 2001 EIS should now be considered as hazardous waste.

15.2.3 Receiving Environment

15.2.3.1 European Union Legislation

Table 15.1 of the 2001 Offshore EIS provides a list of the European waste legislation relevant to the offshore section of the Corrib development. An updated table showing the most recent legislation is provided in Table 15-1 below.

Table 15-1: European Waste Legislation

Directive	Name	Summary
2006/12/EC	Council Directive on Waste	Requires that any establishment that carries out disposal operations or possible recovery operations will require a permit from the competent authority. Permits must cover types and quantities of waste, technical requirements, security precautions, disposal site and treatment method. Directive 2006/12/EC consolidates and replaces Directive 75/442/EEC as subsequently amended.
94/62/EC As amended by 2004/12/EC 2005/20/EC	European Parliament and Council Directive on packaging and packaging waste	Regulation introduces the concept of "producer responsibility" for packaging waste. Member states are required to take measures to achieve 60% recovery by 2011 and material specific targets that range from 15% (wood) to 60% (paper & glass).
75/439/EC As amended by 87/101/EEC 91/692/EEC	Council Directive on the disposal of waste oils	Requires that any establishment undertaking "disposing" of waste oils (such as lubricating oils and used oils but not oil refinery wastes) must obtain a permit from the competent authority. Member states shall take the

Directive	Name	Summary
2000/76/EC		necessary measures to ensure that waste oils are collected and disposed of without causing any avoidable damage to man and the environment.
EC 1013/2006	Council regulation on the supervision and control of shipments of waste within, into and out of the European Community	Establishes a system of supervision and control of all movements of waste. It provides for a common, compulsory notification system and for a standard consignment note for shipments of waste. Requires that any holder of any toxic and dangerous waste who intends to move it across a frontier is required to notify the competent authority of the member states concerned and where applicable, any third state, by means of a consignment note. Conditions are laid down covering packaging, labelling and instructions in the event of danger and an accident.
2000/76/EC	Waste Incineration Directive	Directive introduces controls when incinerating both hazardous and harmless wastes may cause emissions of substances that pollute the air, water and soil, and have harmful effects on human health.
1999/31/EC	Council Directive on the landfill of waste	It defines the different categories of waste (municipal waste, hazardous waste, non-hazardous waste and inert waste) and applies to all landfills, defined as waste disposal sites for the deposit of waste onto or into land. Landfills are divided into three classes: <ul style="list-style-type: none"> - landfills for hazardous waste; - landfills for non-hazardous waste; and - landfills for inert waste.

15.2.3.2 Irish Legislation

The most relevant piece of legislation currently in force is the Waste Management Act 1996 to 2008. The 2001 Offshore EIS lists what this Act provides for. However, as some of the legislation listed has since been revised, an updated list is presented below:

- Waste Management (Licensing) Regulations, 2000 and 2004;
- Protection of the Environment Act 2003;
- Dumping at Sea Act, 1996, As Amended by Dumping at Sea (Amendment) Act 2004 and Sea-Fisheries and Maritime Jurisdiction Act 2006;
- Foreshore Acts 1933–2003;
- Waste Management (Shipment of Waste) Regulations 2007; and
- MARPOL 73/78, Annexes I–VI .

15.2.4 Characteristics of the Proposed Development

The characteristics of the proposed development are as detailed in Sections 2 and 3.

15.2.5 Potential Impact of the Proposed Development

No change from 2001 Offshore EIS.

15.2.6 Do-Nothing Scenario

No change from 2001 Offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

15.2.7 Mitigation Measures

15.2.7.1 Waste Management Plan

Each of the contractors engaged in the offshore works will implement a Waste Management Plan, which lists roles and responsibilities within the contractor's organisation for ensuring rigorous management and control of the wastes generated from the offshore development phases. Any waste generated will be transported to licensed waste facilities.

15.2.8 Predicted Impact of the Proposed Development

No change from 2001 Offshore EIS.

15.2.9 Monitoring

No change from 2001 Offshore EIS.

15.2.10 Reinstatement and Residual Impacts

The 2001 Offshore EIS predicted that there would be no impact on the local environment from the production of solid waste associated with rock placement works and installation and operation of the offshore pipeline and umbilical. New legislation concerning the management of waste will further serve to ensure that there are no impacts.

15.3 Traffic Impact Assessment

15.3.1 Introduction

The text below presents an update on plans to manage the movement of traffic associated with the remaining construction works for the offshore pipeline and umbilical. Effectively, the text relating to onshore operations is limited to the remaining offshore construction related works at the landfall site in Glengad.

The primary support port for offshore construction vessels will be Killybegs. There will be some inevitable interruption to normal operations of Killybegs Harbour or to other vessels that are active along the coast. Local marine support for nearshore works will be from Ballyglass Pier. Potential impacts to local marine transport is covered in the text below.

15.3.2 Study Methodology

Further to the traffic impact assessment undertaken as part of the 2001 Offshore EIS, a SEPIL 'Traffic Management Plan for the Landfall and Pull-in of the Gas Pipeline' was produced by TOBIN Consulting Engineers (February 2008) for the works that were undertaken in 2008. This document was subsequently revised for 2009 and is updated on an ongoing basis to reflect current works.

15.3.3 Receiving Environment

15.3.3.1 Offshore and Nearshore

A number of changes to the fishing activity as described in the 2001 Offshore EIS have since occurred. Fishing activity in the offshore area now consists mainly of shellfish vessels fishing for crab and lobster. There are approximately 110 vessels operating in this type of fishery, in areas close to shore up to 80km offshore. These vessels range in length from 8m to 22m long. The average number of pots fished is 800 per vessel. The pots are fished in trains of approximately 25 for the smaller vessels up to 150 for the largest vessel, with each pot located approximately 30m apart. The ends of each

train are marked with a red surface buoy with a lead rope to the first pot on the seabed. In terms of trawling, the fleet has reduced since 2001, with approximately 8 vessels (12 to 16m in length) operating in mainly inshore waters. An international fleet of large vessels fishing for pelagic fish (including mackerel, herring and scad) operate in the area in spring and again from September to December. The Irish fleet is about 35 strong and with other EU boats, the fleet can swell to 60 vessels at times. Offshore (200m water depth), a number of large Spanish and French trawlers operate year-round (trawling for hake and megrim). Further offshore (up to 800m water depth), Spanish tangle netters are also known to operate.

15.3.3.2 Existing Road Network

Material to be hauled to Glengad landfall will travel on the R314, the L1202, L1202-116 and L1202-45. As indicated in the 2001 Offshore EIS, a number of the roads in the vicinity of the landfall were identified as requiring improvements and local widening. Since 2001, various road improvements have been undertaken including strengthening of the L1204 associated with the terminal site. Further improvement works were also undertaken during 2008 including road widening and pavement improvement works along the L1202 between the junction with the R314 and the entrance to the landfall site at Glengad, , as detailed in Table 15-2.

Further details of the recent works along the R314 and L1202 are provided below.

R314 (Terminal Entrance) to L1202 Junction (Bellagelly South)

During 2008, the existing pavement along this section of the R314 was strengthened by Mayo County Council. The pavement width is generally a minimum of 5.5m and is therefore sufficient to accommodate the safe two-way movement of Heavy Commercial Goods Vehicles (HCV's). The strengthening works comprised a regulating macadam course, a 'meshtrack' fabric and a 100mm layer of bituminous surfacing finished with a double pass of surface dressing.

As the pavement foundation on this section of the R314 was granular material overlying peat there was a risk of pavement damage due to the compressible peat subgrade, which is subject to distortion under loading. To mitigate any damage to the pavement occurring during the landfall works, Mayo County Council were have been undertaking ongoing repair and maintenance of the pavement to an acceptable standard.

L1202

The L1202 has been strengthened and widened where possible and a weak culvert structure at Aughoos South has been replaced. The L1202 can broadly be divided into two areas:

- Sections of road that have a width of less than 5.5m; and
- Sections of road that have a width of not less than 5.5m.

Sections of road that have a width of less than 5.5m.

This results in places where there is insufficient width along the L1202 for two HCVs to pass. In order to manage this situation, it has been possible to provide pause points separated by adequate sight distance, where a priority rule in favour of the loaded vehicle applies. Also, during busy periods, vehicles were moved in batches of up to 5 vehicles operating in a convoy manner through the area of limited width. This approach was successfully adopted in 2008 and 2009.

Sections of road that have a width of not less than 5.5m

In these areas there is sufficient width for two HGVs to pass each other. In general, where passing is possible, the pavement has been improved, aiding the management of traffic on the road.

In December 2008, Mayo County Council continued to work on widening and strengthening of the L1202 between the Junction with the R314 at Bellagelly South and the access to the landfall site.

The L1202 pavement was monitored during the landfall works and damaged pavement repaired by Mayo County Council as necessary.

Table 15-2: Designated Haul Routes for Glengad Landfall upgraded in 2008 and to be maintained

Road	From
R314	Terminal Gate to L1202 junction
L1202-116	Bellagelly South – Aghoos
L1202-45	Pollatomish – Glengad

15.3.4 Characteristics of the Proposed Development

The characteristics of the proposed development are as detailed in Sections 2 and 3.

15.3.5 Potential Impact of the Proposed Development

15.3.5.1 Offshore and Near-Shore

Remaining rock placement works in the near shore sections of Broadhaven Bay and installation of the umbilical will require the presence of various offshore vessels in Broadhaven Bay. It is likely that, due to their size and low manoeuvrability, these construction vessels will cause some impacts to the movements of local vessels over the period in which they are present in the bay, or in the area of Ballyglass Pier.

15.3.5.2 Landfall

The movement of plant, labour, materials and any abnormal loads that may need to be brought to the construction site for the umbilical landfall, and the offshore pipeline pre-commissioning activities are likely to result in temporary impacts to the normal usage of the road network in the vicinity of the landfall.

Materials for the umbilical pull-in operation will consist mainly of services and consumables and winching equipment and associated cabling. In the later summer months, there may be haulage away of surplus materials at an estimated –maximum 10 loads per week.

HCV construction traffic associated with the above landfall works is expected to be a maximum 10 HCVs per week during short periods during the summer of 2011 and 2012, with some associated personnel traffic.

15.3.6 Do-Nothing Scenario

No change from 2001 Offshore EIS. Further consideration of the do-nothing scenario is addressed in Section 13.7.

15.3.7 Mitigation Measures

15.3.7.1 Offshore and Near-Shore

SEPIL employs a fisheries liaison officer (FLO) as a contact point between the company and the local fisheries interests. The FLO is responsible for communicating the construction schedule to the relevant fisheries and maritime organisations throughout the period of the development to enable their members to plan their activities accordingly.

15.3.7.2 Existing Road Network Inventory

The updated Traffic Management Plan will be implemented for the on shore pipeline works and all works associated with the umbilical pull-in and offshore pipeline pre-commissioning activities to minimise traffic impacts. These mitigation measures are applicable for the remaining landfall works and include:

- Signage and controls – road signs on the R313, L1204 and R314 were erected during the upgrade works to facilitate the materials haulage operations. These signs were customised for each location, and will continue to act as a preliminary warning to road users of works traffic and traffic controls extending over a stated time period, as well as advising of possible restrictions and alternative routes.
- Communication by radio, telecoms and print media – providing regular progress reports, and provision of a freephone number to allow the public to comment and raise queries;
- Lighting of vehicles – trucks normally operate on dipped headlights to minimise risks of road accidents;
- Areas of restricted carriageway width – signage in place to warn drivers of priority systems to allow the right of way to laden vehicles, and a protocol for convoy travel of up to 5 vehicles regulated with radio control by Traffic Management Operatives;
- Speed limits and separation distances – maximum speed limit of 60 km/hr is imposed for HGVs on the haul route sections on the R313, L1204, L1202 and R314, with the exception of road areas where convoy operations apply, where speed is restricted to 50km/hr;
- Accommodating the needs of local residents – proper road signs, regular communication, awareness of school bus runs, , driving training and communication, speed controls and maintenance of clean loading;
- Record keeping of amongst other things tachographs fitted to heavy commercial vehicles to ensure compliance with national regulations on maximum working hours and breaks;
- Driver training in accordance with a set code of practice;
- Vehicle inspections and report records;
- Road condition maintenance; and
- Emergencies and contingencies procedures.

15.3.8 Predicted Impact of the Proposed Development

15.3.8.1 Offshore and Near-Shore

There is no change to the nature of the potential impacts as described in the 2001 Offshore EIS.

15.3.8.2 Landfall

There is no change to the nature of the potential impacts as described in the 2001 Offshore EIS. The haul routes can accommodate the expected traffic associated with the remaining landfall construction works and has benefited from strengthening and widening.

15.3.9 Monitoring

SEPIL will ensure that its main contractor and all subcontracting firms involved in the project adhere to the Traffic Management Plan.

15.3.10 Reinstatement and Residual Impacts

It is anticipated that repair works carried out to the main transport routes, in agreement with Mayo County Council, will result in a better road surface following the construction period than before. In addition, SEPIL is committed to reinstating the pavement, as required, after all construction works are completed.

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16 ASSESSMENT OF ENVIRONMENTAL EFFECTS

16.1 Introduction

Section 16 of the 2001 Offshore EIS summarised the potential environmental effects, proposed mitigation measures and residual impacts (impacts remaining after mitigation) associated with the proposed offshore development.

A reassessment of the potential impacts of the offshore facilities yet to be constructed has been completed as part of this Supplementary Update Report. The reassessment has only considered impacts where newly available project or environmental data are available, including the revised schedule of works and detailed method statements that are now available.

The findings of the reassessment result in some changes to the summary presented in Section 16 of the 2001 Offshore EIS. Potential environmental effects, proposed mitigation measures or residual impacts that *do* differ from 2001 are presented in Table 16-1. The central column of the table lists the changed information that is now available and that could have affected the assessment of impacts.

Throughout this section it is noted that whilst nearshore construction activity commenced during 2008, it continued in the summer of 2009 and will require works over a further season. It is therefore acknowledged that some offshore construction-related impacts will have a greater duration than that originally envisaged.

16.2 Accidental Events

There are no changes to the assessment of risks for abnormal operations and accidental events as presented in Section 16.3 of the 2001 Offshore EIS.

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Table 16-1: Assessment of Potential Impacts, Proposed Mitigation Measures and Predicted Impacts for Remaining Facilities Installation

Aspect/Potential Impact	Control/Mitigation Measures	Predicted Impact/Ecological Significance
CONSTRUCTION OPERATIONS WITHIN CORRIB FIELD		
WELL TIE-IN AND INSTALLATION OF FLOWLINES Emissions from vessels – Air Water	Use of low sulphur fuel, well maintained engines Efficient black and grey water treatment systems	NEGLIGIBLE Vessels may be in Corrib field longer than predicted in 2001 Offshore EIS, although impact still predicted to be negligible
OFFSHORE UMBILICAL LAYING OPERATIONS		
PRESENCE & MOVEMENT OF UMBILICAL REEL-LAY VESSEL & OTHER VESSELS: Emissions from vessels – Air Water	Use of low sulphur fuel, well maintained engines Efficient black and grey water treatment systems	NEGLIGIBLE Due to the requirement for further construction seasons the duration of impacts is greater than initially anticipated. The vessels will therefore spend longer on offshore construction operations than predicted in 2001 Offshore EIS. The residual impact is still predicted to be negligible.
NEAR-SHORE/LANDFALL ROCK PLACEMENT AND UMBILICAL LAYING OPERATIONS		
NEAR-SHORE ROCK PLACEMENT OPERATIONS: Emissions from vessels – Air Water Physical impacts to the seabed / loss of seabed habitat	Use of low sulphur fuel, well maintained engines Efficient black and grey water treatment systems Rock placement is required for sections of the pipeline and umbilical that require additional stabilisation. Rock will be placed over as small an area as possible to prevent scour and to ensure that the rock placed footprint is minimised as far as possible. Rock selected is an inert granite and will provide valuable substrate for colonisation of epibenthos.	MINOR The vessels will be present in Broadhaven Bay undertaking rock-placement in 2010 and possibly 2011. The impact is still predicted to be negligible. Permanent seabed habitat loss for the area of the rock placed footprint. Introduction of an equivalent area of hard substrate for epibenthic colonisation in place of the lost soft sediment habitat. The impact is predicted to be minor.

Aspect/Potential Impact	Control/Mitigation Measures	Predicted Impact/Ecological Significance
<p>LANDFALL WORKS</p> <p>General</p>	<p>Notice of particularly noisy operations will be given to local residents</p>	<p>MINOR Visual impact still temporary and minor even though the duration of works is greater than initially anticipated It is also acknowledged that disturbance will now be over more than one construction season.</p>
<p>PRE-COMMISSIONING – OFFSHORE PIPELINE</p> <p>Noise impact</p> <p>Landscape</p>	<p>Information available on the pre-commissioning nitrogen equipment to be located at Glengad indicate that high noise levels will occur during the pre-commissioning works. Therefore, working hours in relation to running the nitrogen plant may be restricted to 07:00–22:00, provided further attenuation can not be achieved. If noise can be reduced to acceptable levels, it would be proposed to run the pre-commissioning plant on a 24-hour basis.</p> <p>The nitrogen plant will be present on site for approximately 1 to 2 weeks at the Glengad landfall site</p>	<p>NEGLIGIBLE</p> <p>No change to predicted impact even though it is acknowledged that disturbance will be over more seasons than originally envisaged.</p> <p>Any visual impacts will be minimal and only result in short-term landscape and visual impacts.</p>
<p>UMBILICAL INSTALLATION</p> <p>Umbilical pull-in operations</p>	<p>Notice of particularly noisy operations will be given to local residents. Umbilical pull-in will be a continuous, 24-hour operation.</p>	<p>NEGLIGIBLE</p> <p>No change to predicted impact even though it is acknowledged that disturbance will be over more seasons than originally envisaged.</p>
OUTFALL AND OUTFALL DISCHARGES		
<p>FORMATION, CONDENSATION AND RAIN WATER</p> <p>Discharge of surface water run-off from terminal</p> <p>Discharge of produced water</p>	<p>Treated surface water outfall located 2.5km north of Erris Head outside Broadhaven Bay cSAC.</p> <p>Treated produced water to be discharged offshore at the manifold in the Corrib field.</p>	<p>NEGLIGIBLE</p> <p>No change to predicted impact.</p>

17 CUMULATIVE IMPACTS

17.1 Introduction

Cumulative impacts can be defined in a number of ways. The definition used in the Institute of Environmental Management and Assessment (IEMA) guidance on EIA originates from the US Council on Environmental Quality, and is as follows:

“the impacts on the environment which result from incremental impacts of the action when added to other past, present and reasonably foreseeable future actions...”

Cumulative impacts therefore can cover all aspects of the environment. While a single activity may itself result in a minor 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.

The Corrib Natural Gas Field Development (the Project) can be divided into the following distinct elements:

- Offshore, comprising the seabed installations, offshore pipeline, umbilical and treated water discharge pipeline;
- Onshore gas pipeline between the landfall and the gas terminal;
- Bellanaboy Bridge gas terminal;
- Peat removal and Srahmore peat deposition site; and
- Onshore 150km Mayo to Galway pipeline.

The 2001 Offshore EIS assessed the cumulative impacts that may arise during construction and operation of the Project as a whole, taking into consideration interactions between all elements of the development. Based on the updated information presented in this Offshore Supplementary Update Report, a re-assessment of the potential cumulative impacts has been undertaken.

A review was undertaken to determine if impacts associated with any other proposed project in the area would have the potential to give rise to significant cumulative effects.

The Sustainable Energy Authority of Ireland plans to develop a National Wave Energy Test Site, which is proposed to be located off Annagh Head, on the western shore of the Mullet Peninsula in County Mayo. The purpose of the wave energy test site off Annagh Head is to provide a location for the temporary mooring and deployment of wave energy machines so that their performance in generating electricity and their survivability can be tested and demonstrated in open ocean conditions. The project will comprise 5 offshore test sites located between 1km and 12km southwest to west of Annagh Head, in varying water depths, and four submarine cables from the test sites to shore at Belderra Beach. There will be a substation to which the cables will be connected and an onshore power lines from the substation to the power grid. It is proposed that the site will operate for up to 20 years with devices on site intermittently throughout the year. The wave energy devices will float at the surface of the ocean and will be moored to the seabed. The cables to shore will be installed 1m below the ocean floor and the onshore cables will be underground.

Information available in the public domain would indicate that the development of the test site would commence in 2012 subject to the relevant consents and licences. A detailed cumulative assessment has not been possible as the details of the development are not yet available, and the development as such is not committed.

The wave energy devices is expected to occupy a negligible area of ocean surface and the moorings will occupy a negligible area of ocean floor. Installation of the cables will cause a temporary localised disturbance to the habitats and species of a very small area of ocean floor, beach and shore as far as the substation and a temporary

disturbance in the immediate vicinity. The installation phase is expected to be brief and following construction there will be no potential for the cables to impact the habitats or species of the ocean floor, beach and onshore area. Air and water emissions associated with the construction will be of a temporary nature and not expected to be significant.

As wave devices are installed, removed and replaced there may be short term very localised disturbance of seabed, habitat and species at the test sites themselves.

Due to the small scale envisaged for this test project, the timing of its possible construction, and its distance from the offshore elements of the Corrib development (greater than 10 km), it is not predicted to have significant cumulative effects when combined with impacts associated with the proposed offshore elements of the Corrib field development, and it has not been assessed any further in this Section.

17.2 Assessment Methodology

A review has been undertaken of the potential impacts associated with each of the distinct elements of the Project through examination of the following key reports:

- Corrib Field (Offshore Field to Terminal) Environmental Impact Statement, RSK Environment Ltd, October 2001;
- Mayo-Galway Gas Pipeline Environmental Impact Statement, Arup Consulting Engineers, May 2001;
- Proposed Bellanaboy Bridge Gas Terminal Environmental Impact Statement, RSK ENSR, December 2003;
- Proposed Srahmore Peat Deposition Site Environmental Impact Statement, TES Consulting Engineers, December 2003;
- Economic Assessment of the Corrib Gas Project, Goodbody Economic Consultants, November 2007;
- Offshore Supplementary Update Report (Rev02) (this report), RSK Environment Ltd, 2009;
- Corrib Onshore Gas Pipeline (including Srahmore Peat Deposition Site), Environmental Impact Statement, RPS, January 2009; and
- RPS Onshore Pipeline EIS 2010.

Cumulative impacts of the Project have been assessed at a national and regional scale.

17.3 National Impact

At a national level, the impacts of the Project as a whole have been considered in the context of effects on the national economy and compliance with national policy.

The Goodbody Report (2007) identifies that the Project will contribute over €3bn to Ireland's GDP over its lifespan, supplying approximately 60% of the country's natural gas needs at peak production. The gas field is estimated to yield approximately one trillion cubic feet of natural gas over an operating life of 15–20 years.

The Project supports Ireland's proposed national strategic fuel switch from solid fuel and oil to natural gas and renewables, and so contributes to Ireland's target to limit national greenhouse gas emissions while ensuring security of energy supply. A national fuel switch from oil and coal towards gas is also likely to result in lower NO_x and SO_x levels nationally.

The Project will make a significant contribution to national energy policy by moderating Ireland's dependence on imported energy. It will also provide stable and economic

energy supplies, enhancing the sustainability of existing industry in the Border Midlands Western Region.

As well as providing natural gas for homes in the region, the Project will make the North West a more attractive investment destination. Potential investors will be attracted by the availability of natural gas as a cheap, reliable source of energy. In addition, the availability of natural gas may lead to electricity generation in the area, which could improve the reliability of electricity supplies. As well as being a benefit for the residents of the area, this is in line with the national need to promote balanced regional development.

17.4 Regional Impact

At a regional level, impacts of the Project have been considered in the context of effects on the physical, biological and socio-economic environment. As detailed in Section 3, the various elements of the Project are at different stages of completion and, therefore, interactions will not necessarily occur between all elements. Installation of the offshore pipeline from the Corrib Field to the landfall at Glengad, and construction of the onshore Mayo to Galway pipeline for example, have already been completed. Construction progress to date for the various elements of the Project and indicative future construction activities are provided in Table 17-1.

The main residual impacts arising from each of the individual elements of the Project have been assessed for their potential to interact with each other. The cumulative assessment has considered impacts arising from the construction and operation of the entire project, and it is considered that cumulative impacts, if any, are more likely to arise during the construction phase. Impacts arising from the operational phase of the Project mainly arise from the operation of the Bellanaboy Gas Terminal, with the remaining elements resulting in few, if any, cumulative operational impacts.

Table 17-4 therefore presents a matrix prepared to aid the identification and assessment of the cumulative impacts of all elements of the Project during construction. Shading has been used to show positive (shades of green) or negative (shades of red) impacts for various aspects of the environment.

An overview of the impacts arising from each of the distinct elements of the Project is provided below in order of their relative construction schedule.

17.4.1 Socio-economic Impacts

17.4.1.1 Traffic

Bellanaboy Bridge Gas Terminal

In terms of the gas terminal, the traffic assessment concluded that the local road network could adequately cater for traffic volumes generated during the construction phase. Since 2001, various road improvements have been undertaken including strengthening of the L1204 associated with the terminal site.

Peat Removal and Srahmore Peat Deposition Site

In terms of the movement of peat from the terminal to the Srahmore peat deposition site, the traffic assessment concluded that the local road network could adequately cater for traffic volumes generated by the construction of the project. The main traffic impact was predicted to result from damage to the pavement due to heavy construction traffic. This was mitigated through extensive road widening and upgrading of local roads. This phase of the overall project is complete and no further transportation of peat from the gas terminal site is envisaged.

Mayo to Galway Gas Pipeline

The Mayo to Galway pipeline was predicted to result in moderate adverse short-term impacts on local traffic along the proposed pipeline route as a result of construction traffic associated with the delivery of pipe, equipment, fencing, hardcore, sand padding and supplies to construction areas and, and the subsequent removal of temporary facilities upon completion.

Offshore Development

The offshore seabed installation (offshore component) was predicted to result in moderate short-term adverse impacts to near-shore-fishing activities as a result of the presence of the pipelay vessels and their associated support vessels during construction. In terms of the landfall component, the 2008 traffic management plan assessment indicated that the existing road network could adequately cater for the volumes of traffic generated during construction but would benefit from strengthening works, which were completed in 2008.

Remaining rock placement works in the near shore sections of Broadhaven Bay and installation of the umbilical will require the presence of various offshore vessels in Broadhaven Bay. It is likely that, due to their size and low manoeuvrability, these construction vessels will cause some impacts to the movements of local vessels over the period in which they are present in the bay.

The haul routes associated with the remaining landfall construction works can accommodate the expected traffic and will benefit from any ongoing strengthening works as required.

Onshore Corrib Gas Pipeline

In terms of the onshore pipeline, the traffic impact assessment has predicted that the road network surrounding the development is capable of facilitating the construction activities. There will however be a moderate impact on the local road network surrounding the development during the construction stage but this will be temporary in nature. Maintenance works will result in a local positive impact for local road users.

Deposition of peat at the Srahmore deposition site is predicted to result in a temporary adverse impacts on traffic caused by haulage trucks transporting peat from the onshore pipeline. However, mitigation measures are recommended to limit the impact on local people and visitors. Benefits will occur from road improvement works which will remain for all road users following the completion of the peat deposition activities.

Cumulative

Construction traffic associated with all elements of the Project has, and will continue to result in increased traffic volumes and may cause delays to other road users for the duration of the construction. However, for future works only traffic associated with the continued construction of the terminal, the remaining near-shore works, and the onshore gas pipeline will occur simultaneously. Although there may be some overlap in 2011, which will lead to a cumulative traffic impact on the local road network, the impact will be slight. This will be further reduced through the implementation of a Traffic Management Plan and the maintenance of local road network.

17.4.1.2 Visual Impact

Bellanaboy Bridge Gas Terminal

The gas terminal was predicted to result in minor temporary visual disturbances as a result of continued construction activities including the presence of large plant and cranes. It was also predicted that there would be permanent visual impact in respect of buildings and high features.

Peat Removal and Srahmore Peat Deposition site

Peat deposition from the gas terminal to the Srahmore peat deposition site was predicted to have short-term adverse visual impacts associated with peat transfer traffic during construction. This phase of the overall project is complete and no further transportation of peat from the gas terminal site is envisaged.

Mayo to Galway Gas Pipeline

The Mayo to Galway pipeline was predicted to result in minor short-term visual impacts during construction as a result of site facilities and working widths.

Offshore Development

The offshore seabed installation (near-shore component) resulted in short-term adverse visual impacts on highly scenic views as a result of temporary activity within the nearshore areas of Broadhaven Bay, including the mooring of a large pipelay vessel, workboats, etc. Similarly, short-term adverse visual impacts have resulted from construction activity in the vicinity of the landfall including the beach.

Short-term visual impacts are predicted in the near-shore areas and at the landfall as a result of construction works for the umbilical pull-in and rock-placement works that have yet to be completed.

Onshore Corrib Gas Pipeline

The onshore pipeline is predicted to result in a substantial negative impact that is temporary in nature as a result of construction activities. This is because the viewer sensitivity is high for protected views designed along the scenic routes in the area.

The use of the Srahmore peat deposition site is predicted to result in short term adverse visual impacts associated with haulage vehicles traveling to the deposition site.

Cumulative

Construction activities associated with all elements of the Project have, and will, result in localised temporary moderate visual impacts. Future cumulative visual impacts will be limited to potential overlap in construction activities associated with the ongoing construction of the terminal, the near-shore works, and the onshore pipeline and associated peat deposition at the Srahmore peat deposition site. However, these sequential impacts will be temporary in nature, despite being extended over a construction period of longer duration than originally envisaged.

17.4.1.3 Noise

Bellanaboy Bridge Gas Terminal

The continued construction of the gas terminal will inevitably lead to increased noise levels. However, as the site is remote, compliance with normal construction noise controls has been achieved. Any particularly noisy operations will be planned in advance to ensure that appropriate community liaison can be put in place.

Peat Removal and Srahmore Peat Deposition site

Peat deposition from the terminal to the Srahmore peat deposition site was predicted to result in minor short-term impacts on noise generated by the transfer of material to the site and movement within the site during construction. This phase of works is now complete and no further peat transits from the gas terminal site are envisaged in the future.

Mayo to Galway Gas Pipeline

The Mayo to Galway pipeline was predicted to result in minor temporary short-term impacts on noise during construction as a result of ripping and rock excavation.

Offshore Development

The offshore seabed installation (offshore component) was predicted to result in negligible impacts on noise. At 65km offshore, the drilling rig and vessel activities were too far from human sensitive receivers to be of concern. This phase of works now is complete.

The pulling in of the umbilical to the landfall, one of the remaining near-shore activities may result in a slight increase in normal daytime noise levels, and potentially a significant increase in noise levels in the evening and at night when the landfall site would normally be quiet. This activity is expected to be of very short duration and therefore impacts will be short-term. Rock placement works in Broadhaven Bay will involve placement of rock over a short section of the completed offshore pipeline. This activity will not generate noise at levels that will have any more than a negligible and temporary impact on the receiving environment.

The pre-commissioning of the offshore pipeline is expected to result in increase in noise levels near the landfall site. The duration of this activity is expected to be in the order of one to two weeks.

Onshore Corrib Gas Pipeline

The onshore pipeline is predicted to result in significant although short term negative noise and vibration impacts during construction as a result of construction noise from pipe trenching operations on land, construction traffic and movement of construction plant, equipment and materials to site.

Cumulative

During construction there has been, and will be, increased noise from construction works and traffic associated with each of the elements of the Project. In the event that works associated with the construction of the terminal, the near-shore works, and the onshore gas pipeline occur simultaneously, it is anticipated that a moderate temporary noise impact would occur. However, as the construction of the onshore pipeline progresses along the route the impact on individual receptors within close proximity to both the terminal and route will diminish rapidly. It should be noted however that the extended duration of the construction schedule will result in cumulative impacts over a longer period of time than originally envisaged.

17.4.1.4 Employment and Local Economy

Bellanaboy Bridge Gas Terminal

Up to 1000 people have been employed during construction of the gas terminal providing a positive impact on the local economy during the construction period with enhanced opportunities for local service providers.

Peat Removal and Srahmore Peat Deposition site

An estimated 50-55 people were required for the peat An Srath Mór (Srahmore) Peat Deposition Site in 2005/2007. These included existing / returning temporary employees. Impacts were predicted to be negligible, as the intention was to utilise existing staff to man the proposed facility. Actual impacts were positive, as the site came into use after existing staff had already been released. This phase of the overall project is complete and no further peat transportation from the gas terminal site is envisaged.

Mayo to Galway Gas Pipeline

An estimated 500 people were predicted to be employed during construction and reinstatement of the Mayo to Galway pipeline. In addition, short-term benefits to local communities in terms of increased income in shops, pubs, cafes/restaurants and accommodation and indirect employment were predicted as a result of pipeline construction activities.

Offshore Development

Construction of the offshore seabed installation to date has involved a workforce of approximately 200 to 300 people over the construction period. However, this was mainly an international specialist workforce with limited local benefits.

Construction of the landfall and the subsequent laying of the offshore pipeline in 2009 involved a workforce of approximately 300 to 400 with a positive impact on the local economy, with enhanced opportunities for local service providers. These included increased trade in local shops, pubs, restaurants, and service providers. There were also opportunities for supply of equipment, catering, transport and delivery of goods. There were also tangible economic benefits to Killybegs from the offshore components of the project.

Onshore Corrib Gas Pipeline

Construction of the onshore pipeline is predicted to result in a significant and positive impact on the local economy from major employment opportunities and construction of the pipeline. During construction it is estimated that 120 to 140 personnel will be employed on the onshore pipeline project. The onshore pipeline is predicted to have an overall positive economic impact on the existing community. Peat removal from the onshore pipeline will also provide direct and indirect job creation during the peat deposition activity.

Cumulative

As detailed in the Goodbody Report, construction of the development will result in significant benefits for the local economy. The local Mayo economy will directly benefit by approximately €181m as a result of the Corrib development. Over 800 jobs will be created during the construction phase including direct, indirect and induced employment. In addition, the region will benefit from the Corrib Gas Partners' existing and planned social investment activities, which represent an indirect benefit from their presence in the community. Successful completion of the Corrib project will encourage further energy exploration activity off the Irish coast.

17.4.1.5 Tourism and Recreation

Bellanaboy Bridge Gas Terminal

The gas terminal was predicted to result in negligible short-term impacts on visitors to the area during the construction period. Whilst bed and breakfast and self-catering accommodation would benefit from increased trade, visitors to the local area who have to pass by the terminal site would notice site activity, increased traffic movements and construction activity, and views into the site from nearby footpaths and bridleways.

Peat Removal and Srahmore Peat Deposition site

In terms of the Srahmore peat deposition site, it was noted that most major tourist attractions are sufficiently remote from the site for their associated visitors to be unaffected by the peat deposition activity.

Mayo to Galway Gas Pipeline

The Mayo to Galway Pipeline was completed in 2006. Negligible short term impacts existed on visitors to the area during the construction period.

Offshore Development

The offshore seabed installation was predicted to result in negligible adverse impacts on tourism and recreation as most major attractions are sufficiently remote from the offshore activities. Negligible adverse impacts are predicted to continue while outstanding near-shore construction works are underway.

Onshore Corrib Gas Pipeline

The onshore gas pipeline will have a slight to moderate temporary negative impact upon visiting communities of the local and wider vicinity of the proposed route during the construction phase.

Cumulative

None of the construction activities associated with the elements of the Project is expected to impact significantly on tourism and recreation. The phasing of construction will ensure that impacts from all elements will be minimised. Where cumulative impacts do occur, despite the extended duration of the construction schedule, they will be temporary in nature and are not expected to be significant.

17.4.1.6 Archaeology

Bellanaboy Bridge Gas Terminal

No impacts on known archaeological sites were predicted as a result of the construction of the gas terminal. During earthworks no archaeological features were discovered.

Peat Removal and Srahmore Peat Deposition site

No archaeological features were discovered.

Mayo to Galway Gas Pipeline

No impacts on known archaeological sites were predicted as a result of the Mayo to Galway pipeline. Possible minor/moderate impacts on unknown sites were identified.

Offshore Development

No impacts on known archaeological sites were predicted as a result of the offshore seabed installation. Possible discovery of unknown archaeological material was identified (with none identified to date).

Onshore Corrib Gas Pipeline

The proposed onshore pipeline route avoids all recorded archaeological monuments and specific sites of archaeological potential. As a result, none of these known or

potential archaeological sites will be directly impacted. However, one recorded archaeological site lies adjacent to the temporary working area and four other sites of archaeological potential remain within the temporary working area or lie adjacent to it. As such, these sites are considered to be indirectly impacted by the proposed onshore pipeline. The potential exists to reveal previously unknown and buried archaeological sites in the future.

Cumulative

As there is potential for unknown archaeological material to be discovered archaeological monitoring has been, and will be, undertaken during construction for all elements to ensure the recognition and recording of any such remains.

17.4.2 Biological Impacts

17.4.2.1 Terrestrial Ecology

Bellanaboy Bridge Gas Terminal

The gas terminal was predicted to result in short-term negligible or minor impacts on terrestrial flora and fauna during construction as a result of vegetation clearance and disturbance to habitats of low ecological interest.

Peat Removal and Srahmore Peat Deposition site

Approximately 450,000m³ of peat excavated from the terminal site was deposited in a cutover peatland at An Srath Mór (Srahmore). Deposition of the peat took place within an area of approximately 63 ha.

This site is one from which peat had previously been harvested for a local power station and is saucer shaped with an extensive drainage infrastructure that was installed for industrial peat extraction. On completion, the site has been allowed to re-colonise by natural species. This promotes the re-establishment of peat-forming conditions and re-instates a peatland ecosystem in place of the original Atlantic blanket bog complex. The vegetation succession will lead to a more varied habitat which will contribute to local biodiversity and complement the ecological significance of the adjacent rehabilitated cutover areas. Over time the habitats will blend with the existing fringe habitats that currently border the development site. The long term prospect is therefore considered to be positive, with permanent beneficial impacts on the development site. The residual impacts overall are considered to be significantly positive given that they should result in habitat rehabilitation and increased local biodiversity.

Mayo to Galway Gas Pipeline

The Mayo to Galway pipeline was predicted to result in temporary short-term impacts on terrestrial flora and fauna during construction as a result of disturbance. Short-term impacts on fauna were limited to the working width, with works timed to minimise disturbance. Potential impacts on flora were minimised through route selection and appropriate construction and reinstatement techniques.

Offshore Development

Seabed disturbance from the installation of the field facilities resulted in permanent habitat loss of benthic faunal communities and crustaceans over a footprint of 392 m² of the seabed (combined footprint for the gathering manifold and pipeline end manifold).

The installation of the pipeline on the seabed resulted in a permanent localised loss of benthic habitat. To a lesser extent the same will be true for the umbilical. The total seabed area actually taken up by the offshore pipeline and umbilical will be approximately 4.28ha. In the near-shore area of Broadhaven Bay the section of the

offshore pipeline that has subject to rock placement has taken up an area of seabed of approximately 1.95ha resulting in the permanent loss of habitat. The footprint of the rock berm placed in Broadhaven Bay in 2009 may increase as result of further rock placement activities in 2010. However, the rock berm will provide stable seabed habitat for colonisation by epibenthic species.

Onshore Corrib Gas Pipeline

The impact of the proposed onshore pipeline on terrestrial ecology is considered neutral or slight negative in the long-term as a result of disturbance during construction. No long-term significant impacts on species of conservation interest present on site, such as otters, badgers, bats and frogs are expected.

Permanent loss of habitat of the onshore pipeline occurs at the LVI, along the access road to the LVI and the tree felling of conifers in the forestry north of Bellanaboy Bridge terminal. This represents approximately 3.5ha. The felling of trees for this pipeline should be viewed as an extension of the forest management in the area, as the mature conifers would be due for felling in rotation.

Cumulative

Construction activities associated with all elements of the Project will result in temporary negative impacts on terrestrial ecology. However, these impacts will not be additive in terms of temporary loss (i.e. in combination they do not result in a greater impact) on ecological resources such as designated conservation sites or natural habitats.

17.4.2.2 Freshwater Ecology

Bellanaboy Bridge Gas Terminal

The construction of the gas terminal was predicted to result in temporary short-term negligible or minor impacts on freshwater aquatic ecology depending upon the successful implementation of pollution control measures, including run-off control.

Peat Removal and Srahmore Peat Deposition site

The Srahmore peat deposition site was predicted to result in negligible impacts on freshwater aquatic ecology with the implementation of appropriate mitigation measures to control discharges. This aspect of the Project is completed and no further peat deposition from the gas terminal site is anticipated.

Mayo to Galway Gas Pipeline

Discharge of hydrotest water into the freshwater aquatic environment as a result of the construction of the Mayo to Galway pipeline was predicted to result in negligible impacts on aquatic ecology.

Offshore Development

There are no predicted impacts to the aquatic (freshwater) ecology from the remaining offshore construction works (see below for marine impacts).

Onshore Corrib Gas Pipeline

Residual impacts on freshwater ecology including salmonids are predicted to be slight to negligible impacts post construction.

Cumulative

Construction activities associated all elements of development (with the exception of the offshore development where there are no predicted impacts) will result in negligible or minor temporary impacts on freshwater aquatic ecology. Cumulative impacts will be limited as impacts on freshwater aquatic ecology will generally be local to individual elements of the overall development.

17.4.2.3 Marine Ecology

Bellanaboy Bridge Gas Terminal

In terms of the treated produced water discharge, the predicted impact of the discharge is considered negligible, in that all of the constituents of the waste water are discharged at or below EQS and are now proposed to be discharged at the Corrib Field. There are no predicted impacts to the marine ecology associated with the construction phase of the terminal.

Peat Removal and Srahmore Peat Deposition site

No impacts were predicted on marine ecology as a result of peat removal and operations at the Srahmore peat deposition site.

Mayo to Galway Gas Pipeline

No impacts were predicted on marine ecology as a result of the Mayo to Galway pipeline.

Offshore Development

The installation of the umbilical will cause some temporary localised disturbance to the seabed sediments, but it is expected that recovery and recolonisation by benthic communities will occur fairly rapidly. Where rock armour or concrete mattresses are laid on the seabed the existing seabed habitats will be permanently lost, however the new introduced hard substrates may attract new species to the area. Overall, the predicted impact to benthic communities is considered negligible, with the exception of the rock-placement works in Broadhaven Bay, which is considered minor, due to the extent of the rock placed area. Projected underwater noise levels associated with the rock-placement operations are not anticipated to have significant impacts. It is considered likely that marine mammals within 200m of operations would demonstrate an avoidance response. Controls to limit any impacts to marine mammals from the generation of noise during remaining near-shore construction will be implemented, and the construction techniques that will be used do not generate high noise levels. Any effect is likely to be transient and restricted to a behavioural response (avoidance).

Onshore Corrib Gas Pipeline

In the unlikely event that an emergency surface intervention should be required during tunnelling, there would be a potential to cause some disturbance of the seabed predominantly due to altered sediment mobility around temporary structures causing scour and deposition. Allowing for mitigation and coupled with the fact that most of the scour will naturally refill with mobile re-deposited material post construction, the residual impacts are expected to be neutral to negative or imperceptible to slight.

Cumulative

The offshore and near-shore installation is the only element of the development predicted to impact on marine ecology. In the event that emergency surface intervention is required during tunneling underneath Sruwaddacon Bay, the cumulative impacts are predicted to be imperceptible in the short term.

17.4.3 Physical Impacts

17.4.3.1 Soils and Geology

Bellanaboy Bridge Gas Terminal

Construction of the terminal resulted in the excavation of approximately 450,000m³ of local peat and excavation of both weathered and unweathered bedrock. However, there was no predicted negative impact on the geology of the area.

Peat Removal and Srahmore Peat Deposition site

The Srahmore peat deposition site was predicted to have no adverse impacts on soils and geology with the implementation of mitigation measures including appropriate timing of works. No further deposition of peat from the gas terminal site is envisaged.

Mayo to Galway Gas Pipeline

The Mayo to Galway pipeline was identified as having a number of potential impacts on soils and geology during construction associated with the crossing of peat areas, the crossing of flood plain areas, the crossing of low-lying sand and gravel areas, areas underlain by karstified limestone, and areas of shallow hard rock. Mitigation measures were identified to minimise such impacts on soils and geology including minimising the length of crossings in these areas.

Offshore Development

The offshore seabed installation (offshore component) was predicted to have minor adverse geological impact, as it is not an area known to be especially important in geological terms. Installation of the umbilical will disturb the seabed and shallow sub-seabed geology temporarily during the construction phase. The umbilical will be buried and the seabed is expected to return to its present morphology within a matter of weeks after construction. Rock placement and any concrete mattresses introduced for seabed sediment scour protection will permanently impact seabed geology by smothering. The rock-placed section of the offshore pipeline in Broadhaven Bay will have a footprint area of approximately 1.95 ha, and the existing seabed geology over this entire area will be permanently impacted. Hard rock substrate will be introduced, which will result in a permanent alteration to the seabed geology in these areas.

Onshore Corrib Gas Pipeline

In the short-term, there will be a slight impact due to the localised loss and/or compaction of peaty soils during construction of the onshore pipeline. Once construction has been completed and following the full implementation of the mitigation measures, there will be an imperceptible impact on soils and geology.

Cumulative

Some individual elements of the Project have and/or will have the potential to result in localised impacts on geology and soils. Any cumulative impacts would not be synergistic, i.e. the combination of these impacts will not result in a more significant impact on soils and geology. Therefore the cumulative impact is considered to be slight.

17.4.3.2 Hydrology and Hydrogeology

Bellanaboy Bridge Gas Terminal

Construction of the gas terminal was predicted to result in minor adverse impacts on hydrology.

Peat Removal and Srahmore Peat Deposition site

The Srahmore peat deposition site was predicted to result in negligible impacts on watercourses adjacent to the site. with the implementation of appropriate mitigation measures to treat and control discharges.

Mayo to Galway Gas Pipeline

The Mayo to Galway pipeline was predicted to result in negligible adverse impacts as a result of changes to drainage during construction.

Offshore Development

The remaining offshore seabed installation works are predicted to result in minor or negligible impacts to the aqueous environment, as releases to the environment are both small in quantity and of very low toxicity.

Onshore Corrib Gas Pipeline

In the short-term, there will be a slight impact due to the localised loss and/or compaction of peaty soils during construction. Once construction has been completed and after the full implementation of the mitigation measures, there will be an imperceptible impact to the original drainage pattern.

Cumulative

A number of the individual elements of the Project have and/or will have the potential to result in localised impacts on hydrology and hydrogeology. However, each element is committed to stringent pollution prevention measures that are considered sufficient to address any impacts. Therefore the cumulative impact is considered to be imperceptible.

17.4.3.3 Air Quality

Bellanaboy Bridge Gas Terminal

Construction of the gas terminal has resulted in emissions of dust and emissions from traffic and machinery. However, construction activities are not predicted to result in significant negative air quality impacts.

Peat Removal and Srahmore Peat Deposition site

The Srahmore peat deposition site was predicted to result in a minor localised impact on air quality through dust generated during positioning of peat at the depository, and exhaust fumes from haulage and on-site vehicles and equipment.

Mayo to Galway Gas Pipeline

The Mayo to Galway pipeline was predicted to result in a minor localised impact on air quality through exhaust fumes from machinery used during construction.

Offshore Development

The remaining offshore seabed installation works are not predicted to have a significant impact on air quality in view of the short duration or periodic nature of the remaining works. In general, there are no resident sensitive receptors offshore and impacts will be negligible. The distances from the landfall are such that there will be no impacts from emissions to air upon local residents.

Onshore Corrib Gas Pipeline

The onshore pipeline will result in emissions of dust (during dry weather only) from construction and emissions from construction traffic. However, this is not predicted to result in significant air quality impacts. Local impacts to air quality along the proposed haul routes as a result of construction traffic are considered to be temporary slight negative.

Cumulative

Construction activities associated with all elements of the Project have and/or will result in temporary impacts on local air quality. In the event that the remaining construction activities associated with the terminal, near-shore works, and onshore gas pipeline occur simultaneously, there will be potential for cumulative air quality impacts. However, where cumulative impacts do occur they will be slight and temporary in nature. Peat deposition associated with the onshore pipeline will not result in an increased cumulative impact on air quality, as Srahmore peat deposition site is located sufficiently away from the other elements of the Corrib development.

17.4.3.4 Assessment of Total Greenhouse Gases

An assessment of the cumulative emissions of greenhouse gas emissions arising from the construction and operation of the Corrib Gas Field Development is provided below. This cumulative assessment includes the carbon losses arising from any peat disturbance for the Project.

Bellanaboy Bridge Gas Terminal

The total greenhouse gas emissions associated with the construction of the Gas Terminal were 43,340 tCO₂eq, of which 6,369 tCO₂eq was due to peat removal.

Mayo to Galway Gas Pipeline

The total estimated greenhouse gas emissions are presented in Table 17-2 below. Details relating to the construction of the Mayo to Galway Pipeline were limited in the EIS and where data was not available, scaled up construction details from the Corrib Onshore Pipeline have been included.

Table 17-2: Total GHG Emissions of the Mayo to Galway Pipeline

Item	Estimated GHG Emissions (tCO ₂ eq)
Construction Materials	37,764
Metals (pipeline Steel)	86,474
Plant Emissions	1,056
Peat Removal	29,670
Material Transport	3786
Personnel Transport	269
Total GHG Emissions	159,019

Offshore Development

The total greenhouse gas emissions for the offshore element of the project are estimated to 164,499 tCO₂eq.

Corrib Onshore Gas Pipeline

The total greenhouse gas emissions for the onshore element of the project are estimated at 30,590 tCO₂eq, 4,059 tCO₂eq of which are the carbon losses from peat disturbance.

Cumulative Impact

Table 17-3 below provides an estimate of the total greenhouse gas emissions associated with the construction and operation of the Corrib Gas Field development.

Table 17-3: Summary of Total Greenhouse Gas Emissions associated with the Corrib Gas Field Development

Project	Construction Emissions (tCO ₂ eq)	Operational Emissions (tCO ₂ eq)	Total Emissions (tCO ₂ eq)
Offshore Pipeline & Well Installation	164,499	-	164,499
Onshore Gas Pipeline	30,590	-	30,590
Bellanaboy Gas Terminal	43,340	691,725	735,065
BGE Mayo to Galway Pipeline	159,019	-	159,019
Total	397,448	691,725	1,089,173

Note: 1. Assumes 15 years of Terminal Operations and 46,115 tonnes per year

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Table 17-4: Cumulative Impact Assessment Matrix - Construction Phase

	Bellanaboy Bridge Gas Terminal	Peat Removal & Srahmore Peat Deposition Site	Offshore Development	Mayo to Galway Pipeline	Onshore Corrib Gas Pipeline	Cumulative
Human Environment						
Material Assets (Traffic)						
Noise						
Employment and Local Economy						
Tourism and Recreation						
Landscape and Visual						
Archaeology						
Physical Environment						
Soils and Geology						
Hydrology and Hydrogeology						
Air Quality						
Total Greenhouse Gases						
Biological Environment						
Terrestrial Ecology						
Aquatic Ecology						
Marine Ecology						

Significant negative impact
Moderate negative impact
Slight negative impact
Neutral
Slight positive impact
Moderate positive impact
Significant positive impact

18 ENVIRONMENTAL MANAGEMENT

18.1 Introduction

This section describes the arrangements for the management of the remaining construction works by SEPIL and its contractors to ensure that the mitigation measures in the 2001 Offshore EIS and this Supplementary Update Report, legislative and contractual requirements, and environmental best practice are implemented. It provides an update to the information presented in Section 18 of the 2001 Offshore EIS.

From the outset, the project has been designed to limit its environmental impact as far as possible. SEPIL's contractors (and their subcontractors) will be expected to conduct their activities in such a way that the impact on the environment during construction is minimised.

One of the key mechanisms for environmental management during the construction stage is the production of Environmental Management Plans (EMPs) and associated documentation, to be developed by the contractors. These are described in more detail in this section.

SEPIL's approach to environmental management is to incorporate the following principles of environmental protection:

- prior assessment of environmental impact;
- minimisation of potential impact through design and other mitigation controls;
- monitoring the effectiveness of controls set; and
- auditing of performance.

This section documents how these principles will be applied by SEPIL to the remaining construction works.

18.2 HSE Policy and Commitments

SEPIL's environmental standards are set by the Shell Group's Health, Safety and Environmental (HSE) Policy (www.shell.com).

SEPIL's Managing Director personally endorses this policy and further requires each member of staff to adopt this policy and to eliminate activities believed to threaten safety, health or the environment.

The policy commits Shell to:

- pursuing the goal of no harm to people;
- protecting the environment;
- using material and energy efficiently to provide products and services;
- developing energy resources, products and services consistent with these aims;
- publicly reporting performance;
- playing a leading role in promoting best practice in industry;
- managing HSE matters in the same manner as any other critical business activity; and
- promoting a culture in which all Shell employees share this commitment.

To support these commitments, Shell will:

- have a systematic approach to HSE management designed to ensure compliance with the law and to achieve continuous performance improvement;
- set targets for improvement and measures, appraise and report performance;
- require contractors to manage HSE in line with this policy;
- require joint ventures under its operational control to apply this policy and to use its influence to promote it in other ventures; and
- include HSE performance in the appraisal of all staff and reward accordingly.

These environmental commitments encompass the environmental philosophy that will be applied by SEPIL to all aspects of the remaining construction works.

18.3 Environmental Management during Construction

18.3.1 SEPIL Key Roles and Responsibilities

The SEPIL staff on site will act primarily in an overseeing role by observing the contractors' performance and by raising issues or intervening where appropriate. A SEPIL Environmental Officer will report to the SEPIL Resident Engineer who holds ultimate responsibility for contractor monitoring and ensuring that contractors' environmental performance is compliant with SEPIL's requirements.

In general, the contractors' Environmental Officer (manager/adviser/engineer) will maintain responsibility for overseeing and implementing the works as well as any subcontractors within their remit from an environmental perspective. The contractors' Environmental Officer will report to the SEPIL Environmental Officer on the contractors' performance.

The SEPIL Environmental Officer in turn will act as the regulatory interface on environmental matters by reporting to and liaising with Mayo County Council, the North Western Regional Fisheries Board, National Parks and Wildlife Services (NPWS) and any other relevant environmental authorities. The contractors' Environmental Officer will provide the necessary support to SEPIL's Environmental Officer to ensure that he/she can adequately discharge these functions.

18.3.2 Environmental Management Plan

The project's EMP outlines how the environmental aspects and impacts associated with the remaining construction works will be managed in terms of their mitigation and control measures. This includes establishing detailed work instructions or procedures as necessary. The project's EMP also outlines how activities will be monitored in terms of environmental performance, the objectives that have been established for the work and specific targets where appropriate.

An Environmental Management Plan/Environmental Protection Plan (EMP) will be established for the works. The EMP will outline procedures to meet the environmental management requirements for the proposed works.

18.3.3 Other Documentation

In principle the environmental management documentation for the construction stage of the project can be categorised in tiers as follows:

- Level 1 - Overall HSE Plan / Environmental Management Plan
- Level 2 - Environmental Procedures
- Level 3 - Detailed construction method statements/Construction manuals

- Level 4 - Monitoring and audit records

18.3.4 Environmental Procedures

A number of Environmental Operational Control Procedures will be established on site to detail the working methods necessary for managing and mitigating environmental impacts caused by construction activity through prevention or amelioration. The environmental procedures include Emergency Procedures that will be implemented in the event of an accident. Operational control is required to ensure the management of all operations and activities associated with significant environmental aspects, policies, objectives and targets. The required level of control is achieved through the implementation of operational procedures.

18.3.5 Method Statements

Detailed and site-specific Method Statements will be produced to cover the methodologies to be employed for all main construction activities. The Method Statements will be developed having regard to advice issued by consultees, and in consultation with them, as appropriate, having regard to health and safety requirements and risks.

18.3.6 Monitoring and Audit Records

During construction, a comprehensive programme of environmental monitoring will be undertaken.

The purpose of monitoring will be to ensure that commitments and standards, as laid down in the conditions of consents, Management Plans, Operational Procedures, and Method Statements are being adhered to and any necessary remedial actions implemented.

Environmental near misses and incidents will be recorded and investigated and appropriate corrective actions put in place. SEPIL and their contractors will operate a policy of self reporting of Environmental Incidents.

SEPILs Contractors will undertake a programme of weekly environmental inspections and monthly environmental audits during the construction phase to ensure:

- that works comply with statutory, planning consent, and all contract requirements;
- to show that works are being undertaken in compliance with the project plans, procedures and method statements; and
- to demonstrate that remedial action has been taken, as necessary.

SEPIL's Environmental Advisor will also carry out appropriate environmental inspections and monitoring of their contractors environmental performance in the form of periodic inspections and audits. Where problems are identified, the corrective action will be identified and a programme of implementation will be agreed with the contractor within a defined time frame appropriate to the severity and importance of the non-compliance identified.

Inspection and auditing results will be reported to SEPIL; they will play an important part in reviewing and updating the EMP as the project progresses.

18.4 Mitigation Measures during Construction

Mitigation measures form part of the EMPs and Method Statements that will be produced to cover the construction activities. These mitigations measures include the following.

18.4.1 Noise

For marine based work in the intertidal and subtidal zones, activities will run on a 24-hour basis. For the general land-based operations at Glengad, working hours will be restricted to 07:00–19:00 Monday to Friday, 07:00–16:00 on Saturday and there will be no activity on Sundays. During the umbilical pull-in operation, it will be necessary to work on a 24-hour basis. Elements of the pre-commissioning of the offshore pipeline are planned to be carried out on a 24-hour basis, however, predicted noise levels currently are such that this work will be curtailed in the period 22:00 - -07:00.

Noise will be minimised by the screening of stationary machinery (generators) use of noise attenuation barriers and turning off such equipment when not in use. Silenced machinery will be used as much as possible to mitigate noise.

A noise survey will be carried out before and during work on the site and near local residences to measure/assess the level and impact of these activities.

18.4.2 Light

When night-time work is necessary, lighting will be directed downwards and away from residences and roads as much as is practicable. However, as the safety of the crew is paramount, some disturbance may be unavoidable.

18.4.3 Oil Spill

Re-fuelling will be restricted to allocated re-fuelling areas. In the event of an oil/diesel spill, the offshore and onshore emergency procedures will be implemented as necessary. Oil spill containers will be stationed at each site and each machine driver will be equipped with and trained to use an oil spill kit kept in the cabin of the machine.

18.4.4 Waste Management

Each contractor will be responsible for the management and disposal of their own waste in accordance with their individual Waste Management Plans. All waste disposal to onshore treatment facilities will be carried out by licensed transport and disposal contractors.

18.4.5 Traffic Management

All construction activities associated with the landfall will adhere to Traffic Management Plan prepared for the activity. The Traffic Management Plan focuses primarily on the haul route for materials to the landfall at Glengad.

18.4.6 Archaeology

Whilst the marine pipe trench was archaeologically monitored in 2002, 2005, 2008 and 2009 and nothing was found during this work, there still may be potential for archaeological remains to be uncovered during remaining works, if any deviation from the original routes occurs.

The DoEHLG will require a monitoring licence for any new marine trenches or onshore topsoil stripping in areas not stripped previously.

Contingency plans to deal with such an eventuality will be put in place for the remaining construction phases.

Given the previous monitoring which has been carried out in the area, the Underwater Archaeology Unit of the DOEHLG have confirmed that no further archaeological monitoring will be required for the umbilical installation works.

18.4.7 Ecology

Pre-entry ecological surveys have been carried out and any constraints associated with the landfall have been identified.

During construction, a working area will be fenced off at the landfall to prevent encroachment by personnel and machinery outside of the allowable work area and to protect the adjacent habitats. There will be adequate signage to further delineate this boundary.

The autumn 2008 Brent Goose survey showed that the feeding behaviour of Brent geese was not affected by onshore or intertidal works associated with the dismantling the causeway, hence, no impacts are anticipated to this population and no additional mitigation is proposed.

Marine mammal observers will be present during all marine construction operations with the Broadhaven Bay cSAC. They will conduct a visual search of the area before start-up of rock placement, surveying or umbilical installation, and any noisy operations will be delayed until 20 minutes after the last sighting of marine mammals within 1000m of construction activities.

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GLOSSARY OF TECHNICAL TERMS

TERM	DESCRIPTION
AERMOD	An atmospheric dispersion modelling system
Appraisal Well	A well drilled as part of an appraisal drilling programme, which is carried out to determine the physical extent, reserves and likely production rate of a field
Bar	A unit of pressure
Bar g	Bars above atmospheric pressure
Baseline survey	Work done to collect and interpret information on the condition/trends of the existing environment
BC	Background concentration
Benthic	Describes organisms that live on or in the seabed
Benthos	Organisms that live on or in the seabed
BGE	Bord Gáis Éireann
BH	Borehole
Biogenic reefs	A marine structure created by animals themselves i.e. <i>Sabellaria</i>
Bioturbation	The mixing of sediments by living organisms that make burrows in soft sediment, i.e. worms
BRC	Background reference concentration
BSL	Benthic Solutions Limited
CCGT	Combined cycle gas turbine
Cd	Cadmium
CFB	Central Fisheries Board
CH ₄	Methane
Christmas tree	The assembly of fittings, or valves on the top of the casing which controls the production rate from the well
Circalittoral	The subzone of the rocky sublittoral below that dominated by algae (the infralittoral) and dominated by animals
CMRC	Coastal & Marine Resource Centre
CO	Carbon monoxide
CO ₂	Carbon dioxide, (a colourless, odourless, incombustible gas present as a minor constituent of the atmosphere, where it comprises 0.35% by volume)
Commissioning	The rendering fully operational of a project or process.
Competent authority	Any agency charged with examining an environmental impact statement with a view to issuing a consent to develop
Completion	The installation of permanent wellhead equipment for the production of oil or gas
Concrete mattresses	Man-made layer for the protection and stabilisation of subsea pipelines and structures
Conduit	A pipe or tube that covers and protects electrical cables
CTD	Conductivity temperature depth
Cuttings	Rock chippings cut out from the formation by the drill bit, and brought to the surface with the mud. Used by geologists, while drilling a well, to obtain formation data
CZMD	Coastal Zone Management Division
DAFF	Department of Agriculture, Fisheries & Food
Db	Decibel; unit for measuring noise
DCENR	Department of Communication Energy & Natural Resources
Decommissioning	The final closing down, and putting into a state of safety of a development, project or process when it has come to the end of its useful life
Demersal	Found at or near the bottom of the sea or lake
DFP	Department of Finance and Personnel
DMNR	Department of Marine and Natural Resources (now the DCENR)

TERM	DESCRIPTION
DNV	Det Norske Veritas
DoEHLG	Department of the Environment, Heritage and Local Government
Drilling rig	A drilling unit that is not fixed permanently to the seabed, e.g. a drillship, a semi-submersible or a jack-up unit.
EC	European Commission
EcoServe	Ecology Consultation Services Ltd
Ecotoxicology	Harmful effects of chemical compounds on species, population and the natural environment
EIA	Environmental impact assessment. The process of examining the environmental effects of development from consideration of environmental aspects at design stage, through to preparation of an environmental impact statement (EIS), evaluation of the EIS by a competent authority and the subsequent decision as to whether the development should be permitted to proceed, also encompassing public response to that decision
EIS	Environmental impact statement. A statement of the effects, if any which the proposed development, if carried out, would have on the environment
Elasmobranch	Cartilaginous fish (includes sharks and rays)
EMP	Environmental Management Plan
Environmental Quality Standards	The EQS values reflect the maximum level in the water body that may be present without affecting biological communities in their functional processes or otherwise give rise to unacceptable adverse effects on the ecosystem or accumulation of substances that are harmful to the biota (EPA, 1997). The Environmental Quality Standards referred to throughout this EIS are those for marine waters (EPA, 1997)
EPA	Environmental Protection Agency. The EPA has the functions of licensing, regulation and control of activities for the purposes of environmental protection
EPIC	Engineer Procure Install and Commission
Epifauna	The animal life that lives on the surface of the seabed, a river bed, etc., or attached to submerged objects or to aquatic animals or plants
EQS	See Environmental Quality Standard
ES	Environmental Statement
ESRI	Economic and Social Research Institute
EU	European Union
Exploration well	A well drilled in an unproven area. Also known as a 'wildcat well'
Fauna	A collective term for the animals of a region
FEED	Front-end engineering design
Field	A geographical area under which an oil or gas reservoir lies
FLO	Fisheries liaison officer
Flora	A collective term for the plants of a region
Flowline	Steel pipeline between wellheads and the manifold, usually between 6 and 10 inches diameter
Formation water	Salt water underlying gas (and oil if any) in the formation
Gas field	A field containing natural gas but no oil
GDP	Gross domestic product
Geohazard	Processes, i.e. landslide, debris flows, settlement & subsidence. Common triggers include changes in groundwater conditions, erosion & over-steepening of slopes, earthquakes etc.
Geophysical	A section of earth science that employs the principles and methods of physics (e.g. seismic (sound), resistivity (electrical resistance) or other) to search for natural resources within the earth's crust, or to obtain information about subsurface structure for various civil engineering works
GIS	Geographical information system

TERM	DESCRIPTION
Glacial erratics	A glacial erratic is a piece of rock that deviates from the size and type of rock native to the area in which it rests. "Erratic" is based on the errant location of these boulders. These rocks were carried to their current locations by glacial ice, often over hundreds of kilometres.
GPS	Global positioning system
Granulometric	Particle size
GWP	Global warming potential
Halocline	A vertical gradient in the salinity of the ocean
HCVs	Heavy Commercial Goods Vehicles
HDPE	High Density Polyethylene pipeline
Hg	Mercury
HGV	Heavy goods vehicle
High Water Mark	The line of high water of ordinary or medium tides
HP	High pressure
HS&E	Health, safety and environment
Hydrocarbon	A compound containing only the elements hydrogen and carbon. May exist as a solid, a liquid or a gas
Hydrography	Physical conditions, boundaries, flow, and related characteristics of the earth's surface waters
Hydrostatically	Relating to the study of the mechanical properties and behaviour of fluids not in motion
Hydrotest (Hydrostatic test)	Non-destructive test used to prove the integrity of a pipeline. The hydrostatic test involves filling the pipeline with water and compressing this to a specified test pressure for a specified duration
IEMA	Institute of Environmental Management and Assessment
IFA	Irish Farmers Association
Impact	The degree of change in an environment resulting from a development
Infauna	The animal life found within the sediments of the ocean floor, river beds, etc.
Infralittoral	The region of shallow water closest to the shore; in marine environments, excluding the intertidal zone
Integrated Pollution Prevention Control – IPPC/IPC	A system of licensing that covers all emissions to air, water and land, including noise and is intended to minimise the impact on the environment by taking account of pollution that may be transferred from one environmental medium to another
Intelligent PIG	A device (pipeline integrity gauge) used for the measurement of several parameters, which operates inside a pipe
IOOA	Irish Offshore Operators Association
KMM	Kirk Mclure Morton
KPs	Kilometre points
Landfall	The point on the coastline where the pipeline transporting natural gas from the Corrib field to the terminal comes ashore
LAT	Lowest astronomical tide
Lay barge	A vessel that is specially equipped to lay submarine pipelines
LNG	Liquid natural gas
LPG	Liquid petroleum gas
LVI	Landfall valve installation
Macrofauna	Animals larger than 0.5mm size living within sediments (visible to the human eye)
Manifold	An item of subsea equipment that gathers gas from each of the wells in the field
Megafauna	Large or relatively large animals of a particular place or time period
mg/l	Milligrams per litre
mg/m ³	Milligrams per cubic metre
MMO	Marine Mammal Observer

TERM	DESCRIPTION
Monitoring	The repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time, also used to assess the effectiveness of control measures
MWL	Mean Water Level
Natural gas	Gas, occurring naturally, sometimes occurring in association with crude oil
NGOs	Non-governmental organisations
NHA	Natural Heritage Area protected under the Wildlife (Amendment) Act of 2000. Some sites have been fully designated while others are still awaiting designation and are referred to as proposed NHAs (pNHAs)
NMVOG	Non-methane volatile organic compound
NO	Nitrogen monoxide, also known as nitric oxide
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
NPWS	National Parks and Wildlife Services of the Department of the Environment, Heritage & Local Government
Oil	A mixture of liquid hydrocarbons of different molecular weights
Operator	The company that has legal authority to drill wells and undertake production of hydrocarbons found. The operator is often part of a consortium and acts on behalf of this consortium
OS(I)	Ordnance Survey (Ireland)
OSPAR	Oslo and Paris Commission
PAH	Polycyclic aromatic hydrocarbons
PE	Polyethylene
PEL	Permissible exposure limit/level
Pelagic	Refers to fish and animals that live in the open sea, away from the sea bottom
PEMP	Project Environmental Management Plan
Petroleum	A generic name for hydrocarbons, including crude oil, natural gas liquids, natural gas and their products
Phyla	A major taxonomic group into which animals are divided, made up of several classes
Physico-chemical	Involving the principles of both physics and chemistry
PIG	Pipeline integrity gauge: remotely operated tool that is sent through the pipeline to gather information
PIG launcher	Equipment for sending PIGs through a pipeline
PIG trap or PIG receiver	Equipment for retrieving PIGs from a pipeline
Plankton	A diverse group of minute animals (zooplankton) and plants (phytoplankton) that freely drift in the water
PLEM	Pipeline end manifold- allows the gas flow from the manifold to be shut off from the pipeline to shore
PM ₁₀	Particulate matter (fine airborne particles) with a diameter of less than 10µm
POCP	Photochemical ozone creation potential
ppm	Parts per million
ppt	Parts per thousand
The project	The elements of the Corrib development that are the subject of this Supplementary Update Report, i.e. intra-field pipelines, manifold, export pipeline and umbilical from Corrib field to landfall valve installation, discharge pipeline from landfall to approx 12.7km from landfall
PSG	Porcupine Studies Group
PSV	Pressure safety valve (relief valve)
Pyrolytic	A compound that can be transformed or decomposed as a result of heat

TERM	DESCRIPTION
QA	Quality assurance
QSR	Quality system regulations/requirements
Reprofiling	Altering the side view of an object or structure
Reservoir	The underground formation where oil and/or gas have accumulated. It consists of a porous rock that holds the hydrocarbons, and a cap rock that prevents its escape
Risk assessment	An analytical study of the probabilities and magnitude of harm to human health or the environment associated with a physical or chemical agent, activity or occurrence
Rock Armouring/ Armour rock	Rocks installed to reduce erosion and protect marine structures
Rock Fracturing	The splitting/breaking of rocks
ROVs	Remotely Operated Vehicles
RPS	RPS Group Plc
RSG	Rockall Studies Group
RSK	RSK Group Plc
SAC	Special Areas of Conservation (cSAC) are protected under the European Union (EU) Habitats Directive (92/43/EEC), as implemented in Ireland by the European Communities (Natural Habitats) Regulations, 1997.
Sacrificial Anodes	Aluminium-Zinc-Indium based alloy used to prevent corrosion, i.e. on steel
Schist	Metamorphic rock defined by well-developed parallel orientation of more than 50% of the minerals present
Scoping	Process of identifying the significant issues that should be addressed by a particular EIA/EIS
SD	Sustainable development defined by the Brundtland Commission (1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"
SDU	Subsea Distribution Unit- distributes the hydraulic fluid and chemicals from the umbilical to the wells
Semi-submersible drilling rig	Floating drilling platform, which is towed to site in an unballasted condition, and ballasted (lowered) for stability upon mooring on location
Semi-natural habitat	Habitat modified by human activity from its original state but with a vegetation composed of native species similar in structure to natural types and with native animal communities
SEPIL	Shell Exploration & Petroleum Ireland Ltd
SEVESO	EU Directive on control of major accident hazards
SFPA	Sea Fisheries Protection Agency
Sheet piling	Vertical supports for trench excavations, i.e. wall support
SIP	Social investment programme
SMR	Sites and Monuments Record (Archaeology)
SO ₂	Sulphur dioxide
Sonar	Sound navigation and ranging: a system for underwater detection of objects
SO _x	Oxides of sulphur
SPA	Special Protection Areas (SPAs) are protected under the EU Habitats Directive, which complements EU Directive 79/409/EEC, The Directive on the Conservation of Wild Birds ('The Birds Directive'), under which the SPAs were initially established
SPI	Sediment profile imagery
Spoil Heaps	Mound of refuse material that has been removed from an excavation
Spoolpiece	Section of pipeline allowing for thermal expansions
sq.m	Square metres
Strings (pipe strings)	Assembled lengths of pipe

TERM	DESCRIPTION
Subsoil	The layer of soil between the topsoil and bedrock
Subtidal	Continuously submerged in the marine environment
Suspended well	A well that has been capped off temporarily
SWD	Shellfish Waters Directive
Syncline	A basin shaped fold or fold system
Synthetic-based mud (SBM)	Drilling mud used to drill through rock that can react with water-based materials
Taxa	Category of organisms
Teleost	Bony fish
Terminal	The plant where the Corrib gas will be separated from any associated liquids to meet BGE export specifications
Thermocline	A layer of water where there is an abrupt change in temperature that separates the warmer surface water from the colder deep water
Till/boulder clay	A poorly sorted mixture of sands, clays and boulders produced by the erosion of rocks by moving ice
TOC	Total organic carbon
Topsoil	The uppermost layer of unconsolidated material on the earth's surface
TP	Trial pit
Trench stability	Ease of producing trenches (without collapse)
TWC	Tide Way Consortium
Udden-Wentworth	A geometric scale of grain sizes that classifies particles of siliciclastic sediment
µg/l	Micro grams per litre
UKOOA	United Kingdom Offshore Operators Association
Umbilical	A 'bundle' of electrical and hydraulic control lines and chemical transportation lines used to a) control and monitor the subsea facilities from the terminal and b) supply methanol and other chemicals to the manifold and wellheads. The bundle is encased in a protective cable
UNECE	United Nations Economic Commission for Europe
Univariate	Containing only one independent variable
US EPA	United States Environmental Protection Agency
Van-Veen Grab	A sampling device based on two hinged bucket sections connected to extended lever arms. On contact with the seabed, the weight of the grab is taken off and closes as this is retrieved collecting the sediment
VOC	Volatile organic compound (a compound that evaporate readily and contribute to air pollution mainly through the production of secondary pollutants such as ozone)
Water of condensation	The hydrocarbon gas in the reservoir contains a certain amount of water in vapour phase. This water in vapour phase condenses out as liquid during the production process as the temperature and pressure of the hydrocarbon gas decreases. This water is known as water of condensation. It is produced throughout field life in rough proportion to the gas production rate
Well	A borehole, lined with steel, that is drilled from the sea bed into the reservoir and through which gas is brought to the seabed surface
WHO	World Health Organisation
Workover	Remedial work to a well.

IMPERIAL/METRIC CONVERSIONS

IMPERIAL TO METRIC	METRIC TO IMPERIAL
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Imperial Unit	Metric Unit	Metric Unit	Imperial Unit
Lengths		Lengths	
1 inch	25.4mm	1mm	0.0397 in
1 foot	0.3048m	1m	3.281 feet
1 mile	1.609km	1km	0.6214 miles
1 nautical mile (nm)	1.853km	1km	0.5396 nautical miles

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