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 CO_2 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 (CO_2) 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 Rossport 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.

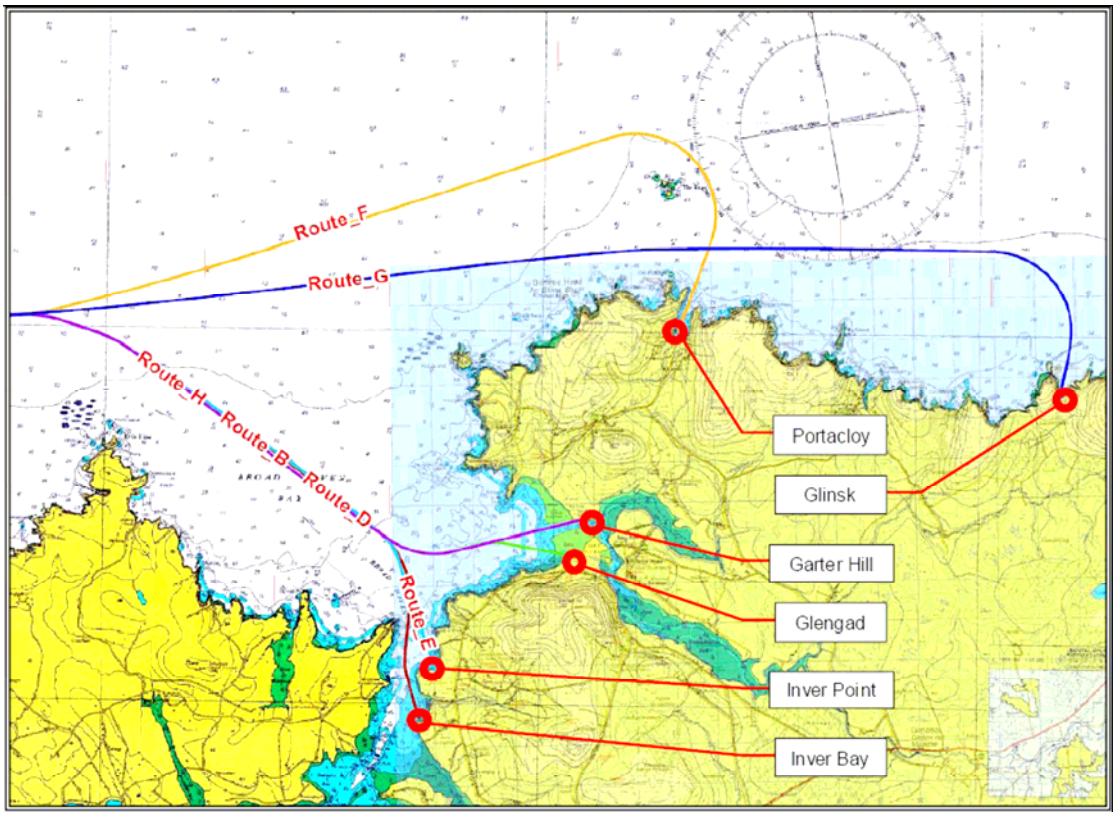

Figure 4-1: Alternative Landfalls and offshore pipeline routes

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 lead 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.