



# Tyrone - Cavan Interconnector

Volume 1

Consolidated Environmental Statement  
Non Technical Summary



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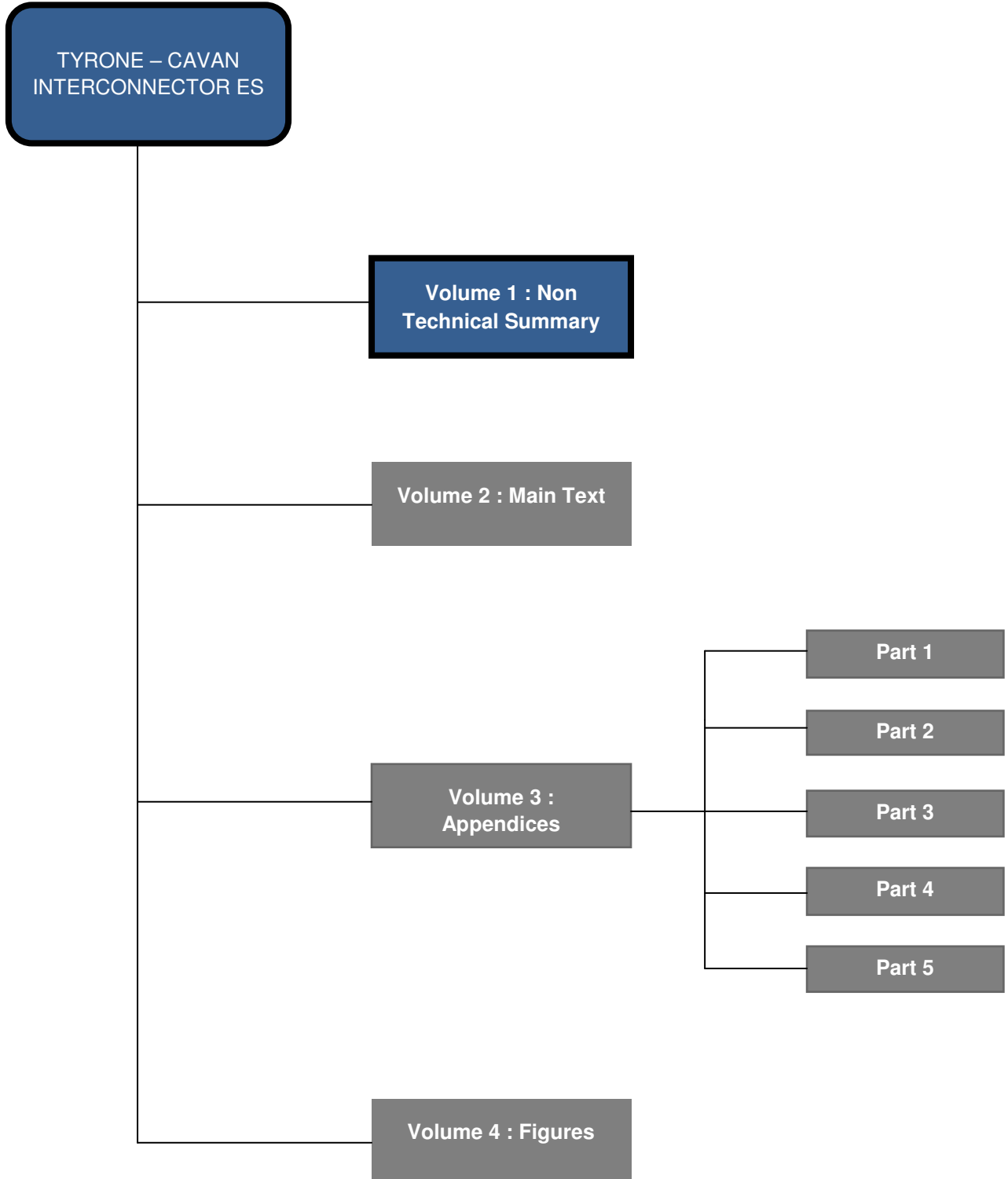
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**This document is Volume 1: Non Technical Summary of the Tyrone – Cavan Interconnector Environmental Statement (ES).**  
The whole ES consists of a number of documents and should be read together.



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# 1 Introduction

## 1.1 Background, Purpose and Context

1. Northern Ireland Electricity (NIE) is seeking consent from the Northern Ireland Department of the Environment, Planning Service (DOE Planning Service), for a new substation at Turleenan, Moy, County Tyrone and an overhead electricity transmission line from this new substation to a point on the border with the Republic of Ireland in County Armagh.
2. The electricity networks in Northern Ireland and the Republic of Ireland were initially independent of each other. However, they are both now joined together (or interconnected), and they operate today as a single all-island electricity network. Unfortunately, the existing interconnection arrangements severely limit the amount of electricity that is allowed to flow across the interconnection, and this limitation is causing inefficiency and increased operating costs. These additional costs mean that all electricity customers on the island are paying more for their electricity than would be the case if the limitations could be removed.
3. The new transmission line being jointly proposed by NIE and EirGrid<sup>1</sup> will form a second independent interconnection link between the two jurisdictions, and this second Interconnector will enable significantly increased power transfer capacity between the two jurisdictions on the island.
4. The additional power transfer capacity will be especially important for electricity customers in Northern Ireland. Improved access to the all-island electricity market will help to reduce electricity prices, and the improved transfer capacity will significantly improve the scope for use of renewable energy from wind generators and will also provide secure access to a larger number of power generation sources. Further detail on these aspects is provided in Section 2 of this chapter.
5. The NIE planning application seeks consent to construct the Northern Ireland element of the proposed Interconnector. An extensive Environmental Impact Assessment (EIA) has been carried out, and an Environmental Statement (ES), which reports on the findings of this assessment has been prepared and provided to the DOE Planning Service in support of the planning application.
6. The purpose of this document is to summarise the contents of the ES in non-technical language. A detailed description of the Proposed Development is set out in the planning application and the ES.

## 1.2 The Proposed Development

### 1.2.1 Scope of Assessment

7. The NIE planning application seeks consent to construct a 400,000 volt (400kV) overhead line in Counties Tyrone and Armagh, and an associated 275/400kV substation in the townland of Turleenan (near Moy), County Tyrone. The overhead line will run for a distance of approximately 34km to the Republic of Ireland border (see Figure I). The overhead line, the substation and associated development are referred to in this Environmental Statement as “the Proposed Development.”
8. The Proposed Development forms the Northern Ireland element of the “Tyrone – Cavan Interconnector” (or “Interconnector”), which is being jointly promoted by NIE and EirGrid, forming part of a major cross-

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<sup>1</sup> EirGrid is the company responsible for the planning and operation of the electricity transmission system in the Republic of Ireland.

border development to improve interconnection between the NIE transmission system in Northern Ireland and the ESB transmission system in the Republic of Ireland.

9. The Proposed Development in Northern Ireland comprises separate elements that have been made subject to two separate planning applications:

### 1.2.2 The proposed overhead line and substation

- The construction and operation<sup>2</sup> of a new 275 / 400kV substation at Turleenan townland, north east of Moy, County Tyrone;
- The removal of an existing 275kV suspension tower and the construction and operation of two new 275kV terminal towers to enable connection of the Turleenan substation to NIE's existing 275kV overhead line;
- The construction and operation of a single circuit 400kV overhead transmission line supported by 102 towers for a distance of some 34km from the source substation (at Turleenan) to a border crossing between the townlands of "Doohat or Crossreagh", County Armagh and Lemgare, County Monaghan, where it will tie into the ESB<sup>3</sup> network. Owing to geographic border definitions in the immediate area of the border crossing point, the overhead line will need to over-sail a portion of land within the Northern Ireland townland of Crossbane for a short distance;

### 1.2.3 The proposed "Associated Works" required for construction of the proposed overhead line and substation

- The formation of temporary access tracks, and other ancillary works associated with construction of the substation and the overhead line.

10. The location of the proposed Turleenan substation and the route of the proposed overhead line and associated works are shown in the attached Figure I. A layout of the proposed substation is shown in Figure II, and drawings showing the typical arrangement and design of the proposed steel lattice towers are shown in Figure III.

11. Further information on the proposed Development is given in Section 5. More detailed information, including proposals for the location and design of each of the proposed towers, and a description of the proposed methods for construction together with associated environmental impact assessments, are set out within the ES and the planning applications.

## 1.3 The Need for Environmental Impact Assessment

12. The Proposed Development falls within Schedule 1, Section 20 of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2012 (referred to as "the EIA Regulations"), and whilst subject to two separate planning applications as described above, EIA has been undertaken for the entire Proposed Development as a whole.

13. The purpose of the ES is to report the findings of the EIA and therefore to inform the DOE, statutory consultees, the public and interested parties about the impacts of the Proposed Development upon the environment. This Non-Technical Summary summarises the ES, full copies of which are available from NIE or which can be downloaded from [www.nie.co.uk](http://www.nie.co.uk). Further information on how or where to see a

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<sup>2</sup> The System Operator Northern Ireland (SONI) will be operating the proposed development.

<sup>3</sup> The Electricity Supply Board (ESB) is responsible for construction and ownership of the transmission system in the Republic of Ireland.

copy of the full ES, and how to comment on the Proposed Development is set out at the end of this NTS (Section 7).

## 1.4 Relationship with Associated Development in the Republic of Ireland

14. The proposed Interconnector extends for a total distance of some 80km from the new substation at Turleenan, County Tyrone, to a point in the vicinity of Kingscourt, County Cavan, in the Republic of Ireland. From that point onwards, the overhead line is expected to continue southwards to an existing 400kV substation at Woodlands, County Meath such that the overall interconnection development will extend for a total distance of approximately 140km.
15. No planning application has as yet been submitted by EirGrid for the portion of the Tyrone-Cavan Interconnector within the Republic of Ireland. In circumstances in which EirGrid has yet to conclude its public consultation exercise and EirGrid's proposed development has yet to be finalised sufficiently, NIE is unable to conduct a cumulative impact assessment (an assessment of the potential impacts from both developments).as part of this ES. However, once EirGrid's proposal has crystallised sufficiently, this will be done.

## 1.5 Previously Published Documents

16. The EIA of the Proposed Development has taken place over a number of years and several documents have been previously published as part of this process:
  - The 2009 ES – published in December 2009 and associated with the initial planning application lodged on 15<sup>th</sup> December 2009 - is the original ES for the Proposed Development;
  - The First ES Addendum – published January 2011, outlining additional information requested by DOE; and,
  - The Second ES Addendum – published October 2011, providing clarifications on the Proposed Development and the results of the additional environmental surveys that had been undertaken.

## 1.6 The Consolidated Environmental Statement

17. In 2012, the Planning Appeals Commission (PAC) requested a single overall document which combined (or consolidated) the previously published documents. The current ES has been published to do just that, and is referred to as the Consolidated ES.
18. The Consolidated ES incorporates the findings of the previously published documents as requested by the PAC, but also takes the opportunity to outline and assess updated information of relevance to the Proposed Development. This includes updates to the proposed design, changes in legislation, results of further environmental surveys, including in particular those in relation to temporary works associated with construction of the Proposed Development, such that the Consolidated ES now provides an overall assessment of the likely significant effects of the Proposed Development. The Consolidated ES therefore supersedes and replaces the previously published ES and addenda as noted above.



## 1.7 Planning Applications

19. The Consolidated ES outlines the assessment of the Proposed Development, which has been formally submitted to DOE as two separate planning applications:
- O/2009/0792/F – the original planning application for the Proposed Development including the substation, towers, overhead line and associated development; and,
  - O/2013/0214/F – a second application relating specifically to the works associated with the construction of the overhead line and towers.

## 2 Project Need

### 2.1 Introduction

1. The proposed Interconnector is a development of long-term importance for Northern Ireland and will deliver benefits for electricity customers in three key areas:
  - **Improving competition** and helping to reduce electricity prices – by reducing existing constraints that are restricting the efficient performance of the electricity market;
  - **Supporting the development of renewable power generation** – by enhancing the flexible exchange of power flows over a large area of the island. This will enable the connection and operation of larger volumes of renewable power generation (especially wind powered generation) throughout the island; and
  - **Improving security of supply** – by providing a dependable high capacity link between the transmission systems of Northern Ireland and the Republic of Ireland.
2. The proposed Interconnector complies with European Union Directives that require enhanced electricity interconnection between EU member states and improved conditions for energy competition throughout Europe. The development of the Tyrone – Cavan Interconnector has been part funded by the EU Trans European Networks (TEN-E) programme, in which it has been listed as a “priority project”. The proposal is jointly supported by the Governments of both the UK and Ireland and is fully compliant with Northern Ireland energy policy, having received specific support from the Department of Enterprise, Trade and Investment (DETI). The project is also supported by the Northern Ireland Utility Regulator.
3. The following are key elements of the “case of need” for the proposed Interconnector. The demonstration of Need, which is summarised below and more fully set out within the ES, is required by Policies PSU2 and PSU8 of the Planning Strategy for Rural Northern Ireland.<sup>4</sup>

### 2.2 Electricity Prices

4. For Northern Ireland to remain competitive and to generate growth, it will be important for energy prices, including electricity prices, to be competitive. The primary mechanism for achieving this objective is to facilitate and encourage competition through market forces. Market liberalisation and competition are therefore important factors driving change across the electricity sector.
5. Competition was the major driver behind the development and implementation (in November 2007) of the Single Electricity Market (SEM) on the island of Ireland. The SEM has been introduced to enable generators and electricity suppliers to compete freely across the island. It aims to keep prices at the lowest possible level by operating a competitive system that chooses the lowest priced sources of power generation at any point in time. However, since the present interconnection arrangements do not provide sufficient capacity (see “Limitations of the Existing Interconnector” below), this results in constraints that limit the benefits that would otherwise be available.
6. The energy regulators and government departments in both Northern Ireland and the Republic of Ireland have explicitly identified the need for improved electricity infrastructure, and especially a second North-South interconnector, as a “key enabler” for the future success of the SEM.

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<sup>4</sup> (DOE, 1993)

7. The DETI Minister, Arlene Foster MLA has recently observed that “*transmission capacity constraints are estimated to cost consumers in Northern Ireland and the Republic of Ireland some £18million to £25million per annum. A second interconnector will remove these costs and is expected to save Northern Ireland electricity consumers £7million per annum*”.<sup>5</sup>

## 2.3 Renewable Energy

8. Northern Ireland and the Republic of Ireland are both particularly well suited to the development of substantial wind energy generation. The wider use of wind energy would bring significant benefits to both economies, whilst improving the overall diversity of supply and reducing dependence on imported energy. The development of further renewable generation is encouraged by both Governments.
9. In September 2010 DETI published the Strategic Energy Framework (SEF). In this document DETI Minister Arlene Foster MLA set a target for 40% of electricity consumption within Northern Ireland to be generated from renewable sources by 2020. The SEF is unequivocal in demonstrating strong support for the proposed Interconnector as a key enabler for the delivery of this target.
10. Wind powered generation on this scale would deliver a significant benefit to the Northern Ireland economy. However, a key constraint to the full development of wind powered generation is the ability of the existing electricity network to absorb and manage this form of power generation. The proposed Interconnector will be a significant step towards addressing this issue by allowing power sourced from renewable generation to access demand and other interconnectors on both parts of the all island network.

## 2.4 Energy Security

11. Northern Ireland has a relatively small electricity network with a limited number of power stations. It is therefore exposed to a greater risk of loss of supply than would be the case in a large and highly interconnected system with a large number of power stations that can depend upon each other for support in the event of unforeseen disturbances.
12. The transmission system operators have recently published a statement on all island generation capacity for the years between 2013 and 2022, and this statement indicates serious concern for the future security of electricity supply (for Northern Ireland in particular) in the years beyond 2016. The document observes the likelihood of electricity supply shortfalls arising from the planned closure of several generating units (required in order to comply with EU emissions Directives), and shows that in the continuing absence of adequate interconnection with the Republic of Ireland, there is likely to be a serious shortfall in available sources of electricity supply in the years ahead.
13. Shortfalls of the nature described above would require the introduction of arrangements to prevent power system failure by switching off the electricity supply (using a rota system for selected areas) during times of peak electricity demand. This outcome is highly undesirable, and underlines the increasingly critical nature of the need for additional interconnection as a matter of urgency.
14. The risk of loss of supply is highly relevant in the context of industrial or commercial investment decisions, and a secure energy environment will ensure the best possible economic advantage for everyone in Northern Ireland.

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<sup>5</sup> In response to NI Assembly question AQW 8572/11-15 on 21<sup>st</sup> February 2012 (AIMS Portal).

## 2.5 Legal and Regulatory Context

15. DETI is the Government department responsible for energy affairs in Northern Ireland. It also has a role in ensuring the provision of the infrastructure that is needed for Northern Ireland's economy.
16. The Electricity (Northern Ireland) Order 1992 sets out the basic licensing regime for carrying out electricity related business activities in Northern Ireland. It places a statutory duty on NIE as a licence holder to develop and maintain an efficient, co-ordinated and economical system of electricity transmission which has the long-term ability to meet reasonable demands for the transmission of electricity.
17. NIE's licence requires it to develop a mechanism for the transmission of electricity in Northern Ireland that takes account of the benefits of efficient, co-ordinated and economical systems for the transmission of electricity on the island of Ireland as a whole. It also requires the company to contribute to security of supply through adequate transmission capacity and system reliability, and to facilitate competition in the supply and generation of electricity.
18. The Utility Regulator is responsible to Government for regulating the ongoing operation of NIE and for protecting the long term interests of customers. The Utility Regulator is, amongst other things, specifically required to promote effective competition between persons engaged in the sale or purchase of electricity through the SEM.
19. The proposed Interconnector is consistent with the legal and regulatory obligations required of NIE by DETI and by the Utility Regulator.

## 2.6 Limitations of the Existing Interconnection

20. The existing 275kV overhead line interconnector to the Republic of Ireland is a double circuit line that is theoretically capable of a maximum power transfer of 1,500MW (Mega Watts). However, since its electrical circuits are carried, both together, on a single series of steel towers, they are exposed to the possibility of a single event (such as an electrical fault or damage) resulting in failure of both circuits at the same time and therefore causing the loss of the entire Interconnector. In order to avoid such a failure causing widespread loss of electricity supplies, the transmission system operators currently have to restrict the interconnector capacity to a maximum level of 450MW.
21. The 450MW restriction creates distortion in the electricity market between electricity generators and electricity suppliers, because it places an upper limit on the amount of electricity that can be traded between the two jurisdictions. It also places a serious constraint on the maximum volume of wind powered generation that can be accommodated by the overall electricity network, in turn creating a serious obstacle to the future development of renewable energy.

## 2.7 Key Requirements for Additional Interconnection

22. In order to remove the limitations described above, the proposed Interconnector must be designed to match the maximum power transfer capacity of the existing interconnector, and must therefore provide for a power transfer capacity of 1,500MW.
23. The proposed Interconnector also needs to present a high level of interconnection security. In order to achieve this, it needs to be physically separated from the existing interconnector, so that the risk of simultaneous failure due to common events will be low.
24. The proposed Interconnector is required to form part of an integrated all-island electricity network. In order to work properly, the proposed Interconnector must therefore be able to operate efficiently and reliably in this mode.

### 3 Policy

1. The Proposed Development is EIA development under the terms of the EIA Regulations, and accordingly this ES has been prepared having regard to Schedule 4 of the EIA Regulations, which provides advice on the operation of the EIA Regulations.
2. The ES demonstrates that the Proposed Development has been designed with due regard to the Regional Development Strategy for Northern Ireland, and has been closely assessed in the context of all relevant Strategic Planning Guidelines, Planning Policy Statements and the policies set out within the Planning Strategy for Rural Northern Ireland.
3. In terms of the underlying or guiding principle as set out in PPS 1 General Principles, paragraph 3 page 4 (also expressed in broadly similar terms in paragraph 59, page 23) the Proposed Development would, as required by the “public interest...” be “carried out in a way that would not cause demonstrable harm to interests of acknowledged importance.” In summary, the Proposed Development complies with the overall thrust of current planning policy. In any event, if there were shown to be harm, policy requires that harm to be balanced against the overriding and imperative need for the proposal.
4. The environmental impacts of the Proposed Development have been rigorously examined through the EIA process. The environmental information gathered in this process has demonstrated that there will be adverse impacts of varying degrees on some facets of the environment. However, in the overall balancing exercise involved in considering a wide range of often competing planning policy, guidance and standards, these adverse environmental impacts are more than outweighed by the strategic need for the Proposed Development as set out in Section 2 (Need), which demonstrates a clear overriding national and regional need for the development in accordance with relevant planning policy on major projects and new infrastructure and the unsuitability of alternatives as set out in Section 4 (Alternatives).
5. The economic benefits of the proposed Interconnector are strongly in the public interest and have been demonstrated as a key component of the justification of need. As confirmed in a recent statement by the Minister of the Enterprise Trade and Investment<sup>6</sup>, the Interconnector is:

*“an absolute necessity and [the lack of the Proposed Interconnector] is costing consumers in Northern Ireland a large amount of money. Therefore it is imperative that it is progressed very soon”.*

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<sup>6</sup> Official Report (Hansard) Monday 4<sup>th</sup> February 2013, Volume 81, No 5.

## 4 Alternatives

1. A number of potential alternatives for delivering the required additional interconnection capacity have been considered, and a fundamental element of NIE’s development process has included the technical, economic, and environmental examination of alternative methods, technologies and routes.
2. The examination of alternatives, (which is fully described within Volume 2, Chapter 4 of the ES), was divided into two primary parts; “*Transmission Alternatives*” to consider alternative methods and technologies, and “*Substation Site Selection and Overhead Line Routeing*” to determine the best possible location and routeing for the Proposed Development.

### 4.2 Alternatives Part One: Transmission Alternatives

#### 4.2.1 Alternatives to Transmission Network Solutions

3. The “all-island” electricity market structure has been designed to separate the electricity supply chain into three fundamental parts:
  - Power generation (production);
  - Electricity networks (delivery); and
  - Electricity supply (retail sales).
4. NIE is responsible for the electricity networks within Northern Ireland, and a fundamental objective for NIE is to ensure that our network provides the most effective and efficient means to serve the requirements of both generators and suppliers by providing the electrical networks (or pathways) for the delivery and sale of electricity.
5. NIE believes that the most beneficial and cost effective way of providing solutions to the three primary drivers presented in Section 2 (Need) above, is to deliver a transmission interconnection link between Northern Ireland and the Republic of Ireland, and that there is no feasible alternative to such a course of action.

#### 4.2.2 Transmission Technology Alternatives

##### 4.2.2.1 Evaluation of Transmission Alternatives – General Principles

6. Any examination of alternative technologies and solutions for electrical power transmission must first recognise the physical and practical differences between the various available technologies and how they each perform technically, environmentally and economically.
7. A power transmission circuit requires a continuous conducting pathway for electrical current that is suitable for the bulk transmission of high levels of electrical power over relatively long distances. The circuit must include two essential elements: electrical conductors for the current (copper or aluminium alloy), and insulators (such as porcelain and atmospheric air, or high-grade plastic) to prevent leakage of the current away from the conductor circuit.

##### **Energy Losses**

8. For a given amount of power transfer, less energy is lost to the environment when the electrical voltage (or pressure) is increased. This is because, with higher voltage, less current flows and this creates less heating of the conductor. However, as the voltage level is increased, it is necessary to increase the amount of insulation to stop the current leaking away. In the case of overhead lines the insulation is

mostly provided by the air, and so for the high voltages used in transmission the distances between the conductors and the ground can be several metres. In the case of underground cables, however, oiled paper or high-grade plastic just a few centimetres thick insulates the conductors from ground.

### System Voltage and Stability

9. At the high voltages required for long distance transmission, these two fundamentally different insulation arrangements mean that an underground cable circuit has quite different effects on the transmission network compared to those of an overhead line. Over long distances these differences can create significant electrical effects, which the system design must account for.
10. Transmission circuits form part of an interconnected network, and each circuit can run for tens or hundreds of kilometres. Thus, each circuit has a significant influence on the overall performance of that network. Whether a circuit is constructed as a line or cable can therefore have an impact on the performance of the entire network. In general, the greater the length of any given transmission line, the greater will be its impact on the overall interconnected network. In circumstances where a particular technology leads to technical difficulties for the operation of the network it is important to limit the extent of its use, and to provide technical measures to mitigate the negative effects in circumstances where there is no practical alternative.

### Other Key Factors: Environmental Impact, Performance, and Cost

11. For technologies where the technical and safety performance is satisfactory there are of course further considerations when comparing technologies for any particular application. First, environmental issues need to be evaluated. This will always present a challenge in comparing overhead lines and underground cables because cables can cause significant environmental impact arising from physical disruption along a continuous corridor, whereas overhead lines have a generally lower environmental impact, but do create unavoidable visual impact.
12. Cost is another consideration. Cable systems, and especially those applicable at the highest voltages, are significantly more expensive to install than overhead lines. In the operational circumstances applicable to transmission lines, cables produce higher electrical losses over their lifetime.
13. Performance issues such as maintenance requirements and circuit availability is a third element to consider. When faults occur, cables take very much longer to repair which means that their overall availability is lower. All of these factors may be treated as technical concerns, but must also be recognised as having an impact on operational costs, and therefore upon electricity market prices.
14. The process of technology evaluation must therefore continuously balance three principal measures:
  - Performance and technical capability;
  - Environmental impact; and,
  - Cost and customer benefits (on a whole life basis).

#### 4.2.2.2 Review of Alternative Transmission Technologies and Methods

15. Having regard to the general principles as noted above, the following were the main questions initially addressed in regard to transmission technology alternatives:
  - (a) whether to apply synchronous alternating current (AC) technology (as already used for the existing electricity transmission system), or whether to introduce an embedded element of direct current (DC) technology that would require specialised conversion equipment for it to operate within the existing AC network,
  - (b) whether the required electrical conductors should be routed over the land (either overhead or underground) or placed primarily under the sea (with land connections to the exiting electricity networks at each end).
16. It was determined that, provided a practical land based alternative could be found, the undersea alternatives (both AC and DC) should be rejected. The main factors leading to this conclusion were (a) that any undersea route would have to be considerably longer than an overland alternative, with



attendant increases in environmental impacts both onshore and offshore, and (b) that the application of undersea technology would entail significant additional cost, risk, uncertainty, environmental impact and engineering complexity in comparison with proven alternatives for the application of land based technology options.

17. For the remaining land based alternatives of AC or DC, overhead or underground, NIE and EirGrid recognised the importance of ensuring that the alternative technologies were fully and properly evaluated in relation to both up to date technology, and the specific circumstances applicable to the transmission system in Ireland. NIE and EirGrid therefore jointly commissioned detailed and comprehensive studies into the available options.

#### 4.2.2.3 Special Studies Commissioned by NIE and EirGrid

##### The PB Power Study<sup>7</sup>

18. A project specific, study carried out by PB Power, experienced international power consultants, comparing a high voltage overhead line transmission option with underground options utilising either AC or DC technologies. The full text of the study report has been available, on the websites of both NIE and EirGrid, since February 2009.
19. The key findings of the study were:
- there is no underground cable circuit, of the kind and length required for the proposed Interconnector, anywhere in the world;
  - most faults on overhead lines are caused by the weather. Any damage can be repaired quickly, typically in a matter of hours. In comparison, faulty or damaged underground cables can be out of service for very long periods of time;
  - an AC underground cable would cost over seven times more to install than an overhead line, and would cost more than 1.5 times as much to operate over its lifetime;
  - a DC underground cable would cost over eight times more to install than an overhead line, and would cost more than twice as much to operate over its lifetime;
  - both overhead lines and underground cables can comply with all national and EU guidelines on the exposure of the general public to electrical and magnetic fields (EMF); and
  - the use of overhead lines and underground cables both give rise to potential environmental impacts, the effects of which can be mitigated through careful design and routeing.

##### The TEPCO Study<sup>8</sup>

20. This study considered the implications, for transmission system reliability and stability, of incorporating long lengths of high voltage underground cables within the existing 'all-island' AC transmission network. The study was performed by Tokyo Electric Power Company of Japan (TEPCO) which, as owner and operator of the world's longest existing 400kV underground cable circuit, is uniquely placed to bring its specific experience to bear on the subject.
21. TEPCO identified a number of potential technical difficulties arising from the use of long high voltage underground transmission cables, and they noted that it would be necessary to install specialised compensation equipment at various locations in order to ensure safe operation of the network.

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<sup>7</sup> (PB Power, 2009)

<sup>8</sup> (TEPCO, 2009)



### The Transgrid Study<sup>9</sup>

22. This study considered the implications, for transmission system reliability and stability, of incorporating high voltage DC (HVDC) circuits into the integrated all-island AC transmission network. This study was performed by Transgrid Solutions (of Winnipeg, Canada), a consultancy with extensive experience in the evaluation of HVDC technology.
23. The key finding of the Transgrid study was that the application of an HVDC solution is generally technically feasible, but would present no significant technical advantages, and would have a number of operational limitations.

### The Technology and Costs Update<sup>10</sup>

24. This is an addendum summarising the results of a review carried out by PB Power to update the information provided in the “PB Power Study” of 2009. It includes a review of up to date technology and application developments worldwide, and draws upon information and conclusions published within a number of recent relevant studies into the subject of transmission technology alternatives. A key output from the updated study has been to provide up to date comparative costs for the identified alternatives.
25. The key findings of the Technology and Costs Update were:
- The most cost effective solution for the proposed Interconnector would be an AC overhead line, estimated to cost around €165m to construct, and about €55m to run over its lifetime.
  - An AC underground cable is estimated to cost over 5 times as much as AC overhead line to construct, and would also cost significantly more than overhead line to run, over its lifetime.
  - An HVDC underground cable link would cost 6 times as much as AC overhead line to construct, and would then cost twice as much as overhead line to run, over its lifetime.

#### 4.2.2.4 Other Special Studies

### The ECOFYS Report<sup>11</sup>

26. This was a report commissioned by the Government of the Republic of Ireland on the comparative merits of overhead lines and underground cables.
27. ECOFYS are internationally recognised consultants in the energy sector, and their report recorded a number of general conclusions broadly similar to those noted by PB Power. The ECOFYS study estimated that underground cables would be about five times more costly to install than an overhead line, and also noted the following conclusion; *“The difference in transmission adequacy is the defining criterion when comparing the technologies. Other aspects certainly affect the technology evaluation. However, any of the advantages of underground cables which were identified in the Study cannot compensate for the negative impact on transmission adequacy.”*<sup>12</sup>

### UK Electricity Transmission Costing Study (2012)<sup>13</sup>

28. This study was performed by Parsons Brinkerhoff on behalf of the UK Department of Climate Change (DECC) with the purpose of informing the UK Infrastructure Planning Commission (IPC) in regard to the

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<sup>9</sup> (Transgrid, 2009)

<sup>10</sup> (PB Power, 2013)

<sup>11</sup> (ECOFYS, 2008) The ECOFYS study may be downloaded from [www.dcenr.gov.ie](http://www.dcenr.gov.ie).

<sup>12</sup> Concluding extract from ECOFYS letter to DCMNR dated 4 July, 2008.

<sup>13</sup> IET / DECC, 31 January, 2012

costs of feasible transmission options. The study and report was overseen by the Institution of Engineering and Technology.

29. Amongst the main findings of the study (in regard to AC technology) were the following:
- Overhead Line is the cheapest transmission technology, with lifetime cost estimates for double circuit 400kV connections varying between £2.2m and £4.2m per km, depending upon length and circuit capacity.
  - Underground cable, direct buried, is the next cheapest technology after overhead line, with lifetime cost estimates for double circuits varying between £10.2m and £24.1m per km, depending upon length and circuit capacity. Operating losses for underground cables are less sensitive to circuit loading than are those for overhead lines.

#### [Meath Tyrone Report, Review by the International Expert Commission](#)<sup>14</sup>

30. In July 2011 the Government of Ireland appointed an International Expert Commission (IEC) of three international specialists to review expert literature already available both in Ireland and internationally, and report on the case for, and cost of, undergrounding the proposed Interconnector.
31. The Commission reviewed the findings of the TEPCO, TransGrid, ECOFYS and PB Power reports, with their findings generally being upheld. The main comments relate to better understanding of the VSC HVDC cable alternative that has emerged over the recent years since other reports were completed. Notably however, the Commission was not persuaded by the ASKON<sup>15</sup> report, concluding that its findings were not consistent with industrial practice for other similar projects in Europe.
32. The report of the IEC<sup>16</sup> was published in January 2012. It examined five reference projects of relevance in comparison with the proposed Interconnector. As a part of this examination the commission concluded that the technical solution must be designed to account for local conditions.
33. The Commission's report stressed that an overhead line still offered significantly lower investment costs than any underground cable alternative. The report specifically recommended against a fully underground AC solution. However, the report observed that if the link was required to be undergrounded, wholly or mainly, that it should incorporate HVDC VSC technology.

#### 4.2.2.5 [Consideration of DC Technology as an Alternative to AC Technology.](#)

34. NIE is familiar with the latest developments in HVDC technology, and notes that HVDC VSC technology has been applied to the design and construction of the recently commissioned East-West Interconnector that connects between Ireland and Britain and which is owned and operated by EirGrid. This 500MW interconnector is the largest and most modern VSC HVDC system in operation in the world today.

NIE has considered the latest and most up to date HVDC technology as part of a thorough assessment of a VSC HVDC circuit versus a standard high voltage AC circuit for the implementation of the proposed 1,500MW Interconnector. Whilst an VSC HVDC link would be able to comply with health and safety requirements, could theoretically be designed and installed to operate within an AC network, and could be designed and installed in an environmentally acceptable manner, it would present serious shortcomings in terms of fitness for purpose.

35. The required interconnection (as explained in Section 2 above) must enable the all-island AC electricity network to operate as a single integrated network. A DC interconnection link will not naturally integrate

<sup>14</sup> [Meath-Tyrone Report, Review by the International Expert Commission, August – November 2011.](#)

<sup>15</sup> [The ASKON Report was prepared on behalf of North East Pylon Pressure \(NEPP\), a group formed to oppose the proposed Interconnector in the Republic of Ireland.](#)

<sup>16</sup> [Available at www.dcenr.gov.ie.](http://www.dcenr.gov.ie)

within an AC network, and a complex automatic control system would be required in order to make the DC link operate properly. Complex control systems of this sort are prone to failures, and the consequences of interconnection failure could cause major disruption to the all-island electricity network. The Transmission System Operators have expressed concern about this, and have cautioned that “taking such a risk when there is a technically superior and less risky option readily available is unnecessary” (EirGrid Final Re-Evaluation Document 2013).

36. There are no working examples anywhere in the world today of a DC circuit embedded in a small and isolated AC transmission network such as that on the island of Ireland.
37. As noted at 4.2.2.3 above, an HVDC underground cable link would cost six times as much as AC overhead line to construct, and would then cost twice as much as an overhead line to run, over its lifetime. If applied to the overall interconnection development, the additional lifetime cost associated with the use of HVDC technology would be in the order of €945m.
38. An HVDC underground cable link would be technically inferior to the standard and proven solution of adopting an AC overhead line, and would also be vastly more expensive. Since both technologies can be applied in an environmentally sustainable manner, NIE has concluded that HVDC technology is not an acceptable technological option for the proposed Interconnector.

#### 4.2.2.6 Consideration of “Partial Undergrounding”

39. Partial undergrounding (i.e. the use of underground cable for sections of a primarily overhead line route) is sometimes an option in circumstances where environmental impact assessment concludes that an overhead line would be environmentally unacceptable in certain defined sections of the route.
40. A “hybrid” option employing a mix of AC overhead line and HVDC underground cable is not practical because of the requirement for large and very costly AC/DC converters at each point of change between the two technologies. NIE’s consideration of partial undergrounding was therefore limited to a fully AC circuit employing AC overhead line in combination with a section (or sections) of AC underground cable.
41. The implications for the proposed Interconnector are considered below.

##### Environmental Issues

42. The size and number of the AC underground cables that would be required for the proposed Interconnector are such that they cannot be installed under public roads in the vicinity of the overhead line route, as these roads are not sufficiently wide. The only practical option would be to install the cables directly across the land. This would have the following environmental implications.
43. The construction effort and consequential environmental impacts associated with the installation of any “undergrounded” section would be considerably greater than that of the overhead line. Installation of the underground cable would require a construction swathe some 20m wide to be cut through the countryside, and this would include construction of a “haul road” able to accommodate the vehicles needed to transport cable drums weighing 45 tonnes or more and large cranes for offloading and equipment handling. This would result in much greater disruption to farming activity and disruption to the wider community than would arise from the works associated with construction of the proposed overhead line.
44. The underground cable construction swathe would have to cut through every hedgerow in its path, leaving a permanent gap. The hedgerow could not be allowed to re-establish itself, as deep rooted vegetation cannot be permitted to grow in proximity to underground cables for safety reasons. This is unlike the case of an overhead line where in many cases the line will sail right over the hedgerows without unduly interfering with them. In circumstances where an overhead line tower is positioned straddling a hedgerow, a section of the hedgerow will be affected during construction, but it will be allowed to re-establish itself afterwards, and only requiring management of the hedgerow to prevent its interference with the overhead line.
45. No buildings, deep rooted trees, or deep ploughing are permitted within a cable reserve to ensure safety and future access. That reserve would be around 20 metres wide, so the use of an underground

cable inevitably sterilises substantial swathes of land from future development. Buildings can, and have been, constructed below overhead lines.

46. It would be necessary to build a 400kV compound at every location where the 400 kV circuit changes from overhead to underground. This “transition station” would have the same appearance as a small 400kV substation. It would require a land area of about one hectare and would consist of an inner compound enclosing the live high voltage equipment, and a small building.

#### Technical Issues

47. Inserting any section of underground cable into an overhead line circuit would have a negative effect on the reliability and performance of the overall electrical circuit and, depending on the lengths involved, could also have a negative effect on the overall electricity network. The overall length of 400kV cable that can be accommodated within the entire island network must be strictly limited, regardless of where it may be used.

#### Cost Issues

48. The Technology and Costs Update described at 4.2.2.1 above contains detailed and up to date cost comparisons of underground and overhead options for the proposed 1,500MW Interconnector circuit. The report found that a single kilometre of 400 kV AC underground cable would cost on average €5.4 million more than the equivalent overhead line.
49. Transition stations would add an additional €5 – 20m million (approximately) per installation. Two such transition stations would of course be needed for each section of underground cable.

#### Overall Conclusion on Partial Undergrounding

50. Partial undergrounding is a potential alternative to a continuous overhead line in circumstances where the substantial additional cost, and the additional environmental impacts, can be proven to offer an environmentally advantageous and cost effective way of overcoming an otherwise unavoidable environmental or technical constraint to an overhead line. However, NIE does not believe that there is any section within the proposed route for the proposed overhead line that presents technical or environmental constraints that are sufficient to justify either the additional cost or the additional environmental impacts arising from the use of underground cable in these locations.

### 4.2.2.7 Overall Conclusions and Observations in Regard to the evaluated transmission technology alternatives

51. Having undertaken a process that incorporated due regard for the likely significant environmental impacts, having considered the conclusions of the above independently commissioned reports, and having taken full account of the further review and assessment of HVDC technology and partial undergrounding options as described above, NIE’s conclusion is that an AC overhead line is the most appropriate technology choice for the proposed Interconnector.

### 4.2.3 Overhead Line Design Alternatives

52. NIE and EirGrid jointly undertook additional studies to determine the most appropriate operating voltage and circuit configuration for the proposed overhead transmission line.
53. An operating voltage of 400kV was chosen because it enables the use of a single circuit overhead line for delivery of the required 1,500MW capacity (rather than the double circuit used for the existing interconnector), and the overhead line towers required for a single circuit are shorter and generally have a reduced overall visual impact compared with the taller double circuit towers. An operating voltage of 400kV matches the transmission voltage already in use within the Republic of Ireland and widely used in Great Britain and elsewhere.
54. NIE and EirGrid undertook further detailed studies to examine the visual impact of alternative tower types. Four separate designs were examined and ranked with respect to their landscape and visual impact, and the CIVI tower (illustrated in Figure III) was selected as the type with the lowest overall visual impact.

#### 4.2.4 Conclusion to Alternatives Part One, Transmission Alternatives

55. The consideration of transmission alternatives as described in this section demonstrates the process undertaken by NIE in order to inform itself in relation to the available technological alternatives having regard to their environmental impact.
56. The process undertaken has demonstrated:
- the worldwide predominance of overhead lines for transmission applications, and the absence of any application approaching the length of the proposed Interconnector;
  - the significant additional cost and technical complexity associated with high voltage underground transmission cables;
  - the superior reliability and performance of AC overhead line technology when applied to integrated transmission systems; and,
  - the determination and selection, having regard to environmental impacts, of a 400kV single circuit tower with a specific design.
57. NIE has concluded that its examination of the transmission alternatives, as summarised above and more fully described in the ES, fully supports its proposal to construct the proposed Interconnector by means of an overhead transmission line using AC technology.

## 4.3 Alternatives Part Two: Substation Location and Overhead Line Route Selection

### 4.3.1 The Initial Identification of Options for Interconnection

58. As set out in Part One of this section 4, and in parallel with the evaluation of transmission alternatives described, NIE and EirGrid have worked together over a long period to determine joint proposals for the selection of transmission system connection points and for the geographic positioning of a proposed overhead AC transmission line.

59. The first stage in the process was to perform a wide range of technical studies in order to determine the most appropriate physical points at which to connect the two power systems with a new interconnector. These studies were performed jointly by NIE and EirGrid engineers, and spanned a period from April 2001 to July 2004. The conclusions of the studies identified five technically possible connection options.

#### Connection Option 1: Multiple 110kV Overhead Line Development

60. This option considered the installation of three new 110kV transmission lines between existing substations on the NIE and ESB power systems:

- Coolkeeragh, County Londonderry – Trillick, County Donegal;
- Newry, County Down - Louth, County Louth; and,
- Tandragee, County Armagh – Lisdrum, County Monaghan.

#### Connection Options 2, 3, 4 & 5: 275kV/400kV Overhead Line Development. (Described below).

61. Several options were considered based on the geographic location of appropriate connection points on the existing 220kV and 400kV transmission systems in the Republic of Ireland and the 275kV network in Northern Ireland. These options were:

##### Option 2: Eastern Option

62. This option involved reinforcing the existing double circuit transmission line connection between substations at Tandragee, County Armagh, and Louth, County Louth, by constructing a further transmission line connection to be operated at either 275kV or 400kV.

##### Option 3: Western Option

63. This option was based on a new 275kV transmission line connection between Coolkeeragh, County Londonderry and Srananagh, County Sligo.

##### Options 4 and 5: Mid-Country Options

64. These options were based on a new 275kV or 400kV transmission line connection between Drumkee, County Tyrone and potential connection points at Arva (Option 4) or Kingscourt (Option 5), both in County Cavan.

#### Connection Option 6 : Upgrading the existing 275kV interconnector.

65. This option considered up-rating of the existing interconnector, which comprises a double circuit 275kV overhead line between Tandragee and Louth substations, from the current design capacity of 1,500 MW to a higher level of capacity.

### 4.3.2 Technical Evaluation of Connection Options

66. Having identified the five options described above, and as the second stage of the process, NIE and EirGrid carried out further detailed technical evaluation on each option in order to determine its suitability for meeting technical performance requirements.
67. The conclusion of this second stage was to reject Option 1 since it was found that this method of interconnection would not be capable of increasing the net transfer capacity in either direction and could not therefore meet the strategic need for additional interconnection capacity. Option 3 was also rejected at this stage since it would connect weaker and more peripheral parts of both transmission systems and would therefore provide lower transfer capacity than other available options.
68. Option 6 was rejected because the source of the existing transfer limitation derives from the risks arising when the towers supporting both of the existing interconnector circuits are exposed to sudden failure arising from a single event. It was recognised that the creation of a larger capacity circuit would not address this fundamental issue. Only a separate, completely independent circuit is capable of doing this.
69. The remaining connection options were carried forward into a further detailed environmental assessment.

### 4.3.3 The Environmental, Technical and Economic Assessment of Connection Options

70. The third stage of the process was to assess the remaining connection options having additional regard to potential environmental impacts, and also to economic and practical considerations. All the identified connection options were contained within an overall geographical area that had a northern boundary defined by NIE's existing 275kV double circuit overhead line between Tandragee and Dungannon, and a southern boundary corresponding to the route of ESB's existing 220kV overhead line between Louth and Flagford.
71. NIE and EirGrid jointly agreed a scope of works for undertaking environmental, technical and economic feasibility studies of the identified study areas and route corridors applicable to each connection option and covering broad geographic areas both north and south of the border.
72. This third stage of study involved the development of a physical and environmental constraints analysis based upon:
- environmental constraints mapping studies to identify and address key environmental issues arising in respect of each study area, including designated landscapes, designated nature conservation sites, landscape character, land zoning, archaeology and cultural heritage, ecology, settlements, community sites, tourism sites etc; and
  - an assessment of physical route/terrain issues which could potentially impact on the construction and maintenance of a practical route within each study area, including identification of topography, urban and rural development, land use, road crossings, geology, quarries, mines, airstrips and other salient features.
73. As landscape and visual impacts were considered to be the most significant likely environmental impacts, NIE's advisers included a professional landscape architect.
74. The salient environmental features of the study area were further investigated by means of surveys and other sources of geographical and environmental information.
75. Route corridor options were identified within the study areas based on environmental, economic and technical considerations. In general, principles for route corridor identification were:
- firstly, and working from the identified connection points within each of the existing transmission systems, to identify the shortest and straightest route corridor that was technically, economically and environmentally achievable. It was recognised as part of this process that any additional length



or additional deviations in the overhead line route would require additional supporting structures or, in some cases, larger structures (for example in the case of a change of direction in the overhead line route), with associated additional environmental and economic impacts;

- secondly, to minimise identifiable environmental impacts by avoiding known environmental constraints, as identified through the constraints mapping exercises, as far as was practicable within geographically possible and technically achievable limits; and
- thirdly, to minimise further potential landscape and visual environmental impacts through the advice of a professional landscape architect.

#### 4.3.4 The Joint NIE and EirGrid Selection of a Preferred Route Corridor

76. The selection of a preferred study area and route corridor to take forward for more detailed route selection and design was made by NIE and EirGrid on balance of environmental, technical and economic considerations having an overall regard to the likely significant environmental impacts. A decision to select connection Option 5, a preferred route corridor running from the vicinity of Drumkee, County Tyrone to the vicinity of Kingscourt, County Cavan was agreed between NIE and EirGrid in October 2005.
77. The selection of this preferred route corridor established a potential border crossing zone in the vicinity of Mullyard townland, County Armagh and broadly defined the route corridors for further development and consultation by NIE and EirGrid within their relevant geographic areas of responsibility.

#### 4.3.5 The Selection of a Detailed Overhead Line Route within the Preferred Route Corridor

78. Following the identification of the preferred route corridor, detailed line routeing studies were then undertaken by NIE in relation to the portion of the preferred route corridor contained within Northern Ireland, together with ongoing liaison with EirGrid in order to ensure that the conditions for the choice of the overall corridor remained valid.
79. Within the preferred route corridor, a three stage process of “line routeing” was conducted.
80. Firstly a data gathering exercise was undertaken. This used a combination of aerial photography, the detailed mapping of houses, commercial buildings, industrial buildings, and Proposed Developments as well as all known environmental constraints, and extensive site visits to gather accurate data throughout a continuous 5km wide corridor surrounding the most direct route through the study area from Drumkee, County Tyrone to the border crossing area agreed with EirGrid.
81. Secondly, detailed overhead line routeing was undertaken to identify a continuous practicable route with regard to the likely significant environmental impacts arising. This process included a general objective to maximise the distance between the proposed overhead line and all known dwelling places for reasons of general amenity.
82. Finally, and following the determination of a practicable and continuous overhead line route, detailed line design and specific locations for towers were determined and refined in a series of changes that were aimed at achieving an acceptable route with the least environmental impact. This process included consultation with local land owners where possible.
83. Each stage in the line routeing process was performed in compliance with NIE Guidelines<sup>17</sup> and with the overall goal of minimising the likely significant environmental impacts associated with the proposed overhead line. NIE was at all stages fully aware that the most effective method of avoiding or reducing the environmental effects of an overhead transmission line is by careful routeing.

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<sup>17</sup> (NIE, J63413 10/98 C 10 CN9261)



#### 4.3.6 The Evaluation of Alternatives for the Location of the Proposed Substation

84. As the overhead line route was being developed, a separate parallel process was undertaken to determine an appropriate position and design for the substation installation necessary for connecting the proposed overhead line to the existing NIE transmission system. Connection needs to be made at a substation location capable of safely accommodating all of the voltage transformation, switching, control and protection equipment required for a major transmission circuit.
85. A key consideration for location of the substation site was the need to identify a site close to the existing 275kV overhead line in order to reduce the need for additional infrastructure to connect into the NIE transmission system. This consideration was made with regard to the additional landscape and visual impacts arising from any additional infrastructure.
86. Four alternative sites were considered for location of the substation. The site at Turleenan, near Moy, County Tyrone, was selected as the preferred location taking into account the following key environmental considerations:
- adequate distance from dwelling houses (over 200m);
  - existence of natural screening, due to mature vegetation and topography which would reduce landscape and visual impacts;
  - further from the Argory (a National Trust property) and the Clonmore Tower (an archaeological feature) than other sites considered;
  - a more southerly location than other sites considered, requiring a reduced overall route length for the proposed overhead line as a result;
  - capable of being elevated above and outside the Blackwater River flood plain, whereas other sites were located wholly within the flood plain; and
  - preferred over other sites for ground quality reasons.

#### 4.3.7 The Evaluation of Alternatives for Design of the Proposed Substation

87. Two key design alternatives were considered by NIE in relation to the proposed substation at Turleenan:
- an arrangement utilising air-insulated 275kV switchgear, which would require the creation of a substantial level area involving significant earth works and landscape disturbance, or
  - an arrangement using more expensive gas insulated 275kV switchgear (GIS), but, owing to its smaller size, would enable significant reductions in earth works and an improved visual aspect within the landscape.
88. NIE's decision, having regard to the likely significant visual effects, was to propose the GIS design for 275kV switchgear within the substation at Turleenan.
89. A design decision also made with regard to the likely significant environmental impact of the Proposed Development was to position the entire proposed substation installation at a level above the "once in 200 years" floodplain level.

### 4.3.8 Conclusion to Alternatives Part Two, Substation Location and Overhead Line Routeing

90. Numerous alternatives for additional interconnection have been considered in the development of the location and routeing for the Proposed Development. Alternatives considered include:
- alternative system connection options, leading to the choice of six possible methods;
  - alternative study areas associated with the choice of a preferred route corridor;
  - alternatives to the line routeing within the preferred route corridor, and the selection of a final proposed route for the proposed overhead line;
  - alternative substation locations, leading to the choice of Turleenan near Moy, County Tyrone; and,
  - alternatives to the substation design, and the final choice of a GIS arrangement.
91. The Proposed Development has been subject to an extensive examination of the available alternatives, at each stage having regard to their environmental impact. A fundamental element of NIE's development process has been to seek the mitigation of environmental impacts by design, and the location of the proposed substation and the routeing of the proposed overhead line are both believed to present the best achievable balance between environmental impacts, technical requirements, and economic limitations.

## 5 The Proposed Development

### 5.1 Summary

1. As stated in Section 1, the Proposed Development can be summarised as:
  - The construction and operation<sup>18</sup> of a new 275 / 400kV substation at Turleenan townland, north east of Moy, County Tyrone;
  - The removal of an existing 275kV suspension tower and the construction and operation of two new 275kV terminal towers to enable connection of the Turleenan substation to NIE's existing 275kV overhead line;
  - The construction and operation of a single circuit 400kV overhead transmission line supported by 102 towers for a distance of approximately 34km from the source substation (at Turleenan) to a border crossing between the townlands of "Doohat or Crossreagh", County Armagh and Lemgare, County Monaghan, where it will tie into the ESB<sup>19</sup> network. Owing to geographic border definitions in the immediate area of the border crossing point, the overhead line will need to over-sail a portion of land within the Northern Ireland townland of Crossbane for a short distance;
  - The formation of temporary access tracks and other ancillary works during construction of the substation and at each of the tower locations.
  
2. Once built, the Proposed Development will become a permanent part of NIE'S infrastructure. Further detail on the Proposed Development is set out below.

### 5.2 Connections / Modifications to Existing Infrastructure

3. The Proposed Development will connect to existing electricity infrastructure at the proposed Turleenan substation, which will provide a connection between NIE's existing 275kV overhead line and the proposed new 400kV overhead line.
4. One existing 275kV tower in the vicinity of the proposed Turleenan substation will be removed, and two new 275kV towers will be constructed to provide a connection to the proposed substation. Temporary structures will be used for roughly three months within the substation while the proposed 275kV towers are constructed.

### 5.3 General Description of the Proposed Substation

5. The substation installation will incorporate a control building, a 275kV GIS<sup>20</sup> building, provision for three 500MVA power transformers with associated firewalls, and an open air 400kV switchyard containing high voltage electrical equipment. The entire installation will be constructed within a 193m x 134m<sup>21</sup> securely fenced compound, and will have a maximum height of 12.5m to the top of the proposed GIS

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<sup>18</sup> The System Operator Northern Ireland (SONI) will be operating the proposed development.

<sup>19</sup> The Electricity Supply Board (ESB) is responsible for construction and ownership of the transmission system in the Republic of Ireland.

<sup>20</sup> Gas Insulated Switchgear.

<sup>21</sup> Maximum overall dimensions to external fencing.

building. The proposed ancillary works will include an access road, surrounding earthworks, land contouring and landscape planting.

6. During operation of the substation, a low level of sensor-operated access lighting will be provided to allow safe access to the building and manually operated high level lighting will be used to permit general maintenance and operation of local controls in the hours of darkness. There will be no lighting in general use during the normal operation of the substation.

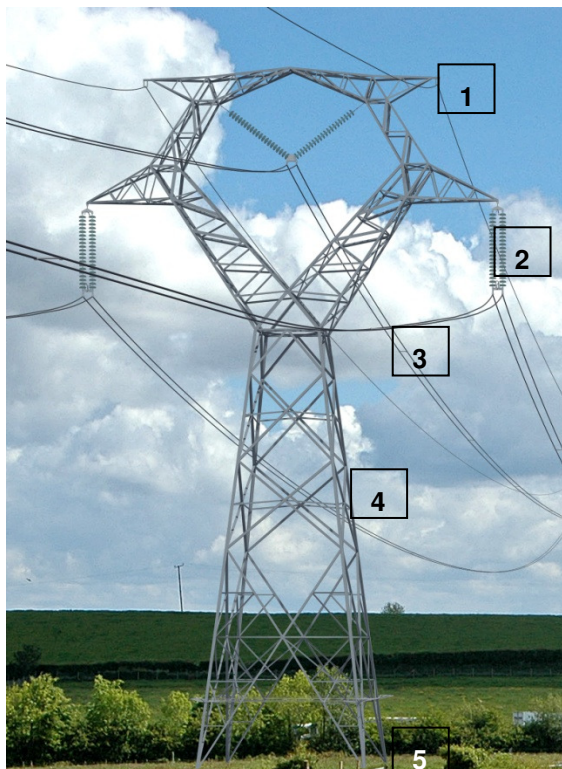
## 5.4 Construction of the Proposed Substation

7. The construction of the proposed Turleenan substation will be a major civil engineering undertaking requiring significant earthworks and specialised equipment.
8. The general construction methods and strategies described below are based upon “best practice” methods used in constructing substations of this type.
9. The estimated construction period for the proposed substation is three years from the start of the site works. The construction process would be split into six segments, broadly as follows:
- site enabling works, including site clearance, the construction of temporary access roads and temporary fencing;
  - earthworks for site levelling and preparation;
  - installation of drainage, and surrounding landscaping and planting;
  - construction of buildings;
  - installation of equipment; and,
  - landscaping, provision of permanent fencing and an access road.

## 5.5 General Description of the Proposed Overhead Line

10. The illustration below shows the general arrangement of the proposed tower that has been selected for the proposed single circuit 400kV overhead line.

**Illustration 1: Arrangement of proposed tower**



1. Earthed Shieldwires
2. Insulators
3. Conductors
4. Tower
5. Concrete foundation for each tower footing

11. The proposed overhead line route is illustrated on Figure I. More detailed information, including the proposed height and location of each tower, is shown in detailed drawings included within the Planning Application.
12. In general the proposed overhead line route starts at Turleenan substation (which is approximately 1.5km north east of Moy) and will travel in a western direction until it crosses the A29 Dungannon - Armagh Road. It will turn to the south west of the A29 road, routeing between Benburb and Blackwater town. After crossing the River Blackwater, the route continues south, crossing the B115 road, the A28 road (approximately 2 km east of Killylea), the A3 road (approximately 5km east of Middletown) and the B3 road (approximately 1 km west of Derrynoose).
13. The proposed overhead line towers will be located at intervals along the overhead line route. The spacing between the proposed towers will range from approximately 158m to 476m and will on average be approximately 336m.
14. The 102 overhead line tower heights range from 25m to 41m and the average height is 34m (The new 275kV towers within the substation site will be 46m and 54m in height).

## 5.6 Construction of the Proposed Overhead Line

### 5.6.1 Overview

15. The estimated construction period for the entire overhead line route has been estimated as three years from the start of the site works, but the construction period at any particular location along the overhead line route would be in the order of four to six months. Materials for construction will be stored at Carn depot, NIE's main regional depot which is close to Craigavon.
16. The overhead line construction will be carried out in parallel with the substation construction work, and will be undertaken in five stages, in the following sequence, and on a rolling programme along the line route. In all cases, the works will be preceded by landowner liaison to agree land access methods, dates and times.
  - Stage 1 – Preparatory Site Work (1 - 7 working days);
  - Stage 2 - Tower Foundations (3 – 6 working days);
  - Stage 3 - Tower Assembly and Erection (3 – 4 working days);
  - Stage 4 - Conductor/ Insulator Installation (7 working days); and,
  - Stage 5 – Reinstatement of Land (1 - 5 working days).
17. Following the completion of construction, temporary accesses and other disturbed land will be reinstated.

### 5.6.2 Stage 1 – Preparatory Site Work

18. Site preparation works will include minor civil work at the tower locations including, where appropriate:
  - Installation of temporary access tracks - Temporary accesses capable of taking construction plant, construction materials and personnel are required for the construction of each tower, installation of the overhead line and the setting up of guarding locations. Detailed proposals relating to the proposed access and temporary working arrangements for each of the proposed tower locations has been set out in drawings provided as part of the Planning Application. Of the 113 proposed access tracks, 53 will be temporarily stoned;
  - Levelling of tower foundation area;

- Vegetation clearance – this will be done where the construction works affect hedgerows or trees and if access points are to be widened for larger machinery. There will also be a need to trim any tall trees that could interfere with the overhead line (to ensure a safety clearance is maintained during operation of the overhead line);
- Diversion of drains;
- Erection of temporary fencing; and,
- Diversion of. BT lines (17 locations) and undergrounding of lower voltage (LV) electricity lines (18 locations).

### 5.6.3 Stage 2 – Tower Foundations

19. The first stage in the construction of the overhead line, after preparatory works, is to construct a foundation for each tower. A standard suite of foundation designs has been developed for each proposed tower to cater for a variety of ground conditions which may be encountered, and full details of these have been provide as part of the Planning Application. The maximum foundation size of any tower is 20 x 20m. The foundation of each tower will require excavation for each tower footing. The excavation will then be filled with concrete and steel to form a foundation for tower construction, and surplus excavated material will be sent to landfill.
20. Any water pumped from the excavation will need to be discharged following treatment. All water pumped from excavations will be passed through a filtration system to allow the settlement of silt before the water is discharged.

### 5.6.4 Stage 3 – Tower Assembly and Erection

21. The steel for the remainder of the tower will be delivered to the site by lorry and various sections of the tower will then be pre assembled on the ground beside the tower.
22. The working area required for construction of each overhead line tower is 35m x 35m (1,225m<sup>2</sup>). The working area for 40 towers will be temporarily stoned.
23. Steelwork for each tower will be delivered directly to site from the Carn depot.
24. Each tower consists of approximately 12.5 tonnes of steelwork that will be delivered by lorry and then assembled and erected on site.

### 5.6.5 Stage 4 – Overhead line Installation

25. The overhead electricity conductors are secured to the towers by means of a stringing operation. This is undertaken between each set of angle towers in a straight line between the two angle towers.
26. Where the overhead line is to be strung over roads and the River Blackwater, protection in the form of guard poles, scaffolding or a telescopic handler will be provided. The protection measures will be positioned both sides of a crossing and will be temporary in nature, for the duration of the stringing operation. The guarding locations will ensure that the stringing operation does not interfere with road users or the River Blackwater.

### 5.6.6 Stage 5 – Reinstatement of Land

27. Once all works are complete, the access route and the construction areas around each tower will be restored to its original condition. This work will be carried out by a specialised agricultural contractor and will be done in consultation with each relevant landowner.

## 6 Environmental Impact Assessment

### 6.1 General Overview of EIA Process

1. The EIA Regulations require an ES to provide “a description of the likely significant effects, direct and indirect, on the environment of the development, explained by reference to its possible impact on:
  - population
  - flora;
  - fauna;
  - soil;
  - water;
  - air;
  - climatic factors;
  - material assets including architectural and archaeological heritage,
  - landscape; and
  - The inter-relationship of any of the above factors”.
2. The ES must include “a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment”.

### 6.2 Scoping

3. The EIA Regulations require an ES to provide “a description of the likely significant effects, direct and indirect”. A review of all environmental aspects of the Proposed Development was undertaken by NIE and its specialist advisers and, following consultation with the DOE Planning Service, those aspects for which likely impacts were not anticipated to be significant were “scoped out” of the EIA. This means that detailed consideration of these issues was either not included at all, or dealt with at a high level. The scoping process applicable to the Proposed Development was confirmed by the DOE, who provided a written opinion on the information to be provided in the ES. Consultations were subsequently undertaken with stakeholders on the basis of the scoping process.
4. The EIA environmental topics scoped out, with reasons for their exclusion from the detailed EIA, are set out below:
  - Wind and transport borne dust may arise during construction activities at both the substation and at the individual tower locations and ancillary development. This will be a short term and temporary impact. It will be minimised through mitigation measures (e.g. damping down material during dry weather);
  - No significant emissions to air are anticipated to result from the construction or operation of the Proposed Development;
  - The project is not expected to have a significant effect on the climate; and,
  - The issue of property values has been scoped out because there is no robust evidence indicating that the Proposed Development is likely to have significant effects on property values.



5. It was concluded that the following impacts should all be thoroughly assessed as part of this EIA:
- Population, as assessed in the following chapters: Electric and Magnetic Fields; Noise; Landscape and Visual; Community Amenity and Land Use; and Socio-Economics.
  - Flora and Fauna, as assessed in the Ecology chapter.
  - Landscape, as assessed in the Landscape and Visual chapter.
  - Material Assets, as assessed in the Cultural Heritage chapter, the Landscape and Visual chapter, the Community Amenity and Land Use chapter, and the Telecommunications and Aviation Assets chapter.
  - Soil, as assessed in the Soils, Geology and Groundwater chapter and Community Amenity and Land Use.
  - Water, as assessed in the Water Environment; Soils, Geology and Groundwater; Flood Risk Assessment; and Ecology chapters.
  - Assessment is also made as to the interaction between these impacts.
6. The summarised conclusions of the individual environmental assessments (contained in full within the ES) are reviewed below.

## 6.3 Consultations

7. Public and statutory consultation was undertaken by NIE and its consultants in respect of the Proposed Development. Consultation was carried out at various levels and at various stages in project progression.
8. Parties consulted included affected landowners, the general public, statutory bodies, the relevant local authorities, non- statutory bodies and interest groups, in an effort to deliver the best achievable proposal. Comments from consultees were taken into account as part of the project design and EIA.

## 6.4 EMF

9. Electric and magnetic fields (EMFs) occur in the natural world, and people have always been exposed to them. The advent of modern technology and the wider use of electricity and electrical devices have inevitably introduced changes to naturally occurring EMF patterns. Energised HV power-transmission equipment is a source of power-frequency or extremely-low-frequency alternating EMFs, which add to (or modulate) the Earth's steady natural fields.
10. Electric-field strengths are measured in volts per metre (V/m) or kilovolts per metre (kV/m). The atmospheric electric field at ground level is normally about 100V/m in fine weather, but may rise to many thousand volts per metre during thunderstorms. Magnetic fields are usually measured in microteslas ( $\mu\text{T}$ ). The Earth has a natural magnetic field, which is approximately 50  $\mu\text{T}$  in the island of Ireland. EMFs are also produced in everyday situations by electrical wiring and electrical appliances.
11. There are no statutory regulations in the UK that limit the exposure of people to power-frequency EMFs. Responsibility for implementing appropriate measures for the control of EMFs lies with Government, who act on the scientific advice of the Health Protection Agency, formerly the National Radiological Protection Board (NRPB). The exposure guidelines in place in the UK as a result of Government policy, formulated in 2004 and reiterated in 2009, are those published in 1998 by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), applied in the terms of the 1999 European Union Recommendation.
12. NIE's policy is that the Proposed Development must comply with Government policy on EMFs and in particular with the Government's EMF exposure guidelines. NIE believes that compliance with



Government policy on EMF exposure levels ensures the appropriate level of protection for the public from these fields.

13. The ICNIRP guidelines recommend that the general public are not exposed to levels of EMFs able to cause a current intensity of more than two thousandths of an ampere per square metre ( $2 \text{ mA/m}^2$ ) within the human central nervous system. This recommendation is described as “the Basic Restriction” and broadly corresponds to the effects of an electric field of  $9\text{kV/m}$  or a magnetic field of  $360\mu\text{T}$ . It is these values which are taken as the relevant public exposure limits in the UK.
14. The highest fields are found under the line, reducing to the sides of the line. Compliance of an overhead line with the exposure guidelines is assessed for the conditions when, broadly, the line is producing maximum possible continuous field, even though in practice fields rarely reach these levels and are usually lower. On this basis, for the Proposed Development, the maximum electric field, which occurs directly underneath the proposed overhead line, will be  $7.7\text{kV/m}$ , and the maximum magnetic field will be  $47 \mu\text{T}$ . Both of these levels are within ICNIRP guidelines and comply with UK Government policy.
15. If the overhead line were to be updated in the future to carry a higher load, it would remain compliant with the exposure guidelines. Similarly, if the UK were to adopt the more recent 2010 guidelines from ICNIRP, the best assessment possible at present is that the line would also remain compliant.
16. The largest field around the substation will be that produced by the overhead line entering it, and therefore the substation will also be compliant with the exposure guidelines.
17. The Proposed Development will thus fully comply with the ICNIRP and EU guidelines on exposure of the general public to EMF. Such compliance meets UK Government policy for providing the appropriate level of protection for the public. Government policy, based on the scientific advice, gives no reason on grounds of a health hazard as to why the Proposed Development should not be constructed and operated, given that it complies with the relevant exposure guidelines.
18. NIE is satisfied that the UK’s policies remain based on current scientific advice. Some countries have adopted other limits, but no country that has adopted more onerous limits or policies has done so because of new scientific evidence that has not been taken account of in the UK. If any significant new scientific evidence emerged, NIE is confident that this would be recognised by HPA and other scientific advisory bodies, who would draw it to the attention of the UK Government. The correct policy for NIE to follow is the UK policy, not the policy in any other country.
19. The details necessary to apply Government policy on EMFs are contained in two Codes of Practice, one on compliance with the exposure guidelines, and one on optimal phasing. These Codes of Practice were explicitly adopted by the Northern Ireland Executive in 2012, thereby confirming that UK Government policy in this area applies in Northern Ireland.
20. The UK Government has considered carefully whether any mitigation measures beyond compliance with the exposure guidelines are necessary in response to the possibility of health effects, and in a statement published in 2009 concluded that the only precautionary measure that is appropriate in relation to HV overhead lines, beyond compliance with the existing exposure guidelines, is a measure known as “optimal phasing”. Specifically, minimum distances between homes and overhead lines are not considered appropriate and do not form part of UK policy.
21. Optimal phasing is a technical feature of the design of overhead lines that have two circuits. The Proposed Development has only one circuit. The policy on optimal phasing does not require the line to be built with two circuits merely to take advantage of optimal phasing, and the line is compliant with the Government policy on phasing.
22. The proposed overhead line complies with the public exposure limits at all places underneath it, not just beyond some specified minimum distance. A person standing directly under the overhead line would be within the exposure guidelines. The fields fall with distance to the sides of the line, and the closest residential property, and all other residential properties, will be within EMF exposure guidelines by a large margin.
23. The occupational guidelines are higher than the public guidelines. Any occupational exposures will therefore also be compliant.

24. There is understandable concern about whether some people, perhaps with existing medical conditions or pregnant women or unborn children, might be more sensitive to any effects of EMFs. However, none of the authoritative review bodies have identified evidence that shows that there is any condition that creates any sensitivity to effects of EMFs at levels below the guideline levels, with the possible exception of people with Active Implanted Medical Devices. The bodies setting exposure guidelines have already built in what, in their expert judgement and study of the scientific literature, is the appropriate level of protection for the general public, taking account of individuals with greater sensitivities where there is scientific evidence to support that.
25. The magnetic field from an underground cable when standing directly over it is often higher than for the equivalent overhead line, but to the sides, the magnetic field from the cable is always lower than for the equivalent overhead line. Government policy is that it is not justified to place power lines underground solely on grounds of EMFs.
26. The most authoritative and independent reviews of EMF science (e.g. by the Health Protection Agency and by the World Health Organization) are outlined in the ES. There is some uncertainty in the science, but that uncertainty is already taken account of in the policies that have been set and which the Proposed Development complies with. NIE is confident that any new scientific developments are taken account of in EMF reviews and guidelines as they arise.
27. There are no significant identified EMF impacts on farming, plants and animals. There is evidence that beehives can be affected by strong electric fields. However, simple mitigation methods (such as earthing the hive) eliminate the impact.
28. There is no known instance in the UK of a power line interfering with correctly fitted modern implanted medical devices, such as pacemakers and hearing aids, and the Medicines and Healthcare Products Regulatory Agency, who are part of the Department of Health, and are responsible for ensuring medical devices in the UK work and are safe, have stated that they do not regard power lines as a significant hazard to pacemakers. The Proposed Development is therefore assessed as not being a significant hazard to implanted medical devices. Any individuals with concerns should, however, consult their own cardiologist or other appropriate doctor.
29. As the Proposed Development is compliant with Government policies for the control of EMFs, specifically with the relevant quantitative exposure guidelines and additional precautionary measures, no additional mitigation measures are called for.

## 6.5 Water Environment

30. The proposed substation is close to the River Blackwater and River Rhone and so mitigation will be put in place to ensure that any potential construction impacts to water quality are not significant. Increased surface runoff rates and volumes are predicted to result from the increase in hard standing. To ensure that this does not increase existing flood risk, a Sustainable Urban Drainage System (SuDS) drainage system which would treat runoff, will be installed. With the effective implementation of mitigation, effects have been assessed to be not significant.
31. As a linear development, the proposed overhead line will cross a number of surface watercourses that vary in size, importance and sensitivity. The majority of the watercourses are small unnamed streams or drains that are tributaries of the larger River Blackwater, Ballymartrim Water and River Rhone. All of these surface waters are included on the Protected Areas Register as a result of their fisheries interests and their ecological status and water quality varies.
32. In identifying the location of the overhead line towers watercourses have been physically avoided as much as is practicably possible. Where works adjacent to watercourses are unavoidable, these can be effectively managed by the proposed mitigation measures, which implement good working practices and ensure adherence to relevant legislation and current good practice.
33. In assessing the significance of impacts careful attention has been made to the importance of the water receptors and the magnitude of any effect, taking into account the relatively small scale and duration of the works.

34. At nine locations ditches may be impacted during construction works to install tower foundations, but these will be reinstated resulting in no overall effect. The impacts of the overhead line and towers have been assessed to be neutral.
35. These measures are detailed in the ES but include proposals to reinstate ditches following completion of the works. Drip trays will be fitted to static construction plant and biodegradable oil used. Spill kits will be stored on site and staff trained in their use. Concrete will be batched offsite. Fuel will be stored and refuelling activities will only take place in designated areas of the construction compound. Concrete washing activities will also only take place in the construction compound and wash waters collected for appropriate disposal offsite at a licensed land fill.
36. Runoff from the site will not be allowed to drain directly into any watercourse and would be treated using measures to filter or settle silt. Silt Management (barrier control) measures will be made to collect and treat drainage from the working areas in order to remove sediments and other contaminants before discharging to surface watercourses. These measures include silt traps, silt fences, filter strips, straw bales and swales as appropriate. The mitigation measures will be positioned within the planning application boundary as close to the working area as possible. In this way the measures will prevent siltation from entering the watercourses.
37. As part of the preconstruction works, thorough landowner consultation will be undertaken to develop a construction methodology that avoids an impact upon the operation of the Linwoods willow plantation bioremediation system. Alternatively NIE will provide a means by which the effluent currently treated by the system can be disposed of. This will ensure there is no significant water quality impact downstream of the treatment area.
38. A water quality monitoring programme will be implemented during construction. This will be targeted on watercourses considered to be at a higher risk of pollution (i.e. towers where there are watercourses within 20 m of the construction works). Daily observations of watercourses close to construction works will be taken. If pollution is suspected, samples will be collected from the point of discharge from the tower construction site, just upstream and downstream of this point, All works will halt until the source has been identified, controlled and any remediation undertaken.
39. During operation, it is predicted that there will be no permanent or long term adverse impacts from the towers, nor from the substation providing that the drainage system is well maintained and NIE operate a Pollution Prevention Plan.

## 6.6 Soils, Geology and Groundwater

40. The Proposed Development is in an area with ground conditions of boulder clay and sand and gravel and peat (not bogs or wetlands) and deposits associated with river valleys. Much of the area is covered by a significant thickness of such material above the bedrock and this limits bedrock close to or above the ground.
41. Two Areas of Special Scientific Interest (ASSI) in the vicinity of Benburb have been designated for their geological interest within 2km of the Proposed Development. These areas would not be affected by the proposed construction and operation of the development.
42. From a review of potentially contaminated sites in close proximity to the Proposed Development, it is concluded that none of the identified sites poses a significant risk of contamination or a constraint to the Proposed Development.
43. The Proposed Development has the potential to cause minor local adverse effects on geology, groundwater and soils. Land take for the tower bases and the substation construction along the length of the overhead line would entail disturbance of surface materials (soils and drift) during construction and would remove the tower base locations and the substation site from other future productive uses.
44. The tower bases have been selected to avoid areas of known peat and the consequent absence of risk of potential slope failures arising from poor cohesion of disturbed peat bodies. No peat was found in the boreholes and trial pits on the proposed substation site and there is no evidence from a site walkover of the presence of peat on the site.

45. The geology that would be affected by the construction of the principal elements of the Proposed Development are widespread in the area and the Proposed Development would have no significant impact.
46. The main effect on geology and soils of the Proposed Development is likely to be limited to the localised loss of good quality soil within the bounds of the construction areas, in particular the substation. However, the relatively small scale of the tower bases and their dispersed distribution means that losses in individual fields will be of low significance. Construction areas avoid potentially high risk, contaminated land and known areas of peat. Proposed mitigation measures would reduce the potential degree and extent of soil degradation and hence reduce the significance of any adverse effects.
47. The proposed excavation for the towers and the substation would result in the generation of approximately 103,730m<sup>3</sup> of surplus materials. It is anticipated that these would comprise naturally excavated materials with no contamination potential. These materials could be managed by removal off-site for disposal to landfill.
48. There is no evidence that the towers or the substation would impact on any areas of contaminated ground. Accordingly, there is no risk that water pumped from the excavations for the towers or from the substation would contain chemical contaminants which would pose a risk to the quality of the surface water systems.
49. The construction of the towers has the potential to cause a temporary modification in the groundwater level and flow where dewatering is required to facilitate construction. Additionally there is a potential impact on water quality through dewatering and the discharge of the pumped water to the surface and/or groundwater systems. Water pumped from the excavations may contain suspended solids and contaminants. There is no evidence that water pumped from the excavations for the towers would contain chemical contaminants. Accordingly, it is concluded that no mitigation measures other than simply settlement to reduce the suspended solids concentration would be required to protect the quality of the receiving water system.
50. Where dewatering is required to install the tower foundations, a survey of existing water supply sources in the vicinity of the tower would be undertaken. Where a potential impact to an existing water supply spring, well or borehole is identified, an appropriate alternative supply would be provided for the period of dewatering.
51. In summary, it is concluded that the construction and operation of the Proposed Development have no significant impact on the geological or groundwater conditions. Any minor impacts would be localized and would be controlled by standard procedures and pre-construction mitigation measures.

## 6.7 Ecology

52. It has been assessed that the Proposed Development will have minimal effects on ecology. Many years of ecological survey have allowed the design to be refined to avoid, as far as possible, areas of greater ecological value. Areas of significant conservation interest, such as species-rich grassland, river channels, bogs and wetlands have been avoided.
53. The Proposed Development covers a large area of land but has a small footprint and therefore the potential for effects is low. Permanent land take is low and habitats lost are generally of low ecological value.
54. The potential for the Proposed Development to have an effect on designated ecological sites has been assessed in the Environmental Statement and through an Appropriate Assessment. No sites of international, national or local conservation value will be negatively affected. The Proposed Development will have a negligible impact (no observable impact) on such sites.
55. The principal effect of the Proposed Development will be the loss of land required for towers, substation and the temporary construction works (such as access tracks). However, since the great majority of the land will be species-poor fields of agricultural grassland, which are of low conservation value, there will be no observable impact.

56. Towers located in or near hedgerows will result in some localised loss of short lengths of hedgerow. There will also be a need to trim any tall trees that could interfere with the overhead line to ensure a safety clearance is maintained.
57. The loss of hedgerows and trees during the construction phase for accesses and working areas will be at a small scale, in relation to the length of the route, although habitat diversity locally will be reduced by the loss. Following removal of temporary access tracks and working areas, every care will be taken to ensure there will be no remaining areas of compacted land. Hedgerows and trees that will be affected will be replanted after the works are completed.
58. The construction of the proposed substation will require the removal of existing, mainly grassland, habitats of low conservation value, together with a number of hedgerow trees. The landforming required to accommodate the substation provides opportunities for habitat creation that will increase the biodiversity interest of the site.
59. The overhead line will have limited negative impact on the mammal, bird and invertebrate species in the area.
60. Badger surveys have determined that there will be no impacts to badger setts, though there may be some disturbance during the construction phase due to low level of activity in the area.
61. Effects on otters will be minimised by siting towers away from river banks, and the techniques used for stringing lines across watercourses.
62. A number of trees potentially used by bats will be removed, but the impact on bat populations is likely to be negligible.
63. There will be a potential for bird species to collide with the proposed overhead line, but for the most vulnerable species, particularly swans, the impact will be negligible; the provision of deflectors at appropriate sections of the line will reduce the potential for impact further for other birds passing over the site.
64. There will be no affect on the availability of potential breeding sites for newts, and there will be no loss of habitats that are likely to be used by the species.
65. Other rare and notable species potentially in the area include the Irish Hare, Freshwater crayfish, Common Lizard and Devils bits Scabious (an important plant for the marsh fritillary butterfly). It has been determined that the impacts will be negligible to any of these species.
66. Mitigation measures are in the main designed to avoid impacts on habitats and species of conservation concern through the implementation of good working practices and awareness of the potential impacts of the works on ecological receptors. Where there is the potential for limited impacts, these will be reduced through the appropriate timing of activities, pre-construction confirmation surveys of such features as badger setts and bat roosts, provision of bat boxes and water quality management measures. Habitat creation at the substation site and other compensatory planting will increase the extent of habitats of conservation value. Therefore effects on ecology have been identified as not significant.

## 6.8 Noise

67. An extensive noise survey has been conducted around the proposed overhead line route and substation site to establish existing noise levels. The environment is predominantly rural, and the background and ambient noise levels reflect this.
68. Potential noise and vibration levels predicted to arise from the construction and operation of the Proposed Development have been determined. The highest predicted noise emissions levels from the Proposed Development will be during construction. However, this impact will be short term, of a limited nature and within normal construction levels. Mitigation measures including 7am to 7pm working hours will be put in place to reduce the potential “worst case” impact from construction noise. The appointed contractor will liaise with the local Environmental Health Officers and residents throughout the construction process. The residual construction noise and vibration impacts following the implementation of these mitigation measures are not predicted to be significant.



69. When construction has been completed, the operational noise from the proposed overhead line, towers, and substation will be at a low level, with the majority of noise arising from continuous transformer/plant vibration at the substation. The overhead line and substation noise emissions have been predicted and assessed, and no mitigation is proposed for noise emissions arising from the operational stage of the proposed Interconnector. The predicted levels are below the recommended levels and targets set by the World Health Organisation and British Standards 8233 and 4142 and are thus within acceptable limits.
70. The potential for noise disturbance from noise from the overhead line and substation has been assessed with regard to the relevant standards. The overhead line and substation will be in a quiet rural area but the substation will be enclosed and mitigation measures provided so that there is no significant impact. The normal operation of the overhead lines will not result in significant noise impacts at dwellings during the daytime or at night.

## 6.9 Cultural Heritage

71. An assessment of impacts to cultural heritage has been undertaken which included consideration of archaeology, historic buildings and historic landscapes.
72. The baseline conditions were collated from the Monuments and Buildings Record held by NIEA, including the Sites and Monuments Record, the Industrial Heritage Record and details of listed buildings, records from Ulster Museum, analysis of historic mapping and aerial photography and a site walkover survey.
73. No physical impacts on known cultural heritage sites are anticipated. The proposed overhead line will impact upon the setting of several archaeological sites and built heritage features. Impacts will be had on the setting of several scheduled raths, listed buildings and a registered garden. An archaeological watching brief will be undertaken during excavation works to ensure that any previously unrecorded archaeological remains are adequately recorded. There are no mitigation measures recommended for impacts on the setting of heritage assets.
74. The overall significance of impact is considered to be Moderate Adverse because of impacts on the setting of designated assets.

## 6.10 Landscape and Visual

75. An overhead line of the size and nature of the Proposed Development will inevitably have landscape and visual impacts. However significant efforts have been taken in both the design and routeing process to minimise these impacts as much as possible. Based on the alternative options considered therefore, the Proposed Development would result in the least impacts to the landscape and visual resource of the study area, for an infrastructure project of this nature.
76. The study area surrounding the proposed overhead line route lies primarily within County Armagh, and includes the eastern fringe of Armagh City. A portion of the study area north of the Blackwater River is within County Tyrone. The proposed overhead line runs west from the proposed substation at Turleenan before turning south, to the east of Moy, passing through generally open, rural countryside to the east of Keady, before connecting to the southern corridor at the Border with the Republic of Ireland. It avoids hilltops with prominent skylines wherever possible and takes as direct a route as is technically possible, limiting the length of overhead line required and reducing the requirement for larger angle towers.
77. The rural hinterland close to the main settlement of Armagh area is populated with many scattered farms, dwellings and small commercial buildings. A few small villages are located along secondary and minor roads and around local educational or commercial centres.
78. The land within the study area is primarily agricultural, consisting of low rolling hills, shallow valleys and structured fields, which often have overgrown hedgerows and many mature trees. Orchards are a prominent feature in the north of the study area.

79. There are no national landscape designations within the study area. The former Green Belts of Armagh and Dungannon lie within the study area. In addition to this there are a number of Registered Historic Parks, Gardens and Demesnes within the study area, as follows:
- The Argory;
  - The Manor House, Benburb;
  - Armagh Palace; and,
  - Tynan Abbey.
80. With regard to impacts on landscape designations the proposed substation and overhead line would not result in any significant effects on the Armagh City and Dungannon Former Green Belts. Significant impacts on Registered Historic Parks, Gardens and Demesnes are predicted on the following:
- The Manor House, Benburb
81. The overhead line lies across the boundaries of Loughgall Orchard Belt and Armagh Drumlins Landscape Character Areas (LCAs) and the wider study area falls within four additional (LCAs) as described within the Northern Ireland Landscape Character Assessment Series, Northern Ireland Environment Agency<sup>22</sup>. LCAs within the study area are as follows:
- LCA 47 Loughgall Orchard Belt;
  - LCA 66 Armagh Drumlins;
  - LCA 45 Dungannon Drumlins and Hills;
  - LCA 64 Lough Neagh Peatlands;
  - LCA 68 Carrigatuke Hills; and,
  - LCA 46 Blackwater Valley;
82. The overhead line as it approaches the border with the Republic of Ireland falls within close proximity to the following LCAs as defined in the Monaghan Landscape Character Assessment Report which was undertaken by Environmental Resources Management Ireland Limited in association with ERA – Maptec Ltd, as follows:
- LCA 6 Mullyash Uplands; and,
  - LCA 2 Blackwater Valley and Drumlin Farmland.
83. Significant impacts on landscape character are predicted on the following landscape character areas:
- LCA 47 Loughgall Orchard Belt;
  - LCA 66 Armagh Drumlins; and,
  - LCA 6 Mullyash Uplands
84. As part of the visual assessment, a Zone of Theoretical Visibility (ZTV) has been produced. The ZTV illustrates the areas, based on elevation and the height of the towers, where the overhead line would be visible from. It indicates that the scheme would theoretically be visible across most areas within 2-3km of the overhead line route, however, beyond 4-5km theoretical visibility would become more fragmented and dispersed.

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<sup>22</sup> DOE, 1999

85. Visibility would be restricted by a combination of roadside vegetation and woodlands throughout the study area. Buildings, landform and local variations in topography would also limit visibility of the overhead line. Actual visibility of the scheme would therefore be less than that illustrated by the ZTV.
86. The visual assessment considered the effects of the substation and overhead line from thirty four viewpoints identified as being representative of the scheme. The assessment concluded that there would be Significant impacts upon 21 viewpoints at the following locations:
1. Clonteevy Bridge over River Rhone on Trewmount Road (B106)
  2. Derrygawley Way to east of Turleenan Substation
  3. Derrygawley Way to south of Turleenan Substation
  4. Trewmount Road (B106) near site access road.
  6. Moy Road(A29) crossing
  7. Culkeeran Lane
  9. Benburb Road
  10. Benburb Road south of Ninewell Bridge
  12. Benburb Priory
  13. Artasooly Road looking towards Blackwater River Crossing
  16. Battleford Road (B115) crossing
  18. Killylea settlement (Fellows Grange Court)
  20. Monaghan Road(A3) east of Norton's Cross Roads
  21. Monaghan Road(A3) crossing
  22. Maddan Road south of Norton's Cross Roads
  24. Drumhillery Road crossing
  27. East of Derrynoose
  28. Derrynoose Road at Curragh Lane looking north
  29. Derrynoose Road at Curragh Lane looking south
  30. Crossbane Road
  31. Crossaghy Road
  32. Castleshane Brae
  33. Tullybuck
  34. Mullyash Mountain
87. The visual assessment considered the effects of the substation and overhead line from the following settlements: Armagh City, Dungannon, Moy, Blackwatertown, Benburb, Killylea, Milford, Middletown, Keady and Derrynoose. The assessment concluded that there would be Significant impacts upon 5 settlements as follows:
- Moy;
  - Blackwatertown;
  - Benburb;
  - Killylea; and,
  - Derrynoose.
88. The visual assessment considered the effects of the substation and overhead line from the following transport corridors: M1, A28, A3, A29, B115, B106 and B3. There are also several recreational paths, cycle ways and local walks in the study area, as follows; The Ulster Way/National Cycle Route 91; National Cycle Route 95; Regional Cycle Route 11; and River Blackwater Canoe Trail. The assessment concluded that there would be no Significant impacts upon transport corridors and paths.



89. Extensive field study of the characteristics of the landscape has shown that due to the scale and topography of the drumlin landscape type that dominates the route, properties that lie within 500m either side of the overhead line route are more likely to have clear views of the proposals. For this reason particular attention has been paid to properties within 500m of the proposals.
90. A total of 427 properties were assessed that lie within 500m of the proposed overhead line route.
91. Overall, in summer 15 years after opening, there will be:
- 19 properties that experience a major adverse impact;
  - 201 properties that experience a moderate - major adverse impact;
  - 103 properties that experience a moderate adverse impact;
  - 31 properties that experience a minor - moderate adverse impact;
  - 64 properties that experience a minor adverse impact; and,
  - 9 properties that experience no effect.
92. Several properties located in the Republic of Ireland have the potential to be influenced by the proposed NIE overhead line and towers. There are properties identified as J50, J51, J51+, J52 and J62.
93. Several properties located in the Republic of Ireland have the potential to be influenced by the proposed NIE overhead line and towers. There are properties identified as J50, J51, J51+, J52 and J62.
94. The substation has more opportunities for landscape mitigation and the 9 properties that lie within 500m of the substation are situated to the west of the proposed site. The topography is such that some views into the site will be screened by the intervening hillside which makes up the western and southern slopes of the proposed site area. Views may be available of the tops of buildings and tall structures associated with the substation site from some individual property receptors. There are some receptors likely to have Significant substation visual impacts at construction. For some properties, the impacts would reduce to Not Significant in summer 15 years after opening, once planting has matured.
95. The route of the proposed overhead line was selected based on the results of an alternatives study which examined the environmental and land use constraints present between various corridor and routing options. Landscape and visual interests were two of the primary environmental constraints that influenced the selection of the preferred route and the development of the proposed overhead line route. The alternatives studies were therefore the principal means by which the permanent and operational effects of the overhead line have been mitigated. Whilst the scheme will give rise to some adverse impacts it is considered to result in the least damaging impacts when compared to alternatives examined as part of the alternatives study.
96. Detailed routing of the proposed overhead line has sought to achieve the best fit with the landscape using landform and vegetation whilst recognising the engineering and technical constraints of the construction and operation of a practical overhead line.
97. The landscape and visual impact assessment indicates that there would be significant adverse impacts upon the landscape of some parts of the study area. There would also be significant adverse effects on the visual amenity afforded from many locations from within the immediate area following the line route. However it is considered that the visual amenity of the wider study area would not deteriorate to a significant degree and the overall impact upon the population in general is therefore restricted to those locations within close proximity to the towers, overhead line and substation.

## 6.11 Community Amenity and Land Use

98. An assessment of the impact on community amenity has been undertaken through the identification of community facilities within 5km of the Proposed Development.
99. A garden centre will be oversailed in part by the proposed overhead line, which will have a temporary moderate adverse impact during construction. Beyond that there is a day nursery approximately 900m from the Proposed Development and a primary school approximately 700m away. The significant impacts to residential, commercial and community facilities will be limited to the construction phase of the Proposed Development. This impact arises from temporary disruption to residential properties along some of access tracks which use non-adopted roads. This will be a temporary major impact, however it will be limited to approximately 29 working days at each tower location.
100. There are currently three planning permissions for chicken sheds directly under the proposed overhead line. If built in their current planned location then there would be no impacts on two of the planning permissions for the proposed chicken sheds because the overhead line would not overhang the buildings.
101. Assuming there is the required clearance there would be a Moderate Adverse impact on planning permission O/2009/0807/F due to the location of the conductors over the buildings. It is assumed that these houses can be safely built and operated as long as the required safety clearance from the overhead line is provided.
102. There will be impacts on 181 agricultural and horticultural land holdings and commercial tree plantations located at the site of the proposed substation and within 60m of the centre of the proposed overhead line.
103. The construction of the proposed substation will require 22.2ha of land and the 102 towers will be located on 3.6ha of land. In addition to this it is assumed that there will be damage to soil on 27ha which is the total area of construction sites, access tracks, guarding locations and under-grounding trenches. During the construction phase there will be imperceptible or slight adverse impacts on 96% of farms, moderate adverse impacts on 3% of farms and major adverse impacts on 1% of farms. There will be a major adverse impact on one beef and sheep farm at the site of the substation. NIE has now an option to purchase this parcel of land.
104. During the operational phase there will be imperceptible or slight adverse residual impacts on 96% of farms, moderate adverse residual impacts on 3.5% of farms and major adverse residual impacts on 0.5% of farms. The major adverse residual impact is on the same parcel at the site of the substation.

## 6.12 Socio-Economics

105. Impacts to tourism will not be direct as no tourist sites will be physically impacted by the Proposed Development. The key sites within the study area (the Argory, Navan Centre and Benburb Priory) will have views of the construction and operational phase but it is considered that these impacts will not be significant. Four recreational routes (e.g. the Ulster Way) will be over sailed by the Proposed Development and will experience a minor adverse impact during construction due to disruption.
106. As there will be a significant impact to the running of a bioremediation area used by the Linwoods facility, mitigation and compensation will be required to be agreed with the landowner/operator.
107. There will potentially be a minor positive impact on employment, including direct employment and indirect employment. There will also be an indirect positive impact on the hospitality industry in the wider regional area at the construction stage of the Proposed Development, as contractors and other workers may stay in the local area during construction.
108. The impacts of the Proposed Development on visitors and visitor spending, employment and local hospitality businesses in the development area have been assessed and it is considered that there will be no significant negative impacts.
109. The savings of £7m per year to Northern Irish electricity customers estimated by DETI are considered significant positive effects to the local economy.

## 6.13 Telecommunications and Aviation Assets

110. As part of the EIA, extensive consultation took place with the authorities responsible for radio, television, aviation and the emergency services that have telecommunications assets.
111. No objections or potential impacts were raised by the telecommunication or aviation consultees. It is concluded that there will be no significant impacts to telecommunications or aviation assets as a result of the Proposed Development.
112. The Proposed Development will meet all technical compatibility requirements as set out by legislation.

## 6.14 Transport

113. The construction of the Proposed Development would result in a temporary increase in traffic levels on a number of roads within the study area. These increases are considered to be minor and as such not significant.
114. Haul routes for construction have been identified as far as possible at this stage for all construction sites from the nearest A or B class road.
115. Overall effects on the public highway by the construction of the overhead line and towers will be reduced by taking access from existing field gateways and laneways. Each access has been individually assessed and requirements for mitigation/enhancement have been identified and suitable measures proposed.
116. Traffic generated during the operation and maintenance of the Proposed Development would be minimal and would not result in any significant effects.
117. With mitigation measures such as an appropriate traffic management plan and suitable liaison with Roads Service, the residual traffic and transport effects are temporary and have been assessed as not significant.

## 6.15 Cumulative and Interrelationship of Impacts

118. As part of the EIA process, likely significant cumulative effects of the Proposed Development must be assessed. This takes two forms:
- The cumulative (or additional) impacts of the Proposed Development with other developments;
  - The interaction of impacts of the between topic areas (e.g. between landscape and ecology).

### Interactions

119. The EIA has included a consideration of the interrelationship or interactions between impacts. The likely significance of these combined and interrelated impacts has been assessed within the individual assessment topics.
120. The assessment of EMF is interrelated to the various assessments of impacts on population, including noise, landscape and visual, community amenity and socio-economics.
121. The assessment of effects on the water environment is closely linked to the ecology and geology and soils assessments. Potential impacts on the water environment such as impacts on water quality could lead to secondary effects on ecological interests, including fisheries interests and aquatic habitats, as well indirect effects on hydrogeology and groundwater resources.
122. The geological basement of the landscape, its surface deposits and the agricultural regimes that utilise soils all have an impact on the nature conservation value and potential of the line route.

123. Geology is a major component of landscape, and land use can result from the quality of the landscape, as assessed in the landscape and visual assessment. Since geology largely determines the underlying shape of the landscape, it also influenced use of the landscape in the historical and archaeological past, and man-made features described in the cultural heritage assessment may have been located on sites determined by the attributes of local geology and soils.
124. Geology has an important impact on the water environment as a determinant of water chemistry, river flow regimes, water storage capacity and watercourse location, and has an impact on water quality through the ability of bedrock and surface deposits to filter pollutants.
125. Good ecological practice will be incorporated within any mitigation or compensatory measures devised to accommodate impacts. In particular, measures designed to mitigate impacts on the local landscape, where these involve new plantings or habitat creation, will be required to take into account existing semi-natural habitats, and will only use species that are locally appropriate.
126. Noise impacts deriving from vehicle movements are inherently related to transport impacts.
127. Cultural heritage impacts to the setting of cultural heritage sites are interrelated to landscape and visual impacts. Impacts to (unknown) cultural heritage sites arising from onsite excavation arise in tandem with other potential impacts from onsite excavation such as impacts to water quality, soils, habitats, and the water environment.
128. Impacts to ecology, cultural heritage and community amenity are interrelated with landscape and visual impacts.
129. Impacts to community amenity are inherently interrelated; all likely significant impacts have been considered in relation specifically to community amenity. In terms of community amenity, impacts arising from landscape and visual impacts, traffic and noise are interrelated.
130. The significance of these impacts has all been assessed within the individual assessments as stated separately.

#### Cumulative Impacts from other developments

131. The cumulative assessment is based on potential impacts resulting from the Proposed Development and other developments which are not yet constructed. The assessment has included the proposed Omagh Tamnamore 50km 110 kV overhead electricity line and substation, which is 1.6km from the Proposed Development at the closest point. It has also included an assessment of other development with the potential for cumulative impacts, including wind turbines and chicken sheds.
132. No planning application has as yet been submitted by EirGrid for the portion of the Tyrone-Cavan Interconnector within the Republic of Ireland. In circumstances in which EirGrid has yet to conclude its public consultation exercise and EirGrid's proposed development has yet to be finalised sufficiently, NIE is unable to conduct a cumulative impact assessment as part of this ES. However, once EirGrid's proposal has crystallised sufficiently, this will be done.
133. Cumulative effects are predicted to be not significant

## 6.16 Transboundary Impacts

134. The EIA Regulations require an assessment of likely environmental effects on other member states (more commonly called "transboundary impacts"), and this has been carried out as part of the EIA since the proposed development, i.e. the Northern Ireland portion of the proposed Tyrone-Cavan Interconnector, is likely to have effects within the Republic of Ireland in the border area of County Monaghan.
135. It should be noted that impacts arising within Northern Ireland from EirGrid's proposals in the Republic of Ireland will be reported separately through a separate Environmental Impact Statement; this should be referred to in considering potential impacts in the Republic of Ireland. As with the cumulative impact assessment, the transboundary assessment will be updated when the EirGrid proposal is finalised.

136. The proposed overhead line route, as it approaches the border between Northern Ireland and the Republic of Ireland, can be viewed within the Republic of Ireland. This includes the Mullyash Uplands looking north towards Northern Ireland and views from locations within the immediate area along the overhead line route.
137. Based on the assessment of the environmental topics within the scope of the EIA, the transboundary impacts (apart from landscape and visual impacts on the Mullyash Uplands) are predicted to be not significant.

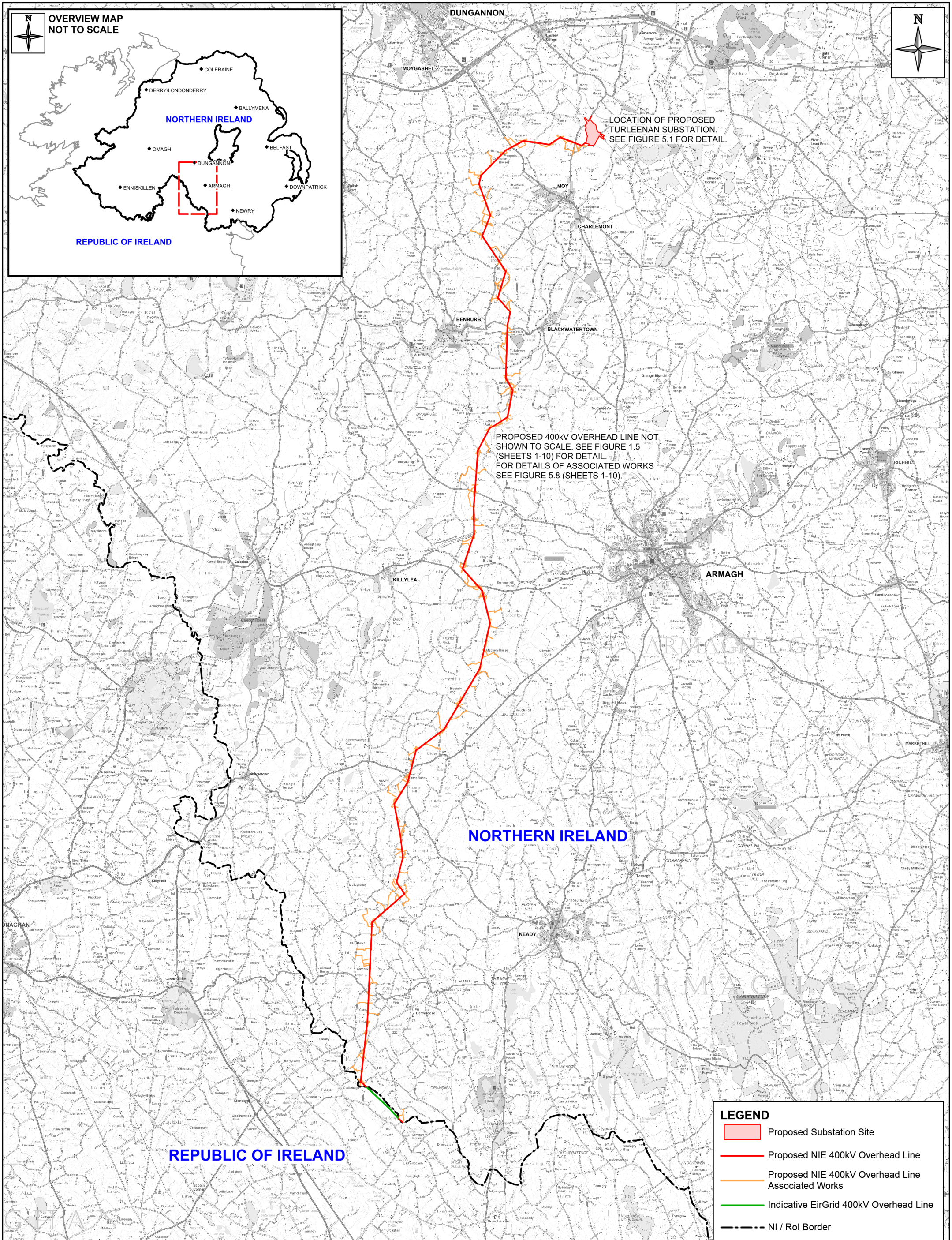
## 6.17 Conclusions

138. The Proposed Development is a major infrastructure project for which the strategic need has been established and confirmed by both regulatory and Government authorities.
139. An extensive process has been undertaken to examine the alternatives for delivery of the Proposed Development having regard to the likely environmental impacts arising from these alternatives.
140. Following the identification of a preferred overhead line route corridor, NIE has undertaken a full EIA of the Proposed Development and of its likely significant effects on the environment. This process has included consideration of EMF, water, noise, soils, geology, ecology, cultural heritage, landscape and visual, community amenity, socio-economic, telecommunications and traffic and transport impacts. When significant impacts were predicted, where possible mitigation by design has been employed to move the proposed towers to alternative locations and to refine the substation design. Where mitigation by design was not possible, mitigation measures have been proposed where appropriate to reduce environmental impacts.
141. The process of assessing environmental impacts within the EIA is reported on in full within the ES. In summary it has been determined that landscape, visual, noise, water, cultural heritage, ecology, geology, soils, traffic, transport, and general construction impacts require the application of mitigation measures, which are reported in Volume 2 of the ES.
142. Of particular note would be landscape and visual impacts, which formed a primary driving force in the development of the proposed overhead line route and substation. A landscape architect assisted with such elements as identifying optimal overhead line routes, tower structure choice, substation site selection and mitigation measures such as landscape screening.
143. Another key consideration in the design of the Proposed Development was the requirement to maximise the distance to dwelling houses for general amenity reasons.
144. On determination of a preferred route corridor an extensive consultation exercise was undertaken. Parties consulted included affected landowners, the general public, public representatives, local authorities, statutory bodies, non- statutory bodies and interest groups in an effort to deliver the best proposal achievable. The consultation exercise undertaken has ensured that all affected parties have had the opportunity to comment upon the Proposed Development in advance of the proposals being finalised. The responses to the consultation have been considered and where appropriate, acted on.
145. In the overall balancing exercise involved in considering a wide range of planning policy, guidance and standards, the adverse environmental impacts arising from the Proposed Development are more than outweighed by the strategic need. There is a clear overriding national and regional need for the Proposed Development in accordance with relevant planning policy on major projects and new infrastructure.

## 7 Copies and Comments

1. If you have comments on this report or the Proposed Development, they can be made to:  
[Planning Service Headquarters](#)  
[Millennium House, 17-25 Great Victoria Street, Belfast, BT2 7BN](#)  
tel: 028 9041 6700  
fax: 028 9041 6802  
email: [planning.service.hq@doeni.gov.uk](mailto:planning.service.hq@doeni.gov.uk)
  
2. The ES and planning application is available to download at [www.nie.co.uk](http://www.nie.co.uk). An electronic copy of these documents on CD-ROM and a hard copy of the Non Technical Summary are also available free of charge, and may be obtained by contacting NIE at:  
[Transmission Projects](#)  
[NIE, 120 Malone Road, Belfast, BT9 5HT](#)  
Tel: 08457 643 643 Website: [www.nie.co.uk](http://www.nie.co.uk)
  
3. Printed and bound copies of the EIA documents are available for £80.
4. Should you wish to purchase a copy you can either:
  - (a) Write to NIE at the address above enclosing a cheque, made payable to NIE, for the appropriate amount. On receipt of this payment, the documents will be immediately dispatched, or
  - (b) Purchase the document directly at the Post Office in Armagh, County Armagh, at the address given below. Payment at the Post Office can be made by either cash or cheque.[Armagh Post Office, Armagh Shopping Centre, Thomas Street, Armagh, BT61 7AE](#)
  
5. The ES can be viewed at the Planning Service Headquarters (address given above) or at any of the locations listed below.  
[Armagh City & District Council, Council Offices, The Palace Demesne, Armagh, BT60 4EL](#)  
Tel: 028 3752 9600  
  
[Armagh Branch Library, Market St, Armagh, County Armagh, BT61 7BU](#)  
Tel: 028 3752 4072  
  
[Portadown Library, Church Street, Portadown, County Armagh, BT63 3LQ](#)  
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Tel: 028 8772 0300





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Client:	
Project:	TYRONE TO CAVAN INTERCONNECTOR CONSOLIDATED ES

Title:	NON-TECHNICAL SUMMARY FIGURE 1: LOCATION PLAN
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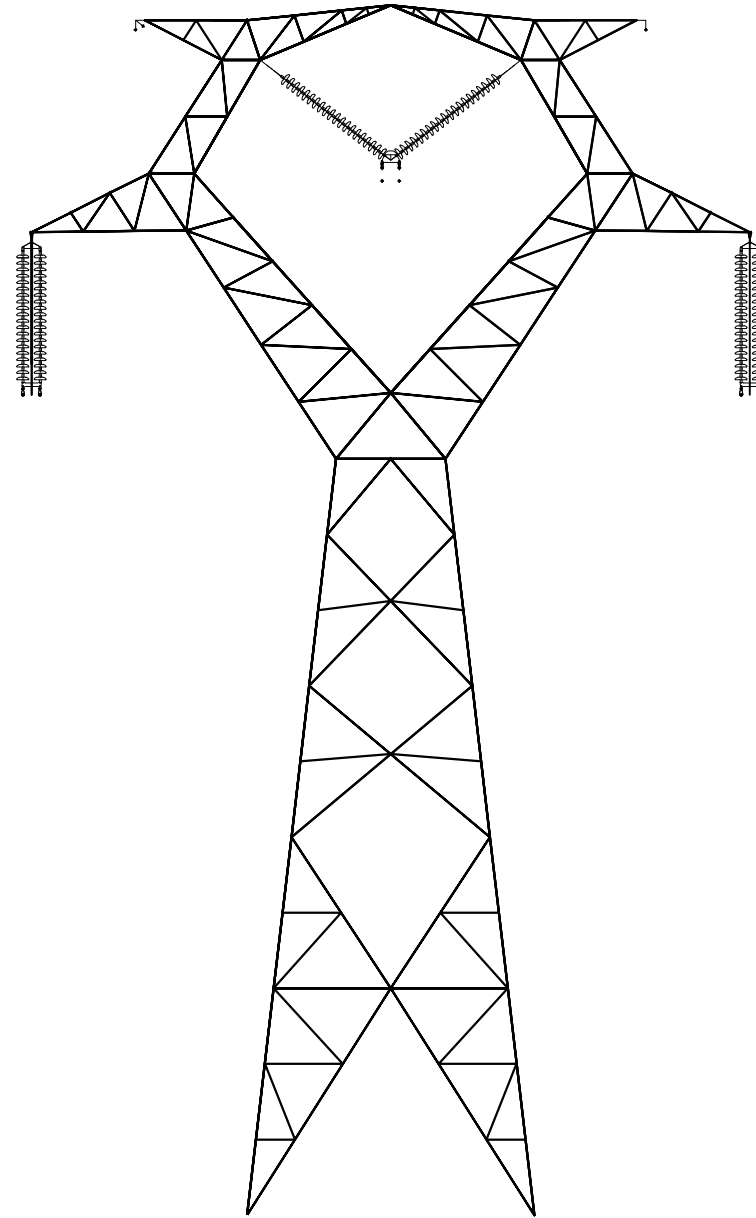
9th Floor The Clarence West Building 2 Clarence Street West BELFAST, BT2 7GP	Tel: +44 (0) 28 9060 7200 Fax: +44 (0) 28 9060 7399 www.aecom.com

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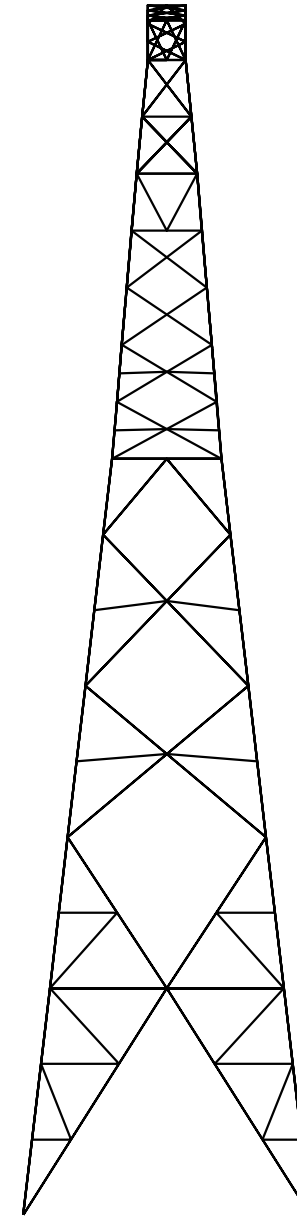


**NOTE**  
1. This drawing is for illustration purposes only.

Please see Planning Application O/2009/0792/F Drawings PE687-D141-093 001 to 102 for detailed drawings of each proposed tower.



FRONT & REAR ELEVATION  
SCALE 1:200



SIDE ELEVATION  
SCALE 1:200

Client:   
Project: TYRONE TO CAVAN INTERCONNECTOR  
CONSOLIDATED ES

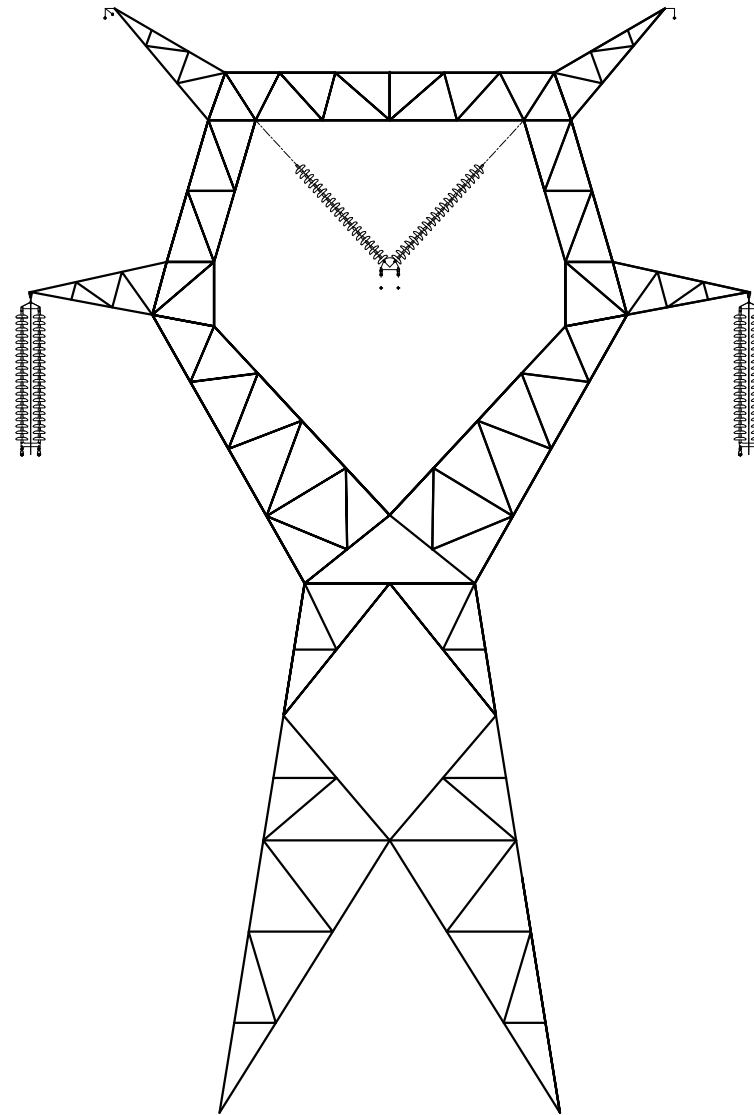
Title: NON TECHNICAL SUMMARY  
FIGURE II  
TYPICAL 400kV SUSPENSION TOWER

  
9th Floor  
The Clarence West Building  
2 Clarence Street West  
BELFAST  
BT2 7GP  
Tel: +44 (0) 28 9060 7200  
Fax: +44 (0) 28 9060 7399  
www.aecom.com

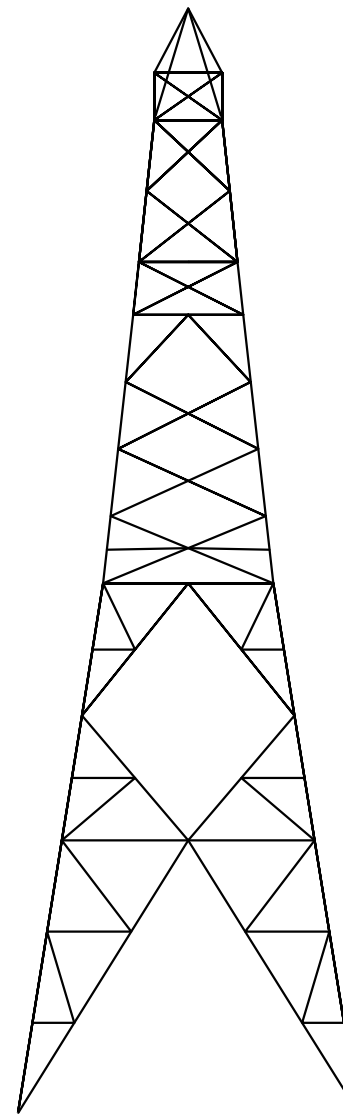
Status: <b>INFORMATION</b>	
Design: ESBI	CAD: KR
Chk'd: FL	App'd: FL
Date: 28/05/2013	Scale: 1:200
No. 60032220/3528/NTS/II	
Rev: .	A3

**NOTE**  
1. This drawing is for illustration purposes only.

Please see Planning Application O/2009/0792/F Drawings PE687-D141-093 001 to 102 for detailed drawings of each proposed tower.



FRONT & REAR ELEVATION  
SCALE 1:200



SIDE ELEVATION  
SCALE 1:200

Client:   
Project: TYRONE TO CAVAN INTERCONNECTOR CONSOLIDATED ES

Title: NON TECHNICAL SUMMARY  
FIGURE III  
TYPICAL 400kV ANGLE TOWER

  
Tel: +44 (0) 28 9060 7200  
Fax: +44 (0) 28 9060 7399  
www.aecom.com

Status: <b>INFORMATION</b>	
Design: ESBI	CAD: KR
Chk'd: FL	App'd: FL
Date: 28/05/2013	Scale: 1:200
No. 60032220/3528/NTS/III	
cm	A3

**NOTES**

**SERVICES**

THE POSITION OF THE SERVICES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE FOR INFORMATION PURPOSES ONLY. TRIAL HOLES SHOULD BE DUG BY HAND, WHERE PROPOSED OPERATIONS ARE IN CLOSE PROXIMITY TO THE SERVICES SHOWN, TO DETERMINE THE PRECISE LOCATIONS OF THE SERVICES.

**LANDSCAPING**

FOR DETAILS OF PROPOSED PLANTING SEE FIGURE 5.7

**KEY**

- PLANNING APPLICATION BOUNDARY FOR SUBSTATION
- - - PROPOSED STOCK PROOF FENCE
- ESTIMATED LEVEL OF A 1% (Q100) FLOOD EVENT
- ESTIMATED LEVEL OF A 0.5% (Q200) FLOOD EVENT
- SLOPES AND BUNDING
- PROPOSED PERMANENT DEVELOPMENT AREA (SUBSTATION AND PERMANENT ROAD INCLUDING EARTHWORKS)

REFER TO FIGURE 5.6 FOR FULL PLANNING APPLICATION BOUNDARY EXTENTS FOR SUBSTATION

PROPOSED 400/275kV TURLEENAN SUBSTATION WITH GIS 275kV AND AIS 400kV DOUBLE BUSBAR LAYOUT.

PROPOSED 2.4m HIGH PALISADE INNER FENCE

PROPOSED 2.4M GREEN RIGID PALADIN OUTER FENCE

PERIMETER OF PROPOSED PERMANENT DEVELOPMENT AREA (SHOWN PURPLE)

10m WIDE FLAT STRIP

3m WIDE FLAT STRIP

1:3 SLOPE ABOVE MUDSTONE/CLAY INTERFACE

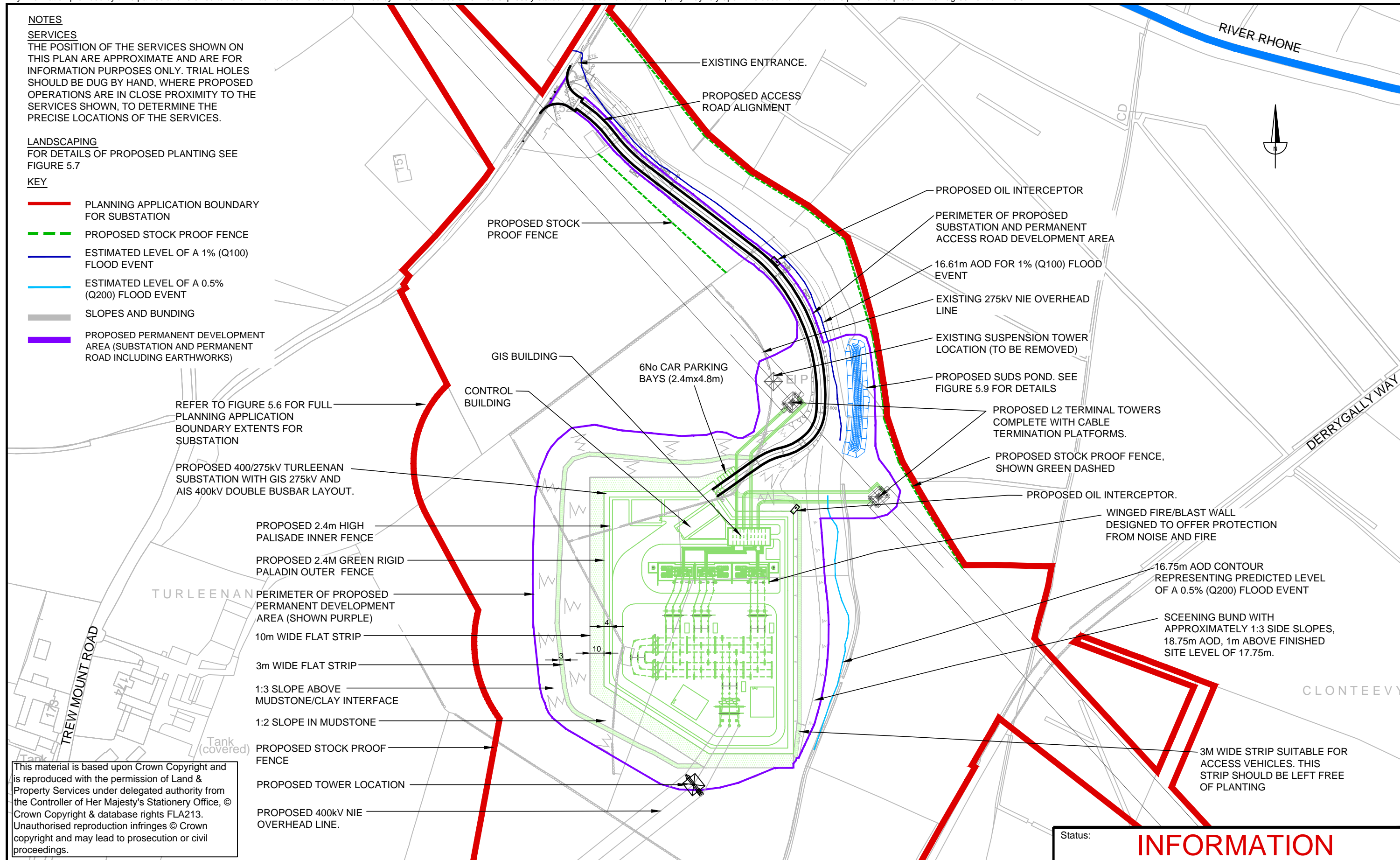
1:2 SLOPE IN MUDSTONE

PROPOSED STOCK PROOF FENCE

PROPOSED TOWER LOCATION

PROPOSED 400kV NIE OVERHEAD LINE.

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Client: 

Project: TYRONE TO CAVAN INTERCONNECTOR CONSOLIDATED ES

Title: NON TECHNICAL SUMMARY  
FIGURE IV  
PROPOSED TURLEENAN SUBSTATION  
GENERAL ARRANGEMENT DRAWING



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