

Laois - Kilkenny Reinforcement Project



110 kV Underground Cable Feasibility Study

PE424-F0000-R000-011-004

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Executive Summary

Feasibility Study Objectives

This study has assessed the feasibility for a new 110 kV AC underground cable connecting the proposed Ballyragget 110 kV Station to a proposed 400 kV Station, south-east of Portlaoise.

The proposed connection is to be made via a single circuit 110 kV cable.

The study had three main objectives:

- To select technically feasible route corridors and evaluate them to determine the optimum route corridor.
- To evaluate any additional ancillary equipment required to ensure the secure, reliable and efficient operation of an underground cable.
- To estimate the cost of the preferred optimum underground route.

Methodology

Study Area

A study area is a broad geographical area within which a suitable route corridor can be expected to be identified. Details of the study area are in section 2.

Route Corridor Selection Criteria

Route corridor selection criteria were established to determine suitable route corridors for a 110 kV AC underground cable. The selection criteria are detailed in section 3.

Desktop study

Based on the route corridor selection criteria, potential route corridors were identified and assessed. The desktop study is detailed in Section 4.

Site Study

All route corridors identified were assessed on site to note any potential conflicts with the desktop findings. Details of the site study are in section 5.

Optimum Preferred Route Corridor Criteria

Following the desktop and site investigation all routes were assessed against the selection criteria matrix. This is detailed in section 6.

Ancillary Equipment

EirGrid to advise if ancillary equipment is required to ensure the secure, reliable and efficient operation of an underground cable. This is detailed in section 9.

Cost Estimate

The cost estimate for the project is outlined in section 10.

The cost estimate to connect the proposed Ballyragget 110 kV Station to a proposed 400/110 kV station via a 110 kV AC underground cable is estimated at €24,183,421.

Based on the feasibility study, and based on a number of assumptions, Routes A, B, D and F were identified as feasible underground cable routes. Route A was identified as the preferred route corridor.

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1 Introduction

EirGrid, the Transmission System Operator, is proposing a 110 kV AC connection between the existing Ballyragget 110 kV station to a proposed 400 kV station, south-east of Portlaoise. Eirgrid have identified network problems which affect both quality of supply and security of supply in the areas of Kilkenny, Carlow, Kildare and Laois. These problems are caused by the increase in load demand in the area over the last number of years, together with the growth in forecast demand in future. To alleviate these concerns, EirGrid has identified the proposed Laois-Kilkenny reinforcement scheme as the most efficient solution

ESB International HV Cables have been appointed by EirGrid to assess the feasibility of connecting the proposed Ballyragget 110 kV Station to a proposed 400 kV station, via a 110 kV AC underground cable.

ESBI HV Cables have been given three main objectives by EirGrid;

- To identify technically feasible cable route corridors and evaluate same, in order to determine the optimum route corridor
- To evaluate any additional ancillary equipment required to ensure the secure, reliable and efficient operation of an underground cable.
- To estimate the cost of the preferred optimum underground cable route.

The report details the methodologies used and studies and investigations undertaken to determine a technically feasibly underground connection which is cost efficient.

Following the detailed investigations, a preferred route corridor was identified.

A number of assumptions have been made when compiling the feasibility report. These are detailed below:

- That sufficient space exists within the public road for a standard trench installation
- That all roads are under the control of the local authority or NRA
- That roads consist of a standard road base and have sufficient structural integrity to accommodate cable installation.

- As is currently the route selection practice for underground cables in Ireland cross country routes were not considered (see Section 3.2).
- Where trenchless installations are required that the ground consists of typical soils and clays
- Only features visible on the surface have been considered in selecting the route. The presence of underground rivers, culverts, services or structures was not investigated.

2 Description of Study Area

2.1 General

A map of the study area is shown in drawing PE424-D8001-005-006-002. The study area is contained within the dashed red area. The study area is located in central Ireland and is bounded by Portlaoise to the north, Kilkenny to the south, Mountrath to the west and Carlow to the east. The towns of Abbeyleix in the west and Castlecomer in the south-east of the study area are the major urban settlements in the region. The remaining settlement pattern is that of ribbon development and of one off housing. The region is dominated by agricultural land use.

2.2 Description of Study Area

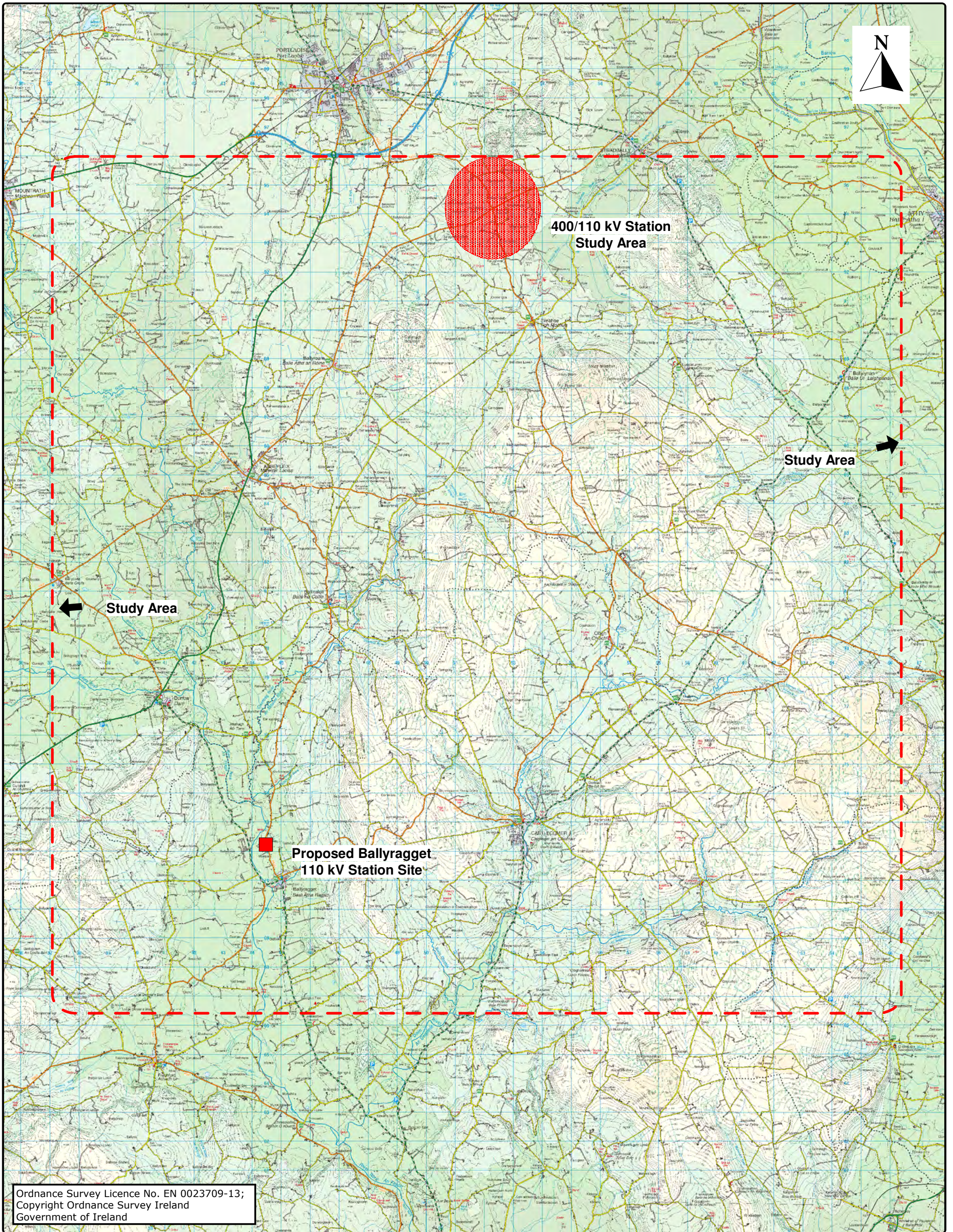
The study area is approximately 841km² (29km x 29km), covering parts of counties Laois, Kilkenny and Carlow. The study area is bisected by the River Nore in the south-western corner. The area is rich in environmental and ecological sites. It is also home to a number of sites of historical significance.

The terrain on the western side of the study area, in the vicinity of Durrow, Abbeyleix, Ballyroan and Ballinakill, is mainly flat and low lying. The eastern side of the study area is more undulating.

The main towns in the area are Abbeyleix and Castlecomer. Abbeyleix is located 14 kilometres from Portlaoise. It is situated near a 12th century Cistercian monastery beside the River Nore. There is a large range of historical structures in the vicinity of the village, including; early monastic buildings, Norman and medieval castles, ring forts and burial grounds. It is located on the N8 National Primary Road. The 2006 census records the population of the town at 1,568.

Castlecomer is located 12 kilometres south of Kilkenny town. It is situated on the River Dinin. The 2006 census records the population of the town at 1,531.

Works were completed on the 28th of May, west of Abbeyleix, on the new M7 Portlaoise – Castletown / M8 Portlaoise – Culahill Scheme (M7/M8 Portlaoise Motorway Scheme) under the National Development Plan. The scheme links into the N7 Castletown – Nenagh project (N7 Scheme) and the N8 Culahill – Castle project (N8 Scheme).



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CLIENT:
EirGrid

PROJECT:
**Laois - Kilkenny
Reinforcement Project**

DRAWING TITLE:
**Laois - Kilkenny
Reinforcement Project
Study Area Map**

REVISION DESCRIPTION:
Study Area Revised

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DRAWING NUMBER		SHEET REV	
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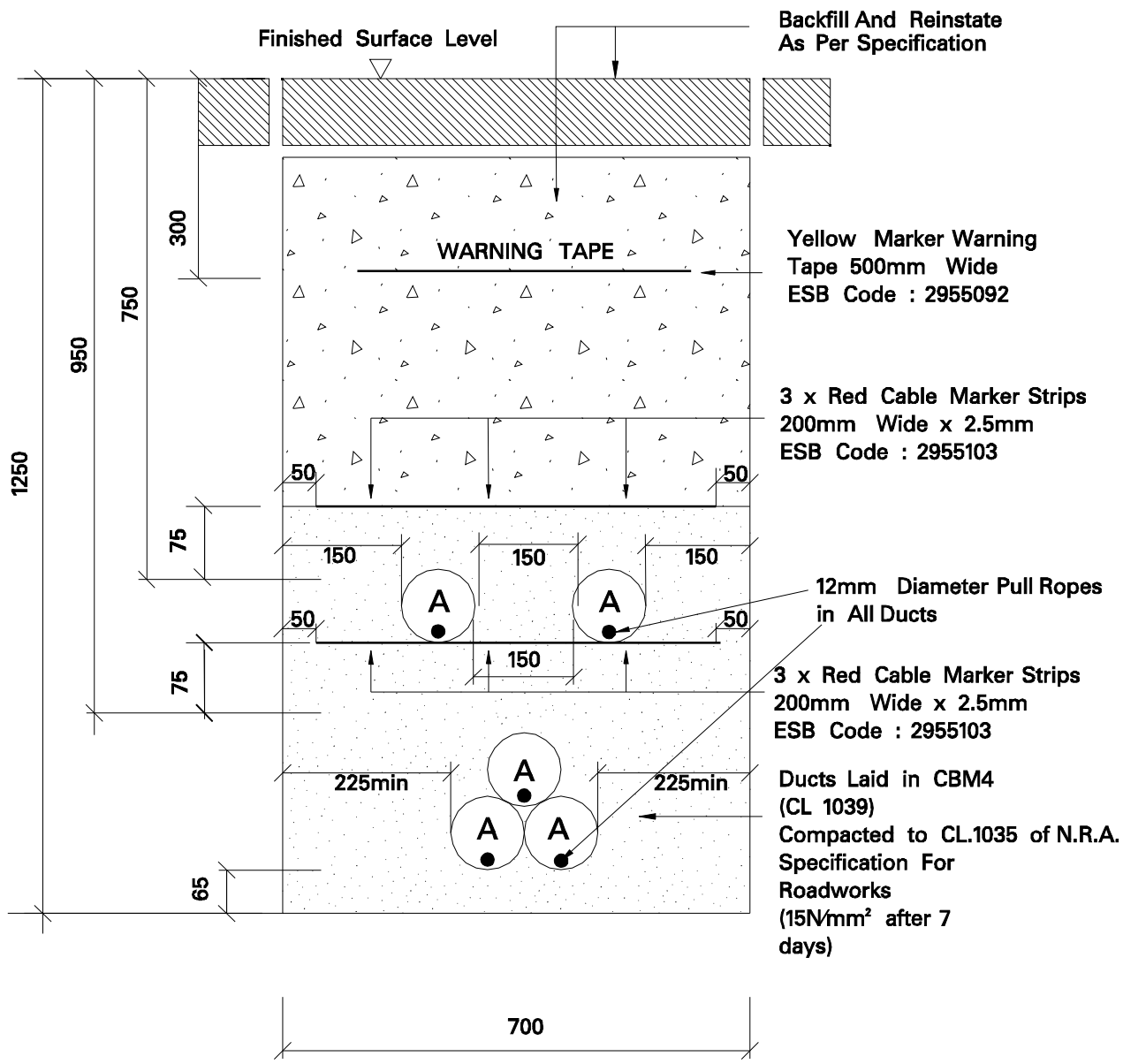
3 Route Selection Criteria

The route selection criteria, outlined in section 3.2, are based on a 110 kV AC underground cable connection consisting of a single circuit 1000mm² XLPE copper conductor cable.

3.1 110 kV Typical Trench Cross Section

Drawing PE424-D7001-001-003-003 shows the cross section and cable configuration at 110 kV.

A
B
C
D
E
F
G



A=125mm Outer Diameter HDPE ESB Approved Duct, SDR=17.6, ESB Code : 9317552

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Client
ESB NETWORKS

Project
HV Cables Standards

Contract
CABLE SERVICES TO ESB

Production Unit
High Voltage Engineering

Drawing Title
TRENCH CROSS SECTION
110kV SINGLE CIRCUIT
TREFOIL DUCT FORMATION
5 WAY

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3.2 Route Selection Criteria

The route selection criteria for this feasibility study are as follows:

- Routes were selected within the public domain (e.g. roadways, public parks etc.) and to avoid private property. Cross country routes have been ruled out for the purpose of this report (see section 3.3).
- Route corridors were investigated to ensure sufficient clearances from existing structures to maintain their integrity.
- Route corridors endeavour to minimise crossings of major roads, railways and water ways.
- Cable routes were identified with the aim of minimising the need for full road closures during construction.
- The routes identified aim to minimise traffic disruption during construction.
- The routes identified aim to minimise impact on the community.
- The proposed route corridors attempt to minimise sharp changes in direction, both in horizontal and vertical.
- The proposed cable route corridors provide suitable locations for joint chambers
- Constructability of the cable route corridor
- The cable route corridor was selected to avoid lakes and water features, where possible.
- Cable routes were selected that minimise the overall length in order to control costs.
- The cable route corridors were selected to minimise conflict with future development.
- Minimum design clearances between existing underground high voltage cables and transmission gas pipelines must be maintained.
- The cable routes identified attempt to avoid areas of significant planting or forestry.
- Environmental constraints including designated areas such as NHA's, SPA's, SAC's and areas of archaeological importance are avoided wherever possible.

- Crossing points under SAC's (Special Areas of Conservation) are avoided or minimised where no other viable alternative exists.
- Access for future maintenance is critical when identifying the cable route corridor.
- Compliance with the current county development plan.
- Current NRA practice is not to allow cable installation in motorways, and only in the national primary network in exceptional circumstances.
- Cable routes installed within Irish Rail land (both existing and disused) were avoided due to rail disruption issues and issues regarding future access for maintenance.

3.3 Cable Installed in Road versus Cross Country

The majority of HV underground cable routes, where technically feasible, are installed along existing roadways and public land rather than across private land. This is in accordance with long established practice of both ESB Networks and EirGrid in Ireland for the following reasons:

- Cables crossing private land may require numerous legal easements with private landowners.
- There are no requirements for private cable easements when an underground cable is installed in public roads.
- The logistics of getting heavy drums (up to 30 tonnes) to joint bay locations may require the construction of haul roads across private land. This requirement does not arise when cables are installed in public roads
- There is a negative short term disruption to farm practice as a result of the construction activities associated with a cable being installed on private land. There is also the issue of the long term disruption to farm practice due to the conditions of the cable easement. This issue would be removed by routing the cable in the public road.
- The cable route would have to be patrolled regularly after installation to ensure it is not being put at risk due to other works taking place nearby. Accessing duct runs for maintenance and repair across private land could also be problematic, especially if haul roads had to be reconstructed to repair any faults.

- Road works on public roads are carried out in a controlled manner, with all documentation required under current health and safety legislation and under licence from the local authority. This is not the case when excavations are undertaken on private land. As a result of this there is increased risk of third party damage and associated risks to the public with cross country cable routes.
- The cable route would pass through an area that contains a high density of existing and potential archaeological sites. Archaeology is unlikely to be an issue at the excavation depths proposed under existing roads. It could become an issue crossing private land.

4 Desktop Study

A desktop study has been carried out using the 1:50,000 OSi Discovery Series Mapping. In order to select potential cable routes, information on environmental, ecological, historical and planning constraints were obtained.

A constraints map was produced showing, where applicable, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Natural Heritage Areas (NHAs) and Sites and Monuments Records (SMR's). All information has been sourced from the latest list of registered sites on the National Parks and Wildlife Service (NPWS) website.

The relevant county development plans of Laois and Kilkenny were also consulted to identify upcoming projects or zoning within the study area. Potential known developments by the RPA, Irish Rail and the NRA were also taken into consideration, where known.

All Candidate SACs, SPAs and Proposed NHAs were also included

Ref: Appendix B: Environmental Constraints Map

Ref: Appendix C: Man-Made Constraints Map

The cable routes chosen take account of the existing technical, environmental and economic constraints in the study area. These are outlined in more detail below.

4.1 Special Area of Conservation

This is a statutory designation which has legal basis in the EU Habitats Directive (92/43/EEC). The main implication of this designation is that any project likely to have a significant adverse impact on the integrity of the SAC may only be carried out for

“Imperative reasons of overriding public interest, including those of a social or economic nature”.

Where a SAC includes a “Priority Habitat” or a “Priority Species”, as indicated in Annex I and Annex IV of the Directive, then

“The only considerations which may be raised are those relating to human health or public safety or, further to an opinion from the Commission, to other imperative reasons of overriding public interest”.

Within the feasibility study area in question, the Rivers Nore and Owenbeg and their flood plains have been designated as being Special Areas of Conservation (SAC). The Lisbigney Bog and Ballyprior Grasslands are also

SPA's in the area. Further investigations would be required to establish whether the SAC's in question contains a Priority Habitat or a Priority Species. A site screening process, in line with the "**Appropriate Assessment of Plans and Projects in Ireland**" guidelines, which have been issued by the NPWS, would be required to assess the potential impact on the SAC and to assess whether a full Appropriate Assessment is required.

Ref: Appendix B: Environmental Constraints Map

4.2 Special Protection Area (SPA)

Special Protection Area's support populations of birds of particular species that are rare or threatened in Europe and require particular measures, including the designation of protected areas to conserve them.

There were no SPA's identified within the study area.

Ref: Appendix B: Environmental Constraints Map

4.3 Natural Heritage Area (NHA)

The basic designation for wildlife is the Natural Heritage Area. In 1995, proposals for over 1,100 NHA's were published and powers introduced for the statutory process of their designation and protection in December 2000. Many of these NHA's have overlapping designations of SAC and/or SPA. The largest NHA in the region is the River Nore/Abbeyleix Woods Complex proposed NHA, located west of the study area and is unlikely to cause any issues for the proposed cable route. The Timahoe Esker is another proposed NHA, located north of Timahoe village.

Ref: Appendix B: Environmental Constraints Map

4.4 Archaeology

All major Sites and Monuments Records (SMR's) and National Monuments are indicated on the Constraints Map. Also included are any protected structures listed in the most recent National Inventory of Architectural Heritage surveys.

Further investigation will be required to locate areas where monuments of archaeological significance may be found along the preferred cable route. Archaeological monitoring may be required in areas of conflict. This will need to be investigated further.

Ref: Appendix B: Environmental Constraints Map

4.5 Rivers/Canals

The River Nore flows from the north-west of the study area to the south in Ballyragget. The river is one of the 'Three Sisters' which flow into the Atlantic Ocean at Waterford Harbour. The river rises on the eastern slope of the Devil's Bit Mountain in County Tipperary, flowing south-eastwards through County Laois and Kilkenny before joining the River Barrow, north of the town of New Ross. The River Nore is 140 kilometres long.

The Owenbeg River is a major tributary of the River Nore. It rises in Bawnogue and joins the Nore at Attanagh, 1.5 kilometres north of Ballyragget 110 kV Station. There is likely to be a minimum of one crossing of this river.

The study area is bisected by a number of other small tributaries which will need to be crossed.

4.6 Roadways

The study area has a well developed road network which links the major towns and villages in the region. The N8 national primary route, which links Dublin to Cork, runs from north to south on the western side of the study area. As previously mentioned in Section 2.2, construction of the M7/M8 Portlaoise Motorway Scheme, located west of Abbeyleix, was completed on the 28th of May.

Regional roads link the remaining towns and villages and a substantial network of local roads also exist. Installation of underground cables in regional and local roads is commonplace, subject to consultation with the relevant stakeholders and utility bodies.

Cable routes are generally chosen with traffic management in mind. Every effort is made to ensure that the knock on effect of construction on traffic flow is minimised. Installation of cable in urban areas, such as Abbeyleix, could pose significant traffic management issues. Further investigation, taking into account the recent opening of the M7/M8 Portlaoise Motorway Scheme, would need to be undertaken if a cable route through the town of Abbeyleix was chosen as the preferred route.

4.7 Railways

There are no existing railway services located within the study area. There is a dismantled railway to the west of Abbeyleix. This was not considered

for a potential cable route due to issues regarding access for maintenance; see section 3.2.

4.8 Settlement Areas

Abbeyleix and Castlecomer are the largest towns in the study area. There are also a number of villages and small towns, such as Durrow, Ballyroan, Timahoe and Ballyragget within the study area. There is a significant amount of ribbon development in the area along many of the regional and local roads. One-off housing and farming residences are commonplace. This will mean that any chosen route will have a significant but short term impact on the local community.

4.9 Other Constraints

Ballyragget Station is located in the south of the study area. There are three 38 kV overhead lines radiating from the station. The Ballyconra – Ballyragget line travels north from the station. The Ballyragget – Castlecomer line travels in a north-east direction whilst the Kilkenny – Ballyragget line travels south from the station.

There are a number of quarries in the locality of the towns of Ballinakill and Timahoe. Any potential cable route in the vicinity would need to consider this if road closures were required.

5 Site Study

5.1 Scope and Methodology

A site investigation was carried out in the last week of October 2009. Weather conditions were good on the day. Due to the distance involved, all of the routes were driven by car to assess their suitability. Where potentially difficult crossing points were encountered, the area was walked and photographed. Notes on each route were also taken during the site visit. A matrix detailing the constraints associated with each potential route option can be found in section 6. Drawing PE424-D8001-005-004-001, in appendix D, shows the potential cable routes that were considered.

5.2 Route Option A

Route A was identified as the preferred cable route. While the route is technically feasible, there are a number of constraints still associated with this option.

This cable route is the second longest of the proposed routes. At 27.3km, it is likely to require a number of trenchless cable crossings and the acquisition of third party easements. The cable route would utilise some of the main roads in the area.

The proposed cable route would exit Ballyragget 110 kV station and travel north along the R432. The road, as shown in Figure 5.1, is seven metres wide in the vicinity of the station. The route travels two kilometres along the R432 until it reaches the first water crossing. Figure 5.2 below shows the approach to the double arched stone bridge crossing the Glashagal River. The bridge appears to have insufficient road cover for cable installation. Therefore, a trenchless installation method may be required with the possibility of third party easements through private property.



Figure 5.1 The seven metre wide R432 at Ballyragget 110 kV Station



Figure 5.2 The bridge crossing of the Glashagal River

The route continues along the straight section of the R432 for 3.5km until it reaches a meandering stretch of road 0.7km long. At this point the route reaches its second water crossing. The large stone bridge crossing the Owenbeg River can be seen in Figure 5.3. It is likely that the bridge has insufficient cover for cable installation. Therefore, a trenchless installation method may be required with the possibility of third party easements through private property.



Figure 5.3 The stone bridge crossing the Owenbeg River

The proposed route then travels 3.1km to the town of Ballinakill. The road continues its meandering nature as its width varies between 5 and 6 metres. The town of Ballinakill has a 20m wide, four-lane main street. Although a number of services are likely to exist in the carriageway, the width of the road suggests that there would be sufficient space to install the underground cable.



Figure 5.4 Ballinakill Main Street

The route continues along the R432 until it reaches a junction 1.5km north of the town. The R432 bears east, signposted Abbeyleix, but the route corridor continues straight on to a third class road. The road is 6m wide

and relatively straight making it suitable for the installation of a cable and it is likely that traffic flow could be maintained with a suitable traffic management scheme in operation.



Figure 5.5 Third class road

The cable route proceeds along the third class road for 2.1km before it crosses a junction with a smaller third class road. The route then crosses the R430 which links the towns of Abbeyleix and Carlow.

North of the crossing with the R430 the regional road maintains its 5-6 metre width with some bends. The route crosses a small tributary of the Owenbeg River 0.8km from the R430 crossing. The bridge would appear to have insufficient cover for cable installation. This means a trenchless installation method including third party easements through private property may be required

The route continues a further 2km along the regional road until it reaches an intersection, Blandsford Cross Road, with a regional road of similar size. The proposed route turns north-west, signposted 'Ballyroan', along the third class road which is similar in nature to the previous road. Figure 5.6 illustrates alignment and working space along this third class road.



Figure 5.6 Example of the wide and straight third class road towards the town of Ballyroan

The proposed route travels 2.8km towards the town of Ballyroan which is located in the eastern side of the study area. The route crosses four small bridges, which all appear to have insufficient cover to allow for cable installation. Therefore, trenchless installation methods and third party easements through private property may be required. The road entering the town maintains its 6 metre width and appears to have been surface dressed recently.



Figure 5.7 The third class road approaching the town of Ballyroan

The route then turns north onto the Ballyroan main street, the R425, which is 10 metres wide.



Figure 5.8 Ballyroan Main Street

The R425 reduces to 6 metres in width as it leaves the town. The relatively straight and open nature of the road means that traffic disruption during construction should be minimal subject to a suitable traffic management plan being in place.



Figure 5.9 The R425 leaving Ballyroan

The route travels 2.8km from the town along the R425 until it bears north-east on to the R427.



Figure 5.10 The junction between the R425 and R427

The cable route must negotiate six separate water crossings over the next 2.8km along the R427. The first crossing is located 100m from the junction. The subsequent locations are 1km, 1.2km, 1.6km, 2.4km and 2.8km from the junction. The streams are all small and appeared to have a limited flow at the time of the site visit. The road appears to have insufficient cover to allow for cable installation. Therefore, trenchless installation methods and third party easements through private property may be required. Alternatively the road has a wide verge and this may be utilised to avoid the requirement for third party easements. This would require further site investigation during the detailed design phase of the project.

The proposed cable route travels a further 2.6km until it reaches a cross-road with the R426 which links the town of Timahoe to Portlaoise. This intersection represents the centre of the study area for the proposed 400 kV station. The station's study area can be seen, highlighted in red, in drawing PE424-D8001-001-006-001.



Figure 5.11 The junction between the R426 and R427

5.3 Route Option B

Route B is a variation of route option A and would also be a viable cable route. The total length of the route is approximately 26.1km kilometres.

The proposed cable route deviates from Route A at a point approximately 2.5km north of Ballinakill on to a smaller third class road. The road is approximately 4.5m wide and follows a slightly meandering path through the countryside. The Department of Transport's "Traffic Signs Manual Updated Chapter 8" states that roads with a width of less than 5 metres require a road closure during construction. Along this particular section of the cable route, consultation with the relevant local authority would be required in order to maintain one lane of traffic during duct installation. It may be possible that the local authority would insist on a full road closure during the works.



Figure 5.12 The 4.5m wide third class road

The cable route would travel 1.4km along the third class road until it reaches the Cobbler's Hill Cross Road, a staggered junction with the R430. North of the junction the third class road maintains its 4.5m width and winding nature. The proposed cable route must then negotiate a second cross roads, Tullore Cross Roads, 1.7km from the previous junction with a third class road of similar size.

The proposed route continues to travel north along the third class road for 2.8km where it must join the R425 south of Ballyroan village. At this point it must also cross a large stone bridge. The bridge may have insufficient cover for cable installation. A trenchless installation method including third party easements on private property may be required.



Figure 5.13 The third class road joins the R425 at the stone bridge entering Ballyroan village

Upon crossing the stone bridge the cable route rejoins Route Corridor A at the centre of Ballyroan village and continues along this route to the proposed 400 kV station.

5.4 Route Option C

Route C is a variation of route option A and aims to utilise the main roads in the study area. It is the longest of the proposed routes, at 28.3km. It is considered a highly problematic route option for the following reason;

- The route travels along the N8 national road in the town of Abbeyleix. The town is heavily congested with traffic and a study would need to be carried out to determine if the opening of the M7/M8 Portlaoise Motorway Scheme reduces traffic volumes significantly.

5.5 Route Option D

Route D is a variation of route option A and would also be a viable cable route. The total length of the route is approximately 26.4km kilometres.

The proposed cable route deviates from Route A at a point approximately 2.8km south-east of Ballyroan at the Blandsfort Cross Roads. From the cross roads the proposed cable route travels north east along a third class road. The road has very few changes in direction and is generally 4.5 to 5 metres wide. However, the road does pass along the side of the Cullenagh

Mountain and becomes quite steep at certain points. Consultation with the relevant local authority would be required in order to maintain one lane of traffic during duct installation.

The proposed route crosses four small rivers located 0.5km, 0.8km, 1.9km and 3.8km from the Blandsfort Cross Road. Each bridge crossing has limited road cover to accommodate cable installation. Therefore, trenchless installation methods including third party easements through private property may be required in each case.

Following the crossing of the fourth river, the route travels a further 1.9km to the town of Timahoe. Entering the town the cable must cross a stone bridge. As can be seen in Figure 5.14 the bridge appears to have insufficient cover for cable installation. The option of a third party easement may prove difficult as there is existing housing on one side and a church/round tower located on the southern side. Further investigation would be required.



Figure 5.14 The stone bridge cover entering Timahoe village



Figure 5.15 The stone bridge entering Timahoe village

Following the crossing of the stone bridge the cable route proceeds into Timahoe village before turning north on to the R426. This road is 7m wide, is relatively straight and has a good surface. The route must cross a stone bridge located 1km outside of Timahoe village. The stone bridge may have insufficient cover for cable installation. Therefore, a trenchless installation method and third party easements through private property may be required.



Figure 5.16 The R426 leaving Timahoe village

The proposed cable route continues a further 3.3km along the R426 until it reaches a cross roads with the R427. As discussed in Section 5.2, this

junction represents the centre of the station's study area for the proposed 400 kV station.

5.6 Route Option E

Route E is a variation of route options A and D and focuses on the road network to the east of the study area. The total length of the route is approximately 28.5 kilometres. It is considered a highly problematic route option for the following reasons;

- A large proportion of the route travels along side the 'River Barrow and River Nore SAC' (002162) which it must cross.
- The route is based mainly along a third class road which has a number of difficult bends, varying widths and is likely to require extra joint bays and full road closures during construction. This would have a major effect on the local community and would be a major issue for the Cemex quarrying company located approximately 3.5km east of Ballinakill.
- Following the crossing of the R430 the route would cross two small stone bridges located 300m apart. Both bridges are only 3m wide and are not suitable for construction traffic to pass over them.



Figure 5.17 The three metre wide stone bridge that is unsuitable for heavy construction traffic

5.7 Route Option F

Route F is a variation of route option A and D and would also be a viable cable route. The total length of the route is approximately 26.6 kilometres. This route was identified as an option should the issue of the bridge entering Timahoe village, discussed in Section 5.5, hinder route option D.

Route F deviates north from Route Corridor D on to a third class road, 1.8km from Timahoe village. This road reduces to 4 metres in width in places and has a number of difficult bends. It is likely that full road closures would be required during the construction stage.



Figure 5.18 The four metre wide third class road

The proposed route travels 1.4km along the third class road until it must cross two small bridges. Each bridge crossing may have insufficient cover for cable installation. Therefore, trenchless installation methods including third party easements through private property may be required.

The route continues 1km, through a cross roads with a third class road of similar size, before reaching a T-junction with another third class road. The route bears east on to the 5m wide third class road. The road has a large grass verge, is relatively straight and has a good surface. The proposed route proceeds 0.8km along this road before rejoining Route Corridor D on the R426, north of Timahoe village.

6 Route Selection Matrix

The following table is the route selection matrix for the cable route options.

	ROUTE OPTION A	ROUTE OPTION B	ROUTE OPTION C	ROUTE OPTION D	ROUTE OPTION E	ROUTE OPTION F
OVERALL ROUTE LENGTH (km)	27.3	26.1	28.3	26.4	26.5	26.6
ALL PUBLIC PROPERTY	NO	NO	NO	NO	NO	NO
PRIVATE WAYLEAVES / EASEMENTS REQUIRED	YES	YES	YES	YES	YES	YES
ENVIRONMENTAL IMPACT	1	1	1	1	3	1
CONSTRUCTABILITY	MODERATE	DIFFICULT	DIFFICULT	MODERATE	DIFFICULT	DIFFICULT
TECHNICAL FEASIBILITY	MODERATE	MODERATE	DIFFICULT	MODERATE	DIFFICULT	MODERATE
CLEARANCE FROM BUILDINGS	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR	CLEAR
TRAFFIC MANAGEMENT IMPACT	2	4	5	4	4	4
POTENTIAL FUTURE CONFLICT WITH 3RD PARTIES	3	2	5	3	3	2
CONFLICT WITH EXISTING HV NETWORK	1	1	1	1	1	1
PROPOSED ROUTE WITHIN SAC/cSAC	NO	NO	NO	NO	YES	NO
POSSIBLE NUMBER OF TRENCHLESS INSTALLATIONS	12 No.	9 No.	11 No.	10 No.	12 No.	9 No.
MINIMUM NUMBER OF TRENCHLESS INSTALLATIONS	1 No.	2 No.	1 No.	2 No.	2 No.	1 No.
ESTIMATED NUMBER OF PRIVATE LANDOWNERS	12 No.	9 No.	11 No.	10 No.	12 No.	9 No.

RATINGS TABLE	
IMPACT	RATING
LOW	1
LOW - MEDIUM	2
MEDIUM	3
MEDIUM - HIGH	4
HIGH	5

Table 6.1 – Feasibility Summary of the Route Options

7 Consultation

No direct consultation with any third parties, stake holders, local authorities or Statutory Bodies was carried out as part of this feasibility study. The information provided is based on a desktop study and site visit. The desktop study information was sourced from a number of locations. All heritage, ecological, conservation and archaeological information was sourced from the latest list of registered sites on the National Parks and Wildlife Services' (NPWS) website. The relevant county development plans of Laois and Kilkenny were also consulted to identify projects or zoning within the study area. Potential developments by the RPA, Irish Rail and the NRA were also taken into consideration, where known.

8 Electric and Magnetic Fields (EMF)

Underground cables are fully shielded, and because of this produce no external electric fields. Magnetic fields are produced by the cables, and EirGrid designs its entire underground cable network so that these fields are minimal, and in compliance with the most up to date international guidelines and recommendations.

Since 1999, the European Union (EU) has adopted the guidelines of the International Commission on Non-ionising Radiation Protection (ICNIRP), which is the World Health Organisation's (WHO) advisors on non-ionising radiation matters. EirGrid complies fully with these guidelines.

The following table gives the ICNIRP guideline reference levels of exposure for occupational personnel and for the general public.

Exposure Guidelines – ICNIRP Guidance Reference Levels		Electric Field Strength (kV/m)	Magnetic Flux Density (μ T)
Occupational	Whole working day	10	500
General Public	Up to 24 hr./day	5	100

Table 8.1 - ICNIRP guideline reference levels for EMF

In this case, the cable proposed has a copper conductor of 1,000 mm², which has a maximum rating of 221 MVA.

The illustration below in figure 8.1 shows the magnetic flux density generated 1 m above ground by the proposed high voltage underground

cable, operating at its maximum design level. It can be seen that, even directly above the cable, the maximum magnetic flux is well within the guidelines, and decays rapidly away from this point. Again, there is no external electric field whatsoever.

In practice, the operating levels will be considerably lower.

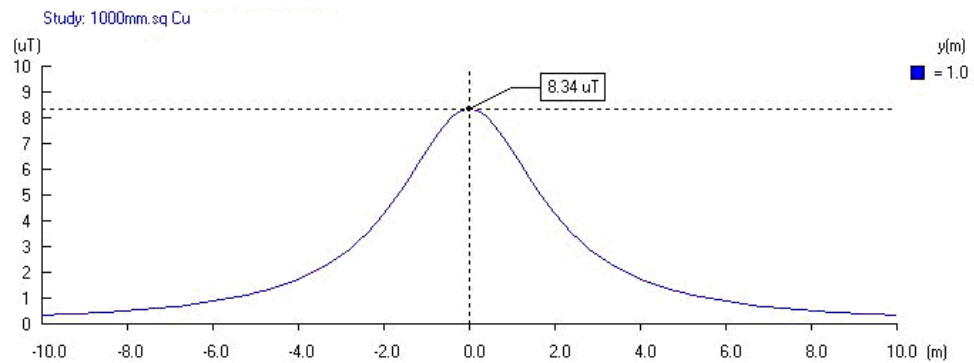


Figure 8.1 - Magnetic flux density at 1m above ground level for the underground cable operating at its maximum design level.

9 Ancillary Equipment

9.1 Substation Requirements and Reactive Compensation

System studies carried out by ESB International on the overhead line versus underground cable options for this feasibility report indicate that no ancillary equipment is required for voltage control, load flow control, harmonics or switching transients when the cable option is employed on the circuit instead of an overhead line. Therefore, there are no significant marginal costs for the cable option with respect to ancillary and other substation equipment if it were to be selected as the preferred circuit solution. Further details on these findings are outlined in the power system studies report; document number PE667-F0400-R300-001-000.

10 Cost Estimate

The costs associated with the cable are detailed below. These are based on route option A.

Time: €470,800

This element of the cost estimate is the figure calculated for supervision on site by the asset owner during installation. It also includes resources required on site for cable jointing, terminations and commissioning work.

Materials: €7,787,289

This element of the cost estimate is calculated based on current rates to procure high voltage cable and all accessories such as cable joints, cable terminations, link boxes etc.

Ancillary: €15,925,332

This element of the cost estimate is based on many of the 3rd party fees that arise during the course of a project such as this. Some of the items included but not limited to civil works, professional fees, permit costs, equipment hire, etc.

System Requirements: None

System studies carried out by ESB International on the overhead line versus underground cable options for this feasibility report indicate that no ancillary equipment is required for voltage control, load flow control, harmonics or switching transients when the cable option is employed on the circuit instead of an overhead line. Therefore, there are no significant marginal costs for the cable option with respect to ancillary and other substation equipment if it were to be selected as the preferred circuit solution.

Total: €24,183,421

This is the total projected overall cost for a cable connection. This figure includes a 10% contingency allowance.

11 Planning

High Voltage underground cables are currently exempt from planning pursuant to **Schedule 2 Class 26 of the Planning and Development Regulations 2001** (which classify the carrying out by any electricity undertaking of development consisting of the laying underground of mains, pipes, cables or other apparatus for the purposes of the undertaking as exempt). However, if the works contravene any of the restrictions on exemptions listed in **Article 9 of the Planning and Developments Regulations 2001**, a planning application will be required. This may be a complication with any proposal to cross the Owenbeg River 3km south of Ballinakill. The planning status of the project will need to be confirmed during detailed route investigations. A site screening of the River Barrow and Rive Nore SAC at this location would be required and if it is found that the SAC is likely to be affected by cable installation, a full Article 6 Appropriate Assessment may be required.

12 Summary of Findings

Having examined the study area and considering the economic, environmental and technical factors, the preferred route corridor, Route A, is shown on drawing number PE424-D8001-005-005-001 in appendix E. This route is deemed to be the optimum route based on the criteria above. The route utilises the R432 from Ballyragget 110 kV station, a 6m wide third class road between the towns of Ballinakill and Ballyroan, and a combination of the R425 and R427 approaching a proposed 400 kV station in the area. However, if major difficulties arise during the detailed design phase, routes B and D are considered technically feasible viable alternatives.

There are, however, a number of significant constraints along the route corridor that could potentially pose a risk to the delivery of the project.

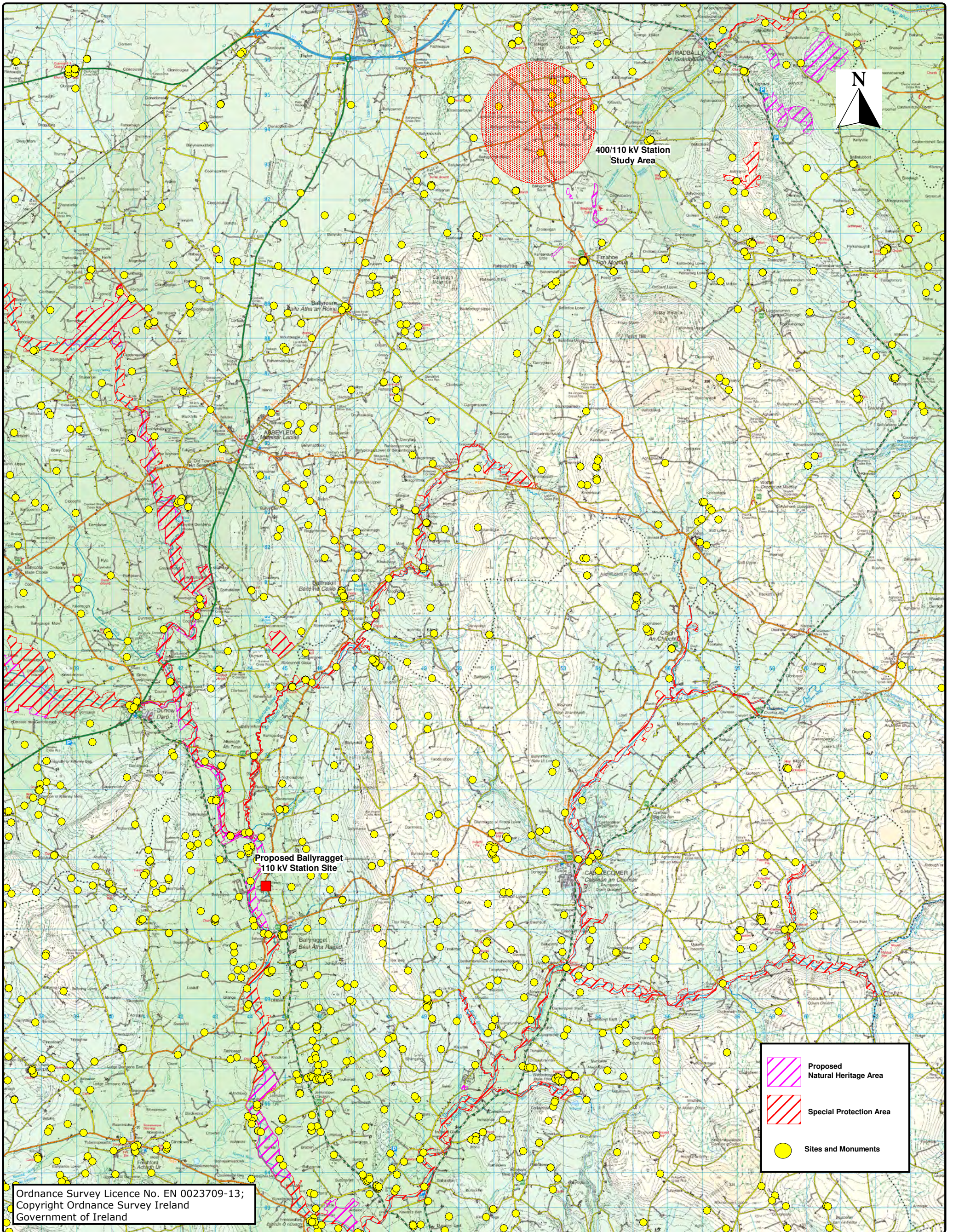
- There would be a requirement to cross twelve separate bridges, all of which may provide insufficient cover for cable installation. Further civil investigation would be required during the detailed design stage of the project to determine feasible crossing techniques for each.
- The advantage that route A has over the other viable route options (routes B, D and F) is that it is likely that the cable can be installed along the identified road network without the need for full road closures during construction. This is a major advantage as it will result in far less disruption to the local community.

13 Appendices

References

National Parks and Wildlife Services	www.npws.ie
Kilkenny County Council	www.kilkennycoco.ie
Laois County Council	www.laois.ie
Carlow County Council	www.carlow.ie
Environmental Protection Agency	www.epa.ie
National Roads Association	www.nra.ie
The Southern Regional Fisheries Board	www.srfb.ie
Dept of Environment, Heritage and Local Government	www.viron.ie
Archaeological Survey of Ireland	www.archaeology.ie
Ordnance Survey Ireland	www.osi.ie
Central Statistics Office	www.cso.ie
Irish Statute Book	www.irishstatutebook.ie
World Health Organisation	www.who.int
ICNIRP	www.icnirp.de

Environmental Constraints Map (PE424-D8001-005-001-001)



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	Proposed Natural Heritage Area
	Special Protection Area
	Sites and Monuments

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Laois - Kilkenny Reinforcement Project

DRAWING TITLE:
**Laois - Kilkenny Reinforcement Project
110 kV Underground Cable Feasibility Study
Environmental Constraints Map**

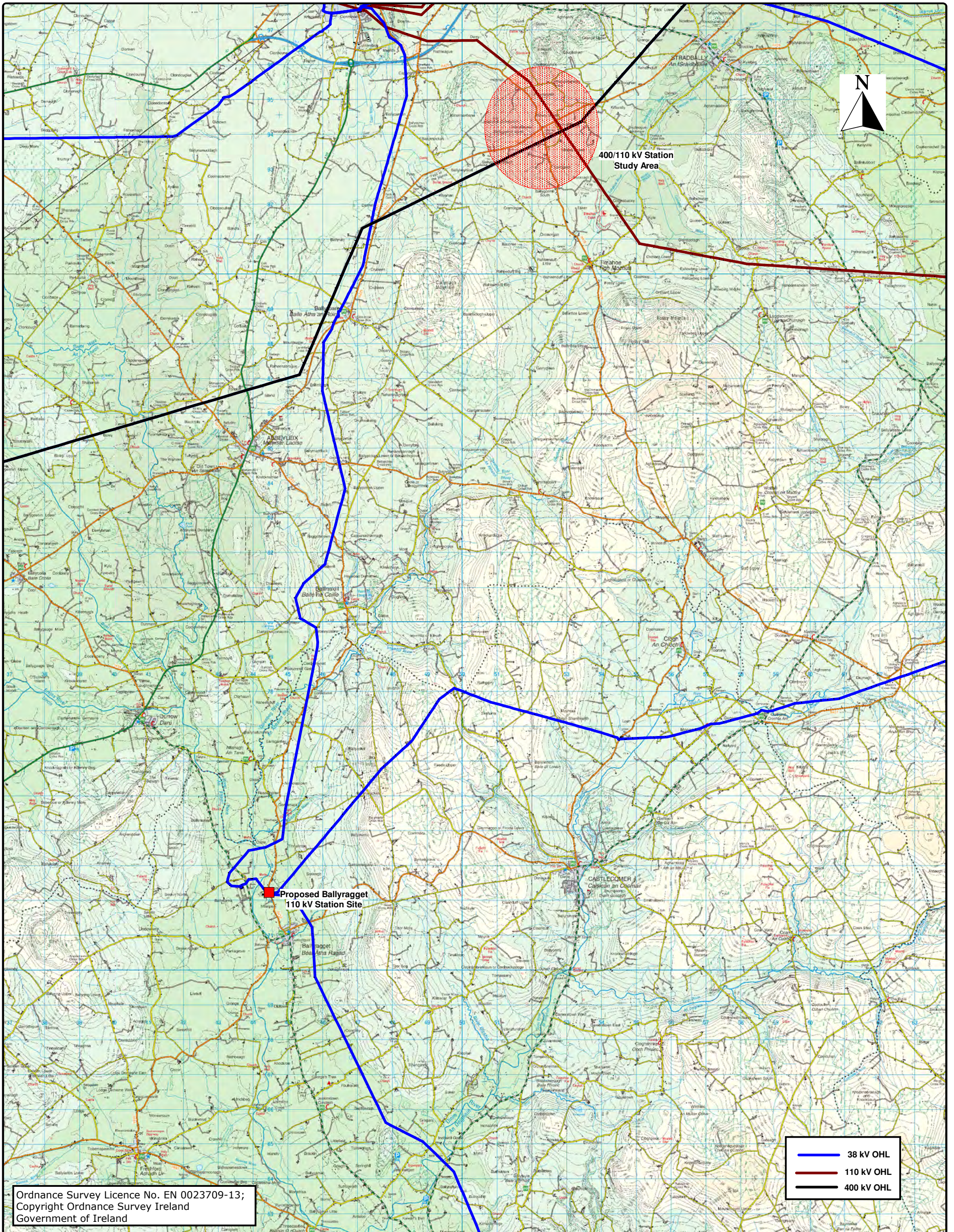
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Man-made Constraints Map (PE424-D8001-005-002-001)



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Feasibility Study
Manmade Constraints Map**

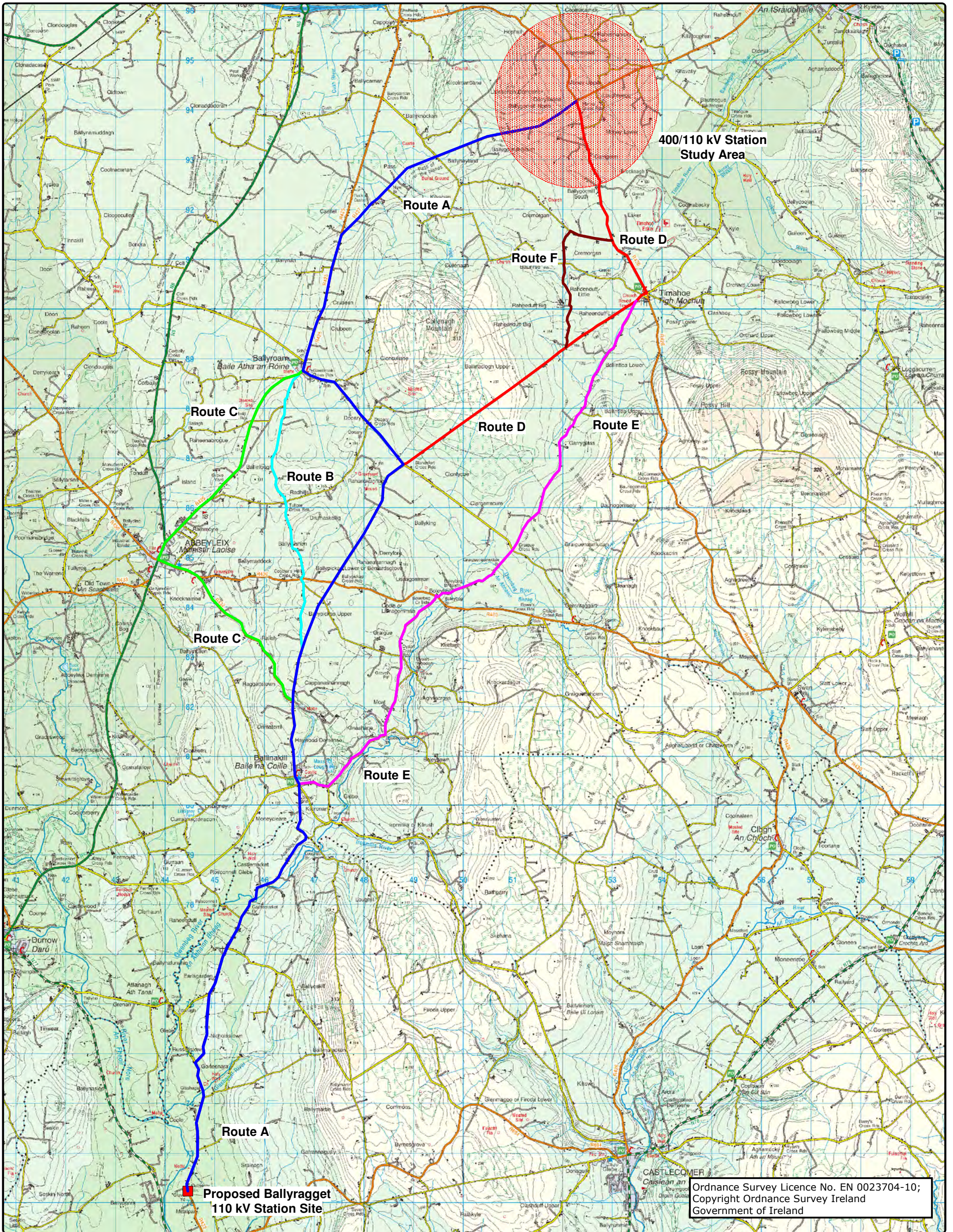
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Cable Route Options Identified From Desktop Study (PE424-D8001-005-004-001)



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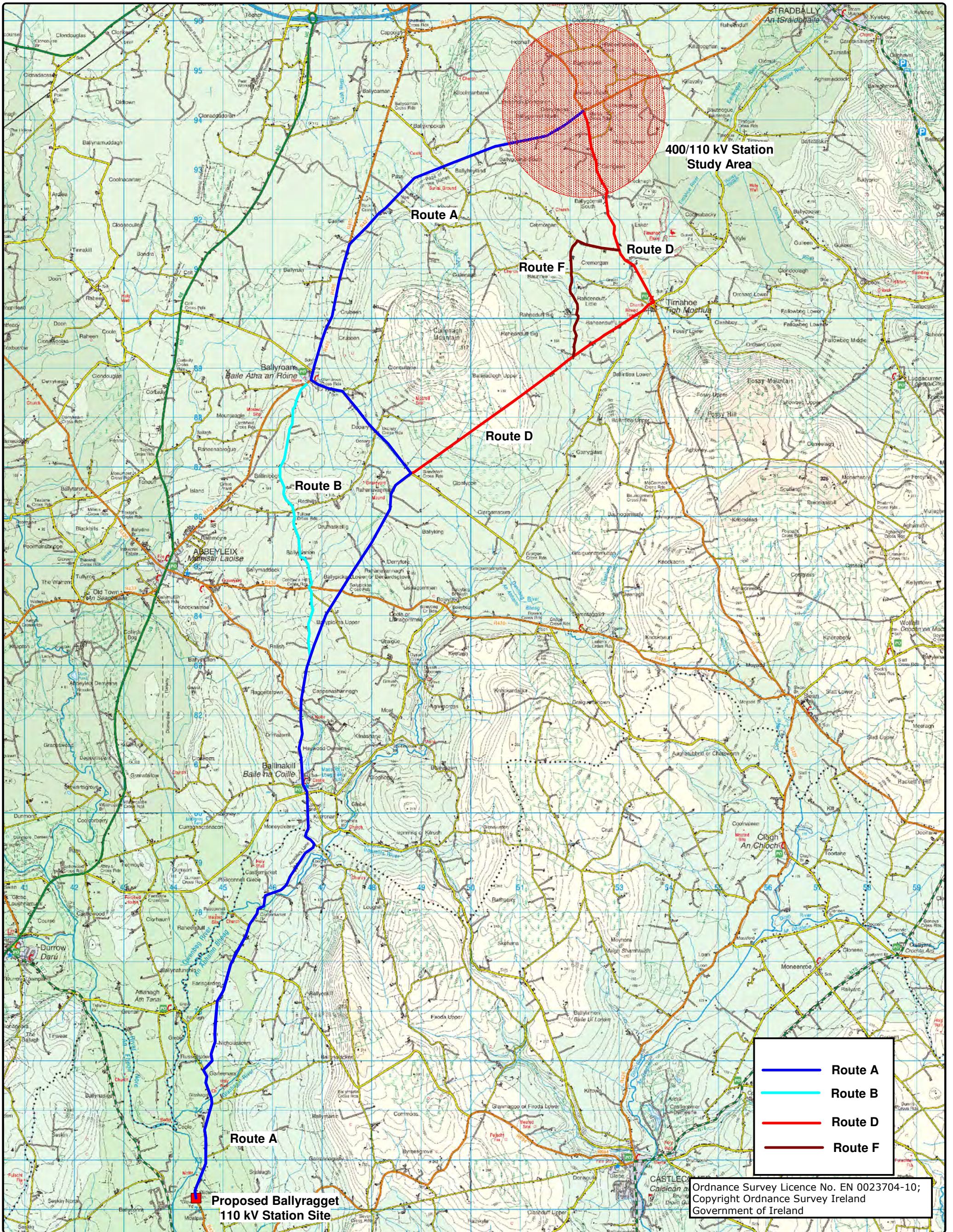
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Viable Cable Route Options (PE424-D8001-005-005-001)



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