
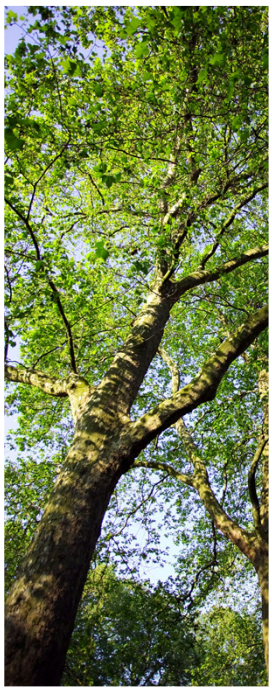


# Millstreet Project

Phase One Lead Consultant's Site and Corridor Identification Report

November 2010
EirGrid plc

EIRGRID

Mott MacDonald

# Millstreet Project

## Phase One Lead Consultant's Site and Corridor Identification Report

November 2010

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# Part A - Project Overview

# 1. Introduction

## *1.1 The Purpose of this Report*

EirGrid has identified the need to develop a new 220/110 kV electrical substation in the vicinity of Millstreet, County Cork. This is required to connect the existing transmission network in the area, specifically comprising connection of the existing 110 kV substation at Garrow, County Kerry and the existing 220 kV Clashavoon to Tarbert transmission line, as illustrated in Figure 1.1 (*Millstreet Project*) below. At this early stage of the project development, both overhead line and underground cable connection options are under consideration. These options are discussed in detail in Chapter 3 (*Substation Site and Route Corridor Selection*), and illustrated in Figure 3.2 (*Route Corridor Selection*), of this report.

The aim of this *Phase One Lead Consultant's Site and Corridor Identification Report* is to identify the potential and preferred substation location(s) and connection route options, and to present an overview of the relevant environmental and engineering constraints associated with each.

## *1.2 Project Justification*

Ireland has an enormous potential for renewable generation, in particular from wind. The Irish Government has set out its targets to achieve 15% of electricity consumption on a national basis from renewable energy sources by 2010, and 40% by 2020. To achieve the 2020 target, significant numbers of new renewable generators (predominantly wind turbines) have to be installed and connected to the transmission network. In order to connect this renewable generation to the existing transmission network, new electricity infrastructure will be needed and one such project which will contribute to achieve the 2020 target is the Millstreet project.

In counties Cork and Kerry, there is a significant amount of renewable generation already connected, either directly or through the distribution system, to the 110 kV transmission network. There are also a large number of planned wind-farm connections. The total capacity of all this renewable generation will at times exceed the demand for generation in the area and therefore will need to be transmitted to other areas for consumption. The existing 110 kV transmission network is not capable of accommodating the combined amount of renewable generation capacity from connected and future renewable generation seeking to connect in these counties. In order to transfer the large amount of renewable generation onto the electricity system it will be necessary to use the higher capacity of the existing 220 kV network in the area.

To facilitate this, modifications to the existing transmission system need to be put in place:

- A new 220/110 kV substation. The new station will be required to direct the renewable power from the 110 kV network to the existing 220 kV network; and

- Modification of the present operating arrangement of the 110 kV network in the area to direct the power to flow towards the new 220/110 kV substation. This will mostly be done by using existing 110 kV circuits, but new 110 kV connections will be required. The Garrow 110 kV substation, located on the border between Co. Kerry and Co. Cork, will need to be electrically connected to the

new 220/110 kV substation. Initially one 110 kV circuit will be required to connect Garrow 110 kV substation to the new 220/110 kV station. However, with the present known amount of renewable generation which could require to be connected into the new 220/110 kV substation, a request for planning permission for a second circuit between Garrow 110 kV substation and the proposed new 220/110 kV substation will be included in this planning application.

## 1.3 Structure of this Report

### 1.3.1 Main Report

This report is structured as follows:

**Chapter 1 Introduction** – provides an outline description of the project in terms of strategic planning and transmission infrastructure.

**Chapter 2 Study Area and Constraints Identification** – identifies the defined study area within which the project will occur and the environmental and other constraints under consideration within that study area and details the consultation process to date.

**Chapter 3 Substation Site and Route Corridor Selection** – describes the substation site and route corridor selection processes.

**Chapter 4 Consultants Findings: Substation Site Environmental Constraints** – explores the key environmental constraints associated with the substation sites under consideration.

**Chapter 5 Consultants Findings: Route Corridor Environmental Constraints** - explores the key environmental and other constraints associated with the route corridors under consideration.

**Chapter 6 Consultants Findings: Engineering Constraints** – explores the key engineering constraints associated with the substation sites and route corridors under consideration.

**Chapter 7 Consultants Findings: Conclusions and Recommendations** – presents the Lead Consultants preferred substation site and transmission connection options.

### 1.3.2 Appendices

The appendices of this report are structured as follows:

**Appendix A EirGrid Policy on the use of Overhead Line and/or Underground Cable** – includes a copy of EirGrid's Policy in this regard.

**Appendix B Study Area Characterisation** - characterises the study area in terms of environmental constraints, as discussed in Chapter 2 (*Study Area and Constraints Identification*) of this report.

**Appendix C Description of Constraints Map Legend** - presents a description of the legends used in the drawings included in this report.

**Appendix D Phase One Map Register and Mapping -** presents a register of figures used in the preparation of this report and maps displayed during the Public Open Days, as discussed in Chapter 2 (*Study Area and Constraints Identification*) of this report.

**Appendix E Phase One Consultation** - includes a sample consultation letter, newspaper advertisements and a copy of the Project Briefing Document, as discussed in Chapter 2 (*Study Area and Constraints Identification*) of this report.

**Appendix F Photographs** - includes photographs of the potential substation sites and access roads.

**Appendix G Cultural Heritage** - includes supporting information for the Cultural Heritage assessment.

**Appendix H Landscape and Visual** - includes supporting information for the Landscape and Visual assessment.

**Appendix I Ecology** - includes a Natura Impact Statement (Screening Stage) of the proposed development.

Due to the large amount of data contained within the appendices of this report, they are contained in a separate booklet which can be either:

- Viewed and downloaded from the project website: www.eirgridprojects.com/projects/millstreet/

- Requested from the project team at the contact details below:

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  EirGrid Plc
  The Oval
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  Ballsbridge
  Dublin 4

  Email: millstreet@eirgrid.com

  Telephone +353 (0)1 702 6642

## 1.4 What is EirGrid?

EirGrid plc is the statutory operator of Ireland's national electricity grid (also called the 'Transmission System'). EirGrid is an independent, state-owned company.

EirGrid has several roles.

- To operate a safe, reliable, economical and efficient national electricity grid.

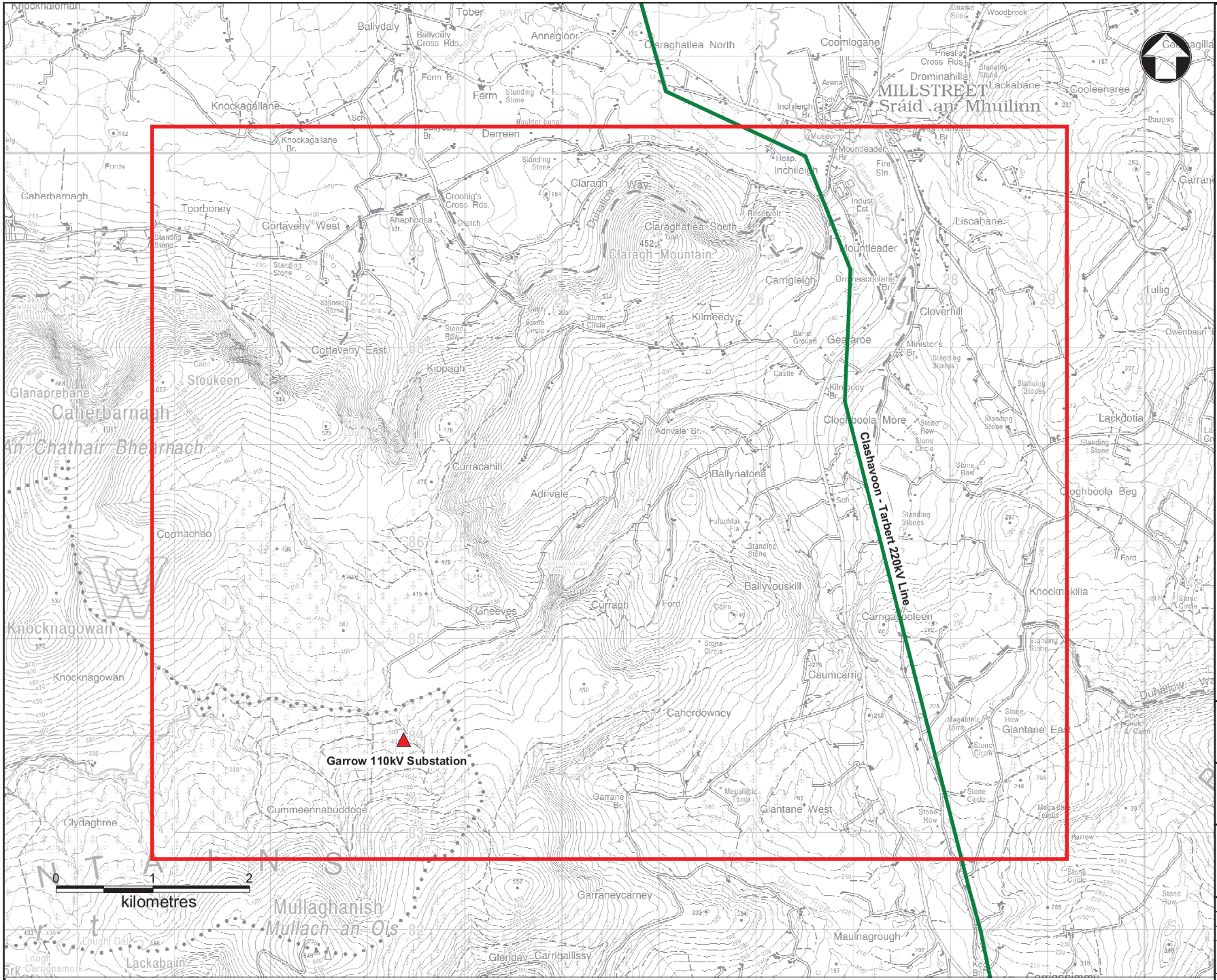
- To plan and develop the grid infrastructure needed to support Ireland's economy.

- To supervise the security of the national grid.

- To schedule electricity generation with power generators and stations.

- To facilitate the market for renewable electricity in Ireland.

It is in this capacity that EirGrid is proposing the new 220/110 kV Millstreet substation and associated transmission connections.




## LEGEND

- Existing Garrow 110kV Substation
- Existing Clashavoon - Tarbert 220 kV Line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Project: Millstreet Project

Figure 1.1

| | | | | | |
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| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |

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Mapinfo file: 261715-N-001
Status: INF
Drawing Number: MMD-261715-N-MI-001
Rev: P1



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## 1.5 Strategic Planning Context

### 1.5.1 Government Objectives

**White Paper on Energy Policy Framework 2007 - 2020**

This paper sets out the government's Energy policy framework 2007-2020 to deliver a sustainable energy future for Ireland to 2010.

Security of supply is identified in the Government White Paper entitled *Energy Policy Framework 2007 – 2020* as being vitally important for the Irish economy. The paper emphasises the necessity for robust electricity networks and electricity generating capacity to ensure consistent and competitive supply of energy.

Strategic Goals outlined in the White Paper in relation to security of energy supply include:

- Ensuring that electricity supply consistently meets demand;
- Delivering electricity and gas to homes and businesses over efficient, reliable and secure networks; and
- Being prepared for energy supply disruptions.

**GRID25**

The Irish government has set ambitious targets for Renewable Energy Sources (RES) which are: 15% of electricity supply by the end of 2010 and 40% by 2020. The South West region of Ireland in particular has been identified as having an abundance of renewable sources to meet these renewable energy targets.

GRID25 – A Strategy for the Development of Ireland's Electricity Grid for a Sustainable and Competitive Future (2008) outlines EirGrid's high level strategy for upgrading Ireland's electricity network up to 2025. Grid25 identified that expected new generation can only be facilitated by the provision of significant new electricity transmission infrastructure in the region.

**National Development Plan 2007-2013**

The National Development Plan 2007-2013 (NDP) sets out the investment programme for Ireland for the period 2007 to 2013 providing for investment in economic infrastructure, social inclusion measures, social infrastructure, human capital and enterprise, science and innovation.

The primary objective of the Energy Programme is to ensure the security of energy supply both nationally and regionally. In terms of the transmission network the NDP states that "*during the period 2007-2013, the main focus of investment by EirGrid will entail improvement of the transmission network for electricity to accommodate increased usage and enhance security of supply, to allow increased connection of sustainable and renewable energy sources to the network and to support greater interconnection with Northern Ireland and Great Britain*".

It is considered that the objectives of the NDP remain valid, despite the current economic downturn.

**National Spatial Strategy 2002-2020**

The National Spatial Strategy (NSS) is a twenty year planning framework designed to achieve a better balance of social, economic and physical development and population growth between regions in Ireland, and to assist in the implementation of the NDP.

The NSS identifies that reliable and effective energy systems such as electricity are key prerequisites for effective regional development. According to the NSS, the trend of growing demand for electricity raises spatial planning issues in relation to priorities for reinforcing the transmission and distribution networks. In this regard, the NSS states that a major programme of work is underway to reinforce the national grid in order to meet international supply standards and to take account of rising demand.

Cork City has been identified as a Gateway by the NSS. Gateways have a key strategic function to provide and support national-scale social, economic, infrastructural and service growth. The town of Mallow has been designated as a Hub in the NSS, with Tralee and Killarney designated as a linked Hub to support the surrounding rural hinterland. Hubs are designated to support the national and international role of the Gateways and, in turn, energise smaller towns and rural areas within their sphere of influence. The area of the proposed development, between Millstreet and Macroom, has been identified as a *"Rural Area with Strong Potential for Diversification"*.

**National Energy Efficiency Action Plan**

The National Energy Efficiency Action Plan 2009 – 2020 sets out Government plans and actions to achieve a target of 20% energy efficiency savings across the economy in 2020 as outlined in the Government Energy Policy framework 2007-2020.

The action plan recognises the planned development of the electricity transmission network as outlined in GRID25 and identifies that energy efficiencies may be further improved through the deployment of new technologies, reinforcement of the system, replacing ageing assets, increased use of embedded local generation and the introduction of improved load-management regimes.

### *1.5.2 Regional Objectives*

**Regional Planning Guidelines for the South West Region 2010 - 2022**

The Regional Planning Guidelines (RPG) for the South West Region were published in October 2010. The RPG notes that demand for electricity in the South West Region is expected to rise by 60% by 2025.

The RPG states that "*it is critical that (the electricity transmission network) is developed in a sustainable manner to ensure that the region has the necessary infrastructure to attract business and accommodate economic growth and the future development of our local economy*". The RPG recognises EirGrid's role in ensuring that there is adequate network capacity to carry power from new generation stations and to ensure a reliable supply to meet growing demand for electricity.

Objective RTS-09 of the RPG states that "*it is an objective to facilitate the sustainable development of additional electricity generation capacity throughout the region and to support the sustainable expansion of the network. National grid expansion is important in terms of ensuring adequacy of regional connectivity as well as facilitating the development and connectivity of sustainable renewable energy resources*".

**The provision of transmission development and reinforcement in the Millstreet area is therefore supported and planned for at a regional level.**

### *1.5.3 Local Objectives*

The majority of the study area under consideration, as discussed in Chapter 2 (*Study Area and Constraints Identification*) of this report, is located in County Cork, however, the south western section encompasses, and the proposed development is required to connect to, Garrow substation in County Kerry. The relevant local planning policy guidelines for both County Cork and County Kerry are therefore considered hereunder.

**Cork County Development Plan 2009**

The Cork County Development Plan 2009 (CDP) was adopted in January 2009. Chapter 6 of the CDP considers Transport and Infrastructure.

In terms of Energy Networks and Infrastructure, Objective INF 7-1(a) states "*It is an objective to recognise the national importance of ensuring security of energy supplies for servicing a whole range of economic sectors in line with the Government's White Paper 'Delivering a Sustainable Energy Future for Ireland."*

Objective INF 7-1(b) states "*It is a general objective, where strategic route corridors have been identified, to support the statutory providers of national grid infrastructure by safeguarding such strategic corridors from encroachment by other developments that might compromise the provision of energy networks."*

Objective INF 7-5 states "*It is an objective of this Plan to ensure that the siting of electricity power lines be managed in terms of the physical and visual impact of these lines on both the natural and built environment and the conservation value of European sites, especially in landscape character areas that have been evaluated as being of high landscape sensitivity. When considering the siting of powerlines in these areas, consideration will be given to undergrounding or the selection of alternative routes*."

The CDP highlights that the provision of secure and reliable electricity transmission infrastructure is essential to ensuring the growth of the local economy.

**Kanturk Electoral Area Local Area Plan 2005**

The town of Millstreet, and the majority of the study area, are located within the Kanturk Electoral Area (EA) and Coomlogane Electoral Division (ED). In terms of planning requirements for the energy industry and utilities generally, the Kanturk Electoral Area Local Area Plan (LAP) 2005 states that safeguards need to be put in place to ensure that energy projects do not in themselves constitute negative impacts, particularly in areas of environmental or landscape sensitivity.

**Kerry County Development Plan 2009 – 2015**

The Kerry CDP recognises that the provision of electrical power is significant to the economic development of the county and that it is vital that Kerry has sufficient capacity to meet current and future needs. Chapter 8 (Transport and Infrastructure) of the CDP includes specific objectives relating to the location of energy services including transmission networks.

Objective INF 8-62(a) states *"It is an objective of the Council to co-operate and liaise with the ESB, EirGrid and other interested providers to ensure adequate power capacity for the future needs of the county."*

Objective INF 8-62(c) states *"It is an objective of the Council to achieve, in consultation with the service providers, the under grounding of new lines where these are proposed in areas of high visual amenity."*

Objective INF 8-63 states *"It is an objective of the Council to support the infrastructural renewal and development of electricity networks in the region, including the overhead lines necessary to provide the required networks."*

**Tralee & Killarney Environs Local Area Plans 2007**

The south western section of the project area is located across the Kerry / Cork border within Killarney Electoral Area. The Tralee & Killarney Local Area Plan acknowledges that there is a relatively poor network of power lines throughout the county and states that it is imperative for the council to facilitate the provision of new high voltage electricity infrastructure in the region.

**The provision of transmission development and reinforcement in the Millstreet area is therefore supported and planned for at a local level.**

## 1.6 EirGrid Policy on the Use of Overhead Line and / or Underground Cable

EirGrid always considers the use of both overhead line (OHL) and underground cables (UGC) when proposing a new high voltage transmission circuit but does so in accordance with its policy on the matter.

This report considers both OHL and UGC options available for both the 110 kV connection required from the proposed new substation to the existing 110 kV substation at Garrow in County Kerry and the required 220 kV connection from the proposed new substation to the existing 220 kV Clashavoon - Tarbert line having due regard to EirGrid's policy on the use of Overhead Line and/or Underground Cable, a copy of which is included as Appendix A of this report. The policy, in the context of the Millsteet project, is discussed further in Chapter 7 (*Conclusions and Recommendations*).

## 1.7 Project Description

The proposed Millstreet Project comprises a new 220/110 kV substation in the vicinity of Millstreet, County Cork. A 220 kV connection will be required from the new substation to the existing 220 kV Clashavoon-Tarbert transmission line. A 110 kV connection is also required from the new substation to the existing 110 kV Garrow substation in County Kerry to facilitate the connection of wind onto the 220 kV network.

At this stage of the project a number of options are under consideration, including substation site location and type and both 220 kV and 110 kV overhead line and underground cable connections. The following sections of this report describe the various structures under consideration. Substation site location and transmission route corridor options are described in detail in Chapter 3 (*Substation Site and Route Corridor Selection*) of this report.

## 1.8 Structure Description

### 1.8.1 Substation Design and Layout

The proposed substation will comprise various electrical installations, structures and a control building. Both GIS (Gas Insulated Switchgear) and AIS (Air Insulated Switchgear) substation design options are currently under consideration.

In an AIS substation all of the high voltage plant and equipment are outdoors in a switchyard, utilising air as the insulating medium. A large site footprint, approximately 10 acres, is therefore required to provide large clearances between electrical equipment. 220/110 kV AIS outdoor equipment typically measures up to 20 metres in height.

The majority of equipment associated with a GIS substation (other than transformers, coupling equipment, and connections) is housed within a building. Sulphur Hexafluoride ($SF_6$) gas is used as the insulating medium which permits a much more compact design. GIS buildings typically have an industrial appearance (dependent on architectural finishing), and range in height from 10 to 12 metres, but may be larger depending on the building design i.e. the building can be elevated to permit access to equipment, which may add up to an additional 4 metres in height. A GIS substation footprint, excluding mitigation planting, typically measures approximately 4 acres.

As detailed above, GIS substations can offer significant advantages over AIS substations in terms of site footprint and reduced structure height. In addition, as the majority of equipment is housed within a building, GIS substations offer the opportunity to design the building to fit into the surrounding landscape. For these reasons, it is currently considered that GIS is the preferred option for the Millstreet Project.

The substation will not generally be manned, although regular maintenance checks are anticipated.

Images of typical AIS and GIS substations are presented in Figures 1.2 and 1.3 below.

Figure 1.2: Typical AIS Substation

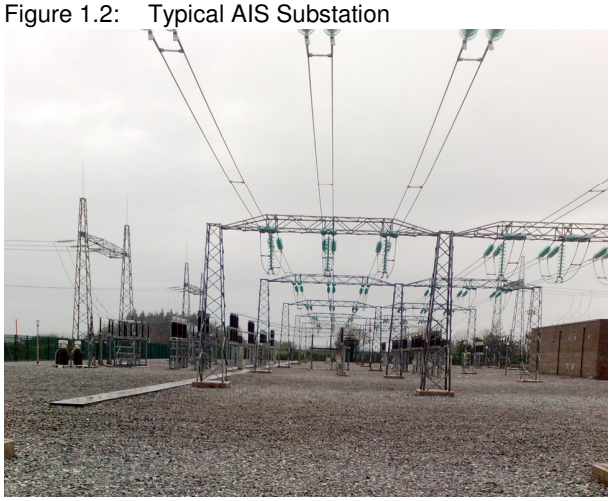


Figure 1.3: Typical GIS Substation

In addition, two new 110 kV circuits from the new substation will be required to link to the existing Garrow 110 kV substation in County Kerry. This will require a modest extension to Garrow substation to facilitate connection of the new circuits. Planning permission for the extension to Garrow substation has been lodged with Kerry County Council by ESB networks.

### *1.8.2 Overhead Line Structures*

The overhead line (OHL) structures may include Single Circuit (SC) and / or Double Circuit (DC) 110 kV and 220 kV lines.

Wood poles will generally be used for 110 kV SC lines; however, lattice steel towers will be required for any angle points, i.e. changes in direction, and at the line ends. Lattice steel towers will be required for all 220 kV OHL and for 110 kV DC lines.

The number and distribution of wood poles and steel towers cannot be determined for an OHL connection at this early stage of the project and will be dependant on the alignment of the preferred route and an assessment of appropriate design options.

**110 kV Overhead Line Structures**

A 110 kV connection is required from the new substation to the existing 110 kV Garrow substation in County Kerry. Potential 110 kV OHL structures are described hereunder.

***Overhead Line SC Intermediate Wood Polesets***

These consist of two wood poles, approximately 5 metres apart connected near the top with a rolled steel channel. The polesets carry three conductors (one circuit) suspended from electrical insulators and two earthwires which are supported at the tops of the poles on earthwire brackets which protrude approximately 0.45 metres above the top of the pole, as illustrated in Figures 1.4 and 1.5.

Figure 1.4: Outline of a Typical 110 kV SC Earthwire Poleset

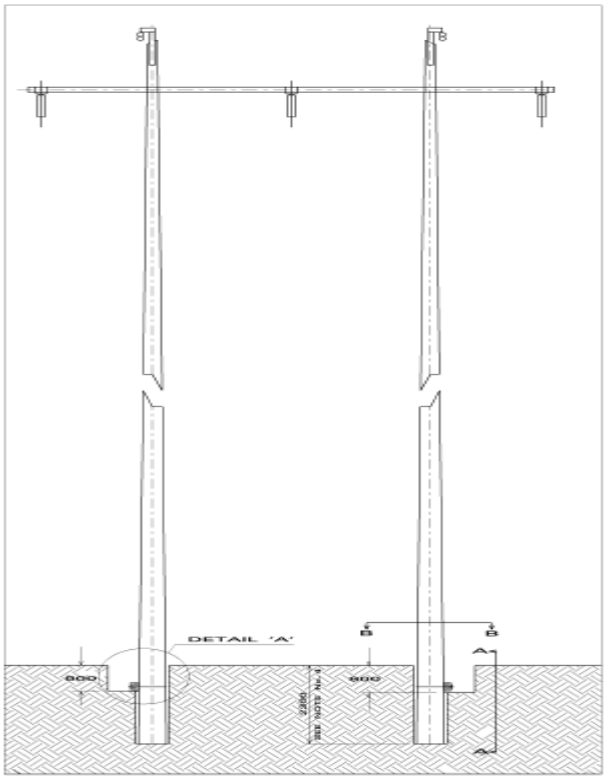


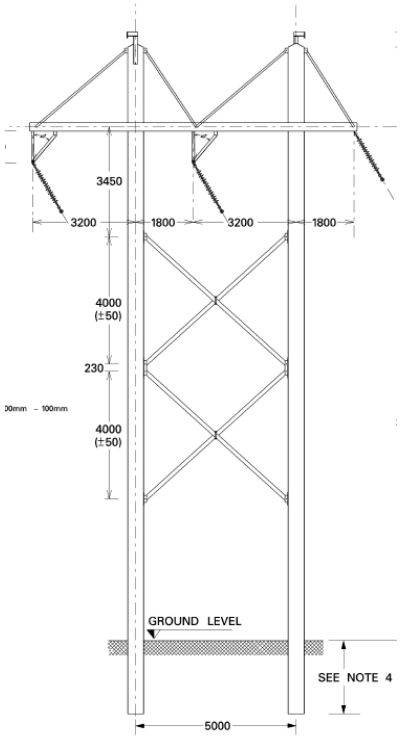

Figure 1.5: Typical 110 kV SC Earthwire section

**Overhead Line SC Angle Structures**

***Braced Poleset (less than 20 degree line angle)***

These polesets look similar to those described above; however the poleset is braced along its centre using two steel channels for extra strength, as illustrated in Figure 1.6.

Figure 1.6: Outline of Typical Earthwire Braced Poleset




### *Steel Angle Towers*

Angle towers are galvanised lattice steel structures used wherever the overhead line changes direction. The angle structure holds three conductors (one circuit) attached to electrical insulators in horizontal formation to its bottom crossarm. Two earthwires are supported on the earthwire peak of the tower, as illustrated in Figure 1.7 and Figure 1.8.

Figure 1.7: Outline of 110 kV Steel Angle Tower

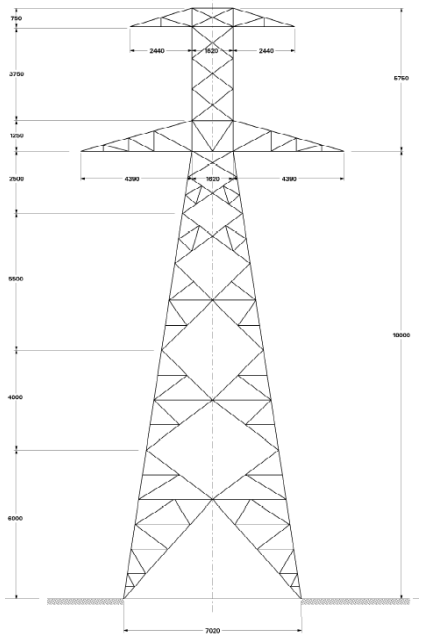


Figure 1.8: Typical 110 kV Steel Angle Tower

### *110 kV Double Circuit Towers*

Double circuit towers for both intermediate and angle overhead line supports are galvanised lattice steel structures. The double circuit tower is characterised by having three conductors (one circuit) arranged in vertical formation on either side of the tower which makes up two circuits. The conductors are attached to the supporting crossarms by means of electrical insulators. One earthwire is supported on the peak of the tower, as illustrated in Figure 1.9 and Figure 1.10.

Figure 1.9: Outline of Typical 110 kV DC Tower

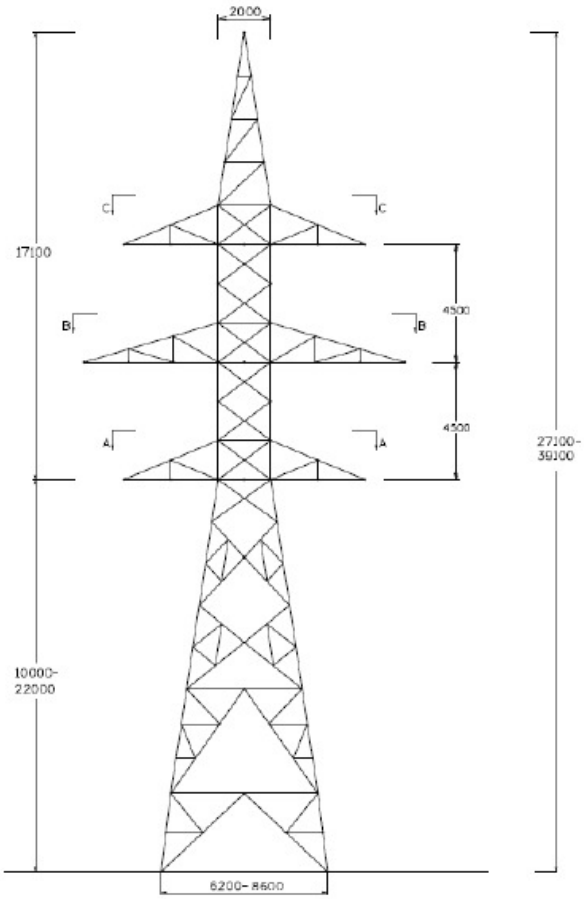



Figure 1.10: Typical 110 kV DC Tower

**220 kV Overhead Line Structures**

A 220 kV connection is required from the new substation to the existing 220 kV Clashavoon – Tarbert transmission line. Potential 220 kV OHL structures are described hereunder.

***220 kV SC Towers***

Single circuit towers for both intermediate and angle overhead line supports are galvanised lattice steel structures. The intermediate and angle structure holds three conductors (one circuit) attached to electrical insulators. Two earthwires are supported on the earthwire peak of the tower, as illustrated in Figure 1.11 and Figure 1.12.

Figure 1.11: Outline of Typical 220 kV SC Tower

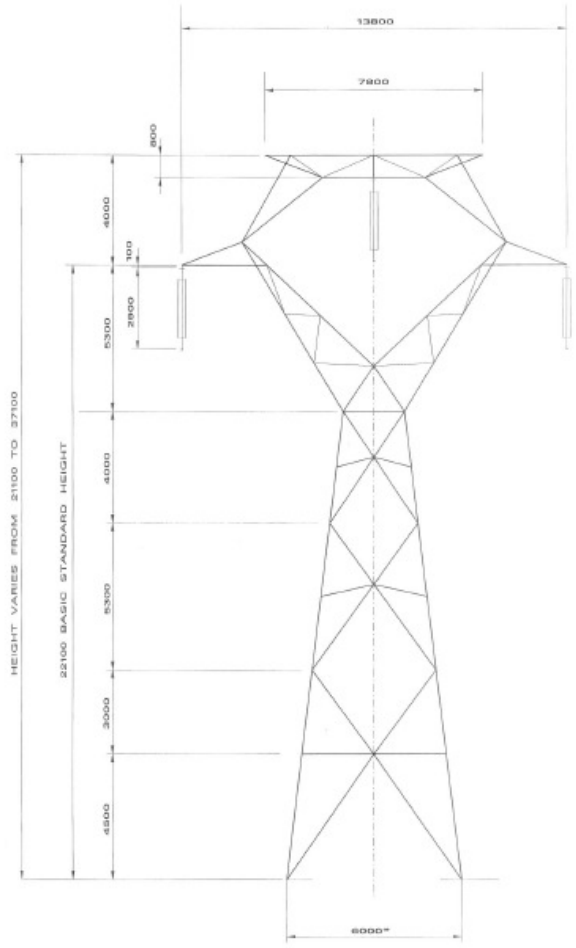



Figure 1.12: Typical 220 kV SC Tower

***220 kV Double Circuit Towers***

Double circuit towers for both intermediate and angle overhead line supports are galvanised lattice steel structures. The double circuit tower is characterised by having a circuit (comprising three conductors) arranged in vertical formation on either side of the tower. The conductors are attached to the supporting crossarms by means of electrical insulators. One earthwire is supported on the peak of the tower, as illustrated in Figure 1.13 and Figure 1.14.

Figure 1.13: Outline of Typical 220 kV DC Tower

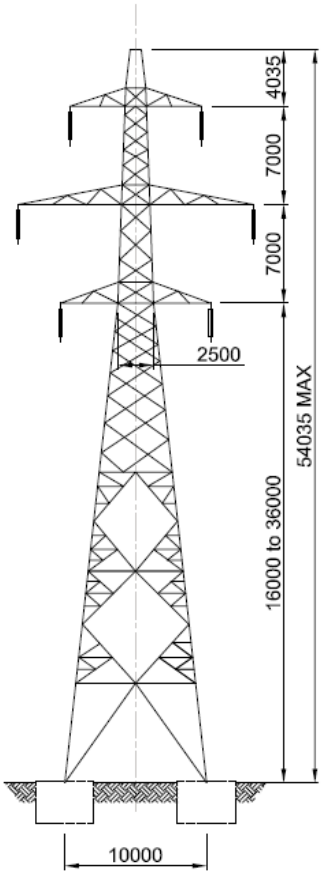



Figure 1.14: Typical 220 kV DC Tower

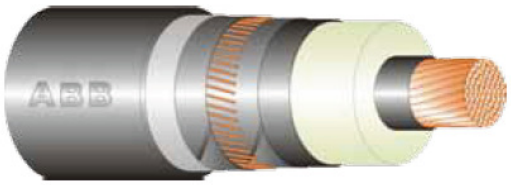
### *1.8.3 Underground Cable Structures*

**110 kV Underground Cable**

The two 110 kV circuits required for connection of Garrow Substation to the new Millstreet Substation can potentially be provided using underground cable instead of overhead line.

The cable that would be used comprises cross linked polyethylene (XLPE) insulated electrical conductors, typically surrounded by HDPE (High Density Polyethylene), with a diameter of approximately 85mm. Three separate cables of this type would be required for each circuit. A typical 110 kV cable circuit is presented in Figure 1.15 below.

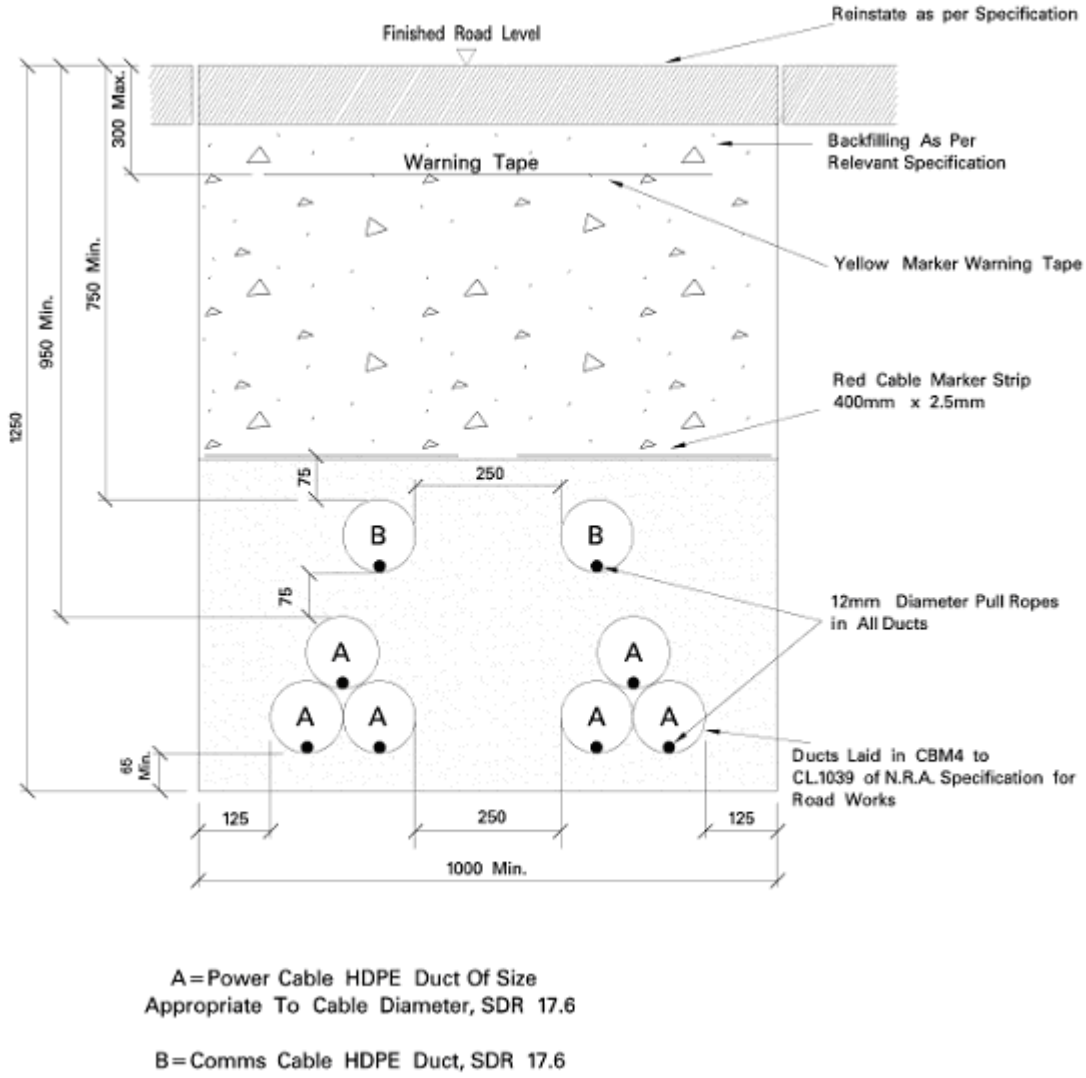
Figure 1.15: Typical 110 kV Cable (Courtesy ABB)




Installation of the underground cable would require burial in a trench of approximately 1 metre width, at a depth of approximately 1.2 metres. The cable would typically be installed in ducts, in trefoil arrangement, surrounded by approximately 500mm of cement bound material. The trench would be backfilled and reinstated, as appropriate. The cables would be pulled through the ducts in lengths of around 500 metres, which corresponds to the approximate length of cable that can be shipped on a standard size cable drum. The sections of cable would be jointed at specially selected joint bay positions, which would also be backfilled and reinstated after jointing to complete the installation.

The 110 kV circuits would follow existing private roads and access routes. It is anticipated that approximately 30-50 metres per day of UGC can be installed requiring no more than 50 metres of the road / track to be open at any one time. A joint bay, which is larger in size than the standard trench required to be installed, would be required at approximately 500 metre intervals. A typical cross section for a 110 kV duct installation is presented in Figure 1.16 below.

Figure 1.16 Typical cross section for 110 kV duct installation for two circuits




**220 kV Undergound Cable**

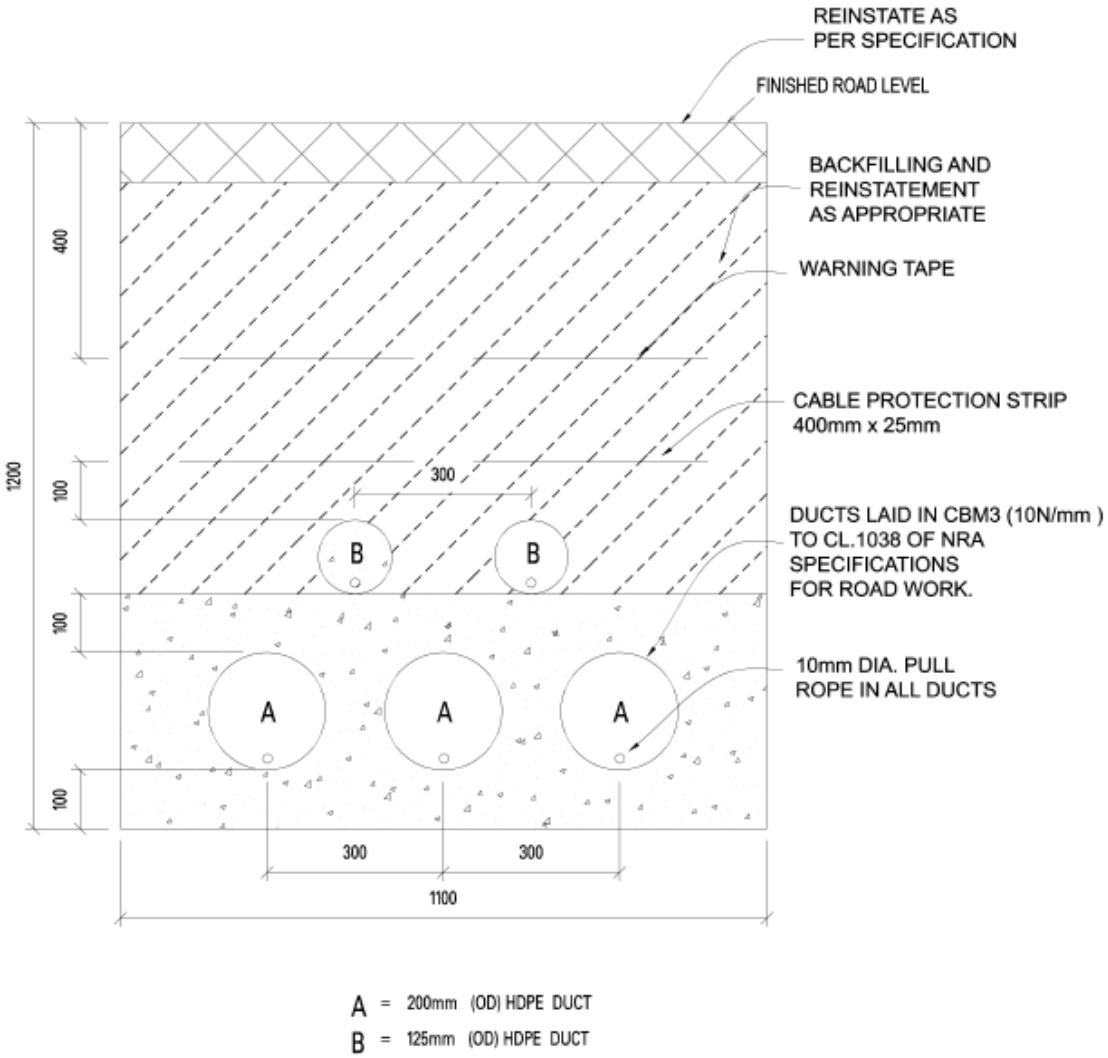
The two 220 kV circuits required for connection of the new Millstreet substation to the existing 220 kV overhead lines can also potentially be installed using underground cable instead of / in combination with overhead line.

The cable for 220 kV is a similar construction to that for the 110 kV in that it also comprises cross linked polyethylene (XLPE) insulated electrical conductors and typically is surrounded by HDPE (High Density Polyethylene). It would have a larger diameter of approximately 110mm. Also, three separate cables of this type would be required for each circuit.

Installation of the underground cable would require burial in a trench of approximately 1.1 metre width, at a depth of approximately 1.2 metres. The cable would typically be installed in ducts, in a flat formation, surrounded by approximately 300mm of cement bound material. The trench would be backfilled and reinstated, as appropriate. The cables would be pulled through the ducts in sections of around 500 metres which is the approximate length of cable that can be shipped on a standard size cable drum. The sections of cable would be jointed at specially selected joint bay positions, which would also be backfilled and reinstated after jointing to complete the installation.

For 220 kV circuits, an UGC option would follow existing road and track routes, where possible. Again it is anticipated that approximately 30-50 metres per day of UGC can be installed requiring no more than 50 metres of the road / track to be open at any one time. A joint bay, which is larger in size than the standard trench required to be installed, would be required at approximately 500 metre intervals. A typical cross section for a 220 kV duct installation is presented in Figure 1.17.

Figure 1.17: Typical cross section for 220 kV duct installation




### *1.8.4 220 kV Overhead Line / Underground Cable Interface*

A line to cable interface mast would be required to connect 220 kV underground cables to existing overhead transmission lines. In the case of the 110 kV UGC, these interface masts would not be required as the cable could run directly between the new substation and the existing Garrow substation equipment without the need to interface with any overhead lines.

Typical images of UGC/OHL interfaces are presented in Figures 1.18 to 1.20 below.

Figure 1.18: Outline of Typical 220 kV OHL/UGC Interface

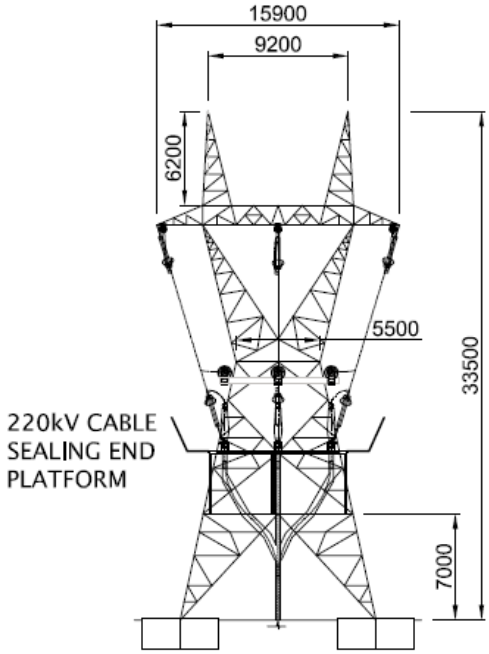



Figure 1.19: Typical OHL/UGC Interface with Platform Mounted Cable (110 kV)

Figure 1.20: Typical 220 kV OHL/UGC Interface with Cable Termination Compound

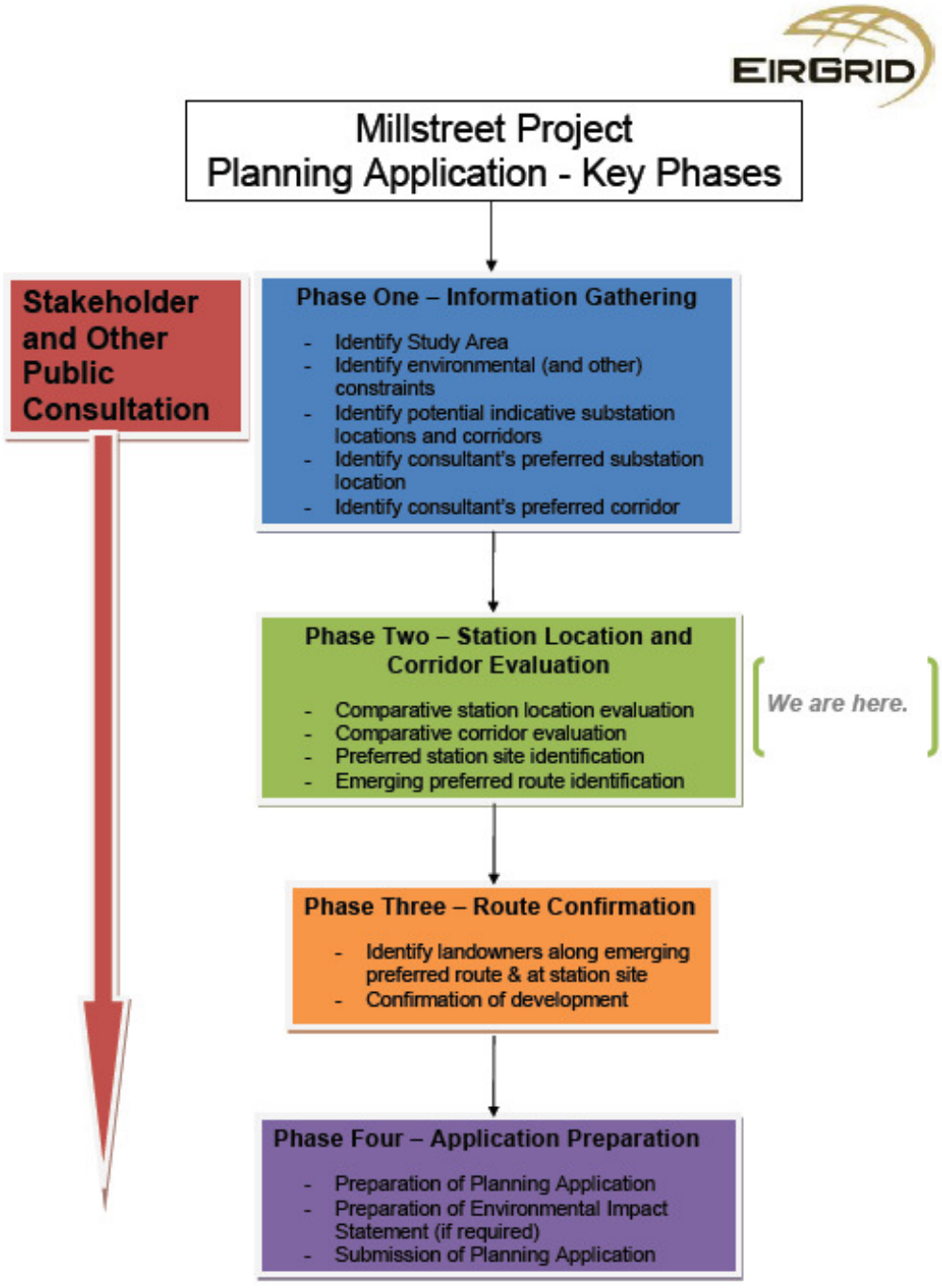
### *1.8.5 Technical Alternatives Considered*

A Clashavoon-Garrow 110 kV circuit was assessed as an alternative and this option was deemed not technically feasible as it would not provide the necessary transmission capacity to transfer the renewable power to the existing 220 kV network in the area.

## 1.9 Project Roadmap

A project roadmap outlining the key phases of the project is provided in Figure 1.21 hereunder.

Figure 1.21: Project Roadmap



## 1.10 Project Team

Mott MacDonald Ireland (MM) is the Lead Consultant on this project. Specialist consultants involved in the project, including the preparation of this report, are as follows:

- **Flora and Fauna -** Tobin Consulting Engineers
- **Cultural Heritage -** Moore Group / Tobin Consulting Engineers
- **Landscape and Visual –** RPS Group

## 1.11 Safety

MM has been appointed as Project Supervisor Design Process (PSDP) whose duties are defined in the *Safety, Health and Welfare at Work (Construction) Regulations 2006* (S.I. No. 504 of 2006). In this capacity MM will coordinate the work of all designers to ensure that the proposed project submitted to An Bord Pleanála, so far as is reasonably practicable:

(*a*) is designed and is capable of being constructed to be safe and without risk to health;

(*b*) can be maintained safely and without risk to health during use; and

(*c*) complies in all respects, as appropriate, with the relevant health and safety statutory provisions.

# 2. Study Area and Constraints Identification

## 2.1 Study Area Identification and Description

Mott MacDonald Ireland (MM) initially identified a study area of approximately 63 square kilometres south of Millstreet, County Cork within which the proposed development could reasonably occur. The area extended from the village of Millstreet in the north to a section of the regional R582 road approximately seven kilometres south in the townland of Carrigacooleen, and from the environs of the R582 in the east to the upland mountain slopes of Mullaghanish and Caherbarnagh in the west, as illustrated in Figure 2.1 (*Preliminary Constraints Map*).

Within this identified study area MM completed a desk-based constraints assessment, utilising existing publicly available datasets. The purpose of the constraints assessment was to identify the least sensitive areas within the initial study area boundary which would be considered suitable for the location and operation of a new 220/110 kV substation, and, associated OHL/UGC connection route corridors.

The determination of environmental and other constraints within the initial study area was based on consideration of the nature and location of the project, the general topography and designated ecological conservation sites i.e. Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA).

## 2.2 Identification of Constraints

In determining appropriate substation site and route corridor options within the preliminary study area, due regard has been had to a number of physical and environmental constraints including those detailed below:

- **Physical Terrain**

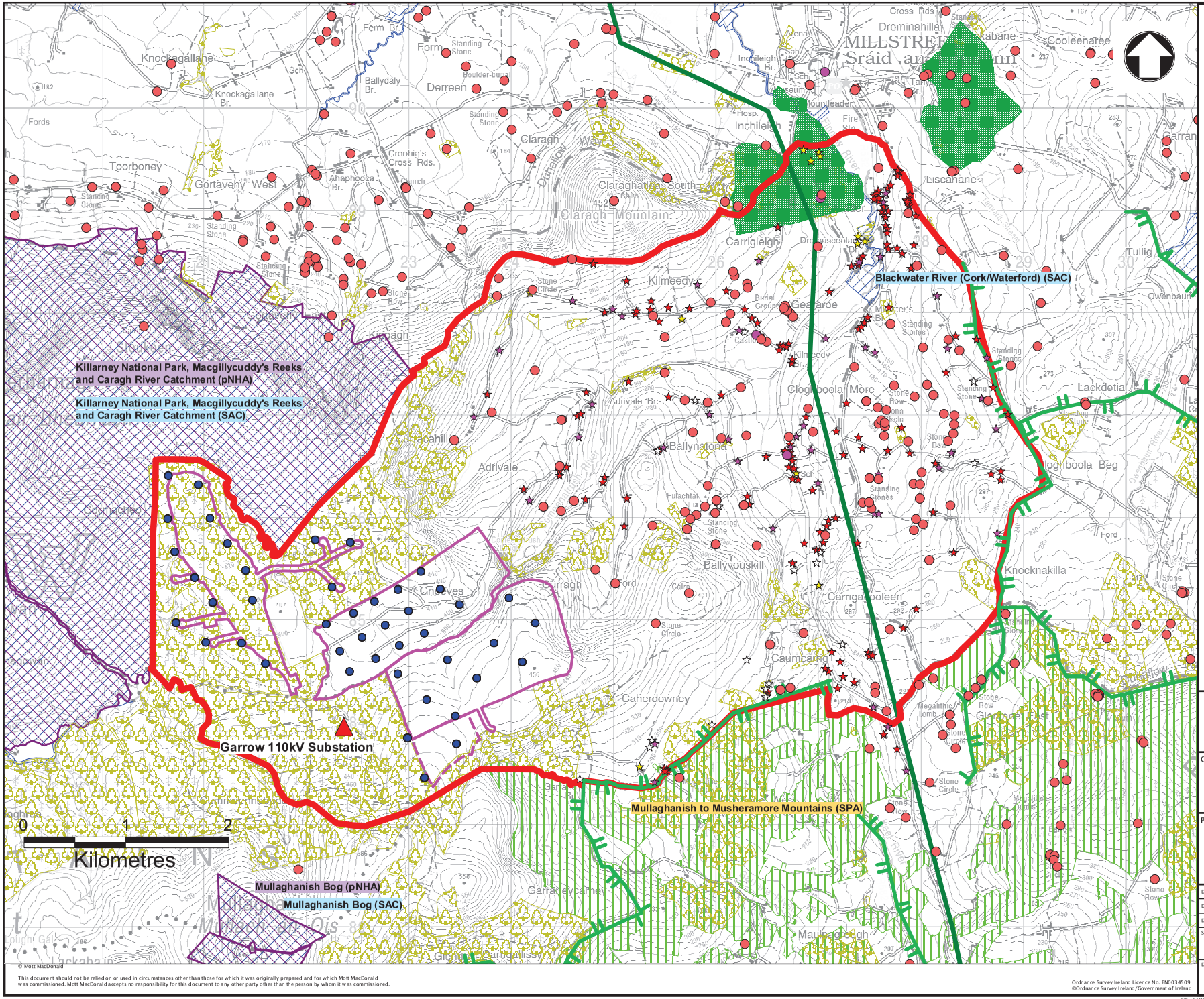
Millstreet and its environs are characterised by a landscape of mountainous terrain, blanket bogland and rivers. These areas include a number of legally designated ecological conservation sites in close proximity to Millstreet including:

- Mullaghanish to Musheramore Mountains Special Protected Area (SPA);
- Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment Special Area of Conservation (SAC) and proposed Natural Heritage Area (pNHA);
- Blackwater River (Cork/Waterford) SAC; and
- Mullaghanish Bog SAC and pNHA.

In addition, the mountainous terrain immediately surrounding Millstreet presents potential visual impact, potential technical and access constraints associated with the development of OHL connections in particular. The area east and west of Millstreet has been designated a scenic landscape. In addition, a number of scenic routes run to the east and south of the study area.

- **Cultural Heritage**

This area of County Cork is characterised by a significant intensity of Bronze Age archaeological features. A significant number of recorded monuments are located in close proximity to Millstreet, including a stone circle located in the townland of Ballyvouskill.




## LEGEND

- Initial Project Study Area
- Existing Garrow 110kV Substation
- Existing Clashavoon Tarbert 220kV Line
- Designated Scenic Landscape
- Forestry
- Scenic Route

### Cultural Heritage Sites

- National Monuments
- Record of Monuments & Places
- Record of Protected Structures

### Environmental Designations

- NHA/pNHA
- SPA
- SAC
- Caherdowney Windafarm (Permitted)
- Curragh, Gneeves & Coomacheo Windfarms (Constructed)
- Wind Turbine

### GeoDirectory Data

*(Data Sourced from An Post)*

- Residential
- Commercial
- Both Residential & Commercial
- Unknown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www.eirgrid.com


Project

Preliminary Constraints Map

Figure 2.1

| | | | | | |
|---|---|---|---|---|---|
| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |
| Scale at A3 | 1:35,000 | Project | 261715 | Status | INF |
| | | Mapinfo file | 261715-N-002 | | |
| Drawing Number | MMD-261715-N-MI-002 | | | Rev | P1 |



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- **Existing Developments**

An adequate design distance is required between wind turbines and OHL to reduce the risk of fallen wind turbines damaging overhead conductors and to prevent excessive wind disturbance of the lines caused by the wake of the turbine blades. Gneeves, Curragh and Coomacheo wind farms are located directly north, east, north west and north east of Garrow substation. Planning permission has also been granted for a wind farm to the south east of Garrow.

In addition, a sandstone quarry occupying approximately 28 acres is located approximately 4 kilometres south of Millstreet.

- **Population Densities**

The main settlements of the area are located in and around the town of Millstreet. Clusters of dwellings are also located adjacent to the R582 (Macroom / Millstreet) road.

## *2.3 Constraints Map Production and Summary*

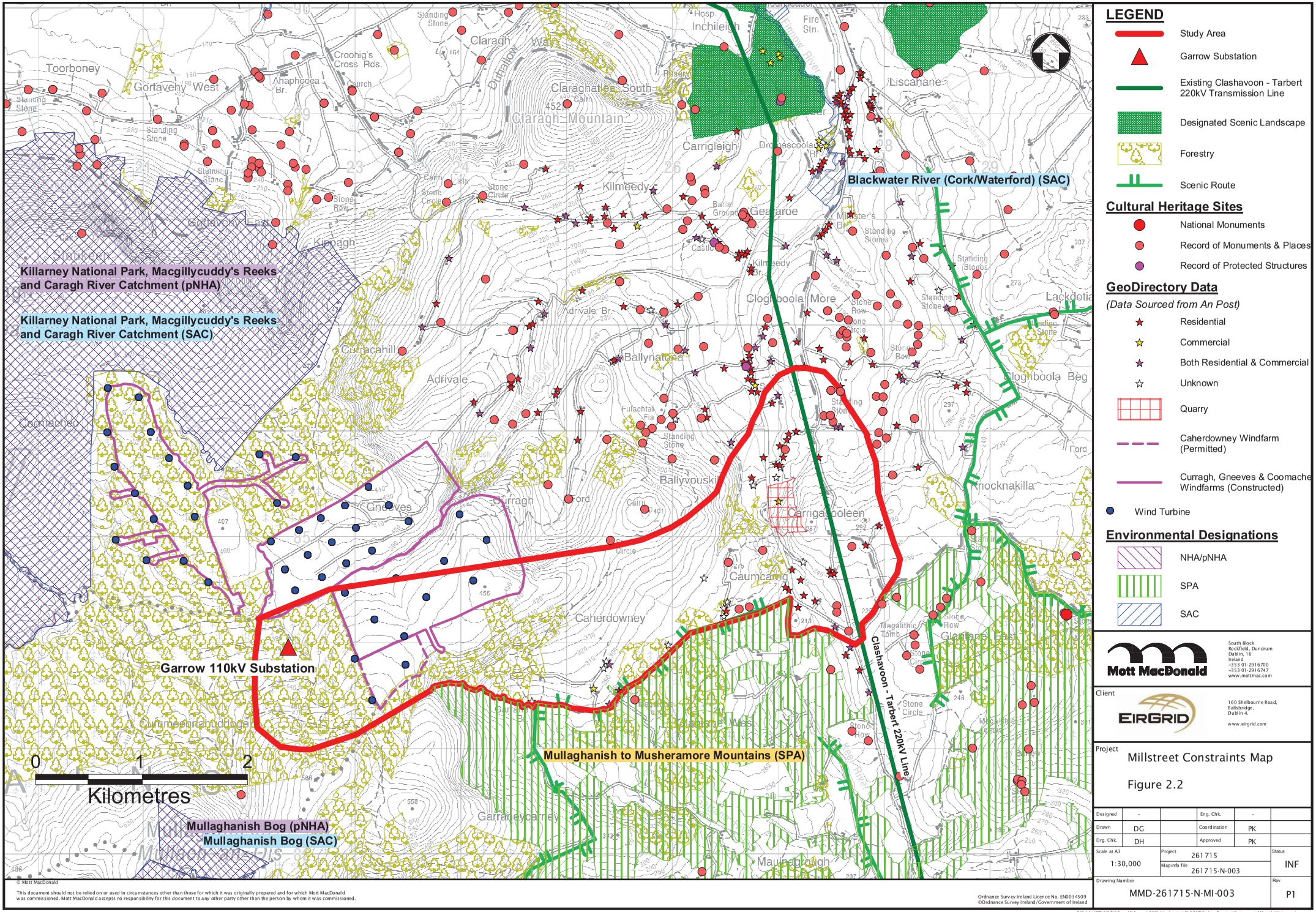
Following the completion of a preliminary constraints assessment, it was determined that; due primarily to physical terrain, existing developments (i.e. wind farms), visual impact and cultural heritage constraints, it would be neither feasible nor preferable to develop in the area to the north and west of the townland of Ballyvouskill. The study area was therefore refined, as illustrated in Figure 2.2 (*Millstreet Constraints Map*).

The refined study area is located approximately 4 kilometres south of Millstreet and measures approximately 9 square kilometres in total, and 1 kilometre from north to south. The study area is dissected by the R582 road to the east and encompasses Garrow substation in County Kerry and Curragh wind farm. The permitted, but yet to be constructed, Caherdowney wind farm is also located in the western section of the study area in proximity to the existing Garrow substation.

The study area has been characterised in accordance with the constraints outlined in Table 2.1 below. Appendix B (*Study Area Characterisation*) of this report presents the findings of the study area characterisation.

Table 2.1: Identified Constraints

| Aspect | Criteria |
|---|---|
| **Man-made Constraints** | |
| Planning | Land use zoning. |
| Land Characteristics | – Physical constraints associated with site and transmission connection route options;<br>– Compatibility with established and planned land uses in the surrounding area;<br>– Proximity to residential properties; and<br>– Standard of existing road network. |
| Cultural Heritage | – Proximity to cultural heritage sites;<br>– Cultural heritage value;<br>– Landscape setting and context;<br>– Amenity value;<br>– Viewer incidence; and<br>– Public accessibility. |
| **Natural Constraints** | |
| Ecology | – Ecological value of the development footprint;<br>– Proximity to designated sites; and |




## LEGEND

- Study Area
- Garrow Substation
- Existing Clashavoon - Tarbert 220kV Transmission Line
- Designated Scenic Landscape
- Forestry
- Scenic Route

### Cultural Heritage Sites

- National Monuments
- Record of Monuments & Places
- Record of Protected Structures

### GeoDirectory Data

*(Data Sourced from An Post)*

- Residential
- Commercial
- Both Residential & Commercial
- Unknown
- Quarry
- Caherdowney Windfarm (Permitted)
- Curragh, Gneeves & Coomache Windfarms (Constructed)
- Wind Turbine

### Environmental Designations

- NHA/pNHA
- SPA
- SAC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Project

Millstreet Constraints Map

Figure 2.2

| | | | | | |
|---|---|---|---|---|---|
| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |
| Scale at A3 | 1:30,000 | Project | 261715 | Status | INF |
| | | Mapinfo file | 261715-N-003 | | |
| Drawing Number | MMD-261715-N-MI-003 | | | Rev | P1 |



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| Aspect | Criteria |
|---|---|
| | – Proximity to water courses. |
| Landscape and Visual | – Landscape fit;<br>– Landscape character sensitivity;<br>– Proximity to designated scenic landscapes and protected views; and<br>– Proximity to sensitive visual receptors. |
| Soils, Geology and Hydrogeology | – Commercial Geology (e.g. mines and quarries)<br>– Soil type and stability; and<br>– Anticipated volumes of excavation and fill required. |
| Water | – Baseline water quality;<br>– Historical flooding<br>– Proximity to water courses; and<br>– Number of crossing points over water courses. |

The characterisations were based primarily on desk-based assessments. Where possible, specialist technical staff visited potential substation sites and transmission connection routes. Where this was not possible due to access issues, inspections were obtained where possible from publicly accessible roads and tracks.

## 2.4 Phase One Consultation

### 2.4.1 Meetings

To date the project team has met with the following stakeholders in order to provide preliminary data regarding the proposed development and to seek to obtain information which will inform the design process regarding key environmental constraints:

- Cork County Council Planning Department – 9th October 2009;
- Kerry County Council Planning Department – 4th November 2009;
- Cork County Council Heritage Unit - 17th November 2009;
- Cork County Council Area Engineer – 17th August 2010;
- Department of the Environment, Heritage and Local Government (National Parks and Wildlife Service) - 16th February 2010; and
- Department of the Environment, Heritage and Local Government (National Monuments Section) - 16th February 2010.

EirGrid has also entered into pre-application consultation with An Bord Pleanála (the Board) with a view to lodging the planning application for the project with the Board in accordance with section 182A of the Planning and Development Act 2000, as amended.

A project specific web page (www.eirgridprojects.com/projects/millstreet/) has been developed to facilitate widespread accessibility to project data and to facilitate the communication of information specific to the project. This project web page will be regularly updated as the project progresses.

### 2.4.2 Public Open Days

**Open Day 1**

The first public information days were held in the Castle Hotel in Macroom on Tuesday 29th June 2010 between 3.00pm and 8.00pm and Wednesday 30th June 2010 between 11.00am and 8.00pm. Prior to the

public meeting a presentation was given to elected representatives detailing the current status of the project and the works undertaken to date. The purpose of this presentation was to ensure that the elected representatives were informed of the proposed development and to obtain their input into the project.

The public information days were advertised in both *The Corkman* and *The Southern Star* newspapers on Thursday 24th June 2010 and Saturday 26th June 2010 respectively. A radio announcement advising of the public information day was also made on *96FM* on 29th June.

A project specific briefing document was provided (as appended to Appendix E – *Phase One Consultation*) and copies of the preliminary study area, presented in Appendix D (*Phase One Map Register and Mapping*) of this report, were distributed during the open day.

No particular issues of concern were raised. However, EirGrid was subsequently contacted by an individual interested in selling a site within the study area. As part of EirGrid's commitment to ongoing consultation with members of the public regarding alternative site and route options, this site has been included in the discussion on environmental and engineering issues associated with substation site selection.

**Open Day 2**

The second public information day was held at the Wallis Arms Hotel in Millstreet on 15th September 2010 between 1.00pm and 8.00pm. The public information days were advertised in both *The Corkman* and *The Southern Star* newspapers on Thursday 9th September 2010 and Saturday 11th September 2010 respectively.

Maps illustrating the emerging preferred substation location and route corridor options, upon which this report is based, were presented (refer to Appendix D) and members of the public were invited to provide submissions, comments, information or queries in relation to the proposed development.

No particular issues of concern were raised during the open day. To date no written submissions from members of the public have been received.

### *2.4.3 Consultation Letters*

Consultation letters were also forwarded to the following stakeholders on 16th July 2010 inviting comments on the proposed development. A map illustrating the identified study area was provided as an attachment (Refer to Appendix E).

- Department of Communications, Energy and Natural Resources
- Department of Community, Equality and Gaeltacht Affairs
- Department of Agriculture, Fisheries and Food
- Department of Transport
- The Arts Council
- The Heritage Council
- Fáilte Ireland
- Health Service Executive
- Regional Health Office (HSE)
- Planning Department, Cork County Council
- Environment and Emergency Services Directorate, Cork County Council
- Community and Enterprise Department, Cork County Council
- Infrastructure and Development Department, Cork County Council
- Department of Environment, Heritage & Local Government
- Bat Conservation Ireland
- Cork County Bat Group
- Environmental Protection Agency
- Teagasc
- Radiological Protection Institute of Ireland
- Commission for Energy Regulation
- Coillte
- Inland Fisheries Ireland
- Eircom
- Bord Gáis
- RTE Transmission Network Limited
- Telefónica O2 Ireland Limited

- Roads Department, Cork County Council
- Water Services Department, Cork County Council
- Housing Department, Cork County Council
- Heritage Officer, Cork County Council
- Mr John McAleer (Director), South-West Regional Authority
- Office of Public Works
- An Taisce
- National Roads Authority (NRA)
- Vodafone
- Meteor Mobile Communications Limited
- Birdwatch Ireland
- Irish Wildlife Trust
- Geological Survey of Ireland
- Irish Aviation Authority (IAA)
- ESB
- Bord Gáis

Responses received from stakeholders, including members of the public, during this phase and subsequent phases of the consultation process will assist in confirming the project study area, the environmental and other constraints therein, the substation site and transmission route selection process, design of the proposed development and the development of the EIS.

# 3. Substation Site and Route Corridor Selection

## *3.1 Potential Substation Site Selection Process*

The project team originally identified 8 potential substation site locations (Sites 1-8) within the preliminary study area, as illustrated in Figure 2.1. As discussed in Section 2.3 (*Constraints Map Production and Summary*) of this report, due primarily to physical terrain, existing developments (i.e. wind farms), visual impact and cultural heritage constraints, it was determined that the area to the north and west of the townland of Ballyvouskill would not be suitable for the construction of a substation site and associated transmission connections.

The preliminary study area was therefore refined and, consequently, two potential substations sites (Sites 7 and 8), which are sited in the wider study area, were discounted. However additional sites, Site 9 and Site 10, were subsequently identified and included in the assessment.

The locations of the potential substation sites discussed in this report are illustrated in Figure 3.1 (*Substation Site Location*) below. Photographs of the potential substation sites and access roads are presented in Appendix F (*Photographs*) of this report. The environmental and engineering constraints associated with each of the above mentioned substation sites are presented in Part B of this report.

## *3.2 Potential Route Corridor Selection Process*

This report considers potential overhead line (OHL) and underground cable (UGC) route corridor options associated with each potential substation site location, i.e. Sites 1 - 6 and Sites 9-10.

A potential 110 kV connection from each of the eight potential substation sites to the existing 110 kV substation at Garrow, County Kerry is under consideration. A potential 220 kV connection is also under consideration from each of the eight potential substation sites to the existing 220 kV Clashavoon-Tarbert transmission line. Both OHL and UGC 110 kV and 220 kV connections are being evaluated for each substation site location, as illustrated in Figure 3.2 below.

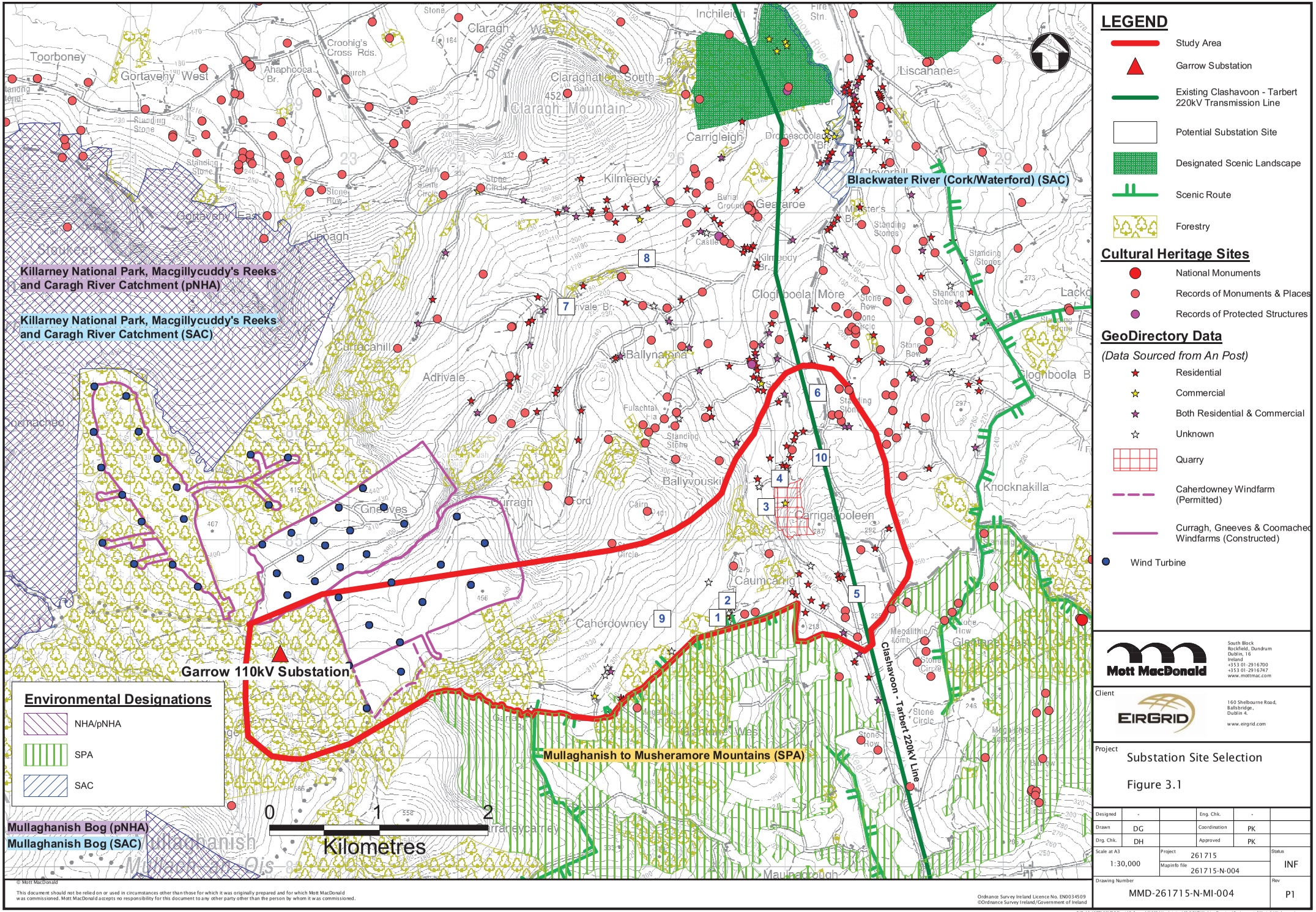
### *3.2.1 Overhead Line Route Corridor Selection Process*

Due primarily to developmental (i.e. wind farms) and ecological constraints (refer to ecological values presented in Figure 4.1, Chapter 4), the 110 kV OHL route corridor follows the same course for all potential substation site options from the existing 110 kV Garrow substation to a junction point in the vicinity of Site 9.

The OHL corridors diverge from this junction point, to the west of the R582, connecting to each potential substation site and the existing 220 kV transmission line as follows:

- Route Corridor A – Northern Corridor;
- Route Corridor B – Central Corridor; and
- Route Corridor C – Southern Corridor.

As discussed above, the determination of the 110 kV OHL option from Garrow substation to the vicinity of Site 9 has largely been defined by the location of the existing and planned wind turbines to the west of the



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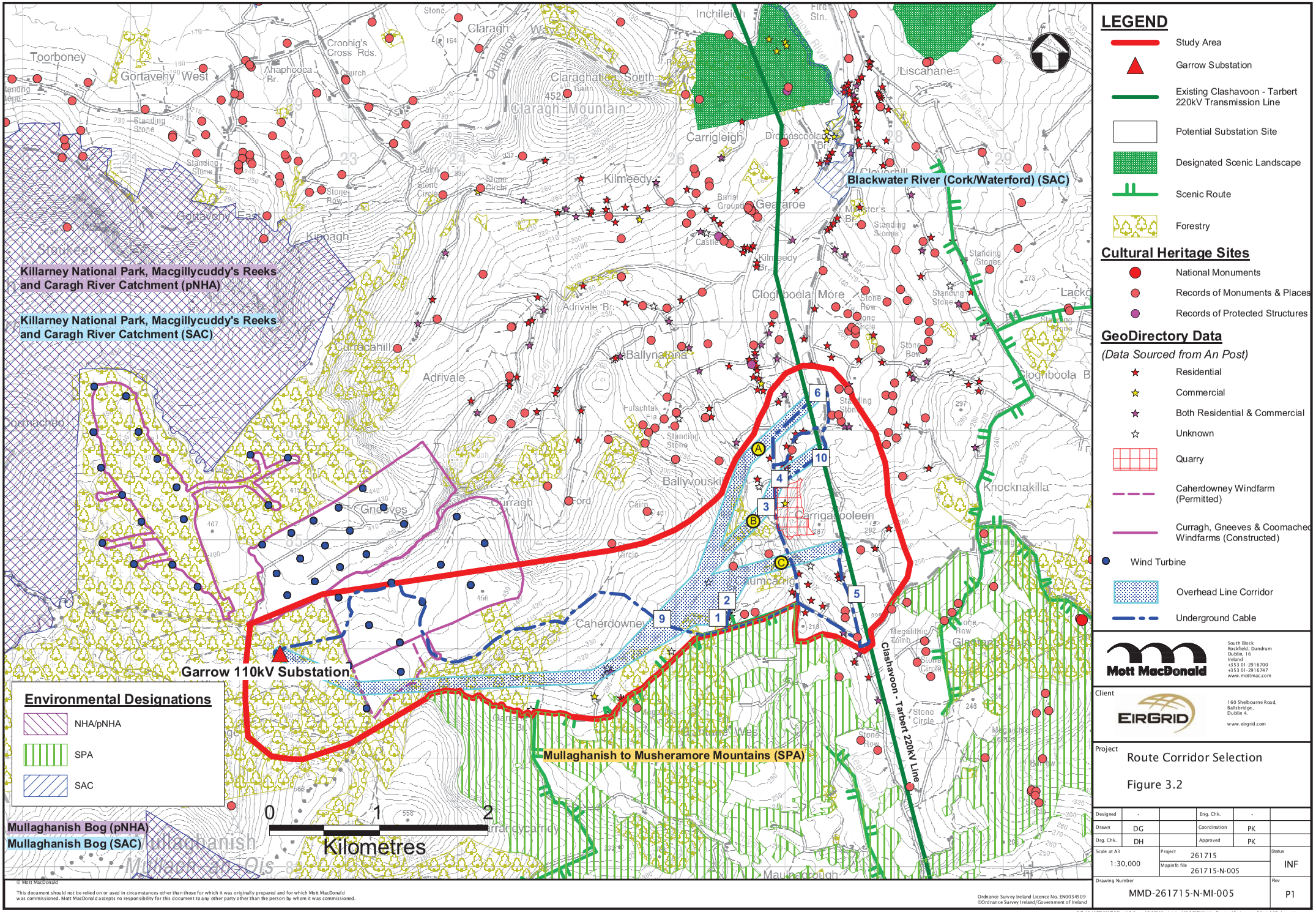


## LEGEND

- Study Area
- Garrow Substation
- Existing Clashavoon - Tarbert 220kV Transmission Line
- Potential Substation Site
- Designated Scenic Landscape
- Scenic Route
- Forestry

### Cultural Heritage Sites

- National Monuments
- Records of Monuments & Places
- Records of Protected Structures

### GeoDirectory Data

*(Data Sourced from An Post)*

- Residential
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- Both Residential & Commercial
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- Wind Turbine
- Overhead Line Corridor
- Underground Cable


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Project: Route Corridor Selection

Figure 3.2

| | | | | | |
|---|---|---|---|---|---|
| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |
| Scale at A3 | 1:30,000 | Project | 261715 | Status | INF |
| | | MapInfo file | 261715-N-005 | | |
| Drawing Number | MMD-261715-N-MI-005 | | | Rev | P1 |



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study area, and the avoidance of ecologically designated sites to the south of the study area, and ecologically sensitive areas within the study area to the north.

The OHL options to the east of Site 9 encompass each substation site under consideration while avoiding a number of physical and environmental constraints including the existing quarry, residential properties and archaeological sites. For example, due to the number of occupied dwellings in proximity to Site 5, a direct OHL route corridor connection is not considered appropriate. An UGC connection from Route C to Site 5 is therefore also being considered.

Potential 110 kV and 220 kV OHL structures are described in detail in Section 1.8.2 (*Overhead Line Structures*) of this report.

**110 kV OHL from Garrow to the New Substation**

The 110 kV OHL options available between the new substation and the existing Garrow substation, include both Single Circuit (SC) and Double Circuit (DC) 110 kV lines.

Wood poles will generally be used for 110 kV SC lines with lattice steel structures normally only required where there is a change in direction and at the ends of the line. Lattice steel towers will be required for all 110 kV DC lines.

It is envisaged that both 110 kV SC and 110 kV DC OHL connection options would be constructed along a single corridor.

**220 kV OHL from Existing 220 kV OHL to the New Substation**

The 220 kV OHL options available between the new substation and the existing Clashavoon-Tarbert transmission line, include both SC and DC 220 kV lines. Lattice steel towers will be required for both options.

The OHL route corridors presented in this report measure 120 metres in width, to allow for two 220 kV SC OHL to be constructed in parallel, however, it may be necessary to construct two separate 220 kV SC OHL connections along two separate OHL corridors.

### *3.2.2 Underground Cable Route Corridor Selection Process*

The area around Garrow substation includes a network of wind farm and forest access tracks which are considered to be of sufficient width to accommodate a 110 kV UGC. The indicative 110 kV UGC route option presented in Figure 3.2 represents an existing wind farm track which is considered to be the most likely route available, although the final determination of the 110 kV UGC route would be subject to negotiations with local wind farm operators and land owners in the area.

This route connects Garrow 110 kV substation to the potential substation sites utilising existing tracks associated with the local wind farms and agricultural lands before connecting with the local road network. A 220 kV connection is then required from the new substation to the existing transmission line.

In the vicinity of Sites 1, 2 and 9, the indicative UGC route runs along the existing verges of the local road along the south eastern boundary of the study area, the regional R582 road and the local road network to the east of the study area connecting to each respective potential substation site location in turn. A number of alternative UGC connections from the R582 to the existing 220 kV transmission line are under consideration, including utilisation of existing road verges and traversing of agricultural land.

# Part B – Overview of Environmental Issues

# 4. Consultant's Findings – Substation Site Environmental Constraints

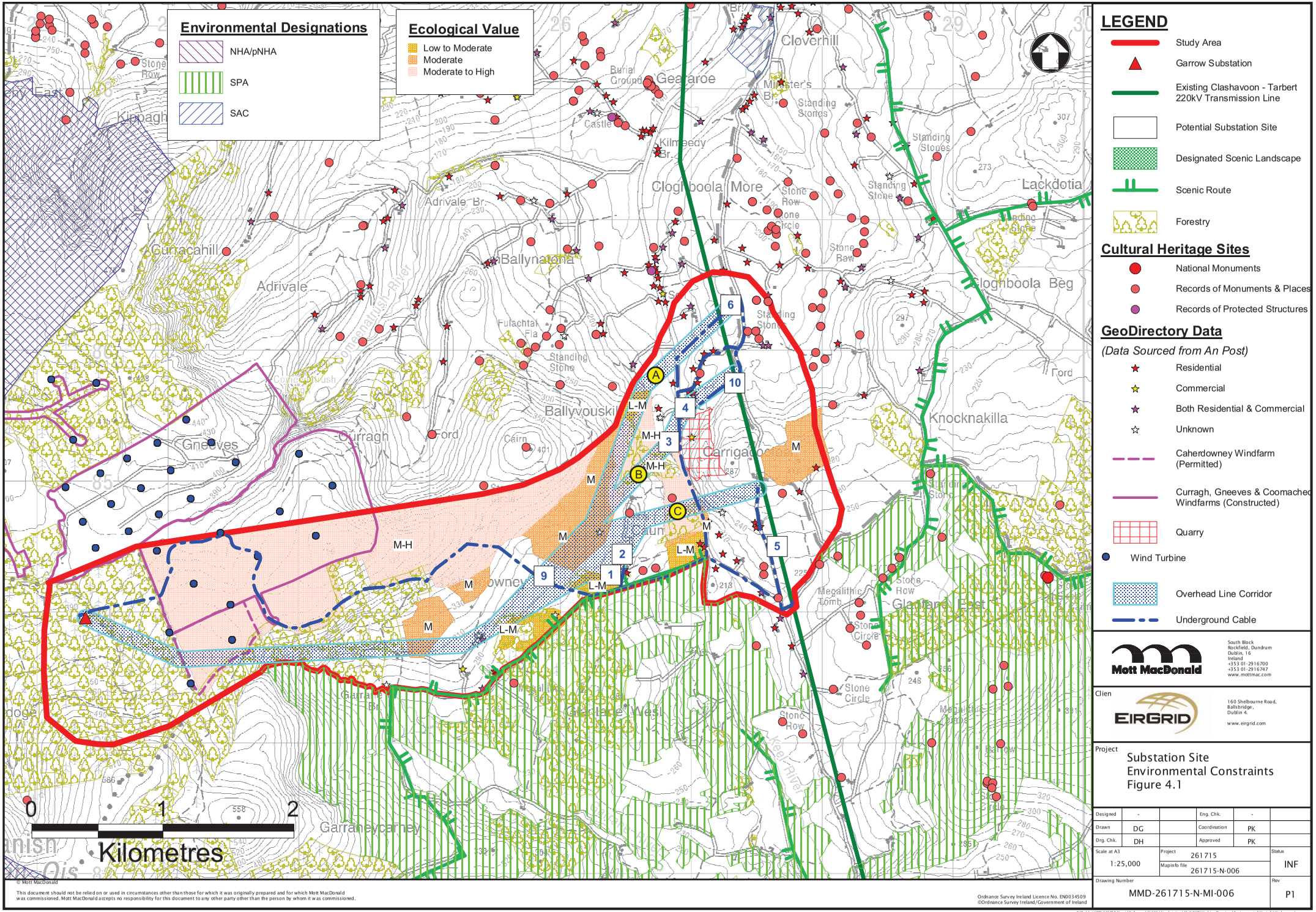
## *4.1 Introduction*

The aim of this chapter is to present an overview of the key environmental constraints associated with the development of the eight remaining substation sites under consideration, i.e. proposed substation Sites 1-6 and Sites 9 and 10, as illustrated in Figure 4.1 below. Details of the substation site identification process are provided in Chapter 3 (*Substation Site and Route Corridor Selection*) of this report; brief descriptions of the 8 substation sites under consideration are provided in Table 4.1 below.

As illustrated in Figure 4.1 (*Substation Site Environmental Constraints*), potential substation sites 1, 2 and 9 are located in the townland of Caherdowney to the north of the L5226 road. Potential substation sites 3, 4, 5, 6 and 10 are located in the townland of Carrigacooleen. Sites 3 and 4 are located adjacent to the R582 road. Sites 5, 6 and 10 are located adjacent to the L5227 road. Photographs of the potential substation sites and access roads are included in Appendix F (*Photographs*) of this report.

Table 4.1: Description of Substation Site Options

| Site Options | Townland Location | Location within the Study Area | Site Description |
|---|---|---|---|
| Site 1 | Caherdowney | Southern section of study area | Brownfield site with hardstanding area, currently in use as a trailer park. The site is relatively flat with forestry plantation to south and west of the site and pasture land to the north and east. Access is gained from a local road via an existing track |
| Site 2 | Caherdowney | Southern section of study area, to the northeast of site 1 | Gently sloping greenfield pasture land. Site 2, adjacent to Site 1, is surrounded by pasture land, with the exception of forestry plantations to the north east and south west. Access to the local road network is provided via the same track accessing Site 1 |
| Site 3 | Carrigacooleen | Eastern section of study area, west of R582, opposite an operational quarry | Brownfield area of relatively flat disturbed ground with overgrown rock outcrops. Site 3 is currently in use as a storage area for machinery associated with the adjacent quarry. The R582 road and an operational quarry are located to the east with forestry plantations to the west |
| Site 4 | Carrigacooleen | Eastern section of study area, directly east of R582, north of an operational quarry and north east of Site 3 | Brownfield area of relatively flat overgrown rock outcrop. An open shed, used for the storage of agricultural crops, currently occupies the site.<br>The R582 road and residential property are located directly west of the site. An operational quarry is located to the south |
| Site 5 | Carrigacooleen | South eastern section | Elevated greenfield site of immature coniferous forestry, gently |





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Project
Substation Site
Environmental Constraints
Figure 4.1

| | | | | | |
|---|---|---|---|---|---|
| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |
| Scale at A3 | 1:25,000 | Project | 261715 | Status | INF |
| | | Mapinfo file | 261715-N-006 | | |
| Drawing Number | MMD-261715-N-MI-006 | | | Rev | P1 |



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| Site Options | Townland Location | Location within the Study Area | Site Description |
|---|---|---|---|
| | | of study area, east of R582. Located between a third class road and the existing Clashavoon - Tarbert 220 kV transmission line | sloping in a south easterly direction. Adjacent to a narrow local road and surrounded by agricultural land and forestry. Duhallow Way walking route is located approximately 350 metres to the east |
| Site 6 | Carrigacooleen | North eastern section of study area, east of the R582. Located between a third class road and the existing Clashavoon - Tarbert 220 kV transmission line | Greenfield agricultural land. Adjacent to a narrow local road and surrounded by agricultural land and one-off housing. Duhallow Way walking route is located directly east of Site 6, a school is located approximately 300 metres to the northwest of the site |
| Site 9 | Caherdowney | Southern section of the study area, directly west of Sites 1 and 2 | Undulating greenfield site sloping in a southerly direction. Currently in use as sheep grazing pasture land. Surrounding lands are agricultural in nature, a forestry plantation is located to the south east. The site is traversed by a drainage ditch, a stream flows to the northeast of the site in a south easterly direction. Access to the local road network is gained via an existing track. Site 9 is located in close proximity to Sites 1 and 2 |
| Site 10 | Carrigacooleen | Eastern section of study area, east of R582, directly northeast of operational quarry | Elevated greenfield site, currently in use as sheep grazing pasture land. Adjacent to a narrow local road and surrounded by agricultural land and one-off housing. Overlooks quarry to southwest and local road to north. Duhallow Way walking route is located directly east of Site 10 |

Potential substation sites are described below in terms of Land Characterisation (Land Use, Residential Amenity and Road Access), Cultural Heritage, Ecology, Landscape and Visual, Soils, Geology and Hydrogeology and Water.

## *4.2 Man-Made Constraints*

### *4.2.1 Land Characteristics*

**Land Use**

Sites 1, 3 and 4 can be categorised as brownfield sites i.e. sites which have previously been subjected to building, engineering or other operations, excluding temporary uses or urban green spaces (Department of Environment, Heritage and Local Government document *Guidelines for Planning Authorities on Residential Density*, 1999).

Site 1 contains a hardstanding area which is currently in use as a trailer park. The site is relatively flat with topography rising to the north of the site towards Ballyvouskill. The site is surrounded by pasture land to the north and east and plantation forestry to the south and west offering visual screening of the site. There is one apparently derelict property located in close proximity to the east of Site 1.

Site 3 is an area of relatively flat disturbed ground / infill currently in use as a storage area for machinery associated with the quarry, located directly east of the adjacent R582 road. Steep rock cliffs with plantation forestry are located to the south and west of the site. A number of residential properties are located to the north with potential direct views of the site. A stream flows along the northwest boundary.

Site 4 is also located adjacent to the R582 road, to the northeast of Site 3 and immediately north of the quarry. The site comprises relatively flat disturbed ground. An open shed, used for the storage of

agricultural crops, currently occupies the site. A number of residential properties are located to the north and west with potential direct views of the site, including a residential property directly opposite the site. A small stream flows along the southern boundary of the site.

Sites 2, 5, 6, 9 and 10 can be categorised as Greenfield.

Site 2 is gently sloping sheep grazing pasture land, located to the north of Site 1. Site 2 is surrounded by pasture land with the exception of plantation forestry to the north east and south west. The aforementioned apparently derelict property is located immediately south of the site.

Sites 5 and 6 are located between a narrow country lane and the existing Clashavoon - Tarbert 220 kV line. Both sites are elevated. Site 5 has been recently planted with forestry. There are two properties located to the north of Site 5 which have potential direct views of the site. Site 6 (agricultural grassland) is located immediately adjacent to the Duhallow Way walking route and approximately 300 metres to the south east of Clogboola National School, a protected structure. The landscape immediately surrounding Site 6 is open.

Site 9, located a short distance to the northwest of Site 1, is an undulating site, sloping in a southerly direction. The site is currently in use as sheep grazing pasture land. A forestry plantation is located to the south east and south west. The site is traversed by a drainage ditch. A stream flows along the north eastern boundary of the site in a south easterly direction. There are no residential properties in close proximity to site 9, although a large agricultural shed is located directly to the south.

Site 10 is located directly east of the Clashavoon - Tarbert 220 kV line and Duhallow Way walking route. The site overlooks the quarry and is currently used for sheep grazing. The surrounding area is open and elevated with direct views onto the site from the R582, L5249 and surrounding residential properties.

**Residential Amenity**

Table 4.2 below details the number of residential, commercial, combined and unknown buildings located within 500 metres of each potential substation site location from the grid references as detailed. This information is based on a desk-based review of GeoDirectory data (a dataset sourced from An Post) and aerial photography of the area. The information provided should be considered as indicative only. It should be noted that the GeoDirectory data are not definitive and can be erroneous. A more definitive determination of the number of buildings within a specified distance of the selected substation site will be undertaken during the EIA stage of the project.

Table 4.2: Buildings within 500 metres of Potential Substation Sites

| Substation Site | Easting | Northing | Residential | Commercial | Combined Residential/ Commercial | Unknown | Total |
|---|---|---|---|---|---|---|---|
| Site 1 | 126385 | 84280 | 1 | 0 | 0 | 4 | 5 |
| Site 2 | 126473 | 84438 | 1 | 0 | 0 | 4 | 5 |
| Site 3 | 126831 | 85297 | 4 | 1 | 0 | 3 | 8 |
| Site 4 | 126955 | 85557 | 10 | 1 | 0 | 3 | 14 |
| Site 5 | 127660 | 84498 | 8 | 0 | 1 | 1 | 10 |
| Site 6 | 127304 | 86344 | 9 | 0 | 5 | 0 | 14 |
| Site 9 | 125877 | 84271 | 0 | 0 | 0 | 1 | 1 |
| Site 10 | 127335 | 85748 | 9 | 0 | 2 | 2 | 13 |

**Road Access**

Sites 1, 2 and 9 are located to the north of the L5226 road, which is approximately 5.5 metres in width. This local road previously provided construction phase access to the wind farms to the west of the study area.

All three sites are accessed via existing tracks. It is considered that the access tracks to Sites 2 and 9 in particular would require improvement works, or new access tracks would be required to be developed, in order to facilitate construction of a substation.

Direct access to Sites 3 and 4 can be gained from the Regional R582 Millstreet / Macroom road. A requirement for significant road improvement works is not anticipated, should Site 3 or Site 4 be developed as a substation.

Sites 5, 6 and 10 are accessed via narrow country roads (L5249 and L5227) of approximately 3 metres in width. Development of any of these sites, for the purposes of a substation, would necessitate significant improvement works of the surrounding road network to facilitate the movement of Heavy Goods Vehicles (HGVs) during the construction phase. These works would result in additional traffic movements and potentially temporarily sever local access along the road.

**Summary Conclusion**

In terms of land characteristics, it is generally the case that development on a brownfield site is preferred. Of the available brownfield sites, Site 1 offers the advantages of a previously developed hardstanding area with visual screening of the site and access to a suitable road network.

Sites 5, 6 and 10 would require significant road improvement works if they were to be developed for the purposes of a substation. In addition, potential direct views of the substation would be gained from residential properties in the immediate surrounding areas of Sites 3, 4, 5, 6 and 10.

Sites 2 and 9 offer similar advantages to Site 1, notwithstanding the fact that they are both greenfield sites. It is also worth noting that, according to GeoDirectory data, there are no residential properties located within 500 metres of Site 9, which is a significant advantage over other sites under consideration. This information has also been supported through field inspections and examination of aerial photography in the study area.

### *4.2.2 Cultural Heritage*

Table 4.3 below details previously recorded cultural heritage sites (CHS) found within approximately 250 metres of each proposed substation location. Lists of the Record of Monuments and Places (RMP) detailed below and OS First Edition Maps of the potential substation sites are included in Appendix G (*Cultural Heritage*) of this report.

Table 4.3: Recorded Cultural Heritage Sites (CHS) found in the vicinity of the proposed substation locations.

| Legal Status of CHS | Reference | Classification | Townland | Distance from Substation* |
|---|---|---|---|---|
| **Site 1** | | | | |
| No previously recorded cultural heritage sites within 250metres | - | - | - | - |
| **Site 2** | | | | |
| RMP | CO048-068---- | Ringfort - Cashel | Caherdowney | 170 |
| RMP | CO048-185---- | Boulder-Burial possible | Caherdowney | 230 |
| **Site 3** | | | | |
| No previously recorded cultural heritage sites within 250m | - | - | - | - |
| **Site 4** | | | | |
| No previously recorded cultural heritage sites within 250m | - | - | - | - |
| **Site 5** | | | | |

| Legal Status of CHS | Reference | Classification | Townland | Distance from Substation* |
|---|---|---|---|---|
| RMP | CO048-159---- | Earthwork | Carrigacooleen | 110 |
| RMP | CO048-104---- | Enclosure | Carrigacooleen | 160 |
| **Site 6** | | | | |
| RMP | CO048-072002- | Souterrain possible | Cloghboola More | 150 |
| RMP | CO048-072001- | Ringfort - Rath | Cloghboola More | 150 |
| RMP | CO048-071001- | Standing Stone (original location) | Carrigacooleen | 170 |
| RMP | CO048-162---- | Souterrain possible | Carrigacooleen | 210 |
| RMP | CO048-071002- | Ringfort - Rath | Carrigacooleen | 210 |
| RMP | CO048-073002- | Souterrain possible | Cloghboola More | 240 |
| RMP | CO048-073001- | Ringfort - Rath | Cloghboola More | 240 |
| **Site 9** | | | | |
| No previously recorded cultural heritage sites within 250m | - | - | - | - |
| **Site 10** | | | | |
| RMP | CO048-071001- | Standing Stone (original location) | Carrigacooleen | 250 |
| RMP | CO048-071003- | Standing Stone (original location) | Carrigacooleen | 250 |
| RMP | CO048-071002- | Ringfort - Rath | Carrigacooleen | 250 |
| RMP | CO048-07070- | Fulacht Fia | Carrigacooleen | 170 |

Note: * Distance is measured from the outer perimeter of the substation location as provided by the client to the NGR location of the CHS feature (usually the centre of the feature). Values have been rounded to the nearest 10m.

Site 1 has been considerably disturbed and does not appear to contain any features of archaeological potential. Furthermore, an inspection of aerial photographs taken prior to its development did not identify any anomalies that may be indicative of archaeological features. There were no anomalies evident on the aerial photographs but the site does straddle a trackway that is featured on the first edition map that has since been removed. There are no recorded features within the immediate area however there are two sites classified as possible boulder burial and ringfort to the east, RMPs CO048-185 and CO048-087 respectively. Site 1 is considered to be of low archaeological potential.

Site 2 is located to the southwest of Cashel RMP CO048-068. However, there are no recorded features in the immediate area and no anomalies or features are evident following a review of aerial photographs and cartographic sources. Site 2 is therefore considered to be of low archaeological potential.

Site 3 has a near vertical stone face to the north and steep slopes elsewhere. There were no anomalies or features evident on either the aerial photographs or the cartographic sources and there are no recorded features in the immediate area. Site 3 is considered to be of low archaeological potential.

Site 4 is located in an area of disturbed ground in a field directly north of the quarry. There were no anomalies or features evident on either the aerial photographs or the cartographic sources and there are no recorded features in the immediate area. Site 4 is considered to be of low archaeological potential.

Site 5 comprises semi mature conifers which restricted the visual inspection of the site, but based on the site visit, and with reference to aerial photographs and first edition maps, the land is of poor quality with limited agricultural value. There are two recorded features to the south east of the site RMP CO048-159 (earthwork) and CO048 – 104 (enclosure). Based on the terrain, the site is of low archaeological potential.

Site 6 has been cleared in more recent times evidenced by bulldozed boulders along the site boundary. Internally the fields have gorse bushes alongside pockets of rushes. A since cleared away boreen appears on the first edition map that crossed the site to the south. To the east on the opposite side of a roadway are

a number of significant monuments including souterrains, raths and standing stones RMP CO048-072001-4 and RMP CO048-071001-3. Given the high incidence of monuments in the immediate hinterland this area is considered to be of moderate archaeological potential.

Site 9 is situated along a townland boundary marked by a small stream between Ballyvouskill to the north and Caherdowney to the south in an area of cleared grassland. The site is also traversed by a drainage ditch. There were no anomalies or features evident on either the aerial photographs or the cartographic sources and there are no recorded features in the immediate area. This site is considered to be of low archaeological potential.

Site 10 is located to the north east of the study area in the townland of Carrigacooleen. There are four field monuments along the site boundary including two non extant standing stones, indicated as Gallaun's, a ringfort to the north east and a fulacht fia site to the west (RMP's CO0-071001, 1003, 1002 and 070 respectively). A review of historical maps identified a number of vernacular dwellings with associated outhouses scattered throughout the subject area. Much of the early mosaic style field patterns featured on the first edition map have been cleared away. Based on the agricultural value of the site and the incidence of monuments in the immediate vicinity this area is considered to be of moderate to significant archaeological potential.

**Summary Conclusion**

Based on both field and desk-based studies, all the proposed substation locations, other than Sites 6 and 10, are considered to be of low archaeological potential and therefore suitable for consideration for development. The sensitivity of Sites 6 and 10 is based on their proximity to a complex of monuments to the east and south east of Site 6 and to the north east and west of Site 10. A visual inspection of Site 6 showed evidence of field clearance and there are no significant surface expressions or anomalies that may indicate sites of archaeological potential. A review of historical maps of Site 10 did not identify any additional cultural heritage features.

## *4.3 Natural Constraints*

### *4.3.1 Ecology*

In terms of flora and fauna all potential sites are considered to be of low ecological value. These are summarised as follows with a description of dominant habitat. Sites 1 (disturbed ground), 2 (agricultural grassland), 3 (disturbed ground), 4 (disturbed ground), 5 (plantation forestry), 6 (agricultural grassland), Site 9 (agricultural grassland) and 10 (agricultural grassland).

Site 5 is the least preferred site as this is hen harrier forage habitat and a hen harrier was noted in the vicinity of this site during summer 2010.

It is considered that, provided avoidance and maintenance of a buffer zone between surface water features and the development, in combination with suitable water pollution control measures, are carried out then, the rest of the potential substation sites (Sites 1, 2, 3, 4, 6, 9 and 10) are broadly equivalent.

### *4.3.2 Landscape and Visual*

Site 1 is bordered by coniferous forestry. The site is adjacent to a small county road that is well treed at this location. There is extensive forestry plantation to the west. The site is used as a hard stand yard to park and store trailers and machinery. To the north the topography rises towards Ballyvouskill. There is one apparently derelict property located to the east in close proximity but very well screened. The site itself is not easily read within the wider landscape due to the screening effect of trees and limited vantage points.

Site 2 is located to the north of Site 1. This site comprises an open elevated field on gently rising slopes. The site is accessed by a narrow lane. The site is difficult to discern from within the wider landscape due to intervening trees. There is one apparently derelict property located immediately to the south that is very well screened by woodland.

Site 3 is located in an area of disturbed ground / infill with steep rock cliffs to the west and south. The topography falls away across a valley to the north. The site is immediately adjacent to the R582 road. There are several dwellings located to the north that have potential direct views of the site.

Site 4 is situated in a field immediately north of a large quarry complex. The site is immediately adjacent to the R582 road. There are a large number of dwellings located to the north and west that have potential direct views of the site including a dwelling directly opposite.

Site 5 is located to the south east of the study area on an elevated site immediately adjacent to a narrow county lane. The elevated land has been recently planted with forestry. There are two properties located to the north that both have potential direct views. The existing Clashavoon - Tarbert 220 kV line is located immediately adjacent to the site.

Site 6 is located to the north east of the study area on an elevated site immediately adjacent to a narrow county lane. The landscape is open in the immediate surroundings. The site is also located beside a long distance footpath. The existing Clashavoon - Tarbert 220 kV line is located immediately adjacent to the site.

Site 9 is situated on rising ground within an open improved field system. There is extensive coniferous forestry to the south east and south west. The topography rises gently to the north towards Ballyvouskill. There is one single country road located to the south. There are no dwellings located in the vicinity. A large agricultural shed to the south of the site is a prominent feature in the local landscape. Wind turbines are visible on the mountains to the rear of the site.

Site 10 is located in the north east of the study area on an elevated site immediately adjacent to a large hard rock quarry. The landscape is open with extensive panoramic views. There are a number of properties located to the north and west that have potential direct views. The site is adjacent to the existing Clashavoon - Tarbert 220 kV line and a long distance footpath.

**Summary Conclusion**

In terms of landscape and visual impact, due to its location in a well screened area remote from residential properties Site 1 is preferred overall. Site 2 located adjacent to Site 1 is the next preferred, although it is slightly more elevated and less well screened. Sites 5 and 9 are next preferred with both reasonably remote from dwellings and fitting reasonably well in the landscape. Sites 3, 4, 6 and 10 are the least preferred.

### *4.3.3 Soils, Geology and Hydrogeology*

In terms of potential impacts on Soils, Geology and Hydrogeology, it is considered that, due to their brownfield characteristics and relatively level topography, potential substation sites 1, 3 and 4 are preferred, although, there is also the potential for historical contamination on site.

Development of Site 2 would require site levelling works and road improvement works. Due to site elevations, Sites 5, 6, 9 and 10 would require more significant ground levelling works than the other sites under consideration. In addition, however, considerable road improvement works would also be required to provide access to Sites 5, 6 and 10.

### *4.3.4 Water*

Due to the proximity of adjacent water courses, Sites 3, 4 and 9 are considered to be potentially the most sensitive to adverse impacts on water quality associated with the development of a substation. A stream borders Site 9 to the northeast, flowing in a south easterly direction towards the Finnow River, which in turn flows into the River Blackwater (Munster). In addition, the site is also traversed by a drainage ditch. It is considered that development of Site 9 may require the culverting of the aforementioned drainage ditches and stream.

In terms of water quality, it is considered that sites which are not located in proximity to water courses are preferred. However, it is clearly the case that, through the careful development and implementation of mitigation measures during construction, in consultation with Inland Fisheries Ireland, potential adverse impacts on water quality can be avoided.

# 5. Consultant's Findings – Route Corridor Environmental Constraints

## 5.1 Introduction

The aim of this chapter is to present an overview of the key environmental constraints associated with the development of OHL and UGC options under consideration, as illustrated in Figure 5.1 below. Details of the OHL and UGC route corridor selection processes are provided in Chapter 3 (*Substation Site and Route Corridor Selection*) of this report.

While OHL and UGC cable connections are discussed separately in the sections below it should be noted that a combination of OHL and UGC options for 110 kV (from the existing 110 kV Garrow substation to the substation site options) and 220 kV (from the substation site options to the existing 220 kV Clashavoon – Tarbert transmission line) are also under consideration.

## 5.2 Overhead Line Options

### 5.2.1 Introduction

OHL options are characterised in terms of Land Characterisation, Cultural Heritage, Flora and Fauna, Landscape and Visual, Soils, Geology and Hydrogeology and Water and are presented in Figure 5.1 (*Route Corridor Environmental Constraints*).

Due primarily to developmental (i.e. wind farms) and ecological constraints (refer to Figure 5.1), the 110 kV OHL route corridor follows the same course from the existing 110 kV Garrow substation to a junction point in the vicinity of potential substation site 9. The OHL corridors towards the existing 220 kV transmission line then diverge as follows encompassing each potential substation site in turn:

- Route A – Northern Corridor;
- Route B – Central Corridor; and
- Route C – Southern Corridor.

The 220 kV OHL options presented encompass each substation site under consideration while avoiding a number of physical and environmental constraints including the existing quarry, residential properties and archaeological sites. Due to the number of occupied one-off dwellings in proximity to Site 5, a direct OHL route corridor connection would be difficult requiring additional angle towers to be constructed in order to maintain appropriate distances from residential dwellings. An UGC connection from Route C to Site 5 is therefore under consideration.

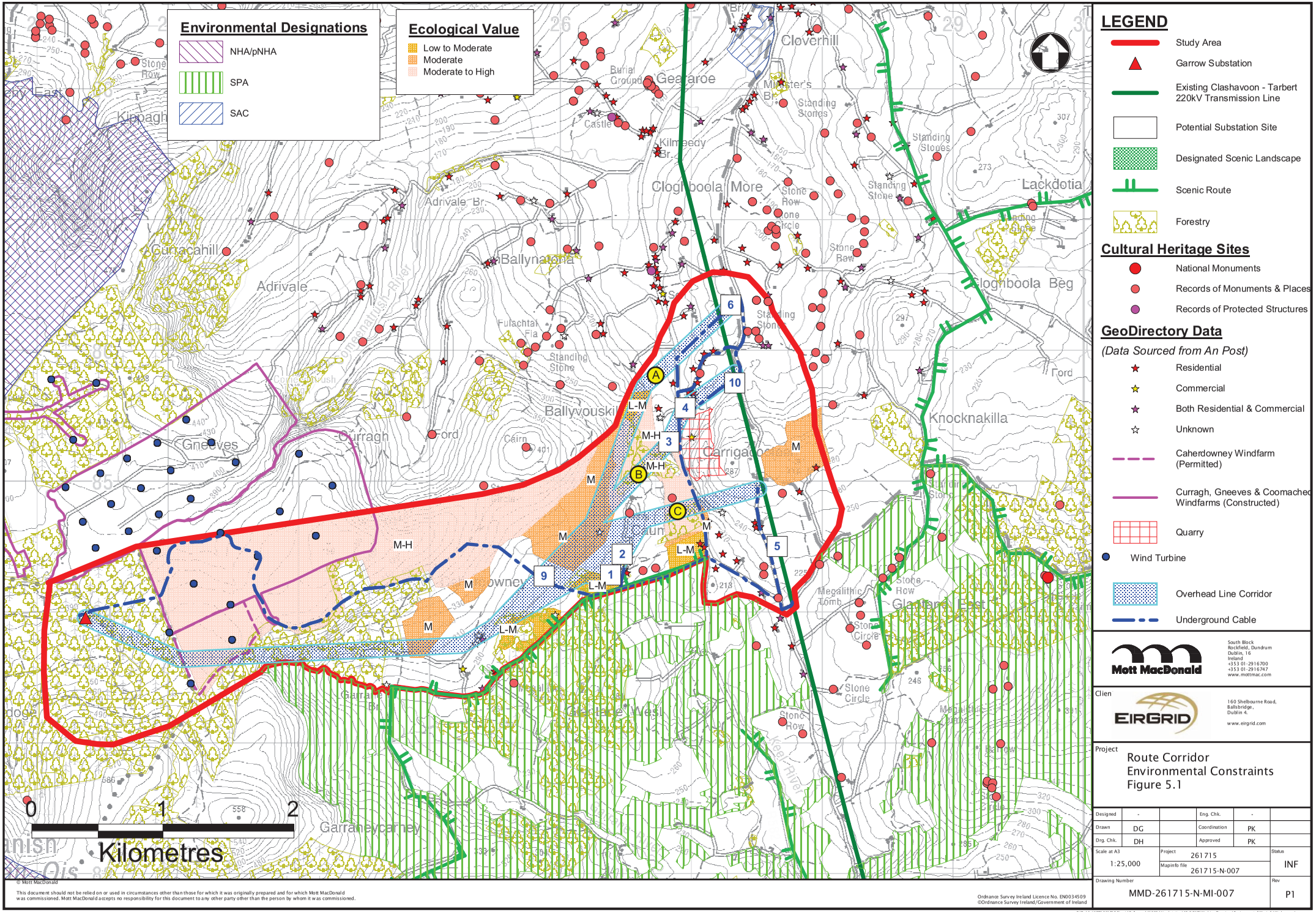
### 5.2.2 Man-Made Constraints

**Land Characteristics**

***Land Use***

The predominant land uses along the OHL Route Corridors are plantation forestry and pasture land.

A 110 kV connection will be required between the new substation and the existing Garrow substation while a 220 kV connection will be required between the new substation and the existing Clashavoon-Tarbert transmission line. The development of OHL would necessitate a permanent change in land use along part





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Project
Route Corridor
Environmental Constraints
Figure 5.1

| | | | | | |
|---|---|---|---|---|---|
| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |
| Scale at A3 | 1:25,000 | Project | 261715 | Status | INF |
| | | Mapinfo file | 261715-N-007 | | |
| Drawing Number | MMD-261715-N-MI-007 | | | Rev | P1 |



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of the route. In particular, development through forested areas would necessitate a 60 metre wide buffer zone of cleared ground from the OHL in order to facilitate line maintenance and reduce the risk of fallen trees damaging overhead conductors. In addition, construction phase activities have the potential to cause short-term nuisance in terms of land use due to increased traffic movements and disruption.

Due to the required connection to Garrow substation, and the necessary separation distance from existing and planned wind turbines, development of 110 kV OHL through the forested area to the west of the study area is considered to be unavoidable. Similarly, development through the forested area along Route Corridor B cannot be avoided. However, it would be possible to avoid development through planted areas along the eastern sections of Route Corridors A and C.

Designated scenic routes are located to the south and east of the study area. All three route corridors are located in close proximity to Duhallow Way walking route. It is considered that there is potential for some localised indirect impacts on tourism, amenity and recreational resources associated with the development of OHL in the area as a result of visual impacts.

As Route Corridor C is the shortest available route corridor, and development through planted areas along the eastern section can be largely avoided, development of an OHL along Route Corridor C is preferred in terms of land use.

***Residential Amenity***

Appropriate distance from residential properties was a determining factor in the selection of route corridor options presented. It is considered that each of the OHL route options presented are equivalent in terms of residential amenity.

***Road Access***

The construction phase of the development will result in a short-term and temporary increase in traffic due to Heavy Goods Vehicle (HGV) movements and construction worker traffic. However, utilisation of existing suitable road infrastructure would limit the requirement for additional construction traffic and disruption. At this preliminary stage of the project it is considered that both the regional R582 road and the local L5226 road, which is orientated along the southern boundary of the study area, are sufficiently wide to permit two HGVs to pass safely, negating the need for significant road improvement works along these routes.

Careful design and the development and implementation of appropriate mitigation measures, such as traffic management plans, will minimise the potential for adverse traffic impacts in the local area.

It is considered that each of the OHL route options presented are equivalent in terms of road access.

**Cultural Heritage**

There are five recorded monuments, places or finds listed in the standard inventories in the general vicinity of the proposed route corridors. They are RMPs CO048:68 and CO048:069 both classified as cashels CO048:87 a ringfort, CO048:185 a boulder burial and CO028:103 a possible fulacht fiadh. All the above except the latter are located in Caherdowney townland, the fulacht fiadh site is in Carrigacooleen. In all instances the proposed route options will not directly impact on any of recorded sites. All the potential impacts will be indirect and visual in nature.

***Cultural Heritage Impacts of 110 kV OHL Corridor from Garrow Substation***

This section of the route corridor is common to all the proposed routes under consideration and will not impact directly on any recorded cultural heritage sites. It will however potentially impact on two of the four cultural heritage sites (CHS) revealed during a field survey of the study area along the access ways. All

these sites appear on the OS first edition map and all are currently extant with varying degrees of preservation. These sites are detailed in Table 5.1 below.

Table 5.1: Architectural Sites

| Legal Status of CHS | Reference | Classification | Townland | Distance from route corridor |
|---|---|---|---|---|
| None | CHS 1 | Vernacular house and outbuildings | Caherdowney | Under the corridor |
| None | CHS 2 | Vernacular house and outbuildings | Caherdowney | 150 metres |
| None | CHS 3 | Vernacular house and outbuildings | Ballyvouskil | 100 metres |
| None | CHS4 | Vernacular house and outbuildings | Caherdowney | 30 metres |

CHS 1, occurring to the north of Garrane Bridge is directly under the corridor. This vernacular house is in reasonably good condition and is currently being used as a shed. West of this is CHS2, a ruined complex comprising a number of buildings surrounded by a copse of trees. The route will pass 120 metres to the south.

The RMPs CO048:87 (a ringfort) and CO048:185 (a boulder burial situated to the east and south east of the scheme) will not be impacted by the development. Both monuments are naturally screened by a ridge line and existing tree cover. There are no other recorded or unrecorded CHS's along this section.

***Route Corridor A***

Route Corridor A, the most northerly option, will divert north / northwest from Site 9 along the eastern slope of a hillside before re-diverting to the northwest in the direction of site 6. This option will not impact directly on any recorded cultural heritage sites along the route corridor.

This option will however traverse an area 100 metres to the east of RMP CO048:068, which is classified as a cashel. The site is a circular area (diameter 28 metres) enclosed by a collapsed stone wall (1.4 metres high; 3.5 metres thick), topped by later field fence. This cashel survives in good condition and enjoys commanding views to the east, south and west. The potential impacts on this site from the proposed development would be visual, however, this is mitigated in part by good natural screening to the north.

RMP CO048:069 is located further to the west and is situated on a high shelf on the western slope of a hillside with good views to the north of the valley. The potential impact of the development on setting of this site would be considered imperceptible. Route option A will also bypass the unrecorded site CHS 3 to the west. This site consists of a number of ruins all but hidden by vegetation. The sites lack of access, amenity and general condition would determine the potential impact as slight.

In overall terms, with regard to potential impacts on the cultural heritage resource, Route Corridor A is the least sensitive of the three corridors.

***Route Corridor B***

Route Corridor B extends northwest from site 9 and dog-legs via Sites 3 and 4 before terminating at the existing line route. This option will pass north of RMP sites CO048:68 and CO048:69, both of which are classified as cashels.

This option will traverse an area to the immediate north of two aforementioned cashel sites RMP CO048:068 and RMP CO048:069.

RMP CO048:068, the nearest site, is located approximately 90 metres south of the corridor, RMP CO048:069 is approximately 240 metres away. In both instances the potential impacts on this site of the proposed development would be indirect and visual in nature.

Route Corridor B is the second most sensitive of the three line routes.

***Route Corridor C***

Route Corridor C is the most southerly option and extends west / northwest to the immediate south of the RMP cashel sites CO048:68 and CO048:069.

This option is nearest to both the cashel sites, RMP CO048:068 and RMP CO048:069, and runs 30-50 metres to the immediate south of the sites. Due to the proximity of Route Corridor C to both the recorded sites this corridor would have the most significant potential impact on the context and setting of the archaeology and is considered as the option with the greatest sensitivity.

### *5.2.3 Natural Constraints*

**Ecology**

The western half of the route corridor, which is the same for all options, is dominated by managed mature forestry which is a relatively unimportant habitat ecologically. It is noted that the route traverses the Garrane River at this point. It is therefore recommended that a final 110 kV OHL route should pass along the northern edge of this route corridor to minimise impacts on the adjacent SPA (to the south) and the Garrane River.

No potential or confirmed hen harrier nest sites were noted during the survey of the study area in spring / summer 2010. Hen harriers were confirmed occasionally foraging in the study area during 2010. A number of potential bat roost sites were surveyed in summer 2010 and no bats roosts were identified as being present. The final alignment route selected will consider potential bat and foraging sites detailed which may be utilised in the future.

The proposed development should avoid watercourses on site as far as possible and maintain a suitable buffer zone (minimum 10 metres) which avoids disturbance to the riparian zone. It is recommended that final tower locations and access routes utilise available tracks and roads as far as possible. Towers should be located as far as possible in habitats of low conservation value including improved farmland, “made” ground and mature forestry.

The lands immediately west of the R582 road, which will need to be crossed by all OHL route options, are particularly sensitive as they consist of a mosaic of sensitive habitats. Due to the steepness of the land, protection of water quality will need the careful consideration of appropriate mitigation measures.

Areas considered to be of moderate to high ecological value should be avoided as far as possible. These areas are relatively sensitive habitats to an OHL development. Best ecological practice guideline mitigation will be specified in the EIS where these areas are unavoidable.

In terms of ecology Route Corridor B is the preferred route though there is little difference to Route Corridor C. Route Corridor A is the least preferred as it traverses a longer footprint of open moorland (moderate to high ecological value). Hen harrier foraging sites are also most extensive along Route Corridor A.

**Landscape and Visual**

In terms of landscape and visual impact, the three OHL corridors presented are broadly very similar. Route Corridors A and B have a more northern route that crosses the R582 in an open valley area with large numbers of residential properties in the immediate surroundings. Route Corridor C has the most southern alignment, fits best with the landscape, is well screened where it crosses the R582 and is remote from residential properties.

When the three route corridor options are considered with potential landscape and visual impacts, Route Corridor C is preferred due to its overall shorter length, low proximity to dwellings, best use of existing tree cover and fit in the landscape. There is no preference between Route Corridors A and B as they both have similar impacts on landscape character and in particular have high potential for visual impact on residential properties.

**Soils, Geology and Hydrogeology**

While the three route corridor options presented are broadly similar in terms of soils, geology and hydrogeology, Route Corridors A and B would require development on peat bogs for approximately 1 kilometre and 500 metres respectively. Route Corridor C avoids this area to a large extent and is therefore preferred. However, the suitability of soils and geology at a local level for the development of transmission towers cannot be definitively established at this stage of the project and will be subject to more detailed assessments of soil conditions.

**Water**

All of the route corridor options presented will require the traversing of at least three watercourses, the Clydagh, Garrane and Keel Rivers. However, Route Corridor A will necessitate traversing watercourses at a minimum of five points. Route Corridor B crosses watercourses at a minimum of four points.

Route Corridor C is therefore considered to be the least sensitive to adverse impacts on surface water quality.

**Summary Conclusion**

Based on available information at this stage of the project, Route Corridor C is the preferred corridor in terms of land use, ecology, landscape and visual, water quality and soils, geology and hydrogeology. Route Corridor C is the least preferred in terms of indirect impacts on cultural heritage sites.

Although Route Corridor A is considered to be the least sensitive in terms of cultural heritage, it is the least preferred in terms of ecology as it traverses a longer footprint of hen harrier foraging habitat and open moorland (moderate to high ecological value). Route Corridor B is the preferred route in terms of ecology and is considered to be broadly similar to Route Corridor C in terms of land use, ecology landscape and visual and water quality.

## *5.3 Underground Cable Options*

### *5.3.1 Introduction*

It is understood that the existing access tracks from the townland of Caherdowney to Garrow substation are of sufficient width to permit the installation of 110 kV UGC. These tracks are associated with existing and planned wind farms and forests in the area. The local road network along the southern boundary of the study area and the R582 are also considered to be of sufficient width to permit installation of an UGC in the roadway and, where possible, in the verge.

The UGC options presented in this report follow the indicative route of the wind farm access tracks and local road network, connecting to each respective potential substation site location, prior to connection with the existing Clashavoon – Tarbert 220 kV transmission line. A number of alternative 220 kV UGC connections to the existing transmission line are under consideration following the existing road network, tracks and traversing some agricultural land.

Two 220 kV UGC circuits are required to “loop in” the existing 220 kV line to the proposed new substation. One 220 kV UGC circuit will facilitate connection of the new substation to the existing line from the south

(Clashavoon). The other 220 kV UGC circuit will connect the new substation to the existing line from the north (Tarbert). It is intended to follow the existing roads where possible, and ideally to use separate routes for each UGC circuit to facilitate installation, minimise traffic disruption, limit cable de-rating and improve security of supply.

Separate routes for each of the new 220 kV UGC circuits are also preferred because of the narrow widths of local roads in proximity to the existing 220 kV line which are approximately 3 metres. It is considered difficult to install two 220 kV cable circuits along a track of this width.

The UGC route options under consideration are presented in Figure 5.1. It should be noted that these routes are indicative only at this stage of the project and subject to detailed consultation with Cork County Council Roads Department and wind farm operators in the area.

### *5.3.2 Man-Made Constraints*

**Land Characteristics**

Where possible the UGC will be installed along existing roads, tracks and road verges, thereby minimising potential impacts on land use. The determination of the final optimum UGC route will be subject to consultation and agreement with Cork County Council Roads Department and wind farm operators in the area.

Where agricultural land is required to be used it is preferred that the land take has recently been, and is regularly, disturbed as a result of agricultural practices. The installation of an UGC will require land take along the entire route requiring an appropriate buffer zone to be kept permanently clear of trees to prevent damage caused by tree root systems. The distance required will be dependant on the type of tree and expected future growth. Areas of commercial forestry should therefore be avoided, if possible.

Where possible, cables should be installed along field boundaries thereby minimising potential impacts on land use and damage caused by farm machinery. If hedgerows and field boundary walls are required to be removed they should be reinstated, where practicable.

The areas shown along the cable routes are generally characterised by sparsely populated, one-off housing and ribbon development along the road network.

There is no gas supply network in the area and existing underground services are generally limited. However, further consultation is required to determine if there are any future planned developments in the area which could be impacted by the UGC routes presented.

The installation of UGC will result in a short-term increase in traffic during the construction phase. The potential significance of this impact will be dependant on the amount of material required to be imported, the duration of works, the extent of use of the road network and the potential impact on local residents.

In terms of UGC options, the utilisation of existing tracks and verges is preferred; however, if this is not feasible it is considered that potential significant adverse impacts on land characteristics can be mitigated.

**Cultural Heritage**

The proposed underground cable options will not directly impact on any recorded cultural heritage sites however it will impact within the constraint zone of a lime kiln (RMP CO048-088) and a fulacht fia (RMP CO048-070---) at Carrigacooleen (Fulacht Fia). Elsewhere there are two recorded monuments and places in the general vicinity of the proposed route in Caherdowney classified as both a ringfort and a possible boulder burial (RMP's CO048:087 and CO048:185 respectively). Both sites in Caherdowney are set back from the road in an adjoining field and should not be adversely impacted.

The kiln site at Carrigacooleen is located at a crossroads and the fulacht fia is located along the local L5249 road but the implementation of standard archaeological procedures should mitigate against any impacts.

### *5.3.3 Natural Constraints*

**Ecology**

The installation of an UGC requires disturbance of ground along its entire route. The western half of the 110 kV UGC route crosses an area of moderate to high local ecological value comprising of upland blanket bog and wet heath which are listed on Annex 1 of the EU Habitats Directive. However, it is proposed to utilise existing tracks and roads in this area thereby minimising potential impacts on ecology. If existing tracks and roads cannot be utilised it is recommended that an alternative route is found avoiding the sensitive bog / heath habitat in this area.

The remainder of the route is largely located within habitats of low ecological value including tracks, improved grassland and the existing road network. The final impacts are not known at this stage as the works footprint may require removal of roadside verges, hedgerows / tree lines and scrub if the road footprint is not extensive enough. The selected route will therefore be subject to further detailed assessments during the EIA stage of the project, refer to Figure 1.21 (*Project Roadmap*).

**Landscape and Visual**

As detailed in Appendix B (*Study Area Characterisation*) of this report, the predominant landscape character in the area (Mountainous Rounded Open Moorland) has been assessed as being highly scenic, of "Very Attractive" Landscape Quality, of high value nationally with a high sensitivity to change.

While there are no designated scenic landscapes in the area, there are a number of scenic routes in the immediate surroundings with potential views of the proposed development.

There are potential impacts associated with visual effects on vegetation above the UGC, however, these can be mitigated against through careful route selection and reinstatement following construction works. It is recommended that the UGC routes avoid areas of elevated land and steep slopes where possible to further minimise the potential for these impacts.

In terms of UGC options it is considered that utilisation of existing tracks and verges is preferred, however, if this is not feasible it is considered that potential significant adverse visual impacts can be mitigated.

**Soils, Geology and Hydrogeology**

The western section of the 110 kV UGC route traverses an area of peat bog. Areas of rock outcrop are also prevalent in proximity to the quarry, to the west of the R582. These areas should generally be avoided for UGC routes due to access issues and potential impacts on groundwater flows. However, as existing tracks and roads are proposed to be used the potential for these impacts should be minimised. If existing tracks and roads cannot be used in these areas it is recommended that an alternative route is considered.

Potential impacts of an UGC route on soils, geology and hydrogeology can be significant as excavations are required along its entire route. Utilisation of existing tracks and roads is therefore preferred. In order to assess the potential adverse impacts of the UGC options on soils, geology and hydrogeology, the soil conditions along the routes would need to be determined with due regard to the suitability of infill material and associated impacts on hydrogeology.

**Water**

The UGC options presented generally avoid watercourses, although the Finnow River does traverse the R582 regional road, in proximity to Site 4.

There is potential for surface water quality impacts associated with the installation of an UGC due to siltation and surface water run-off. Interceptors and sediment ponds should be installed as required along the route to avoid potential for contamination of water courses during the construction phase.

UGC also have the potential to impact on drainage systems along its route. Excavated material should therefore be re-instated, if suitable, where this is not appropriate infill material of similar hydraulic conductivity should be used. If required, the design of modifications to drainage systems along the route of the UGC should be informed by environmental assessments and consultation with the relevant stakeholders.

Water courses should be avoided, where possible. Where a watercourse is required to be crossed, the use of existing bridges or directional drilling should be considered in preference to diversion of water courses.

It is considered that utilisation of existing tracks and verges are preferred; however, if this is not feasible it is considered that potential significant adverse impacts on water quality can be mitigated through specific design and construction measures.

**Summary Conclusion**

The utilisation of existing tracks and roads where possible is preferred in terms of UGC routing. If this is not possible the area of peat bog to the west and north of the study area should be avoided where possible and an alternative route considered. Further assessments are required in order to determine the comparative potential impacts of the UGC options on ecology, cultural heritage and soils, geology and hydrogeology.

Detailed consultation with Cork County Council Roads Department, wind farm operators and land owners in the area is required to determine the feasibility of installing cable along the existing tracks and roads.

# 6. Consultant's Findings – Engineering Constraints

## 6.1 Introduction

This chapter identifies the key engineering requirements and constraints associated with the route corridor and substation site options proposed in terms of ground conditions, construction, operation and maintenance and cost.

Transmission connection options are discussed with due regard to EirGrid policy, included in Appendix A of this report, which states that an overhead line (OHL), where feasible, should be used in preference to underground cable (UGC) on the basis that typically it provides the most technically acceptable and cost effective solution.

## 6.2 Ground Conditions

### 6.2.1 Overhead Line Routes

Although detailed investigations have not been undertaken at this stage it is considered that part of Route Corridor A may require OHL support structures in boggy or poor ground conditions. Otherwise the routes appear to show similar characteristics. All OHL in each route option will have to be designed to maintain adequate ground clearance given the undulating nature of the terrain.

### 6.2.2 Underground Cable Routes

The ground conditions which affect UGC installation include the soil type, ground thermal resistivity, ground water levels and underground obstructions such as buried services.

In the case of soil type a large presence of rock can result in a more expensive and lengthy installation campaign which may require specialist equipment. In the lands adjacent to the quarry it can be expected that this could be an issue if a route is chosen away from the public road and track.

The thermal resistivity of the ground is also important to ensure that the cable does not overheat. At this stage it is not known whether this is likely to be an issue or not. Studies at a future date will inform this consideration further. It is expected though that, within reason, with careful design this can be allowed for in the design and selection of the cable system.

Where the water table is high there can be difficulties in dewatering trenches and joint bays during the installation work. From the information available to date it is understood that this is unlikely to be a major issue for the cable routes proposed.

Underground buried services can pose a problem if there are large gas, electric or water mains which may need diverting or avoiding to install the cable. From the information available to date it is understood that this is unlikely to be a constraint for the cable routes proposed.

### 6.2.3 Substation Site Locations

The substation should be located on stable ground which provides good load bearing capacity to enable the substation buildings and structures to be safely constructed with a minimum of ground improvement /

stabilisation or piling works. In addition, it is necessary to ensure that ground electrical resistivity of the site is sufficiently low.

At this stage in the process, it is not possible to be definitive regarding the precise ground conditions which apply at each site, however, it is considered that sites 5, 6, 9 and 10 would require additional engineering works in order to improve ground load bearing capacity, to provide a level surface and to ensure adequate drainage. Sites 3 and 4 are located in close proximity to an operational sandstone quarry which would suggest high soil resistivity values which would necessitate complex earthing system design especially given that there are a number of domestic properties nearby.

Ground conditions are not considered to be a determining factor when considering the three route corridor options proposed.

Minimum river crossings can be achieved through the development of Route Corridor C.

## 6.3 Construction

### 6.3.1 Overhead Line Routes

Route Corridor A marginally represents the longest line and will have the largest requirement for new tower structures and access routes. Route Corridor B is a shorter route, however because of the changes in direction associated with this route additional angle towers, which are larger in size, will be required. Route Corridor C is the shortest route and accordingly will require fewer structures.

Otherwise all routes will permit standard tower type designs and conventional construction methodologies to be used.

### 6.3.2 Underground Cable Routes

The likely installation methodology is for the cables to be installed in plastic ducts at a depth of around 1 metre. The ducts are expected to be installed in a cement bound sand mix which would then be backfilled with suitable materials containing protective tiles and marker tapes laid along the route. The excavated trench would be reinstated at a minimum to the same standard of the existing roadway or verge.

It is considered that there would be a requirement for a traffic management plan for the cable route options in the roadway which would be produced in consultation with the local authority. Cable installations of this type are regularly undertaken and it is considered that this is unlikely to be a major issue for any of the options presented, provided appropriate management and consultation is undertaken.

Ideally the underground cable route should be as straight as possible to ensure that cable can be pulled in without exceeding the maximum design pulling tensions and to keep within the cable design bending radius. Accordingly the design of the cable routes would be such that tight bends are avoided.

### 6.3.3 Substation Site Locations

Access must be provided for delivery of power transformers and equipment to the proposed substation site. Sites 3 and 4 are located adjacent to a regional road while sites 1, 2 and 9 are located adjacent to a local good quality road which provided construction access including associated road upgrading to the existing wind farms located in the western section of the study area. It is considered that these roads provide sufficient width for construction related traffic. Sites 5, 6 and 10 are located adjacent a local road which is not sufficiently wide to allow two cars to pass. Considerable road widening works would be required along an extensive section of this road to allow HGV traffic to pass safely and connect to the adjacent regional road.

The substation site is required to be of sufficient size to accommodate the substation itself and the construction phase laydown areas, car parking and welfare facilities. It is considered that Sites 3 and 4 would only be able to accommodate a GIS substation and even then there is significant risk that there may not be sufficient space available to accommodate the full extent of the substation facilities required. In addition, Sites 3 and 4 would present logistical difficulties regarding the accommodation of construction phase ancillary facilities. The other sites are considered suitable to accommodate a GIS substation.

## 6.4 Operation and Maintenance

### 6.4.1 Overhead Lines Routes

Route Corridor A, being the longest line, will have the highest risk of fault incidence and will require the most fault repair and routine maintenance. Correspondingly, Route Corridor C being the shortest will have a lower operational and maintenance requirement.

### 6.4.2 Underground Cable Routes

**General**

Under normal conditions there is minimal requirement to access or inspect an underground cable once in service. In the unlikely event of a fault occurring on a cable then excavation would however be required to access the faulted section of cable and carry out a repair. The paragraphs below describe the implications of a cable faults and its repair for the 220 kV and 110 kV cables.

**220 kV Cable Circuits**

In the case of the 220 kV cable, the routes considered use the public road network. Therefore access would have to be agreed with the local authority and where required, a traffic management plan put in place for the duration of the excavation and repair of the cable. It is likely that the new cable will be installed in ducts and this will also facilitate replacement of sections of cable with reduced requirements for excavation and disruption to traffic or inconvenience to the public

It is anticipated that a fault on a section of 220 kV UGC could result in a circuit being out of service for up to 4 weeks while the fault is located and a new section of UGC is installed, jointed and tested. CIGRE's (the International Council on Large Electric Systems) Technical Brochure 379 (April 2009) *Update of Service Experience of HV Underground and Submarine Cables Systems* states an average of 25 days repair time for UGC of 220 kV and above.

As both the proposed and existing 220 kV circuits form part of the critical electrical grid infrastructure providing supplies to the entire south east, the loss of one of these 220 kV circuits could have a significant impact on customer supplies in the region. This would tend to favour the use of 220 kV OHL instead of UGC in this instance as they are considered to be more reliable.

**110 kV Cable Circuits**

In the case of the 110 kV circuits the routes identified are existing (stoned and unstoned) access tracks. In this case excavation and reinstatement associated with a repair would be much quicker to complete than in a paved roadway. Also given that these tracks are not in general use by the public the disruption to traffic and residents could be anticipated to be less than on the road network considered for the 220 kV cables.

The 110 kV circuits would have a typical repair time of 2 to 3 weeks depending again on how quickly the fault can be located. The aforementioned CIGRE report states an average of 15 days for UGC of 60kV and above.

As the 110 kV circuits are required primarily for allowing the power generated from wind turbines to connect to the system failure of one of the 110 kV circuits will have less of an impact to electrical supplies locally, as demand can be catered for by the 220 kV transmission network. The advantage of OHL over UGC at 110 kV therefore is of less significance.

### *6.4.3 Substation Sites*

While temporary road widening works could be undertaken during the construction phase, access to the site for operators and maintenance teams would also be required during the operational phase. For the reasons outlined above it is considered that proposed sites 5, 6 and 10 are the least preferred substation site options when considering operation and maintenance access.

## *6.5 Cost*

### *6.5.1 Overhead Line Routes*

Costs associated with the overhead line routes will generally be a factor of the length of the line required given similar ground conditions and numbers of angle towers. Accordingly Route Corridor C being the shortest and with a requirement for fewer changes in direction is likely to offer the cheapest solution. At this stage it is not known if there would be a difference between OHL options along Route Corridor A and Route Corridor B.

### *6.5.2 Underground Cable Routes*

The normal cable design and methodology as described earlier is likely to be the same regardless of the cable route chosen. It is expected that the shortest route will provide the cheapest solution. It is expected however, that other issues such as ease of construction, security of supply, access issues and potential to remove existing overhead line may determine the final routes selected.

It is expected that the cost of cable solutions will be significantly greater than the cost for overhead line options.

### *6.5.3 Substation Site Locations*

The main cost difference between the options will be in the choice of whether an AIS or a GIS substation is selected. Typically a GIS substation is more expensive to construct than an AIS substation, although costs can vary widely for different locations with different ground conditions and access road land purchase costs.

Once the technology (AIS or GIS) has been selected the main cost differences between substation sites arise in the civil works, which could include ground improvement / stabilisation, levelling, piling and access road construction.

Site 1 is close to the existing road and a large proportion of the site has already been levelled and in fill material installed. Therefore, although piling for the substation buildings and equipment will be required, it can be expected that substation civil costs will be less than the other site options.

Site 2 can be expected to be more expensive than Site 1 due to the sloped nature of the site and the requirement to level the site and upgrade / construct the access road.

Sites 3 and 4 are close to the existing public road and are characterised by level and rocky ground. This would provide ideal ground for foundations without the necessity of piling. However, given the space constraints at these sites it is likely that innovative and expensive substation design solutions would be

required to accommodate the full extent of the substation facilities. Accordingly costs for this option will be high.

Sites 5 and 6 would require ground levelling, piling and significant access road improvement and will also have higher costs. In addition Site 6 will require the longest OHL route which will further add to the costs.

Sites 9 will require ground levelling works and a new access road. Site 10 will also require significant ground levelling works. It can also be expected that significant road improvement works would be required similar to those required for options 5 and 6.

## *6.6 Summary Conclusion*

From an engineering perspective, the preferred substation site is Site 1 followed by Site 2 and Site 9. These sites also permit use of preferred Route Corridor C for the overhead line.

More detailed consideration would need to be undertaken to establish the suitability of the remaining substation sites. In particular, proposed substation sites 3 and 4 are considered least favourable because of insufficient space and anticipated difficulties associated with the earthing of the substation.

It is considered that, from an engineering constraints perspective, OHL Route Corridor C is the preferred option as it is shortest overall. It is considered that Route Corridor A or B could be utilised as an alternative if the preferred corridor was not available.

It is expected that the 220 kV and 110 kV UGC can be accommodated within existing tracks and public or private roads without major technical issues. Connection of the new 220 kV UGC to the existing OHL north of the quarry and a separate 220 kV UGC connection to the south would provide for separate cable routes and also have the potential for removal of approximately 2 kilometres of 220 kV overhead line.

# Part C – Lead Consultant's Recommendations

# 7. Conclusions and Recommendations

## *7.1 Introduction*

A comprehensive range of environmental and engineering criteria were taken into consideration when characterising the study area, substation site locations and transmission connection options. This chapter of the report identifies the lead consultant's emerging preferred substation site location and OHL/UGC route corridors based on a review of available information.

## *7.2 Substation Site Appraisal*

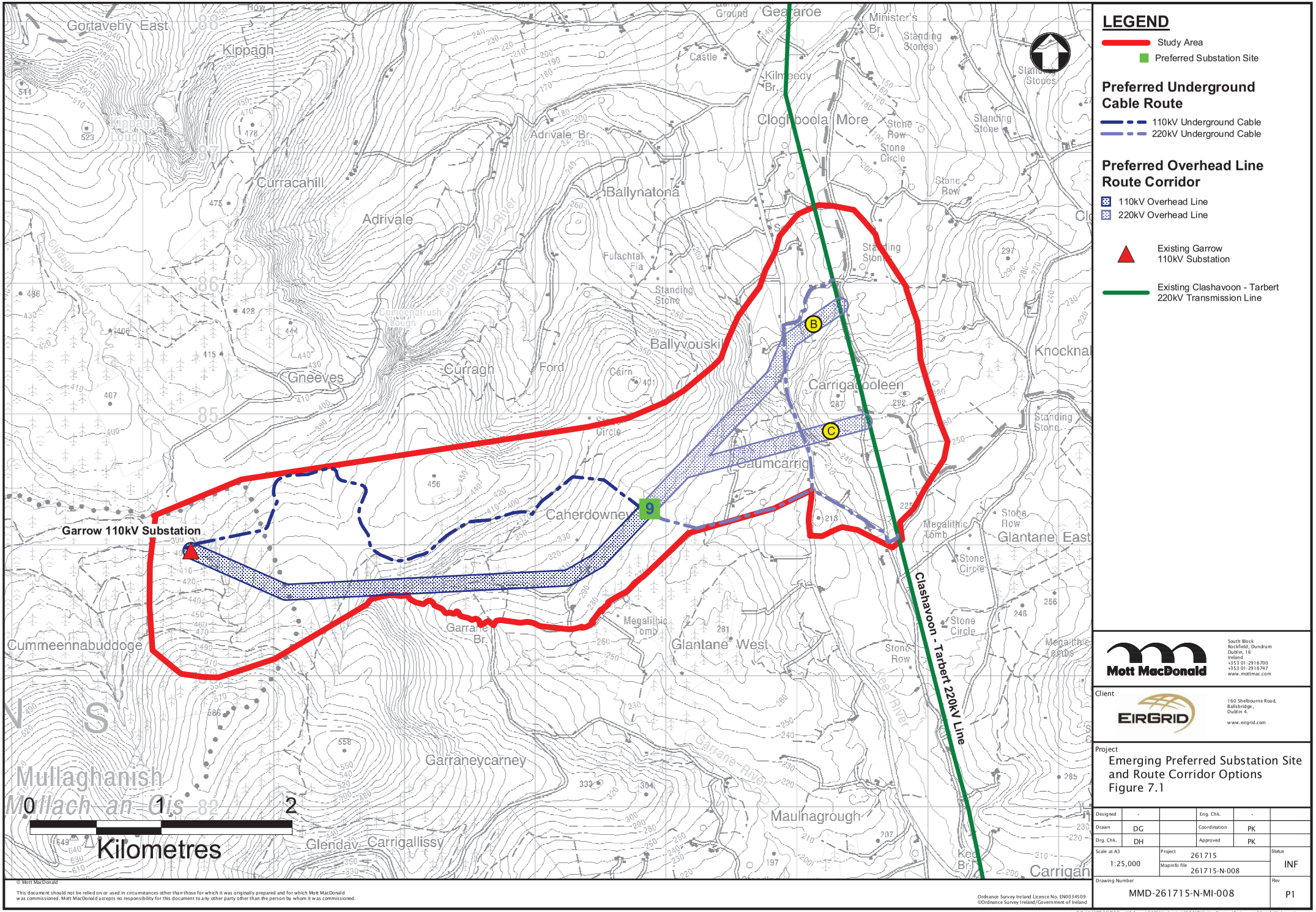
On completion of the analysis of available information for each of the alternative site options from a technical and environmental viewpoint, it is considered that Site 1 is preferred overall. Sites 2 and 9 in immediate proximity to Site 1 are next preferred.

Site 1 is a relatively level, brownfield site located in close proximity to an existing road of sufficient width to permit access during the construction phase. The site is well screened and of low archaeological potential.

Sites 2 and 9 are both greenfield sites located in close proximity to a suitable access road. Both sites are of low archaeological potential. Site 2 is well screened while Site 9 offers sufficient available space for landscape mitigation. Both sites will require site levelling works, although the works required at Site 9 will be more significant. In addition, Site 9 is located in close proximity to a water course; suitable buffer zones and pollution control measures will therefore be required to limit the potential for adverse impacts on water quality. Overall, while there are a number of potential environmental impacts associated with the development of Site 9, in particular in terms of soils, geology and hydrogeology and water quality, it is considered that these can be mitigated.

Sites 1, 2 and 9 all offer easy access to a road network of sufficient width with extensive coniferous forestry to the southeast and west. All sites can be integrated reasonably well into the landscape; Site 9 has a large agricultural shed in close proximity for visual context in an otherwise rural landscape and has sufficient available space for landscape mitigation. In addition, in contrast to any other identified sites, there are no residential properties located within 500 metres of the site, according to GeoDirectory data, field inspections and examination of aerial photography.

During initial public and landowner consultation, it has emerged that Site 9 is more readily available for acquisition and development in contrast to Sites 1 and 2. The availability of a site, and consent of a landowner, is considered to be of crucial importance to the timely and successful construction, operation and maintenance of a project. Having regard to the fact that Sites 1, 2 and 9 are of generally similar technical and environmental suitability, but that Site 9 is likely to be readily available for acquisition, Site 9 is presented as the preferred substation site in Figure 7.1 (*Preferred Substation Site and Circuit Connection Routes*).



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Project
Emerging Preferred Substation Site and Route Corridor Options
Figure 7.1

| | | | | | |
|---|---|---|---|---|---|
| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |
| Scale at A3 | 1:25,000 | Project | 261715 | Status | INF |
| | | Mapinfo file | 261715-N-008 | | |
| Drawing Number | MMD-261715-N-MI-008 | | | Rev | P1 |

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The following issues are associated with the remaining sites:

Site 3

- A number of residential properties are located to the north of the site with potential direct views of the site.
- Site 3 is of insufficient size to easily accommodate a substation, laydown area and construction phase compound.
- High soil electrical resistivity values are anticipated necessitating complex substation earthing design systems.

Site 4

- A number of residential properties are located to the north and west of the site with potential direct views of the site.
- Site 4 is of insufficient size to easily accommodate a substation, laydown area and construction phase compound.
- Anticipated difficulties associated with earthing a substation due to expected high soil electrical resistivity values.

Site 5

- A number of residential properties are located to the north of the site with potential direct views of the site.
- Significant road improvement works of the surrounding road network would be required to facilitate the movement of HGVs during the construction phase.

Site 6

- Significant road improvement works of the surrounding road network would be required to facilitate the movement of HGVs during the construction phase.
- The site is elevated and open in the immediate surroundings and is of moderate archaeological potential with potential direct views of the site.
- The site is of moderate archaeological potential.
- The site is located in proximity to Cloghboola National School, an architecturally protected structure, and Duhallow Way walking route.

Site 10

- Significant road improvement works of the surrounding road network would be required to facilitate the movement of HGVs during the construction phase.
- The site is elevated and open in the immediate surroundings with potential direct views of the site.
- The site is located adjacent to Duhallow Way walking route and is of moderate archaeological potential.

- High soil electrical resistivity values are anticipated necessitating complex earthing design systems.

## 7.3 Route Corridor Appraisal

The following 110 kV and 220 kV route corridor option appraisals are based on the assumption that Site 9 comprises the preferred substation site location. The emerging preferred substation site (Site 9) and route corridors are illustrated in Figure 7.1.

### 7.3.1 Overhead Line Connection

**110 kV Overhead Line Connection**

The 110 kV OHL connection options available from Garrow Substation to Site 9 are restricted due to existing and planned wind farms in the area, areas of moderate to high and moderate ecological value to the north and designated areas to the south of the study area. The 110 kV route from Garrow to Site 9 is dominated by managed mature forestry which is a relatively unimportant habitat ecologically. It is however recommended that a final 110 kV OHL route should pass along the northern edge of the route corridor in order to minimise impacts on the adjacent SPA (to the south) and the Garrane River

While the 110 kV route corridor will not impact directly on any recorded cultural heritage sites (CHS), it will potentially impact on two of the four cultural heritage sites identified during a field survey of the route corridor along the access ways.

One of these CHS, a vernacular house which is currently in use as a shed, is located to the north of Garrane Bridge and is directly under the corridor. The second CHS is located further west, approximately 120 metres to the north of the corridor. The second CHS is a ruined complex comprising a number of buildings surrounded by a copse of trees. Both of these sites were identified as potential bat roost sites, although no bat roost were identified as being present during a field survey undertaken in summer 2010.

**220 kV Overhead Line Connection**

Due to its overall shorter length, low proximity to dwellings, best use of existing tree cover and fit in the landscape, Route Corridor C is the preferred 220 kV OHL corridor connection from Site 9 to the existing Clashavoon-Tarbert transmission line in terms of landscape and visual, land use, water quality and soils, geology and hydrogeology. Route Corridor B and Route Corridor C are considered to be broadly similar in terms of ecology, landscape and visual, land use, water quality and soils, geology and hydrogeology. However, Route Corridor B is longer than Route Corridor C.

Although Route Corridor A is preferred in terms of cultural heritage, it is the least preferred in terms of ecology as it traverses a longer footprint of hen harrier foraging habitat and open moorland (moderate to high ecological value).

For the reasons outlined above, Route Corridor B would be the next preferred if two Single Circuit (SC) 220 kV options are required to be installed along separate route corridors, rather than a DC option.

It is anticipated that a Double Circuit (DC) 220 kV OHL option would be constructed along a single route corridor i.e. preferred Route Corridor C.

In addition, two SC 220 kV OHL connections to the existing 220 kV Clashavoon – Tarbert transmission line via both Route Corridor B and Route Corridor C may present an opportunity to remove approximately 1 kilometre of existing transmission line between the two OHL connection points. A single 220 kV DC OHL connection will require construction along one corridor only. Construction of a 220 kV DC OHL along a

single corridor will not present the same opportunity for the removal of existing OHL, in addition, the associated DC towers will be larger in size.

### *7.3.2 Underground Cable Connection*

**110 kV Underground Cable Connection**

The area between Garrow Substation and Site 9 includes a network of wind farms and forest access tracks which are considered to be of sufficient width to accommodate a 110 kV UGC. The indicative 110 kV UGC route presented in Figure 7.1 represents the most likely route available and follows an existing wind farm access track, although the final determination would be subject to negotiations with local wind farm operators and land owners in the area.

The potential environmental impacts associated with the installation of an UGC can be significant as excavations are required along its entire route, rather than the intermittent disturbance required for OHL foundations. In particular there is potential for adverse impacts on ecology, water quality, cultural heritage sites and soils, geology and hydrogeology. However, there is potential for significant comparable benefits over OHL options, especially in terms of landscape and visual impacts and the context and setting of cultural heritage sites. The majority of the study area and surrounding environs is acknowledged to be a highly scenic landscape of high value nationally with a high sensitivity to change, including a significant intensity of archaeological features.

The 110 kV connection to Garrow substation would not require a line/cable interface mast as the 110 kV UGC could run directly between the new substation and the existing Garrow substation equipment without the need to interface with any overhead lines.

As outlined in Section 6.4 (*Operation and Maintenance*), the typical repair time for 110 kV UGC circuits is two to three weeks. As the 110 kV UGC from Garrow substation to the new substation is primarily required to allow power generated by wind turbines to connect to the system, the failure of one of the 110 kV UGC circuits is not anticipated to have a significant impact on local electrical supplies, as demand can be catered for by the 220 kV transmission network. This issue is discussed further in the context of EirGrid's policy on the use of overhead line and / or underground cable in Section 7.4 below.

In addition, the use of 110 kV UGC in this area would avoid the potential for adverse impacts on the previously unrecorded CHSs, the adjacent SPA and the Garrane River associated with a 110 kV OHL option, as discussed in Section 7.3.1.

**220 kV Underground Cable Connection**

The preferred 220 kV UGC option presented in Figure 7.1 follows the route of the existing road network. As discussed above there is potential for environmental impacts associated with a 220 kV UGC option. While detailed assessments are required in order to establish the comparative potential impacts of the 220 kV UGC option on ecology, cultural heritage and soils, geology and hydrogeology when compared to the 220 kV OHL options, it is considered that potential adverse environmental impacts associated with a 220 kV UGC connection can be mitigated through careful route selection and reinstatement following construction works.

In addition, it is anticipated that two UGC circuit connections to the existing 220 kV Clashavoon – Tarbert transmission line will be required, due primarily to the road widths along the local road network. These connections may present an opportunity for the removal of approximately 2 kilometres of existing OHL between the two 220 kV UGC connection points. This is considered to have potentially significant positive impacts on landscape and visual amenity and the context and setting of sites of cultural heritage significance in the surrounding area.

However, as outlined in Section 6.4 (*Operation and Maintenance*), the existing 220 kV Clashavoon - Tarbert transmission circuits forms a critical part of the electrical grid infrastructure, providing electricity supplies to the entire south east, the loss of one of these circuits could have a significant impact on customer supplies in the region. The average repair time for 220 kV UGC circuits is 25 days. This issue is discussed further in the context of EirGrid's policy on the use of overhead line and / or underground cable in Section 7.4 below.

In addition, it should also be noted that 220 kV OHL/UGC interface masts of approximately 25 to 35 metres in height would be required to connect 220 kV UGC to existing transmission lines. It is considered that if an UGC connection is proposed, the new 220 kV cable termination would be mounted on a platform on the new mast. However, further detailed design is required to confirm that this is achievable. If this is not achievable, because of the need to install other transmission equipment (such as surge arrestors, current transformers and line traps), a compound in the order of 20 metres x 20 metres would be required at each line to cable interface point.

## 7.4 EirGrid Policy on the Use of Overhead Line and / or Underground Cable

In terms of its licence as Ireland's Transmission System Operator EirGrid has a statutory obligation to operate, maintain and develop a safe, secure, reliable, economic and efficient electricity transmission system in Ireland, while having due regard for the environment. In accordance with this obligation EirGrid has developed policies and practices for the planning, construction and operation of high voltage overhead lines and underground cables in Ireland (publicly available at www.eirgrid.com). Whenever a new high voltage circuit is proposed, these policies guide the decision on whether to use overhead line or underground cable.

EirGrid policy (refer to Appendix A) confirms that an underground cable will only be used if all of the following four conditions apply-

1. An overhead line is not environmentally feasible;

2. A technically and environmentally acceptable route for underground cable can be found;

3. The effect that the electrical characteristics of underground cable have on the transmission network is acceptable, and the relative 'availability' of the underground cable is tolerable; and

4. The relative greater cost of the underground cable above that for overhead line can be justified.

For the Millstreet project there are four circuits to be considered. These four circuits involve different voltage levels and comprise:

- 2 x 220 kV circuits from the planned new 220/110 kV substation to the existing Clashavoon –Tarbert 220 kV line

- 2 x 110 kV circuits from the existing Garrow 110 kV substation to the planned new 220/110 kV substation

EirGrid policy is discussed in more detail regarding these circuits in the following sections.

### 7.4.1 220 kV Circuits

In relation to condition (1) of EirGrid's policy on underground cables above, Chapter 3 (*Substation Site and Route Corridor Selection*) of this report confirms that there are three route corridors, within which it is technically feasible to route either a 220 kV single circuit overhead line or a 220 kV double circuit overhead

line from the existing Clashavoon – Tarbert 220 kV overhead line to the site of the planned new 220/110 kV substation. It is further confirmed that the impact of such overhead lines would, in the opinion of the environmental experts, be environmentally sustainable. It is the case therefore that condition (1) does not apply and EirGrid, in compliance with its policy on the matter, must propose an overhead line solution for this part of the project.

Notwithstanding this fact, detailed consideration has been given to the use of underground cable for this part of the project and this has established the following:

In relation to condition (2) of EirGrid's policy on underground cables above, technically feasible route options for 220 kV underground cable were identified and the impact of installing such underground cable in one or more of these is considered by the environmental experts to be environmentally sustainable. As such condition (2) does apply.

In relation to condition (3) of EirGrid's policy on underground cables above, a relatively short length of 220 kV underground cable (circa 2 kilometres) would be required for this project and the electrical characteristics of such a short length of 220 kV cable could be accommodated safely by the regional transmission network. The electrical characteristics of the cable required for the underground cable option is therefore deemed tolerable based on this assessment.

The latest fault statistics show that 220 kV underground cables suffer more faults, namely faults that require repairs, than 220 kV overhead lines when compared on a per kilometre basis. The statistics also show that the average time taken to repair a 220 kV underground cable is 25 days while the average time to repair a 220 kV overhead line is less than one day. It is an established fact therefore that a 220 kV overhead line will have a much better availability for service over its lifetime than an equivalent underground cable.

There are three 220 kV circuits out of the Cork area to the rest of the network, one to Killonan, one to Great Island and the one to Tarbert (via Clashavoon) that is the subject of this report. The integrity of these three circuits is crucial to the ability to transport power out of, and into, Cork. Any degradation in their availability and / or reliability will impact on EirGrid's ability to operate this part of the network securely. The insertion of a section of 220 kV underground cable, into what is now the Clashavoon – Tarbert 220 kV overhead line, is likely to have a negative impact on the availability for service of the overall circuit. Such degradation in availability is not acceptable and it can therefore be considered that condition (3) does not apply.

In relation to condition (4) of EirGrid's policy on underground cables above, EirGrid has estimated the cost associated with a 220 kV overhead line and a 220 kV underground cable solution. Based on the emerging preferred overhead line corridor and the emerging preferred underground cable route, it is estimated that the underground cable would cost approximately 500% more than the overhead line. This is based on construction costs only and does not include landowner costs associated with an overhead line option. As such the relative high cost of an underground cable cannot be justified for this part of the project. As such condition (4) does not apply.

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

As three out of the four conditions do not apply, EirGrid is proposing a 220 kV overhead line connection from the planned new 220/110 kV substation to the existing Clashavoon – Tarbert 220 kV line.

### *7.4.2 110 kV Circuits*

Although EirGrid has a policy on underground cables, in this case the policy does not apply for the two 110 kV circuits between Garrow 110 kV substation and the planned new 220/110 kV substation, due to the fact

that all substations feeding into Garrow including Garrow itself, were constructed exclusively to connect renewable generation to the transmission system and therefore no electricity consumers are directly impacted by these substations.

Notwithstanding this fact, detailed consideration has been given to the use of underground cable for this part of the project and this has established the following:

As this is a relatively short circuit length circa 4 kilometres, a technically feasible cable route was identified and the environmental impacts are sustainable. The cable route identified runs along tracks which have already been constructed and used by the windfarms in the area. The existing network of tracks provides viable duct routes that could be used for 110 kV cable circuits.

Garrow 110 kV substation was constructed for the sole purpose of providing a cluster of windfarm generators with a connection to the transmission network. The 110 kV circuits connecting Garrow 110 kV substation with the new 220/110 kV substation will be used to direct the renewable generation to the higher capacity 220 kV network. The circuits will therefore function as a radial feed and not form part of the meshed transmission system. No electricity consumers are supplied direct from Garrow 110 kV substation or from the circuits that connect it to the transmission network. In this circumstance the relative less reliability and availability provided by an underground cable solution has less impact on the transmission system and in this regard can be deemed acceptable. The technical assessment on the impact of this short distance of cable, confirmed that the electrical characteristics of this underground cable on the transmission network is acceptable.

EirGrid has estimated the costs associated with a 110 kV overhead line and a 110 kV underground cable solution. A significant network of roads and tracks is in place and any new 110 kV cable can be routed along this existing network. As the existing network consists mainly of unpaved tracks and roads, the excavation and reinstatement of the network will cost less than a regular 110 kV cable installation project. It is estimated that as the majority of the cable route is along an unpaved access track, that the civil works will cost approximately 40% less than it would on a public road. As the environmental impacts of an underground cable connection in this case are considerably less than that of an overhead line connection, EirGrid believes that the relative greater cost of the underground cable above that for overhead line is justifiable.

EirGrid is proposing that the most appropriate connection on balance for this part of the project is a 110 kV underground cable connection from the existing Garrow 110 kV substation to the planned new 220 kV substation. If the policy on underground cables applied to this part of the project, EirGrid would have to construct an overhead line connection between the two substations as there is a technically feasible corridor, within which to route two 110 kV single circuit overhead lines or a 110 kV double circuit overhead line.

## *7.5 Recommendation*

Having reviewed all available data it is the opinion of Mott MacDonald Ireland Limited (Lead Consultant) that, of the available sites, Site 9 is the emerging preferred substation site location which should be progressed to Phase Two of the Project Roadmap, as illustrated in Figure 7.2 below.

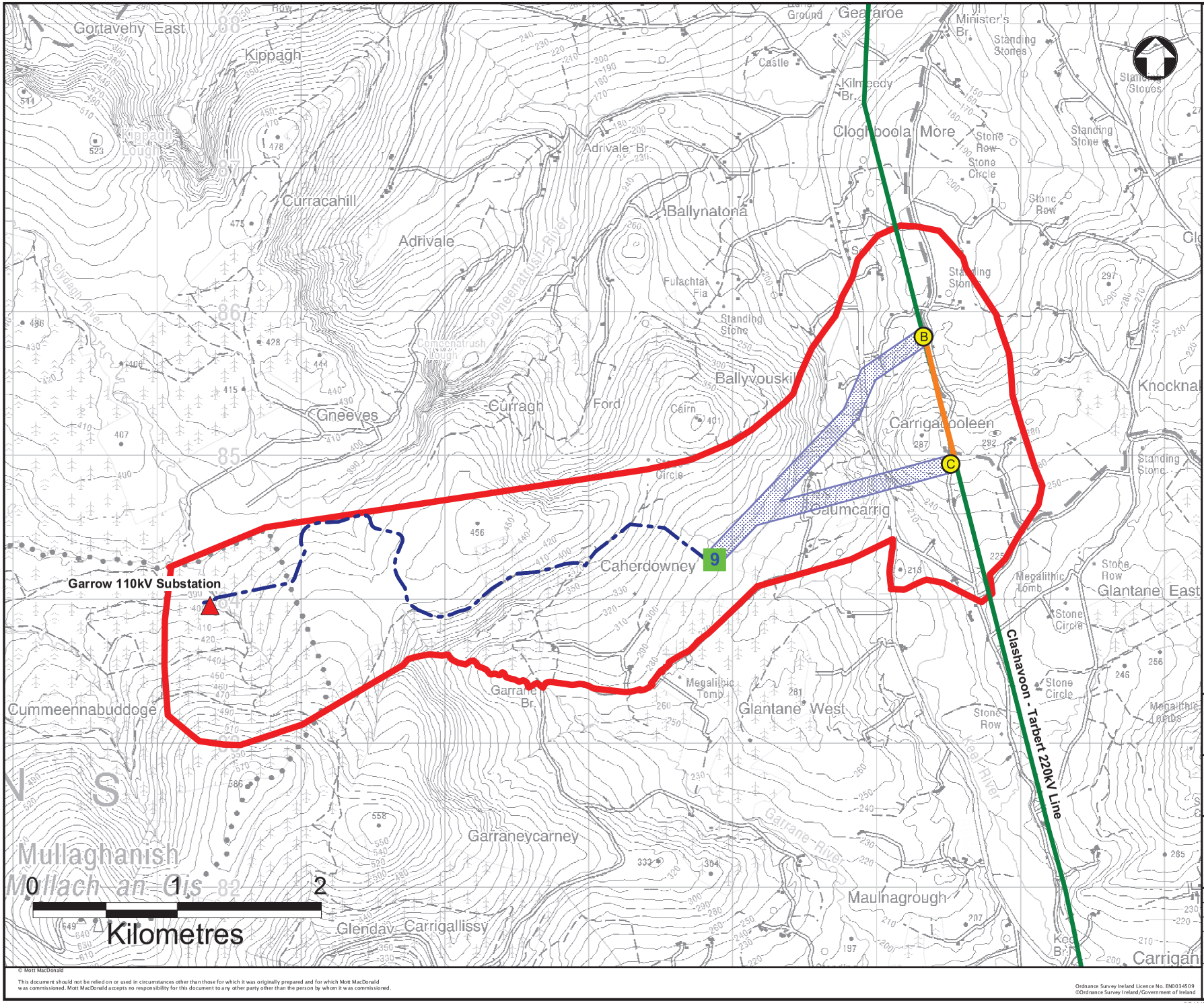
If the project progresses with Site 9 as the preferred substation site location, it is the opinion of the Lead Consultant that a 220 kV OHL connection from Site 9 to the existing 220 kV Clashavoon – Tarbert transmission line is preferred. This is due primarily to the potentially significant risks to security of supply associated with 220 kV UGC circuit failures on power supplies into and out of the Cork region.

While the potential for a 220 kV OHL to impact on the context and setting of cultural heritage sites in the area is acknowledged, it should also be noted that direct impacts on cultural heritage sites can be avoided. It is therefore considered that Route Corridor C is the overall emerging preferred 220 kV DC OHL route

option available. If two SC 220 kV OHL routes are required, it is considered that use of Route Corridor C and Route Corridor B is preferred. This opinion is considered to be reasonable based on the competing constraints in the study area and the greater archaeological value of the broader area outside of the study area.

As outlined previously, the same security of supply risks do not apply to the 110 kV UGC option. It is therefore considered that the preferred 110 kV connection option is an UGC from Garrow substation to Site 9 utilising the existing network of wind farm and forest access tracks in the area.

Phase Two of the Project Roadmap (refer to Figure 1.21) will examine the emerging preferred 220 kV OHL and 110 kV UGC route corridors presented in Figure 7.2 below. A comparative evaluation of the emerging preferred options will be undertaken including identification of specific routes for the proposed circuits and siting and design options for the substation. The recommended route and substation design will be progressed to Phase Three of the Project Roadmap.




## LEGEND

- Study Area
- Preferred Substation Site

**Preferred Underground Cable Route**

- 110kV Underground Cable

**Preferred Overhead Line Route Corridor**

- 220kV Overhead Line
- 9 — C: Preferred DC 220kV Overhead Line
- 9 — C — B: Preferred SC 220kV Overhead Line
- Existing Garrow 110kV Substation
- Existing Clashavoon - Tarbert 220kV Transmission Line
- Potential for Removal of Existing 220kV Transmission Line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Project
Emerging Preferred Substation Site and Route Corridors
Figure 7.2

| | | | | | |
|---|---|---|---|---|---|
| Designed | - | | Eng. Chk. | - | |
| Drawn | DG | | Coordination | PK | |
| Drg. Chk. | DH | | Approved | PK | |
| Scale at A3 | 1:25,000 | Project | 261715 | Status | INF |
| | | Mapinfo file | 261715-N-009 | | |
| Drawing Number | MMD-261715-N-MI-009 | | | Rev | P1 |



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