4 ALTERNATIVES

4.1 INTRODUCTION AND PROCESS FOR CONSIDERING ALTERNATIVES

It is a requirement of the EIA process that alternatives considered during the development of the project be described and the main reasons for choosing the proposed development be set out.

The consideration of alternatives is a fundamental aspect of environmental appraisal for any transmission infrastructure. The appraisal is an iterative process which follows a structured process as follows:

- Alternative options of achieving the objectives of the project are identified at a technical level;
- Following identification of a preferred project solution at a technical level, a study area is identified;
- Within the study area a number of alternative substation locations and overhead line (OHL) and/or underground cable (UGC) route corridors are identified and assessed having regard to the constraints identified therein;
- Based on the assessment an emerging preferred substation site and an emerging preferred route corridor emerges;
- The emerging preferred substation site and emerging preferred route corridor are then reviewed in respect of feedback received during the consultation phase;
- A preferred substation site and preferred route corridor are identified;
- A preliminary substation design is determined for the site and an indicative line route is designed within the preferred corridor; and
- Finally, a substation is designed for the preferred site and the loop-ins to the substation are finalised.

In order to assist in understanding the various reporting and consultation processes and environmental appraisals, including alternatives, which were undertaken throughout the project, as well as the project development process in general, the Stage 1 and 2 Lead Consultant's Reports which are included as appendices to the Planning Report should be read in full.

In order to understand the basis for the technical alternatives it is first necessary to understand why this project is required (i.e. project need).

4.2 PROJECT NEED

The Laois-Kilkenny Reinforcement Project is required to address forecasted constraints on the existing transmission network in the Midlands Region, South East Region and County Kildare (referred to from here on in this report as the Area of Concern (AOC)). In assessing the technical need for reinforcement of transmission infrastructure in this area, two issues were identified;

- Ensuring security of supply; and
- Improving quality of supply.

Although the proposed infrastructure will be located in County Laois and County Kilkenny, it will address and improve the above the concerns in relation to both security and quality of supply over the wider Area of Concern, including the counties of Carlow, Kildare, Kilkenny, Laois and Wicklow.

4.2.1 EXISTING ELECTRICITY TRANSMISSION INFRASTRUCTURE

This section gives a general description of the existing electricity transmission system in Ireland and its purpose. It also describes the transmission network in the Area of Concern in more detail, all with a view to assist in understanding the need for the proposed Laois-Kilkenny Reinforcement Project.

4.2.2 EXISTING TRANSMISSION SYSTEM IN IRELAND

The transmission system in Ireland essentially refers to the higher-capacity electricity network, and comprises the 400 kV (i.e. 400,000 Volts), 220 kV and the 110 kV networks. The transmission system map of Ireland as of January 2012 is shown in Figure 4.1. This is also available on EirGrid's website (www.eirgrid.com). The 400 kV network is represented by red lines, the 220 kV network by green lines and the 110 kV by black lines. Various forms of generators connected to the transmission system are also shown.

Electricity is supplied to most individual customers through the lower voltage distribution system (typically 38 kV and below), which is connected to the transmission system at the 110 kV substations. At these substations, power flows from the transmission system to the distribution system to supply demand. Electricity is distributed to end users via the lower and medium-voltage distribution network, for which there is a separate Distribution System Operator (DSO).

The transmission system needs to be robust to be able to fulfil its purpose which is to reliably and economically transport electricity from generation stations to demand centres around the entire country where the power is required by customers. The transmission network is meshed which means that there are multiple network paths on which to transport power to any substation so as to ensure that all customers have the benefit of the most secure, reliable and economic power at any point in time.

The amount of power required by industrial, commercial, farming and domestic customers varies depending on the time of day and year and other factors such as weather, holidays etc. The number of generators providing power and the amount of power each generator provides to the system is constantly monitored and adjusted to match the changing customer requirements. The transmission system, therefore, must be flexible and able to cope with the flows of power arising from a wide range of combinations of generation and electrical demand. The transmission system must also be robust enough to withstand a scenario where a transmission line is unavailable, due to an unforeseen event (such as a fault or for planned maintenance), or a generator suddenly becoming unavailable (so that another generator located elsewhere has to be used instead).

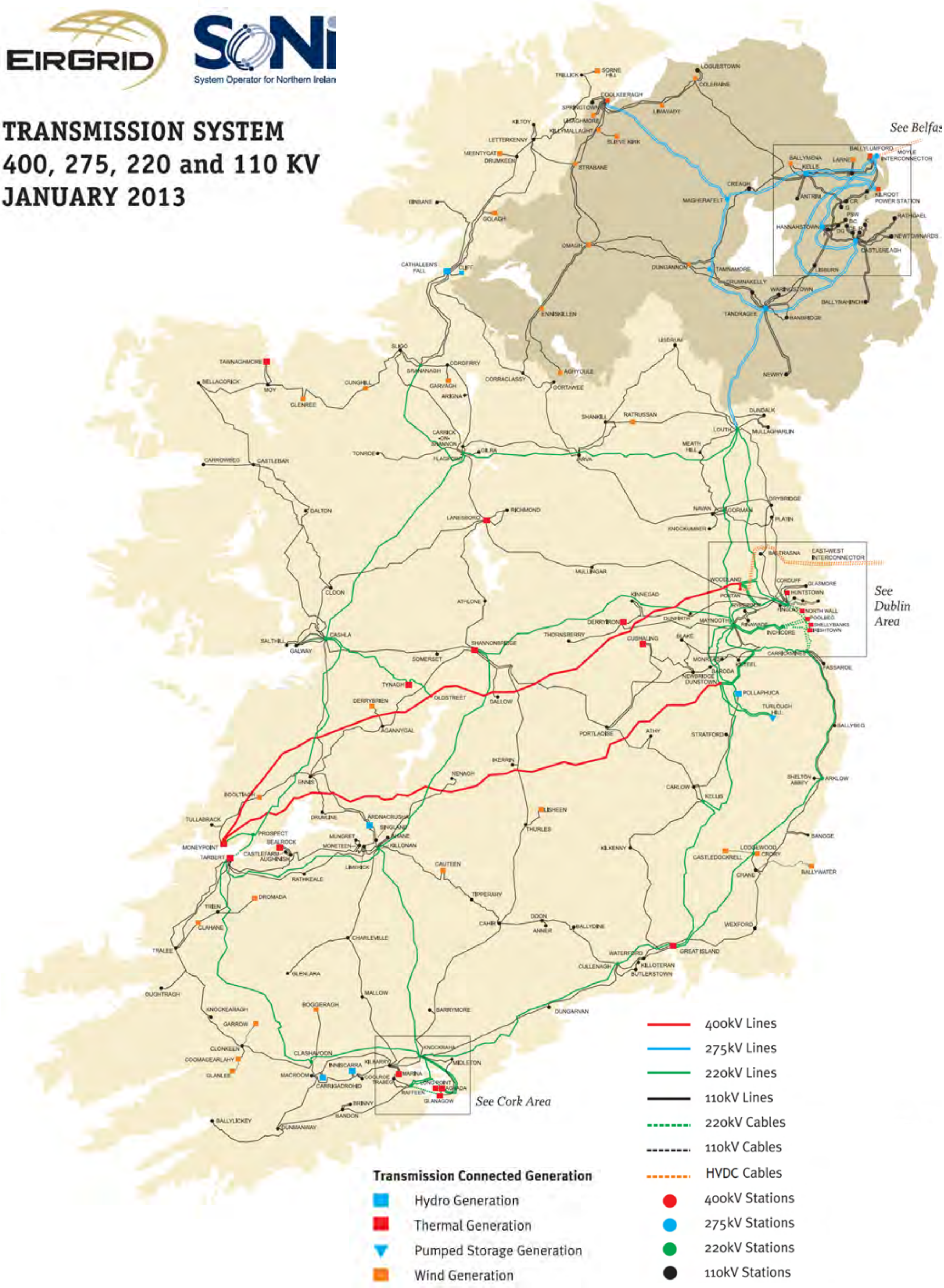

Figure 4.1 Map of Ireland's Transmission System (as of January 2012)

Development of the transmission system is essential when future changes to generation and demand would otherwise jeopardise the safety and integrity of the system. Decisions in this regard are made in reference to the Transmission Planning Criteria (TPC) which set out standards for reliability and quality of transmission services. In summary, the TPC are the technical standards to which the grid must comply. The TPC, which are available on EirGrid's website, require the transmission network to be designed to withstand outages of any circuit or other item of equipment while maintaining continuity and quality of electricity supply. These criteria must be met under normal operation conditions, and also when any item of plant (lines, transformers, generators etc.) is out for essential maintenance. EirGrid as the Transmission System Operator is statutorily obliged to ensure compliance with these criteria and it is in compliance with this function that EirGrid strategically plans the network to ensure that its reliability and security is maintained before any possible weaknesses occur.

4.2.3 DESCRIPTION OF THE TRANSMISSION NETWORK IN THE AREA OF CONCERN

The area where the existing transmission network is of concern is highlighted (within the purple dotted line) in Figure 4.2 and includes counties Carlow, Kildare, Kilkenny, Laois and Wicklow. The main Area of Concern is with the strength and reliability of the 110 kV network within this area.

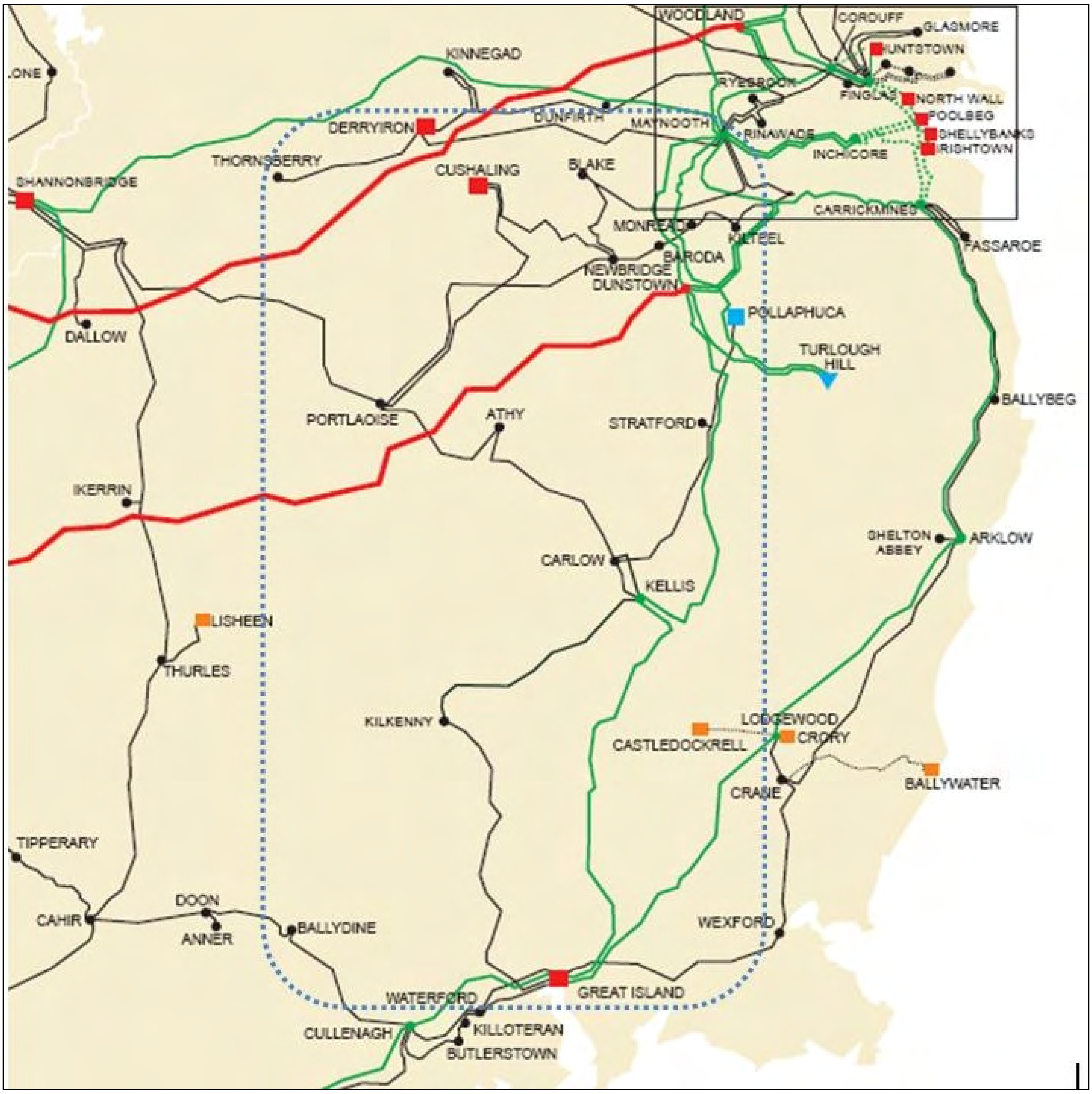

Figure 4.2 Transmission System Map Showing the Transmission Network in the Area of Concern

There are several 110 kV substations (black dots on the map in Figure 4.2) in the Area of Concern through which power is supplied to the underlying distribution system. Of these, the following 110 kV substations supply major demand centres in the Area of Concern including: Carlow, Kilkenny, Kilteel, Monread, Newbridge and Portlaoise.

The 110 kV network in this area is supported by the stronger 220 kV network at Great Island, Kellis, and Maynooth substations via 220/110 kV transformers. The 220 kV network in turn is supported by the existing 400 kV network at Dunstown 400 kV station in Co. Kildare. It should be noted that the existing 400 kV circuit passes through the Area of Concern, but of crucial importance it does not currently have a direct connection into the 110 kV network in this area.

Peat-fired generation located at Cushaling 110 kV station and hydro generation at Pollaphuca 110 kV station also provides support to the 110 kV network when available and in operation.

Figure 4.3 illustrates the evolution of the transmission network in the Area of Concern from the 1980's until today. Since the 1980's increased demand in the area has been accommodated at existing substations or through the connection of new substations – Athy, Baroda, Kilteel, Monread, and Stratford – which has increased the stress on the transmission system as the network feeding the area has remained largely unchanged in that time except for a few exceptions.

To maintain the network within standards, through the past 30 years a number of reinforcements have been made to strengthen the network, including the addition of the Kellis 220/110 kV substation in 1996, the looping of the Cushaling-Blake 110 kV line into Newbridge substation providing Newbridge with an extra two connections, and the establishment of Cushaling 110 kV station to connect a new generator. In addition, in recent years, capacitor banks have been installed in the area to support the voltage. Capacitors are electrical devices that are installed in stations to support the local voltage. These type of devices are suitable for boosting the voltage in an area in the short term, but would not be considered as long-term solutions, as their effect is reduced when more demand is added to the system, subsequently decreasing the voltage even further. Despite these works, the need to significantly reinforce the network in this area has been identified in technical studies.

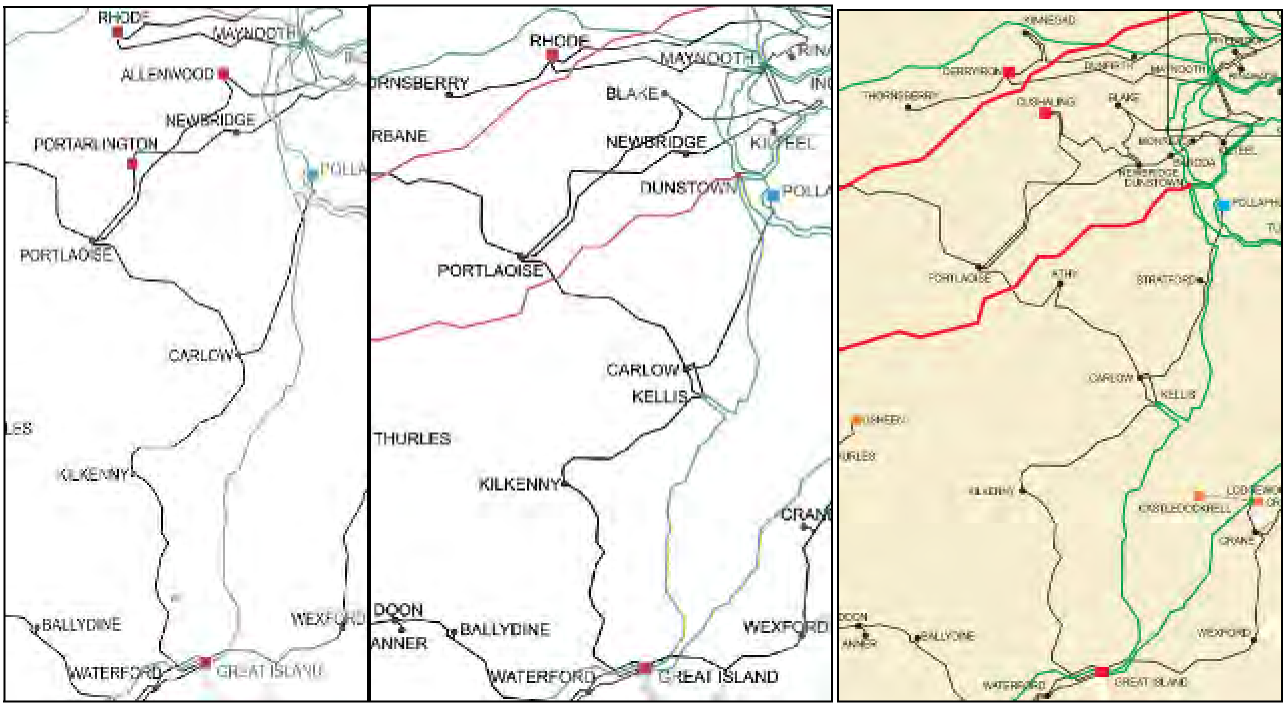

Figure 4.3 Maps Illustrating Evolution of the Transmission System in the Area of Concern from 1980, 1997 and 2012

4.2.4 Limitations of the Existing Electricity Infrastructure

The need in the Midlands Region, South East Region and County Kildare is twofold and the two issues will be described individually in the below section. Each of these issues in of themselves is required to be addressed;

- Improving quality of supply; and
- Ensuring security of supply.

4.2.4.1 Improving Quality of Supply

Quality of supply is a collective term for many performance issues affecting the transmission system, including issues relating to low voltages, increased potential for fluctuation in voltage (or voltage dips) and a proximity to voltage collapse, which ultimately leads to complete loss of electricity supply.

The 110 kV network in the Area of Concern is supported by the stronger 220 kV network at Great Island, Kellis, and Maynooth substations via 220/110 kV transformers. If any of the 220 kV circuits (lines or transformers) feeding these stations are unexpectedly lost, the underlying 110 kV network would see a reduction of its strength and hence the voltage would decrease and be more unstable (i.e. a small change in the network would have a large effect on the voltage).

Studies carried out in 2008 estimated that the network would be outside standards as set out in the TPC by as early as 2010 when the combined demand in the area was expected to have reached 420 MW. However, as a result of the economic downturn, annual energy demand for electricity countrywide has fallen by 7.8% since 2008 (as quoted on page 10 of EirGrid's Transmission System Performance Report 2011) while the peak demand has dropped by about 5% in the same period. The peak demand in the Area of Concern was 390 MW in 2011 and is now expected to reach critical levels by 2020, based on median system demand growth rates quoted in the All Island Generation Capacity Statement 2012. If actual demand were to increase in line with the higher growth forecast, the problem could arise as early as 2016. These critical dates need to be considered against the length of time required for planning consents and constructing such new infrastructure.

The most onerous loss of an item of plant for the Area of Concern is the outage of the Dunstown - Kellis 220 kV circuit which would result in the voltage at a large number of substations across the area being outside of acceptable voltage limits. In this scenario, the 110 kV network would only be connected at Maynooth 220 kV station, Great Island 220 kV station and Shannonbridge 220 kV station. With the amount of demand that is fed within this area, these connections would not be enough to maintain the voltage in the area within the limits as set out in the TPC. In addition, the unexpected loss of the Kellis - Kilkenny 110 kV circuit would similarly result in stations being outside acceptable voltage limits, although it would be more localised around Athy, Carlow, Kilkenny and Stratford 110 kV stations. Furthermore, other contingencies (unplanned outages involving the above mentioned circuits and others) during essential maintenance outages were also identified that would result in 110 kV circuits in the area becoming overloaded and the voltage at a larger number of substations across the counties of Carlow, Kildare, Kilkenny, Laois, and Wicklow falling outside standards.

4.2.4.2 Ensuring Security of Supply

From a transmission network perspective, security of supply is concerned with maintaining continuity of electrical supply to consumers. As such, it is taken to mean the ability of the transmission network to reliably transport electrical energy from where it is generated to the demand centres where it is consumed. In relation to security of supply the Transmission Planning Criteria (TPC) states that "The load that would be isolated for the loss of two 110 kV lines shall not exceed 80 MW of distribution load". The loss of this amount of demand (i.e. load) during the outage situation is described as unacceptable from a security of supply perspective.

Kilkenny 110 kV substation, which is the only 110 kV substation in County Kilkenny, is connected to the rest of the transmission system by two transmission lines, namely the Kellis – Kilkenny 110 kV and Great Island – Kilkenny 110 kV lines.

The peak demand at the Kilkenny substation recorded in 2012 is 74 MW, which approaches the 80 MW limit specified in the TPC. During a maintenance outage, when either circuit is out of operation for a prolonged period for maintenance, the subsequent unplanned loss of the other circuit would interrupt the supply of electricity to the substation. The loss of both these circuits would isolate Kilkenny 110 kV substation from the rest of the transmission system. In this situation the area fed from Kilkenny 110 kV substation would suffer a complete loss of its electricity supply. Although the risk exists that both circuits could be out simultaneously, the risk of this occurring is more likely during periods of planned maintenance. For that reason, EirGrid attempts to schedule maintenance outages at times other than the peak demand periods, generally from March through to October, in order to minimize the potential for impact.

In the studies conducted in 2008 the demand in Kilkenny, during the normal maintenance period, reached 63 MW and was expected to reach the specified 80 MW by 2019. Due to the recent economic downturn, the demand during the normal maintenance period in 2012 reached 62 MW and is now expected to reach the specified 80 MW limit by 2028 based on the median system demand growth rates quoted in the All Island Generation Capacity Statement. As can be seen from the above, the demand levels for the Kilkenny 110 kV substation is back to 2008 levels, but the growth rates applied have been reduced to a long-term annualised growth rate of 1.6% (from 2.9%). Any incremental increase outside of the expected organic growth in demand would accelerate the timing of the need significantly. For example, a step increase in demand of 10MW, as a result of a new customer connection or an expansion of existing customer's facility would require the third circuit into Kilkenny by 2020.

Based on the uncertainty as to when the third circuit would be required, this factor does not now present the same urgency as before, however it is important to understand that it will still emerge in time. It is also essential to recognise that a change in the economic climate or a small change in the demand supplied by the station could accelerate the need for the third circuit. This uncertainty in the timing of the third circuit, combined with the long lead-in time for the planning, consenting and construction of transmission infrastructure makes it prudent for EirGrid to consider the security of supply driver when addressing the separate quality of supply issue to achieve an efficient solution for the entire Area of Concern.

Thus , the proposed development will provide a third circuit into the Kilkenny 110 kV substation maintaining supply in the situation described and so will enhance the security of supply for County Kilkenny.

4.3 TECHNICAL ALTERNATIVES

To address issues of quality and security of supply, as identified above, four reinforcement options were considered. All the options that were considered were designed to meet the technical needs of transmission reinforcement in the Area of Concern, and are described and discussed in the section below.

- **Option 1**, presented in Figure 4.4, reinforces the existing network with a new 400/110 kV station at Laois, which connects into the existing 400 kV circuit between Dunstown and Moneypoint stations; and the existing 110 kV circuit between Athy and Portlaoise stations. The new reinforcement will also connect a new 110 kV circuit between Laois and Kilkenny stations making use of the existing line from Kilkenny to the existing Ballyragget 38 kV station which will be expanded to a 110/38 kV station. The benefit of connecting the new 400/110 kV station into the existing Athy – Portlaoise 110 kV circuit is that it will provide a direct injection from the highest capacity 400 kV network into the 110 kV network in Counties Carlow, Kildare and Laois which will address the quality of supply in those counties, improving the voltage. The connection to Kilkenny station will address the quality and security of supply issues in the broader Kilkenny area. The option shows very strong technical performance and the least amount of new circuit build (i.e. approximately 30 km).

- **Option 2**, shown in Figure 4.5, provides a 220/110 kV injection at the existing Dunstown 400/220 kV station. This option would require an extension to the infrastructure in this station to include a new 110 kV busbar and the addition of a 220/110 kV transformer. The network in Kildare is reinforced with a new 110 kV circuit between Dunstown and Monread stations. The South East region is strengthened by means of a new 110 kV circuit between Dunstown and Pollaphuca stations. Security of supply issues in Kilkenny are addressed by means of a new 110 kV circuit from Kilkenny to Carlow stations which provides a link to the 220/110 kV injection at Dunstown station via Pollaphuca and Carlow 110 kV substations. Additional voltage support in the form of 15 MVAr capacitor bank is required at Doon and Wexford stations. This option comprises approximately 59 km new circuit build.

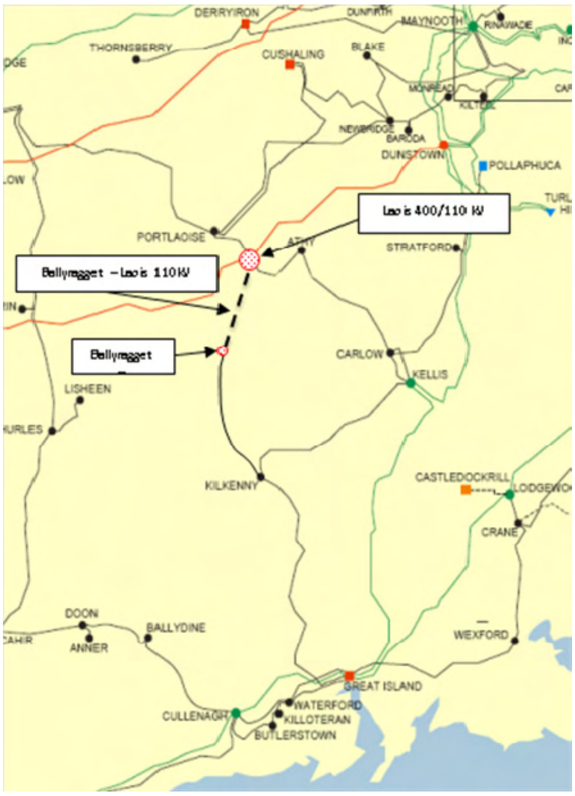

Figure 4.4 Map illustrating the reinforcements associated with Option 1

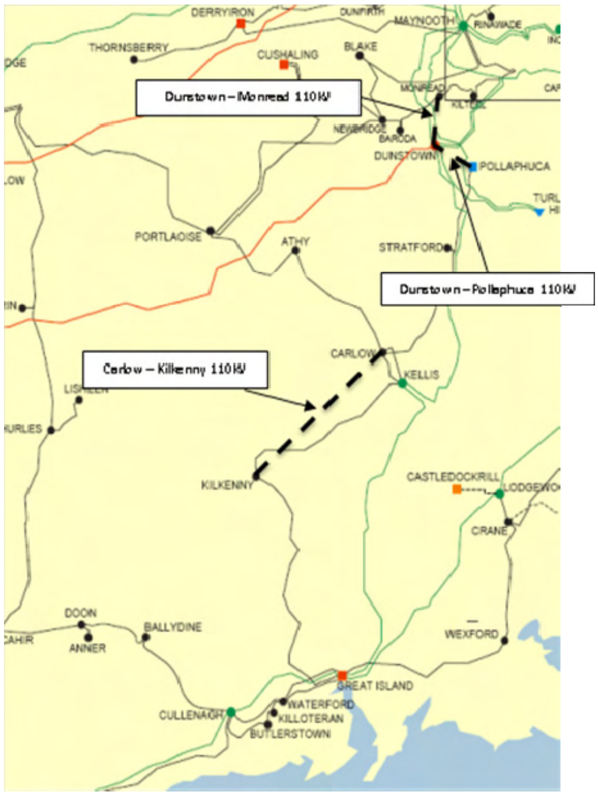

Figure 4.5 Map illustrating the reinforcements associated with Option 2

- **Option 3**, shown in Figure 4.6, comprises entirely 110 kV circuit build. The network in Kildare is reinforced with a Maynooth – Monread 110 kV circuit. The Carlow and Kilkenny areas are reinforced with the introduction of a 15 MVAr capacitor bank in Carlow 110 kV station and two new 110 kV circuits; (i) Carlow – Kilkenny and (ii) Kilkenny – Lisheen via Ballyragget. Additional voltage support in the form of 15 MVAr capacitor bank is required at Doon and Wexford stations. This option comprises approximately 84 km new circuit build.

- **Option 4**, shown in Figure 4.7, uses a combination of 220 kV and 110 kV reinforcements. Security of supply in Kilkenny is addressed with a new 220/110 kV station in Kilkenny looped into the existing Great Island-Kellis 220 kV line. A new Carlow - Portlaoise 110 kV circuit adds further strength to the south east network. The network in the Kildare region is reinforced by the introduction of a Maynooth-Monread 110 kV circuit. Additional voltage support in the form of 15 MVAr capacitor banks are required at both Doon and Wexford stations. This option comprises the most new circuit build, approximately 26 km of double circuit 220 kV and approximately 63.5 km 110 kV.

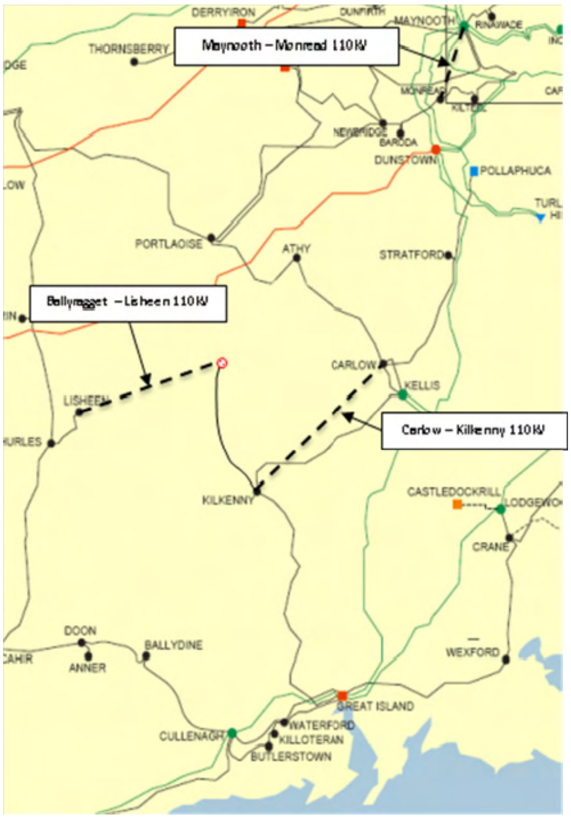

Figure 4.6 Map illustrating the reinforcements associated with Option 3

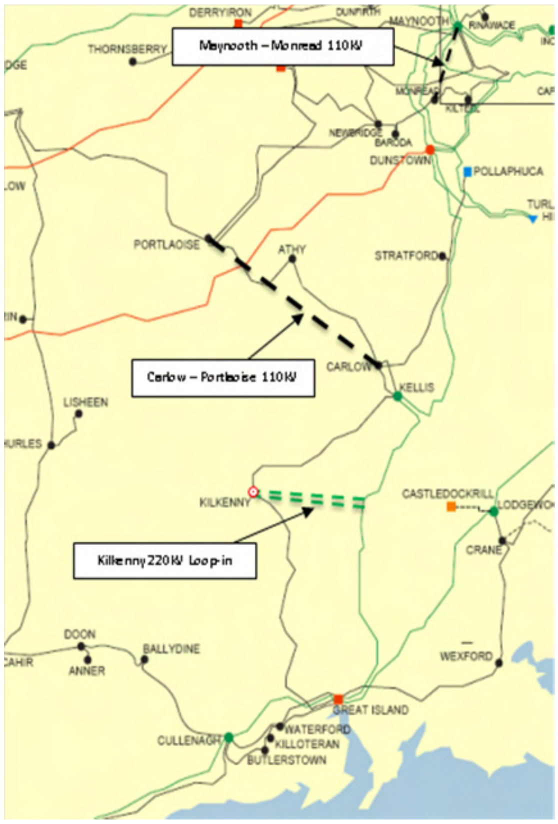

Figure 4.7 Map illustrating the reinforcements associated with Option 4

4.4 PREFERRED REINFORCEMENT OPTION

The options were compared by considering their relative performance from a technical and economic perspective. A high-level environmental assessment was done to ensure that each of the options would be implementable from an environmental perspective.

Each of the options was considered to adequately address the identified network constraints, but a comparison of the relative technical performance of each of the options indicated that Option 1 would provide the greatest incremental growth in capacity. This option would represent a strong platform for future economic growth for the Area of Concern and defer the need for any further reinforcement requirements well beyond that of any of the other options.

It must be considered in this regard that this strategic infrastructure will have a lifespan of several decades. Furthermore, when compared to the alternative options, Option 1 represents the least amount of new transmission infrastructure to be constructed (i.e. approximately 30 km of 110 kV new transmission circuits compared with approximately 59 km, 84 km and 116 km for Options 2, 3 and 4 respectively).

In terms of network efficiency (i.e. transmitting power with the least amount of losses), Options 1 and 2 performed the best with both achieving similar results.

A comparison of the initial capital costs and the operating and maintenance costs for each option indicated that Option 1 had the lowest cost. Furthermore, as stated above, Option 1 created the greatest amount of additional capacity, which would mean that as the system requirements continue to grow out into the future, the timing of the next transmission reinforcement (and its associated capital cost) could be deferred further into the future than any of the other options. This would directly translate into an economic value above that offered by the other options.

In conclusion, all four options meet the network requirements to ensure a suitable level of reliability and quality of supply in the area of concern. Based on a comparison of the four options, Options 1 and 2 are preferable to Options 3 and 4 from an economic and efficiency perspective. Option 1 is preferred to Option 2 as it involves the least new circuit length and adds the greatest amount of spare network capacity for future growth.

Option 1, the Laois-Kilkenny Reinforcement Project, is therefore the best solution to meet the long-term needs of the area.

4.5 ALTERNATIVE TECHNOLOGY

4.5.1 SUBSTATION TECHNOLOGY ALTERNATIVES (AIS VS. GIS)

As described in Section 3.2.3 and in Section 1.8 of the Stage 1 Report, two technologies were considered for the 400/110 kV substation: Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS). EirGrid concluded that it was appropriate to proceed with the GIS option in this instance. The decision to proceed with GIS was based on both the cost and technical aspects as well as taking into account the overall smaller size and associated reduced environmental impact.

4.5.2 UNDERGROUNDING AS AN ALTERNATIVE TECHNOLOGY

The option of undergrounding both the Coolnabacky to Moneypoint/Dunstown 400 kV connection and the 110 kV Coolnabacky-Ballyragget circuit was investigated as part of the consideration of alternatives.

The process of considering undergrounding follows a policy (Policy on the use of Overhead and/or Underground Cable) which has been developed by EirGrid, which is detailed in Section 3.2.5 of the Planning Report, and may be summarised as follows:

An underground cable will be used only when all of the following conditions apply:

1. An overhead line is not environmentally and/or technically feasible.
2. A technically and environmentally acceptable route for an underground cable can be found.
3. The effect on the transmission network due to the electrical characteristics of the underground cable is acceptable, and the relative poorer 'availability' of the underground cable relative to that of an equivalent overhead line is tolerable.
4. The relative greater cost of the underground cable when compared to an overhead line can be justified.

4.5.2.1 Coolnabacky-Ballyragget 110 kV Circuit

Having regard to the Laois – Kilkenny Reinforcement Project, application of the policy resulted in the following outcome.

In relation to condition (1) of the policy for the 110 kV circuit, Chapters 4, 5 and 6 of the Stage 1 Report confirm that there are three environmentally feasible corridors including variants of these corridors, within which to route a 110 kV overhead line, and that the predicted environmental impacts of such a development are sustainable. As such, condition (1) does not apply.

In relation to condition (2) of the policy, EirGrid commissioned ESB International to carry out a feasibility study to identify an underground cable route option. This study identified and evaluated several feasible routes identifying one preferred route. This study entitled '110 kV Underground Cable Feasibility Study' (Ref: PE424-F0000-R000-011-004) is included in the Stage 1 Report, Appendix A-2. A further environmental study was then carried out on this one cable route. This report found that while there are some environmental impacts, especially during the construction phase, these can be minimised with appropriate mitigation measures and the environmental impacts are therefore sustainable. This study is entitled 'Environmental Reports in Relation to an Underground Electricity Circuit for the Laois-Kilkenny Reinforcement Project' and is included in the Stage 1 Report Appendix A-3. As such condition (2), does apply.

In relation to condition (3) of the policy, a project specific technical screening study has examined the electrical characteristics of using a cable for the proposed circuit. This study found that whilst the use of a cable would result in a more onerous utilisation of the local 110 kV network, the overall effect is deemed tolerable. This study entitled 'Power System Studies: Laois-Ballyragget Cable Feasibility Studies' is also included in the Stage 1 Report, Appendix A-4.

In relation to condition (3) of the policy, the availability of both an overhead line and an underground cable has been assessed based on a combination of fault data from the Irish Transmission System and from CIGRÉ data on 110 kV faults. From these it has been concluded that on average, over its lifetime an overhead line will give a better service availability than an underground cable. This is based on the knowledge that, on average, the fault rates of underground cables are comparable with the fault rates of overhead lines (sustained faults as opposed to transient faults) however the repair times for underground cable faults (average repair time of 15 days for 110 kV UGC) are considerably longer than for faults on overhead lines (average repair time of less than one day). It follows therefore that an overhead line will provide a better level of service availability, and is therefore more reliable than an equivalent underground cable. Based on this criterion and for this development, an overhead line is considered preferable to an underground cable.

In relation to condition (4) of the policy, the costs for both an overhead line and an underground cable solution have been estimated. Based on the emerging preferred overhead line route corridor identified in the Stage 1 Report, Chapter 6 and the emerging preferred underground cable route identified in the Underground Cable Feasibility Report, it is estimated that the underground cable would cost nearly three times more to install than the equivalent overhead line. The relative high cost of an underground cable cannot be justified given the fact that viable overhead line solutions exist and therefore condition (4) does not apply.

In summary, EirGrid's position on the use of high voltage underground cable and overhead line in the Ireland states that all four of EirGrid's conditions must apply for an underground cable to be used for a proposed circuit.

As only one of the four policy conditions is applicable, EirGrid are proceeding with an overhead line solution for the 110 kV circuits which is consistent with relevant policies.

4.5.2.2 400 kV Coolnabacky-Moneypoint/Dunstown Connection and the Athy-Portlaoise 110 kV Connection

Having identified the preferred site for the substation (again the term 'preferred' should be taken to mean 'best fit' or 'least constrained' from a technical and environmental perspective), the next step was to consider in detail how the existing OHLs would be "looped into" the new substation (i.e. how the incoming circuit, irrespective of whether it is underground cable or overhead line, is routed to connect to the equipment within the substation).

In order to determine the most appropriate connection method, EirGrid commissioned a feasibility study on the connection options to the proposed Coolnabacky substation from the existing 400 kV overhead line entitled "Assessment of 400 kV Connection Methods to Coolnabacky Substation" (see Stage 2 Report, Appendix J). The proposed substation is located approximately 1.4 km from the 400 kV line. Overhead line connectivity to the transmission network from candidate sites was a key consideration when assessing suitability of substation sites.

The Athy – Portlaoise 110 kV line is adjacent to the proposed substation. 110 kV connection options available to the substation are by overhead line to the substation site with very short lengths of cable to the compound.

In the feasibility study four methods of connecting the Dunstown – Moneypoint 400 kV line to the proposed Coolnabacky 400/110 kV substation were examined:

1. Double circuit underground cable (DC UGC)
2. Single circuit underground cable(s) (SC UGC)
3. Double circuit overhead line (DC OHL)
4. Single circuit overhead line(s) (SC OHL)

In order to establish the preferred connection method ESBI produced preliminary designs for all four connection methods, environmental assessments were then carried out by environmental consultants and technical suitability and costs were established for each of the methods. Using this information a preferred connection option was recommended.

The report recommended that the preferred connection option from the proposed Coolnabacky 400/110 kV substation to the existing Dunstown – Moneypoint 400 kV line and the existing Athy – Portlaoise is by way of a 400 kV double circuit overhead line and a 110 kV overhead line respectively with very short lengths of underground cables within the substation compound.

As part of the final connections, referred to in technical terms as “loop-ins”, of the overhead lines into the proposed substations at Coolnabacky and Ballyragget, very short sections of underground cable are used within the station compounds. These very short lengths of cable within the substation are required in order to achieve the optimal technical design for the loop-ins.

4.6 ALTERNATIVE SUBSTATION LOCATIONS

4.6.1 SUBSTATION STUDY AREAS

As part of the Stage 1 Lead Consultants Report, a study was carried out to assess the suitability of potential 400/110 kV substation study areas. This study was requested following consultations with a local community group. EirGrid was asked to consider an alternative location at Cullenagh for the proposed substation study area. The subsequent report examined four potential study areas including Cullenagh, Abbeyleix, Cashel and EirGrid substation study area. The four study areas examined can be seen in Figure 4.8.

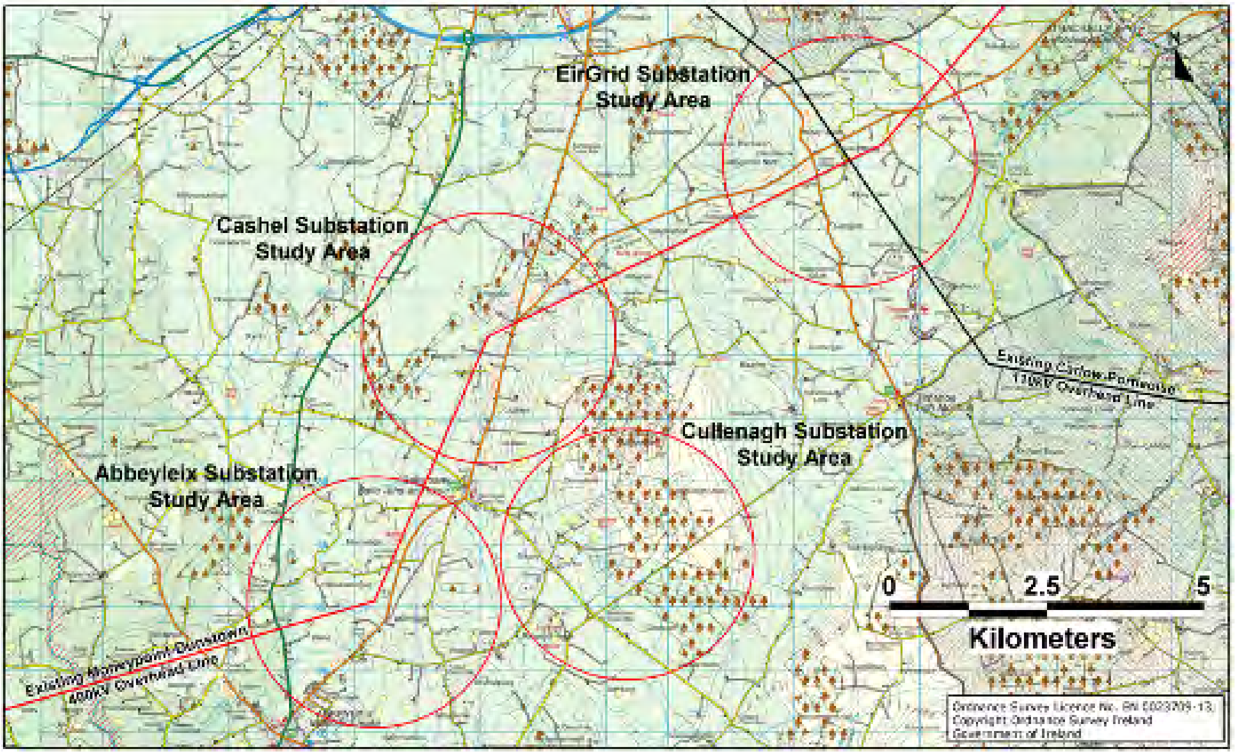

Figure 4.8 Alternative Substation Study Areas

The four substation study areas were assessed under the following technical, environmental and other relevant criteria:

- Vehicular Access
- Study Area Topography
- Study Area Flooding history / Drainage
- Existing planning permissions in Study Area
- Study Area Settlement pattern including population
- Existing infrastructure within Study Area
- Environmental constraints
- Transmission system connection potential of study area
- Cost

The originally proposed substation study area as proposed by EirGrid was deemed to be the most suitable location having regard to physical, environmental, technical and social factors associated with the type of development proposed and the inherent suitability of the receiving environment to accommodate same. A copy of the report can be found in Stage 1 Report, Appendix F-2. On completion, the findings of this report were then relayed to the local community group.

4.6.2 Substation Locations

The process for identifying alternative station locations and how a preferred station location emerged is described in the Stage 1 Lead Consultants Report Chapter 3. This section summarises the information in the Stage 1 Report.

Following identification of the study area and mapping of constraints, nine suitable land folios within the study area were identified as being potentially suitable in which to site the planned substation, primarily comprising those which avoided identified environmental and other constraints to the optimum extent. The potential sites considered within that area denoted on Figure 4.8 as the “EirGrid Substation Study Area” are identified in more detail in Figure 4.9.

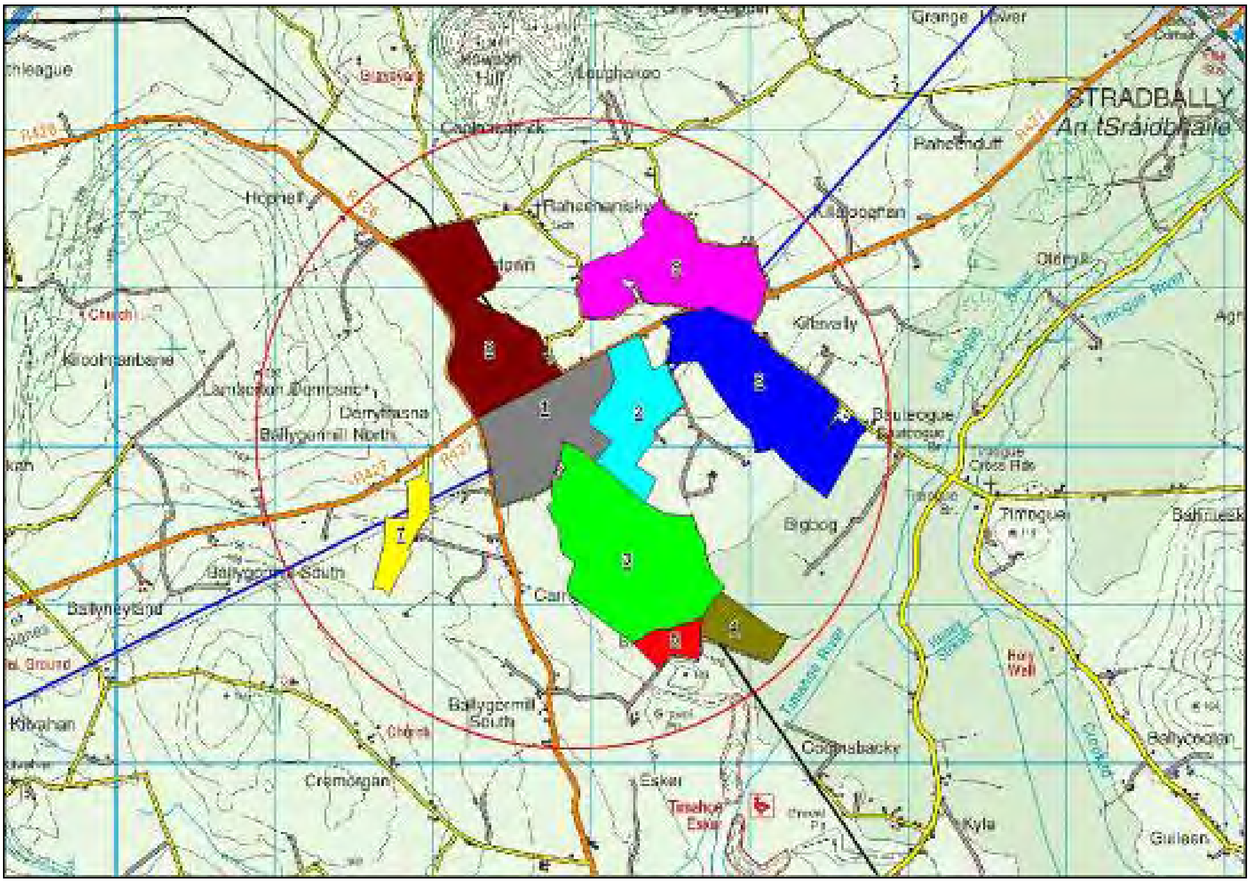

Figure 4.9 Potential Substation Sites Considered

The conclusion of the Stage 1 Lead Consultants Report was that, of 9 no. originally identified potential sites/folios, the substation site identified in dark green as Site 4 emerged to be the optimum site option to meet the requirements of this project whilst having the lowest potential environmental impact on the receiving environment. The full report '400/110 kV Emerging Substation Site' can be found in the Stage 1 Report, Appendix G.

4.7 ALTERNATIVE OVERHEAD LINE ROUTE CORRIDORS

The process for identifying alternative line route corridors and how an emerging preferred corridor was identified is described in detail in Chapter 6 of the Stage 1 Report. This section summarises the information in the Stage 1 Report.

The environmental and other constraints identified within the project study area were used to assist in identifying possible route corridor options between the two substations (being the planned new 400/110kV station as identified in Chapter 3 and the existing Ballyragget substation).

Potentially feasible corridors within which a transmission line could be accommodated were identified and are set out in the Stage 1 Report and can be seen reproduced in Figure 4.10 below.

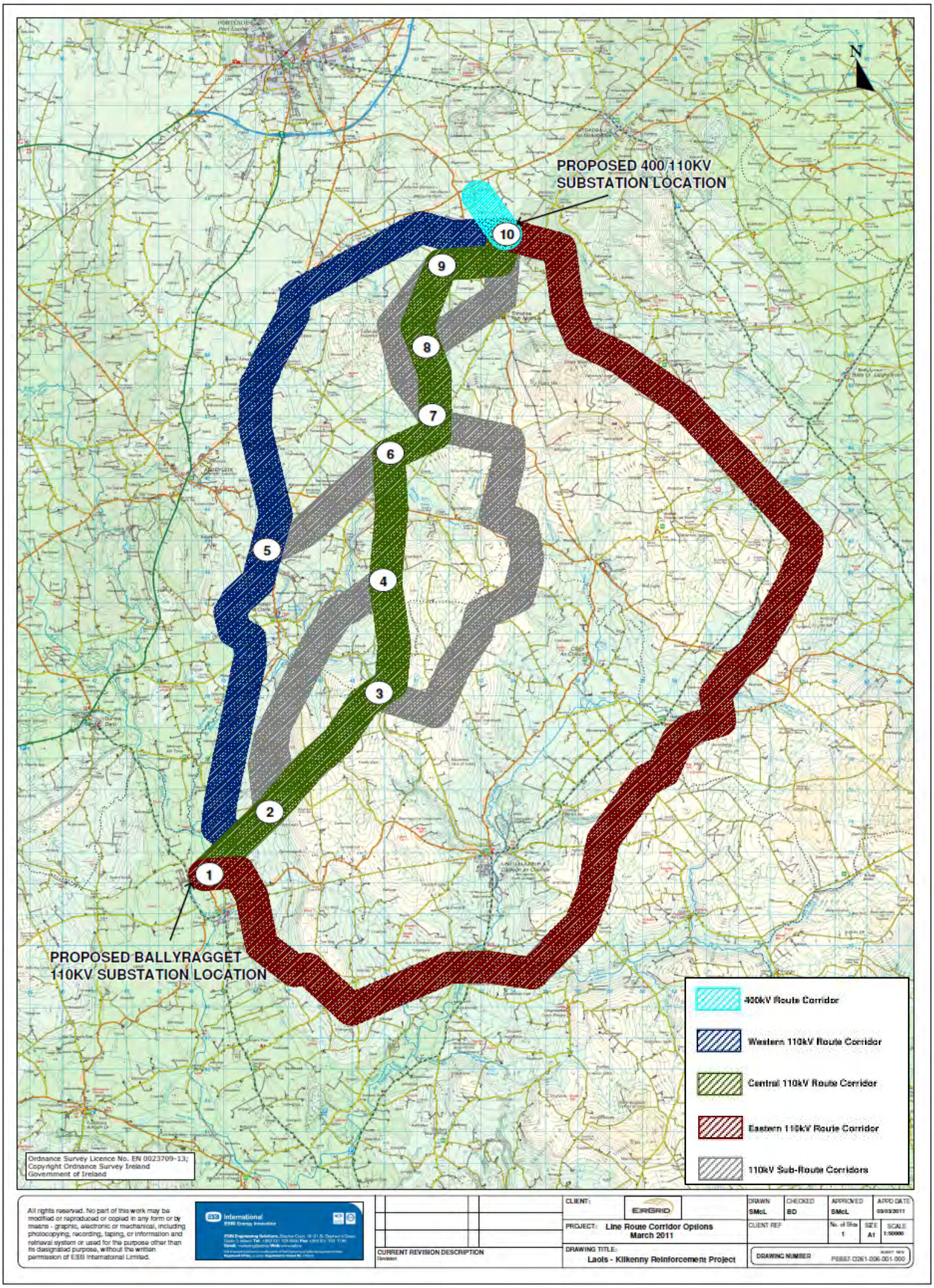

Figure 4.10 Potentially Feasible Line Route Corridors (as presented in Stage 1 Report)

The following describes at a high level how these corridors were selected and the characteristics associated with each.

4.7.1 IDENTIFICATION OF FEASIBLE ROUTE CORRIDOR OPTIONS

Having regard to the constraints identified within the project study area (summarised previously in this report), a number of feasible route corridors, within which a transmission line could potentially be accommodated were then identified. The identified corridors avoided the identified constraints to the greatest extent practicable or feasible. These can be broadly classified as a western corridor, a central corridor and an eastern corridor. A number of 'sub-options' were also developed having regard to the constraints identified. The corridors were typically 1km wide and the reasons for selecting same are as follows:

- Western Corridor (28km)

  The western corridor (Nodes 1-5-10) was primarily selected as it follows the route of the existing Ballyragget-Portlaoise 38 kV line and is therefore an established powerline corridor (albeit for a lower voltage line than is being proposed in this instance). Further north, the western corridor changes direction and follows the route of the existing 400 kV Moneypoint-Dunstown overhead line towards the identified Coolnabacky substation site.

- Central Corridor (and variants) (c.26km)

  The central corridor was selected as it is the most direct route that minimises the impacts on the majority of the constraints identified. This corridor, and it's variants/sub-options, largely avoid the main population centres and associated one off housing, as well as keeping to the transitional upland plains (off ridgelines and out of river valleys). Where constraints were unavoidable, variant sub-corridors were identified and considered.

  The reasons for selecting these were as follows:

  - <u>Node 1-3</u>: Established to follow the existing 38 kV line route, however this route traverses higher ground and a designated high amenity area.

  - <u>Node 2-4</u>: Established as an alternative to Node 2-3-4: which mainly avoids the aforementioned High Amenity Area (although not entirely as it is constrained from doing so by the cSAC to the north).

  - <u>Node 4-6</u>: Established to minimise impact on cSAC by crossing river at a narrow point (Boleybeg Bridge North on a tributary of the Owenbeg river). Neither of the supporting structures (polesets) are within the cSAC at this crossing point.

  - <u>Node 3-7</u>: An alternative to 4-6 which was established to avoid forestry, higher ground and the cSAC.

  - <u>Node 5-6</u>: An alternative off the western corridor established to avoid Abbeyleix, Ballyroan and the existing 38 kV and 400 kV lines.

  - <u>Nodes 6-7-8</u>: Chosen to avoid traversing the higher ground of Cullenagh Mountain. Node 7-9 is an alternative to this.

  - <u>Nodes 8-10</u> and <u>Nodes 8-9-10</u>: Corridor options for connecting to the Coolnabacky substation site. These options have regard for housing, Timahoe village and Timahoe Esker.

- Eastern Corridor (44km)

  This corridor (Nodes 1-10) is the longest of the alternatives as it attempts to avoid the high amenity area to the east of Ballyragget. It is further constrained by Castlecomer and associated one off housing/ribbon development along the N77/N78, which results in a limited number of locations being available to cross these roads, as well being constrained by the Barrow and Nore cSAC.

- 400 kV Corridor (1.8km)

  This corridor is determined by the identified site location of the proposed substation at Coolnabacky and routing options from the Moneypoint-Dunstown 400 kV line to same. It parallels the existing 110 kV Portlaoise-Athy line route.

4.7.2 ASSESSMENT OF ROUTE CORRIDOR OPTIONS

Following identification of the above corridors, a qualitative multi-criteria comparative evaluation of all corridors was undertaken, ensuring the input of each technical and environmental specialist discipline. This resulted in corridors, or parts thereof being designated as Emerging Preferred, Less Preferred and Least Preferred. The objective was to identify a corridor (or indeed a composite corridor) that on balance had the least overall impact on the identified constraints.

- Human Beings: The central corridor has the lowest population (124 addresses) when compared with the other corridor options (west 442 and east 330). The central corridor is the least constrained in terms of population numbers and population density and would present relatively more options for line routing. It is therefore the preferred option with respect to Human Beings.

- Cultural Heritage: The central corridor was most preferred on the basis that it contains the lowest number of cultural heritage sites, and does not contain any large clusters of archaeological monuments or NIAH structures. The overall density of monuments in this corridor is also low (0 National Monuments - however 1 has subsequently been confirmed as being a National Monument, 0 NIAH structures, 23 recorded monuments). The central corridor is therefore the preferred option with respect to Cultural Heritage.

- Landscape: The central corridor is preferred as it minimises landscape and visual impacts more than the other alternative corridors considered, given the topography and characteristics of the receiving environment.

- Ecology: The emerging preferred corridor is the central corridor. The corridor passes over higher ground of the Castlecomer Plateau so is somewhat removed from the habitats and species of interest along the River Nore lowlands. The corridor involves one single crossing at a narrow section of the cSAC. The western corridor would also need to cross the cSAC, also passes close to the sensitive environment of Lisbigney bog, and is close to lowland areas that are frequented by wintering waterbirds and as such could interfere with flightpaths. The eastern corridor is least preferred as it is the longest and will therefore have the largest construction footprint. Additionally it would need to cross cSAC twice and also passes over Coan Bog NHA.

- Soils and Geology: The least preferred options were western corridor (node 1-5) and eastern corridor (1-10) due to the presence of blanket peat. The central corridor was preferred, however it was noted that potential impacts at all other nodes would be similar throughout. There is an identified site of geological significance (Timahoe Esker) near the Coolnabacky substation site.

- Hydrology and Hydrogeology: It was noted that the level of impact for all options was slight negative and moderate negative for all corridor options however the western corridor (nodes 5-10), eastern corridor (nodes 1-10), and the 400 kV corridor were least preferred due to the presence of both regionally and locally important sand and gravel and bedrock aquifers. The most preferred corridor was central corridor (variant). It should be noted that such potential constraints are generally overcome by means of good construction practice in line development.

The findings of these assessments are set out in detail in the Stage 1 report and associated appendices. They were included on CD as part of the application to the Board for planning approval and are available online on the project website (http://www.eirgridprojects.com/projects/laoiskilkenny/phaseonereports/).

The corridor evaluation process resulted in the central corridor being identified as the emerging preferred option, in the Stage 1 Report. Some disciplines preferred Node 2-3-4 whilst another preferred 2-4. Node 2-4 was considered to have the least impact on the designated High Amenity Area and its associated Scenic Views whilst Node 7-9 and 7-8-9 were amalgamated as they overlapped substantially and both were considered equally feasible.

Even though each corridor option was initially considered by each environmental discipline in isolation, all identified the central corridor as being the most preferred. It should be noted that, per EirGrid's Project Development and Consultation Roadmap, no decision was made in this regard at this stage of project development. Rather the findings of the Stage 1 Information Gathering form the basis and focus for public and stakeholder consultation and engagement, with the intention of receiving feedback.

In this regard, following this Stage 1 evaluation, the emerging preferred corridor and associated Stage 1 report were issued to all stakeholders for consideration and feedback in May 2011.

Stage 2 began by considering all feedback in respect of the publication of the emerging preferred corridor.

A minor modification (corridor widened by 30m at node 7) was made to the emerging preferred corridor due to line route design within that corridor. A second minor modification (corridor widened by 600m at node 9-10) was made to the emerging preferred corridor due to line routing exercise which sought to avoid the Timahoe Esker.

In general no feedback emerged during this period of consultation which required EirGrid to fundamentally re-appraise its process, information gathered, evaluation or conclusions.

During Stage 2 of the roadmap process, all corridor options were re-evaluated again in light of modifications made above and also in light of all other stakeholder feedback received. It concluded that the preferred corridor remained the emerging preferred corridor as previously identified in Stage 1, with the two minor modifications described above.

Thus by the end of Stage 2, a preferred corridor had been identified that on balance, generally avoids the constraints identified as far as is reasonably possible (the use of the term 'preferred' in this context should be considered to constitute a 'best-fit' or 'least- constrained' option). It is not suggested that there will be no impact associated with such infrastructural developments – zero impact is not possible – but it does seek to minimise impacts on all identified constraints, primarily by means of avoiding them in the first instance.

Following confirmation of the preferred route corridor the next step in EirGrid's Roadmap process was the identification of a feasible line route within that corridor. The most significant constraint here is generally the avoidance of houses and avoidance of other constraints that the corridor itself has not been able to avoid given its 1km width (e.g. cSAC river crossing), or that encroach into the corridor boundary. The line route identification process generally occurs in the context of direct landowner engagement (where possible and which has generally occurred in this instance), and on site surveys and assessment. This continues up to the submission of the application for the proposed development with associated environmental assessment.

The overhead line route selection process attempts to generally avoid many changes of direction, which in turn minimises the number of steel angle towers required, and maximises the number of straight runs supported on the wood polesets.

The preliminary indicative overhead line route is set out in the Stage 2 Report and is seen reproduced in Figure 4.11 below.

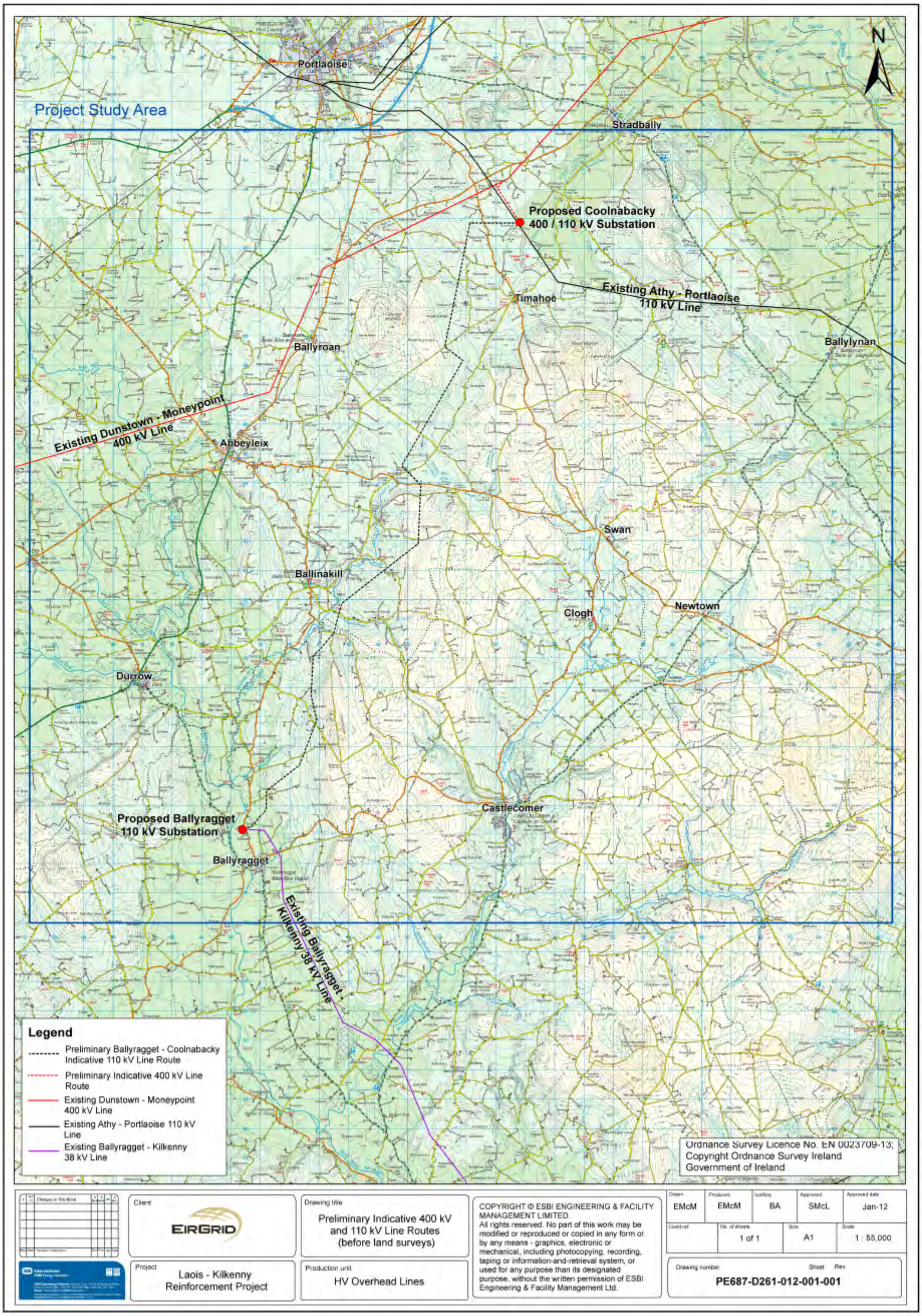

Figure 4.11 Preliminary Indicative Overhead Line Route (as presented in Stage 2 Report)

4.8 AMENDMENTS TO INDICATIVE LINE ROUTE

Following feedback from landowners and from the environmental consultants, and as a result of landowner engagement, walkover and desktop studies, a number of localised modifications were made to the initial indicative 110 kV line route issued to the landowners. The majority of the modifications are only moves of a few metres and were requested by either the environmental specialists or the line route designer to improve upon the original indicative line route. Other modifications were requested by the landowners, some of which were significant and the environmental consultants were requested to review these further.

At the time of publication of the Stage 2 report, only angle tower locations (used where the line changes direction and the structures that therefore actually determine the alignment) were identified - intermediate poleset locations had not been determined. Where landowners did not consent to environmental consultants entering lands to carry out surveys, some angle masts have been placed on improved grasslands with less ecological value than hedgerows.

Stage 3 appraised in more detail the previously identified route for the OHL. Refinements to the OHL generally arose as a result of the engagement process with landowners and other directly affected parties. Where possible, requests for changes were accommodated.

4.9 CONCLUSION

As a result of the iterative project development process, referencing the Project Development Roadmap, and having regard to careful consideration of alternatives, a final project solution emerged that is the subject of the application made to the Board for planning approval, and the potential for significant environmental effects of which are considered in this EIS.