The Grid West Project

Volume 1

Constraints Report

August 2012

TOBIN CONSULTING ENGINEERS

TOBIN
Patrick J. Tobin & Co. Ltd.

REPORT

PROJECT: **The Grid West Project**

CLIENT:

EirGrid plc
The Oval
160 Shelbourne Road
Ballsbridge
Dublin 4

COMPANY:

TOBIN Consulting Engineers
Market Square
Castlebar
County Mayo

www.tobin.ie

DOCUMENT AMENDMENT RECORD

Client:	**EirGrid plc**
Project:	**The Grid West Project**
Title:	**Constraints Report**

PROJECT NUMBER: 6424				**DOCUMENT REF: 6424-A 6424 Report Template 200812.doc**			
Rev A	Final Constraints Report	MH	200812	MG	200812	MG	200812
Revision	**Description & Rationale**	**Originated**	**Date**	**Checked**	**Date**	**Authorised**	**Date**
TOBIN Consulting Engineers							

TABLE OF CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF APPENDICES

LIST OF CONSTRAINTS FIGURES

1 EXECUTIVE SUMMARY

The purpose of this Constraints Report is to identify key environmental and other constraints within the defined study area which may influence the identification of potential indicative corridors and substation site options, and ultimately an indicative line route, along which the proposed transmission line will be sited.

A “constraint” incorporates two strands: it includes factors which could comprise potential obstacles in the identification of substation locations, route corridors and line routes, and might best be avoided where possible or appropriate; it also includes considerations which will assist in the design of the project. Constraints are identified to ensure a comprehensive understanding of the study area.

This report has been compiled based on desktop studies, site visits and consultation with a number of strategic stakeholders and members of the public. This Constraints Report will include considerations of ecology, landscape, geology, water, cultural heritage, settlements, utilities & infrastructure and engineering constraints; factors which may influence the development of a transmission line. The constraints described in this report are based upon a review of local, regional and national datasets. This report is presented as part of Stage 1 of the EirGrid Project Development & Consultation Roadmap, entitled *Information Gathering*. The constraints identified within the study area have been identified and mapped.

1.1 ECOLOGY

Based on this assessment, it is clear that the study area has a large number of important ecological sites and receptors. At this stage avoidance should be prioritised, where possible, of all designated sites in particular Natura 2000 sites (Special Areas of Conservation and Special Protection Areas), Ballycroy National Park, Natural Heritage Areas, designated freshwater pearl mussel catchments (in rivers protected as Special Areas of Conservation) and lakes.

It is also recommended that other features of ecological significance detailed in this report be avoided as much as possible at the corridor selection stage or, if this is not possible, be fully considered at a more localised scale at later stages in the project i.e. Stage 2 *Corridor Evaluation*, based on more detailed studies. Other important ecological receptors include proposed Natural Heritage Areas, other freshwater pearl mussel catchments, fens, turloughs, bogs, wet heath, semi natural woodland, wintering bird sites and semi natural grassland. This approach is recommended given their importance in a national context and the commitments of the National Biodiversity Plan (2011-2016) which includes conservation of ecosystems, habitats and species particularly high value habitats.

1.2 LANDSCAPE

The main international, national and county level landscape designations have been identified and mapped. In the absence of finalised national guidelines, each local authority uses its own terminology to describe parts of the landscape considered to be of significant aesthetic or recreational value on a county scale. This desktop study has been supplemented by a site visit which verified the key

constraints and ascertained the characteristics of the wider landscape. The most important constraints are those of international (candidate World Heritage Sites) and national significance. The remainder of the constraints vary in their importance, and in the nature of their sensitivity.

1.3 SOILS & GEOLOGY

The most relevant geological constraints within the study area for this stage of the project have been identified and mapped. It is recommended that Irish Geological Heritage Sites (proposed Natural Heritage Areas and County Geological Sites) are avoided, where possible, and that areas of peat, bedrock outcrop and karstified rock, are also avoided. In addition, it is also recommended to reduce the potential for unfavourable construction conditions in areas of steep topography and to reduce the requirement for specialised geotechnical input at the construction design phase.

It should also be noted that additional studies and site assessments will be carried out as the project progresses, since geological features are often quite localised and of more significance locally, and can be more effectively considered at later stages of the project when decisions start to be made with regard to the design of the transmission line.

1.4 WATER

The most relevant water related constraints within the study area for this stage of the project have been identified and mapped. It is recommended that larger lakes are avoided, where possible, and that floodplains in the vicinity of rivers are avoided. In addition, it is also recommended to avoid areas where there is a high occurrence of turloughs, estuarine and coastal areas. Major rivers may be a physical constraint but where there is a requirement to cross rivers, best practice should be incorporated into project design and construction so as to minimise pollution risks particularly for freshwater pearl mussel catchments.

Additional studies and site assessments will be carried out as the project progresses. In addition more specific information on water features, including water quality baseline studies and water status under the Water Framework Directive may influence the selection of the indicative line route for the proposed transmission line.

1.5 CULTURAL HERITAGE

Based on this assessment, it is clear that the study area has a rich and varied archaeological and historical past, with multi period monuments, ranging from humble sites of local interest, to large complexes of international significance. All of the features, from a prehistoric megalith, to a 19th century gate pier, have varying degrees of statutory protection but the primary principle should be their preservation *in situ.* Given the nature of the project, and the relative flexibility in designing transmission lines, this initial goal is achievable, thus the emphasis will be on reducing any potential impacts from the proposed development on the settings of monuments, structures and areas of cultural heritage significance.

1.6 SETTLEMENTS

The study area includes within it, a wide range of settlements, one national Gateway centre (Galway City) and three designated Hubs (Castlebar, Ballina and Tuam). There are otherwise a wide range of smaller towns and villages but generally the population density of this part of Ireland is relatively low and well below the national average. The lists provided of settlements are comprehensive including many very minor settlements to which there is reference in county development plan settlement strategies.

Some rural areas have seen significant levels of development including extensive 'one-off' housing, these may present significant difficulties for the eventual delineation of any route corridors. There is a band of higher density development in a north south direction through the centre of the study area from Ballina towards Galway. Generally densities are lower on the western and eastern parts of the study area and generally lower in the vicinity of the existing Flagford substation than in the vicinity of the existing Cashla substation.

1.7 UTILITIES AND INFRASTRUCTURE

All of the known utilities and infrastructure within the study area for this stage of the project have been identified and mapped.

The identified utilities and infrastructure are a constraint in that the route of any proposed corridor will have to take due consideration of the location of any existing utilities and infrastructure. In addition, the utilities and infrastructure identified will have an impact on the location of the new Bellacorick substation site. This substation location will be further influenced by the location of wind farm generators near Bellacorick, which will require connections to the new substation at Bellacorick.

1.8 ENGINEERING CONSIDERATIONS

Based on studies carried out to date, high voltage alternating current, overhead line technology is the preferred technology for the Grid West project. The engineering design will be undertaken in accordance with international best practice. It is important that the technology selection is kept under constant review, such that both the technology and the design can be adjusted if the constraints and consultation indicate that this is necessary.

1.9 CONCLUSION

This Constraints Report has identified the key environmental and other constraints within the defined study area, which may influence the identification of both substation site options and potential indicative corridors, and which may ultimately define an indicative line route along which the proposed transmission line will be routed.

While the Project Team is confident that an extensive database of all 'recorded constraints' has been gathered, it has also recognised how important local knowledge is in identifying unrecorded constraints that may be of folkloric or local importance and which are often left undocumented. This information is

very often only garnered from dialogue with local people living in the area. One of the objectives of consultation with the public is to allow such dialogue to take place.

With the publication of the Constraints Report, we are now in a position to consult on this report and associated Constraints Mapping. This Constraints Report is available to stakeholders (public, statutory and non statutory agencies) in order to seek their input on this report, so that any comments can be taken into consideration at an early stage in the project development. This consultation is being undertaken in line with the EirGrid Project Development & Consultation Roadmap and involves:

- Face to face meetings with stakeholders;
- A series of Open Days for the public, widely advertised in the study area;
- The production of a 'Guide to Constraints Report';
- Making the material available in the project Information Centre in Castlebar; and
- Publishing the Constraints Report on the dedicated project website.

2 INTRODUCTION

2.1 THE PURPOSE OF THIS REPORT

The purpose of this Constraints Report is to identify key environmental and other constraints within the defined study area which may influence the identification of potential indicative corridors[1] and substation site options and ultimately an indicative line route[2], along which the proposed transmission line will be sited.

A "constraint" incorporates two strands: it includes factors which could comprise potential obstacles in the identification of substation locations, route corridors and line routes, and might best be avoided where possible or appropriate; it also includes considerations which will assist in the design of the project. Constraints are identified to ensure a comprehensive understanding of the study area.

This report has been compiled based on desktop studies, site visits and consultation with a number of strategic stakeholders and members of the public. This Constraints Report will include considerations of ecology, landscape, geology, water, cultural heritage, settlements, utilities & infrastructure and engineering constraints; factors which may influence the development of a transmission line. The constraints described in this report are based upon a review of local, regional and national datasets.

This report is presented as part of Stage 1 of the EirGrid Project Development & Consultation Roadmap, entitled *Information Gathering, (refer to Plate 2.1 herein)*. It is divided into Volume 1, which contains the Main Report, Volume 2, which contains the Constraints Mapping, and Volume 3, which contains the Appendices associated with the report.

2.2 ABOUT EIRGRID

EirGrid plc (hereinafter referred to as 'EirGrid'), is an independent, state owned company and is the statutory Transmission System Operator in Ireland. EirGrid's statutory functions include:

- 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; and
- To facilitate the market for renewable electricity in Ireland.

It is in this capacity that EirGrid is proposing the Grid West 400kV project.

[1] A potential indicative corridor is one which achieves the necessary starting and endpoints in the vicinity of Bellacorick and either Flagford or Cashla, which avoids the statutorily and primarily constrained areas, which is positioned to minimise the impact with respect to the other constraints, and which is technically feasible.
[2] Indicative Line Route is a line along which the proposed transmission line will be constructed within the corridor.

2.3 GRID25

'*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, in response to the Irish Government's White Paper - '*Delivering a Sustainable Energy Future for Ireland'* (2007). Grid25 is a major initiative to put in place a safe, secure and affordable electricity supply throughout Ireland, supporting economic growth and utilising Ireland's renewable energy resource to its maximum potential. Further details on this Strategy are detailed in *Chapter 3 Strategic Planning Context* of this report.

The Grid25 Implementation Programme (IP) 2011-2016 sets out a practical overview of the early stages of the Grid25 Strategy for major investment in the transmission grid in order to meet the long term needs of the country. The Grid25 Strategy (and the IP) is consistent with the Government's renewable generation target of achieving 40% of electricity generated from renewable resources by 2020. This IP underwent Strategic Environmental Assessment (SEA) in order to anticipate and avoid adverse impacts arising and to provide a clear understanding of the likely environmental consequences of decisions arising from the Grid25 IP.

As part of this process, Strategic Environmental Constraints Mapping was also prepared by EirGrid in order to provide relevant information on environmental constraints so that environmental issues could be taken into consideration from the earliest possible stages of strategic transmission reinforcement. For the purpose of the Grid25 IP SEA the country was divided into 3 Sectors (taking into consideration combinations of the regions defined in the National Spatial Strategy (NSS):

- Sector 1 The Border and West Regions;
- Sector 2 The Midland, Mid East, South East and Greater Dublin Regions; and
- Sector 3 The Mid West and South West Regions.

The Grid West project is part of Sector 1.

2.4 GRID WEST PROJECT

Grid25 is EirGrid's strategy to develop and upgrade the electricity transmission network from now until 2025. The Grid West project is the largest Grid25 project in the West, initially accounting for an estimated €240m of the investment earmarked for the region. By connecting the electricity generated by the region's huge renewable energy resources, the Grid West project will facilitate significant job creation and investment. It will contribute to national recovery and growth while at the same time allowing the region to attract inward investment which requires a strong reliable source of power.

This project is needed as it is Ireland's national goal is to achieve 40% of electricity consumption from renewable sources by 2020. These renewable resources include wind, wave and tidal energy. The existing transmission infrastructure in this region needs substantial investment to accommodate the West's increasing levels of renewable generation.

2.4.1 Objectives of the Grid West project

The West of Ireland, and County Mayo in particular, has significant potential for the development of renewable generation, particularly wind and ocean energy (tidal/wave). EirGrid has issued connection offers to connect 647MW of wind energy under the Gate 3 Group Processing Approach[3] from a number of wind farm developments in the Bellacorick area. As part of the EirGrid Grid25 Strategy to develop the Irish electricity transmission network, EirGrid is to install initially one new high voltage electricity transmission line from the Bellacorick area to connect to the existing national grid, at either the existing Flagford substation in County Roscommon, or the existing Cashla substation in County Galway. Based on the region's renewable potential it is envisaged that, in time, the project will involve the construction of a second line which will connect to the other station (either Cashla or Flagford). The pace at which the second line will be installed is dependent on a number of factors, including the speed at which further renewable energy generation is developed in the region.

EirGrid's analysis of these requirements has to date highlighted that a new 400kV line, with an associated substation in the vicinity of the Bellacorick area, and extensions to the existing substations, at either Flagford or Cashla, will be required. The straight line distance from Bellacorick to either Cashla or Flagford is approximately 100km. A number of different technology options were considered as part of the EirGrid technical analysis. In accordance with the Grid25 Strategy and to provide the capacity and capability to maximise future development of the network, EirGrid concluded that the 400kV option was preferred. It has also been found that there were no significant technical considerations to differentiate between connection from Bellacorick to the existing Flagford substation, and alternatively, connection from Bellacorick to the existing Cashla substation, and on that basis it considered that both options should be taken forward for consideration of which is best to serve the Gate 3 requirement, while recognising that connection of renewables beyond the Gate 3 horizon will require the second line.

The Grid West project is proposed to meet the development needs of the transmission system, allowing the country to meet its energy requirements and obligations for generation of energy from renewable sources. Its primary purpose will be to allow the connection of approximately 647MW of Gate 3 wind generation proposed in the County Mayo area around Bellacorick. However, in the future, the project will form part of the electrical network necessary to transmit renewable energy from the West of Ireland as well as meeting the long term electricity needs of consumers and promoting development in the region.

[3] The Commission for Energy Regulation (CER) approved Group Processing Approach (GPA) applies to the vast majority of renewable generators applying for connection to the network. Under the GPA or 'Gate' process, applications for connections are processed in batches rather than sequentially. New generator applicants join a queue. On a date, of the CER's choosing, the gate is closed (Gate 3 was the last process) and those already in the queue, satisfying certain criteria which can change with each Gate, are included in the next batch of applicant processing. There is currently no direction from the CER as to when the next round of processing of applicants (those currently in the queue) will take place.

2.5 TERMS OF REFERENCE

2.5.1 Project Overview

In December 2011, TOBIN, together with URS and Drury, were appointed by EirGrid to provide '*Engineering, Planning, Environmental and Communication Services*' for the Grid West project. The overall objectives and scope of work for the Grid West project are set out herein.

Overall Objectives of the Grid West project

- Put in place the necessary infrastructure to facilitate the connection to the existing transmission system of large-scale (approximately 647MW) renewable generation in the West of Ireland;
- Ensure all works are carried out in a safe, secure, reliable, economical, efficient and environmentally sensitive manner; and
- Engage pro-actively and constructively with stakeholders.

Objectives for this Scope of Work

The objective of this phase of the project is to obtain statutory approval for a new 400kV circuit between the general Bellacorick area and either of the existing 220kV stations at the Flagford substation in County Roscommon or the Cashla substation in County Galway. Based on the region's renewable potential, it is envisaged that, in time, the project will involve high capacity power lines from Bellacorick in County Mayo to both Flagford in County Roscommon and Cashla in County Galway.

The routes selected (at later stages in the project) will aim to minimise impacts and will have regard to the Holford Rules[4], the Cigré Guidelines[5] and other best practice guidelines.

2.5.2 Project Development & Consultation Roadmap

The core process in delivering the Grid West project is the EirGrid Project Development & Consultation Roadmap, (from hereon referred to as the *Roadmap*[6]) which identifies the key stages of the project and aligns this with the consultation stages, refer to Plate 2.1 which highlights this Roadmap. EirGrid seeks to follow a structured framework of project development that provides for a clear and transparent process for the benefit of all stakeholders. The Project Team has to date followed this comprehensive Roadmap, which prescribes a staged approach to project development, in order to ensure that the views of the public, stakeholders and all other interested parties are heard.

This Roadmap ensures that the approach taken for this project is to move from information gathering and seeking public input, to evaluation and consultation before endorsing a preferred corridor, and following further public input, moving to a specific indicative line route. This Roadmap is common to all Grid25 projects and it aims to choose the best line route, in consultation with stakeholders, with

[4] For further details on the Holford Rules, refer to http://www.nationalgrid.com/NR/rdonlyres/E9E1520A-EB09-4AD7-840B-A114A84677E7/41421/HolfordRules1.pdf

[5] Founded in 1921, CIGRE, the Council on Large Electric Systems, is an international non-profit Association for promoting collaboration with experts from all around the world by sharing knowledge and best practice for power systems

[6] http://www.eirgridprojects.com/media/EirGrid%20Roadmap%20Brochure%20July%202012.pdf

comprehensive information, leading to a workable statutory consent and ultimately a timely construction period.

Plate 2-1 EirGrid Project Development & Consultation Roadmap

2.5.3 Constraints Report within the Context of the EirGrid Roadmap

This Constraints Report is the first major report to be published in Stage 1 *Information Gathering*. The report identifies a number of constraints as being of primary importance for the corridor identification for the Grid West project. It also considers other issues more broadly e.g. national planning strategies and certain legal considerations, which although not considered an obstacle for the purposes of corridor

identification, potentially comprise issues for the later stages of route identification and environmental impact assessment, as per the Roadmap. Such considerations will be dealt with at the appropriate stage of the project development. This is not to suggest that these other issues are unimportant, rather that there are some issues that are of greater significance to the overall development of the project at the corridor identification stage.

A copy of the report will be made available to stakeholders (the public, statutory and non statutory agencies) in order to seek their input on this report, so that any comments can be taken into consideration at an early stage in the project development. In disseminating the report, the Project Team are seeking views as to whether all of the key constraints have successfully been captured.

3 SUMMARY OF COMMUNICATIONS TO DATE

EirGrid is committed to early, meaningful and ongoing two-way consultation with all interested parties, including statutory and non statutory consultees on the proposed Grid West project.

The project's primary objectives in this stage of consultation is to:

- Explain the need and rationale for, and the benefits accruing from the project, clearly and consistently to all stakeholders and key audiences.
- Deliver a consultation process which engages the interest of national, regional and local stakeholders, in line with the EirGrid Project Development and Consultation Roadmap.

Consistent with these objectives and reflecting the early stage of the project, much of the Project Team's interaction with stakeholders has focused on the communication of the need, rationale and benefit accruing from the Grid West project and inviting comments on the study area map and constraints within the study area that should be considered by the Project Team. To date, the introduction of the project has been met with widespread welcome and there has been significant recognition of the need for infrastructural development to make use of the western region's natural resources and to sustain and facilitate job creation.

3.1 PUBLIC CONSULTATION

3.1.1 Stage 1 – Constraints Stage Consultation

The first phase of public consultation on the Grid West project was launched successfully by An Taoiseach, Mr Enda Kenny TD and Minister for Communications, Energy and Natural Resources, Mr Pat Rabbitte TD at an event on the 4th of May 2012 at the National Museum of Ireland – Country Life, Turlough Park, County Mayo. A press release was issued to local and national media and an information brochure (No. 1) was published and made available to the general public. This approach is in line with the objective of communicating the need, rationale and benefit of the project clearly and consistently to all stakeholders and key audiences.

The event was opened by the Mayor of Mayo Cllr. Austin O'Malley. Speakers included Ms Bernie Gray, Chairperson of EirGrid, An Taoiseach, Mr Enda Kenny TD and Minister for Communications, Energy and Natural Resources, Mr Pat Rabbitte TD. In addition, a presentation on the project and the EirGrid Project Development and Consultation Roadmap was made by Mr Alan McHugh, Grid West Project Manager.

Website and Lo-call Number

On the 4th of May 2012, the project's dedicated website www.eirgridprojects.com/projects/gridwest went live. An email address gridwest@eirgrid.com and a lo-call number 1890 94 08 02 were put in place to provide channels through which the public can get more information on the project and provide feedback. This is in line with the project's communications strategy of using a wide range of channels to communicate and consult with the public.

Public Advertisements

Following the launch of the project, advertisements (introducing the project, explaining contact details and a map of the proposed study area) were placed in the following print media in the week commencing the 7th of May 2012:

- Connacht Tribune;
- Connacht Sentinel;
- Connaught Telegraph;
- Mayo News;
- Leitrim Observer;
- Roscommon Herald;
- Sligo Champion;
- Tuam Herald; and
- Western People.

Castlebar Information Centre

As part of the project's commitment to providing a range of channels to facilitate communication and consultation on the Grid West project, a project Information Centre was opened on Monday the 11th of June 2012 in Linenhall Street, Castlebar, County Mayo. The office is open on Mondays and Tuesdays, from 9am to 5pm and is manned by two personnel. A press release was issued to local media informing them of the opening of the Information Centre.

Open Days

The Roadmap seeks to ensure that the views of the public and other stakeholders interested in the project are heard. To this end, Open Days were held in the following venues:

Thursday, 6th June 2012	Kiltane GAA Club, Bangor Erris, County Mayo
Friday, 7th June 2012	Downhill Hotel, Ballina, County Mayo
Thursday, 14th June 2012	Corralea Court Hotel, Tuam, County Galway
Friday, 15th June2012	Border Midland Western Regional Assembly, Ballaghaderreen, County Roscommon

The main objectives of the initial Open Days were to:

- Provide the general public with information about the project;
- Offer members of the public a place to ask questions;
- Identify and address, where possible, concerns of members of the public; and
- Allow stakeholders to provide feedback for consideration by the Project Team.

Each Open Day ran from 1pm until 8pm, and each location was set up on a consistent thematic basis allowing the Project Team to explain the rationale and need for the project with displays of the transmission network, high level Grid West messages, the Roadmap and the study area.

Advertisements/Promotion of Open Days

Prior to the series of Open Days, a press release was issued to local media and advertisements were placed in local print media and local broadcast media. Posters on the Open Days were also provided to Country Librarians in the study area for distribution to local libraries within the study area and close to Open Day locations. Local public representatives were also invited to the Open Days.

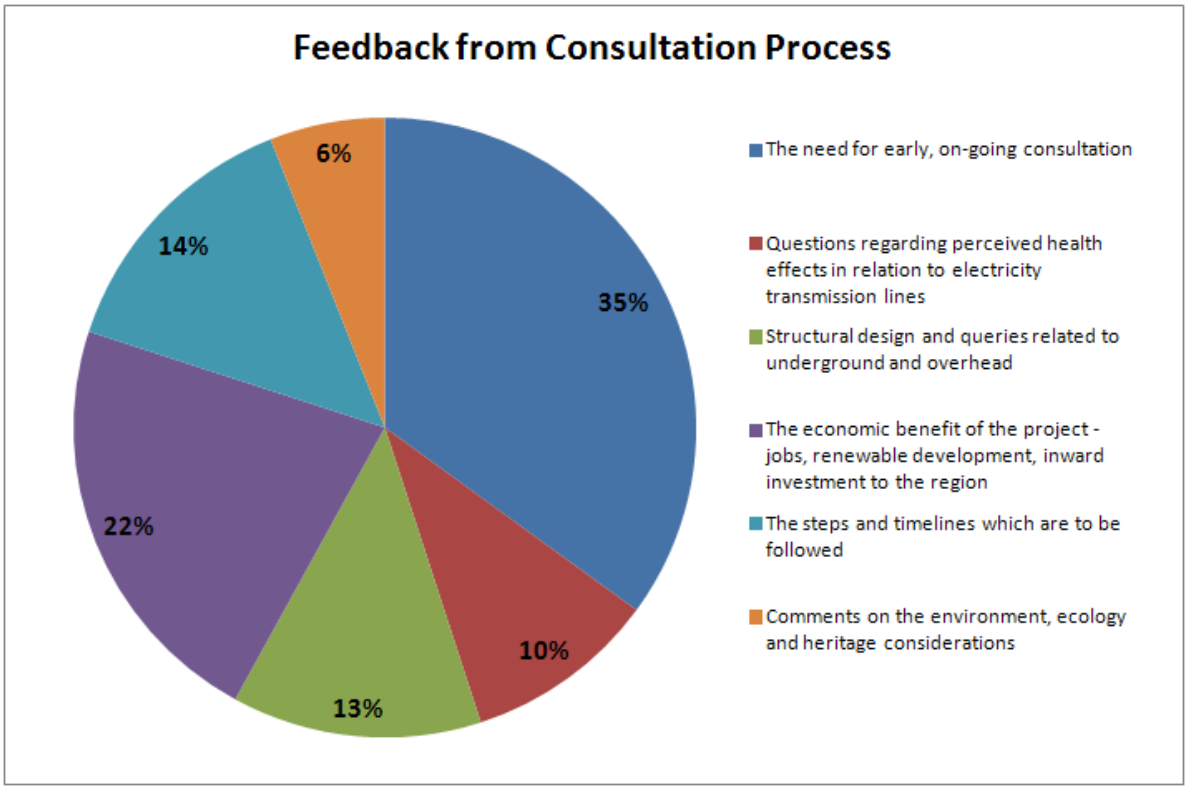
3.1.2 Response to Consultation Process

The Project Team actively seek feedback from stakeholders. In addition to receiving general comments and information on potential constraints across the study area, feedback received was grouped under six broad headings:

1. The need for early, on-going consultation;
2. The economic benefit of the project – jobs, renewable development, inward investment to the region;
3. Questions regarding perceived health effects in relation to electricity transmission lines;
4. Structural design and queries related to underground and overhead;
5. Comments on environment, ecology and heritage considerations; and
6. The steps and timelines which are to be followed.

Plate 3.1 reflects the frequency with which each theme arose in engagements with stakeholders.

Plate 3-1 Feedback from Consultation Process



3.2 STRATEGIC STAKEHOLDER CONSULTATION

As part of the initial consultation process, efforts were made to engage early with certain stakeholders for Stage 1 *Information Gathering*, by virtue of their statutory roles in the planning process or in local government in the study area. Members of the Project Team have consulted with the following:

- National Parks and Wildlife Service (NPWS) in relation to ecological matters;
- Development Applications Unit (DAU) in the Department of Arts, Heritage and the Gaeltacht (DAHG), in relation to cultural heritage matters;
- Mayo County Council;
- Galway County Council;
- Roscommon County Council;
- Sligo County Council; and
- Leitrim County Council.

Additional consultation took place with other stakeholders during the constraints studies by individual specialists, including:

- Local authorities in the study area;
- Coillte;

- Geological Survey of Ireland (GSI);
- Heritage Officers in each of the local authorities;
- Bord Gáis Energy;
- Irish Aviation Authority (IAA); and
- National Roads Authority (NRA).

As detailed in Chapter 2 *Introduction*, it is anticipated that further stakeholders will be identified and consulted, inviting them to comment on the Constraints Report.

4 STRATEGIC PLANNING CONTEXT

As noted in Chapter 2 of this report, planning policy considerations, although not considered an obstacle for the purposes of corridor identification, potentially comprise considerations for the later stages of route identification and environmental impact assessment, and therefore require to be understood at an early stage of project development.

4.1 STRATEGIC INFRASTRUCTURE ACT (2006)

The Strategic Infrastructure Act was passed into law in 2006. The relevant sections (Sections 182A and 182B) came into force in January 2007. It amends the principal planning act, the Planning and Development Act 2000, by providing an amended process of planning consent for developments considered to be of strategic importance.

The Act inserts into the principal Act (2000) new sections (Section 182A and 182B) that require that applications for development concerning electricity transmission shall be made directly to An Bord Pleanála.

A definition is provided of 'electricity transmission' which:

> *shall be construed in accordance with section 2(1) of the Electricity Regulation Act 1999 but, for the purposes of this section, the foregoing expression, in relation to electricity, shall also be construed as meaning the transport of electricity by means of … a high voltage line where the voltage would be 110 kilovolts or more.* (Section 182A (9)).

4.2 NATIONAL POLICY

4.2.1 The Energy Policy Framework 2007 – 2020

The Department of Communications, Marine and Natural Resources (DCMNR[7]) has produced a White Paper - '*Delivering a Sustainable Energy Future for Ireland*' (2007), which sets out the Government's Energy Policy Framework for the period 2007-2020. The report details future challenges and sets out a framework for 2020. Amongst other matters, the White Paper seeks to expand the use of renewable energy and cut emissions of greenhouse gases. The key policy is to ensure a reliable and competitive energy supply.

The White Paper, noting Ireland's dependence on imported fuels, seeks to ensure security of energy supply, to promote sustainable energy and to enhance competitiveness of energy supply.

Section 3.1 states the need for quality energy infrastructure of sufficient capacity. We *'need robust … electricity networks and electricity generating capacity to ensure consistent supply'.* Immediate priority has been given to ensuring sustained investment in electricity networks while delivering enhanced levels of electricity interconnection.

[7] The DCMNR is now known as the Department of Communications, Energy and Natural Resources (DCENR)

The Government committed itself to the following:

> *We will ensure completion of the ongoing capital investment programme in transmission and distribution networks by 2010 and oversee further extensive investment in a programme expected to total €4.9bn up to 2013;*
>
> *We will, through EirGrid, publish a Grid Development Strategy in 2007 covering the period 2008-2025, which will set out the plans for the development of the transmission system over a 20 year horizon. The Strategy will take account of growing transmission demands given our economic growth as well as technology developments. It will be aligned to and facilitate greater certainty in relation to generation plant location, the growth of renewables, interconnection and the development of the all-island energy market framework as well as spatial strategy and regional development objectives (Section 3.2.3)*

In addition the White Paper envisages substantial investment in electricity transmission (Section 3.5.1) *We will ensure through EirGrid's Grid Development Strategy 2007-2025 and in light of the All-Island Grid Study the necessary action to ensure that electricity transmission and distribution networks can accommodate, in an optimally economic and technical way, our targets for renewable generation for the island to 2020 and beyond; (Section 3.5.2).*

The White Paper also sets the target of 33% of electricity to be produced from renewable generation by 2020. This has subsequently been increased to 40%.

4.2.2 The National Climate Change Strategy 2007 – 2012

In order to reduce the contribution of power generation to Ireland's greenhouse gas emissions, a national target has been set. By 2020, 40% (previously 33%) of electricity consumed will be generated by renewable sources. Ongoing investment in electricity transmission will 'continue to reduce losses of electricity' and support the 2020 target.

4.2.3 National Renewable Energy Action Plan 2010

This action plan is required under Article 4 of Directive 2009/28/EC. The Directive establishes the basis for the achievement of the EU's 20% renewable energy target by 2020. Member States are required to adopt a National Renewable Energy Action Plan and submit this to the European Commission. The plan follows a common template agreed by the European Commission. It sets out the targets for the share of energy from renewable sources consumed in transport, electricity and heating and cooling in 2020, taking into account the effects of other policy measures relating to energy efficiency on final consumption of energy. Ireland's overall target is to achieve 16% of energy from renewable sources by 2020.

Under electricity, the action plan states that there has been significant growth in electricity from renewable sources in recent years. All key national entities (including the Energy Regulator, distribution

and transmission system operators and the renewable energy sector) are '*working with the Government to deliver the 2020 target through grid connection and grid development strategies'*.

4.2.4 National Spatial Strategy (NSS) 2002 -2020

The NSS is a twenty year national planning framework to achieve a better balance of social, economic, physical development and population growth between regions.

The spatial strategy has placed counties Galway, Mayo and Roscommon in the West Region while Sligo and Leitrim are categorised as being part of the Border Region. Galway City and Sligo Town are both identified as Gateways while Castlebar, Ballina and Tuam have been designated as Hubs.

Section 3.7.2 deals with Energy and there are specific references to supporting electricity transmission:

- Developing energy infrastructure on an all-island basis is a prime consideration;
- There may be potential for streamlining infrastructure co-ordination, planning and delivery by combining different types of infrastructure in one physical corridor, where feasible;
- The increase in competition in the electricity market under the EU liberalisation programme has raised a number of issues regarding the reinforcement of the distribution network and accommodating new loads;
- Particular emphasis is placed on upgrading the grid in the western counties due to accelerated growth in the Border, Midlands and Western (BMW) regions;
- It is vital that written statements in county and city development plans '*support the timely commissioning of transmission infrastructure';*
- There is a need to address electricity infrastructure in county development and local plans to facilitate national, regional and local economic progress; and
- There is a need for more co-operation with grid operators to ensure the availability of corridors for overhead cables and continuity of supply for existing and new users of electricity.

Section 3.8 of the NSS introduces the '*Strategic Infrastructure Priorities*'. It is stated that, in some circumstances, it may be necessary to consider the advance provision of key infrastructure ahead of actual need.

Section 3.8.2 of the NSS makes specific reference to electricity transmission as a strategic infrastructural investment priority. It includes the following initiatives:

- Improving reliability of electricity supply in western and border areas, amongst others, through enhanced access to the national grid, e.g. securing progress on the proposed national grid link from Galway to Sligo;
- Strengthening supply networks to and within the proposed Gateways and Hubs; and
- Strategic strengthening of the grid, serving particular clusters of employment-related demand in peripheral areas.

4.2.5 National Development Plan (NDP) 2007 -2013

As part of its 'roadmap' for Ireland's future, the NDP sets out an overall energy programme and a strategic energy infrastructure sub-programme.

The energy investment needs over the period of the plan include interconnection, market integration, network extension and storage.

An investment of €8.5 billion in energy is envisaged including the investment of €1.2 billion in a '*Strategic Energy Infrastructure Sub-Programme*' (P. 137). *Investments of over €1.2 billion in the life of the NDP in this area are required in the short to medium term to bring strategic energy infrastructure up-to-date and foster continued economic and regional development.* (P.138).

With regard to EirGrid, it states:

> *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. Expenditure of some 770 million is envisaged on the transmission system over the period of the Plan.* (P. 141).

4.2.6 Government Policy statement on Strategic Importance of Transmission and other Energy Infrastructure, Department of Communications, Energy and Natural Resources (DCENR), July 2012[8]

The DCENR published the Government Policy Statement, of which the key elements are as follows:

- The Government affirms the imperative need for development and renewal of our energy networks, in order to meet both economic and social policy goals. The planning process provides the necessary framework for ensuring that all necessary standards are met and that comprehensive statutory and non statutory consultation is built into the process.
- The Government acknowledge the need for social acceptance and the appropriateness of exploring ways of building community gain considerations into project planning and budgeting. Delivering long lasting benefits to communities is an important way of achieving public acceptability for infrastructure.
- The State network companies are mandated to plan their developments in a safe efficient and economic manner. They are also required to address and mitigate human, environmental and landscape impacts, in delivering the best possible engineering solutions.
- The major investment underway in the high voltage electricity transmission system under EirGrid's Grid25 Programme is the most important such investment in Ireland's transmission system for several generations.
- While the Government does not seek to direct infrastructure developers to particular sites or routes or technologies, the Government endorses, supports and promotes the strategic programmes of the energy infrastructure providers, particularly EirGrid's Grid25 investment

[8] http://www.dcenr.gov.ie/Press+Releases/2012/Government+publishes+Energy+Infrastructure+Policy+Statement.htm

programme across the regions, and reaffirms that it is Government policy and in the national interest, not least in the current economic circumstances, that these investment programmes are delivered in the most cost efficient and timely way possible, on the basis of the best available knowledge and informed engagement on the impacts and the costs of different engineering solutions.

It is mandatory for planning authorities and An Bord Pleanála to have regard to this policy statement as of the date of publication (18th July 2012).

4.2.7 Grid25

In 2008, EirGrid published '*Grid25 A Strategy for the Development of Ireland's Electricity Grid for a Sustainable and Competitive Future*[9]' a plan to upgrade the national electricity transmission network up to the year 2025. This seeks to develop and strengthen the national electricity grid in order to meet future power demands and to facilitate new power generation. Generation will include renewable resources which are often in locations where there has previously been little or no power generation so that absence of transmission infrastructure is a serious impediment to development necessitating significant reinforcement of the grid. The largest proportion of renewable development (35%) is expected to be in the North West Region (covering the counties of Galway, Mayo Sligo, Leitrim, Roscommon and Donegal). Grid reinforcement is also necessary to provide for industrial development and population growth in the regions.

It is expected that the capacity of the bulk transmission network (220kV and 400kV) will need to be doubled. Proposals are included for the development of an additional length of 20% of the transmission network. This report states that 400kV lines are preferred to 220kV because of their greater capacity; in that a 400kV line carries three times as much power as a 220kV line. This report states that it is expected that €750 million will be invested in the grid in the north west region.

The Grid25 Strategy states that in the Mayo/Galway area, there is expected to be 880MW of wind generation and 240MW of wave generation. Major projects for this area include:

> *'Major infrastructural development from Mayo to the main bulk transmission system in the eastern part of the region'.*

The benefits of this and the other grid projects for the region are seen as:

- The North West can become a net exporter of power to the rest of the island, reducing its reliance on generation from outside the region;
- Plans will facilitate the growth of renewable generation connections in the region; and
- The increased power supply will accommodate and help attract future industry.

[9] All of the figures quoted in this section of the Constraints Report, are taken from the Grid25 Strategy which may have been modified since the publication of this document.

The Grid West project is specifically identified in the Grid25 Implementation Programme (IP) 2011-2016[10], which has been subject to Strategic Environmental Assessment (SEA).

4.3 REGIONAL PLANNING GUIDELINES

Regional Planning Guidelines set out the spatial planning objectives for that region, providing a framework for long term strategic development. The guidelines also ensure successful implementation of the National Spatial Strategy at regional, county and local level.

4.3.1 Western Regional Planning Guidelines 2010 – 2022

The Western Region includes the counties of Galway, Mayo and Roscommon. Chapter 5 of the Guidelines deals with the Infrastructure Strategy for the region.

Section 5.5.1 specifically outlines the fundamental importance of electricity transmission and includes the following statements:

- The existing grid is not capable of transporting the energy generated from renewable sources and significant reinforcement is therefore required. The extension of a 220/440kV line from the south and east to Bellacorick, County Mayo is referred to as a possible development.
- In principle, planning authorities '*should consider and support where appropriate the provision of energy networks'*, provided that it can be demonstrated that it is required to facilitate significant economic or social infrastructure, the route has due consideration for impacts through environmental assessment, the design has the least impact on the environment without excessive cost, mitigation measures are included where impacts are identified and that it is consistent with international best practice regarding materials that will ensure a safe, high quality network.
- A key requirement for the West Region is that grid investment must be guided by the need to remedy immediate deficiencies and also by an expected long term moderate growth in population and economic development.

The Guidelines include the following relevant polices and objectives:

- Policy IP40 states that the proposal in Grid25 for additional investment in the West Region must be supported.
- Policy IP42 states that investment to upgrade the existing transmission and distribution network and to build new circuits must be supported.
- Objective IO50 specifically supports the Grid25 proposal to upgrade 700 kilometres of the existing network.
- Objective IO49 supports the construction of new 110kV and higher lines, especially across West Galway and North Mayo.

[10] This draft Implementation Programme (IP) is a practical overview of how the early stages of Grid25 are to be implemented. For further information refer to: http://www.eirgrid.com/media/GRID25%20Implementation%20Programme.pdf

4.3.2 Border Regional Planning Guidelines 2010 – 2022

The Border Region covers Sligo and Leitrim as well as the other border counties (Louth, Monaghan, Cavan and Donegal). Chapter 5 of the Guidelines deals with the Infrastructure Strategy for the region.

Section 5.4.2 outlines the strategic importance of the electricity transmission network, referring to regional and local authorities as '*custodians over the grid'* both in terms of a national and regional asset.

Section 5.4.2.3 and 5.4.2.4 of the Guidelines relate specifically to the Border Region and the existing electricity transmission network. It is stated that the electricity transmission infrastructure will need to be strengthened due to an increase in generation sources. This will involve a combination of upgrading and the building of new '*extra-high voltage'* infrastructure, as the system is nearly at full capacity.

Section 5.4.2.6 outlines future requirements and identifies key projects that are critical to the future development of the region.

Policy INFP23 stipulates that, in principle, development plans should facilitate the provision of energy networks, provided that it can be demonstrated that there has been due consideration for social, cultural and environmental impacts along the route where required, the design of infrastructure will minimise environmental impacts (including impacting upon human beings), the development is consistent with international best practice, undergrounding of lines is considered in the first instance and mitigation measures included where impact is inevitable.

4.4 LOCAL PLANS

4.4.1 Mayo County Development Plan 2008 -2014

The Mayo County Development Plan is the statutory development plan for the county of Mayo including the proposed Bellacorick terminus of the proposed transmission line as well as a significant part of the study area.

Part 3.1.3 Transport and Public Infrastructure outlines the following policies:

Policy TI-IC 1 requires major public and private utilities infrastructure to follow the line of existing infrastructure of a similar type, unless there are over-riding issues of public safety *etc*., in order to minimise impact on the landscape and natural environment.

Policy TI-IC 3 aims to protect areas of high sensitivity identified in the *Landscape Appraisal of County Mayo* and other environmentally sensitive areas from large-scale visually intrusive energy infrastructure.

Policy TI-E 1 will facilitate the provision of a high quality electricity infrastructure in the county whilst seeking to protect and maintain biodiversity, wildlife habitats, scenic amenities, including protected views, and nature conservation.

Policy TI-E 3 seeks and will facilitate the extension of the national 220kV electricity network in Mayo.

Part 2.1.1.2 outlines an overall strategy for infrastructure and aims to '*ensure that the energy supply and distribution throughout Mayo is expanded and upgraded sufficiently to enable economic enterprise and other developments to locate in the county*'.

Renewable Energy Strategy for County Mayo 2011- 2022

Mayo County Council has prepared a Renewable Energy Strategy for the county. The strategy was prepared in the context of national and EU renewable energy targets.

The strategy is explicit in its support for the development of energy infrastructure in the county.

Section 4 outlines the importance of EirGrid's upgrading of the National Grid. Grid25 is the strategy for the development of the national electricity grid for a '*sustainable and competitive future'*. Mayo forms part of the '*North West Region'* in this plan – an area that has the largest expected regional distribution of renewable generation capacity.

The Renewable Energy Strategy for County Mayo states that this upgrading is '*imperative for the future development of energy production in Mayo*'. Inaction will result in, *inter alia*, an inability to meet new customer requirements and would have '*severe consequences on the ability of Ireland to meet its renewable energy targets and its long-term sustainable energy supplies'*.

Section 4.5 of the strategy states that energy generation potential in County Mayo is *'enormous'* but it will not be possible to utilise the county's natural resources for renewable energy (or to efficiently produce energy from conventional sources) without essential upgrades to the national grid. A 400kV line will be required to achieve this. This would have less long-term impact on the environment and local communities that constructing a multiplicity of 220kV lines. Securing the provision of a 400kV line is to be a priority for Mayo County Council.

4.4.2 Sligo County Development Plan 2011 – 2017

The Sligo County Development Plan is the statutory development plan for the county of Sligo including some of the northern part of the study area.

Chapter 11 Energy and Telecommunications outlines the following:

Policy SP EN-1 aims to support the sustainable infrastructural development of energy generation and transmission networks, to ensure the security of energy supply and provide for future needs.

Objective SO-EN-1 stipulates that significant landscape views must be protected from the visual intrusion of large-scale energy infrastructure.

Section 11.1.1 maintains that electricity transmission development is critical to Sligo's ability to attract business and accommodate economic growth.

Policy PE-EL 1 relates specifically to the provision of electricity and aims to facilitate the provision of new high voltage electricity infrastructure in County Sligo.

Policy PE-EL 2 supports the maintenance and upgrading of electricity infrastructure throughout the county.

4.4.3 Galway County Development Plan 2009 – 2015

The Galway County Development Plan is the statutory development plan for the county of Galway, including a large part of the study area including the existing Cashla substation, near Athenry.

Section 2 of the county development plan sets out a Spatial Planning Strategy for the county. This includes proposals for an *Eastern Strategic Corridor* [11]; an area with a high concentration of valuable infrastructure. Refer to Figure 13.1 Utilities and Infrastructure Constraints Map. One of its objectives is to facilitate the upgrading and increase of such facilities. Overhead powerlines '*will be considered*' and the corridor will 'support activities which would not be appropriate in proximity to centres of population or sensitive environments'.

Section 7 Infrastructure considers energy infrastructure requirements:

Policy IS32 states that the local authority will '*support the infrastructural renewal and development of electricity networks in the county*', including the overhead infrastructure required to provide the networks.

Objective IS24 states that the '*Planning Authority shall seek to reserve a strategic corridor free from conflicting or inappropriate development (Map IS2) for the purposes of providing necessary overhead electrical supply and distribution infrastructure between Galway and Screeb and other strategic infrastructure elements of the Grid Development Strategy'*

County Galway Wind Energy Strategy 2011 - 2016

Galway County Council has prepared a Wind Energy Strategy for the county. The strategy provides strategic direction to encourage renewable energy and to guide the siting and design of wind energy developments in appropriate locations within the county. This document has been informed by local, regional, national, EU and international agreements, policy and legislation in relation to climate change, energy security and renewable energy.

Specific objectives include:

[11] The Corridor is only defined in 'indicative terms' in the Galway County Development Plan but includes the lands within 2km of the Galway to Dublin Railway.

- Work towards a target of 500MW of wind energy in County Galway, to enable Galway to make the initial steps toward a low carbon economy by 2020. This target will enable Galway to generate the equivalent of over 70% of its electricity needs from wind energy.
- Support a plan led approach to wind energy development in County Galway predicated on the optimal harnessing of the county's wind energy resource, and at a minimum requiring that 40% of Galway's electricity needs can be met from renewable energy sources, including wind farms.

The relevant documents that informed this strategy include the following:

- Renewable Energy Directive EU Directive 2009/28/EC, which made legally binding targets for electricity to be generated from renewable energy generation by 2020; and
- The Government White Paper on Delivering a Sustainable Energy Solution for Ireland, which set a target to have 33% of electricity come from renewable sources by 2020 (this target increased to 40% in 2009 in the carbon budget).

4.4.4 Roscommon County Development Plan 2008 – 2014

The Roscommon County Development Plan is the statutory development plan for the county of Roscommon, including much of the eastern part of the study area and including the existing Flagford substation.

Section 3.11.2 electricity states the following:

> '*It is critical that adequate capacity, in terms of both energy and energy infrastructure, is available within the county to support its development. The growth of the national economy has placed extra strain on the national electricity generating capacity. This plan will aspire to create sustainable communities which in turn require investment in electricity infrastructure including networks and generating stations'*.

The local authority also acknowledges the need to increase existing transmission lines within the county to at least 220kV and to 400kV in the longer term. They also recognise that the development of secure and reliable electricity transmission infrastructure is vital for economic development.

Policy 75 aims to support the statutory providers of the National Grid infrastructure by safeguarding such strategic corridors from encroachment by other developments that might compromise the provision of electricity networks where strategic route corridors have been identified.

Policy 76 aims to promote and facilitate the doubling of the transmission voltage where required, in order to reduce power wastage by 75%.

Objectives 68 – 72 all aim to facilitate and promote high voltage electricity infrastructure within County Roscommon, to work in collaboration with EirGrid and actively promote the Government's White Paper '*Delivering a Sustainable Energy Future for Ireland, Energy Policy Framework 2007-2020'*, including the delivery of electricity over an efficient network.

Roscommon Wind Energy Strategy

The Roscommon Wind Energy Strategy is still in its pre- draft stage. In its absence the following most recent information is relevant:

The '*Strategic Issues Paper'* for 2014-2020 county development plan (published in June 2012) states the following under the heading Energy: '*With rising oil prices and the need to adopt more environmentally sustainable practices, renewable energy sources will become increasingly important. Some alternative sources of power include hydroelectric, solar, wind power as well as biomass power'*.

4.4.5 Leitrim County Development Plan 2009-2015

The Leitrim County Development Plan is the statutory development plan for the county of Leitrim, part of which is included in the study area's northeastern section.

Section 2.10.04 outlines the Planning Authority's support for new electricity supply infrastructure, including high voltage transformer stations and new power lines, stating that this is required to reinforce the transmission network to cope with growing electricity demand from existing and new customers. Such infrastructure is also:

'*recognised as a key factor in supporting economic development and attracting investment to the area'.*

The authority's preferred option for high voltage lines (220kV and above) is that they are placed underground. Applications for the erection of high tension lines must take residential amenity into consideration.

The authority will be guided by the Landscape Character Assessment (LCA's) in determining the acceptability of proposed transmission lines in sensitive landscapes.

4.5 CONCLUSION

The current proposal will reinforce the electricity grid in the West of Ireland providing the necessary high quality transmission infrastructure for industrial and employment growth as well as facilitating the development of renewable energy sources in the region.

It is the adopted policy of the Government to improve facilities for the transmission of electricity by investing in the national grid. This is expressed in energy documents such as the Government's White Paper and in the National Development Plan (NDP). The National Spatial Strategy (NSS) places a particular emphasis on improving the grid in western counties.

Detailed proposals are set out in EirGrid's Grid25 Strategy including the provision of major new infrastructure connecting Mayo to the existing national grid. This is necessary to provide for the future demands of industry and population growth in the area. It is policy to expand the use of renewable energy sources which also requires investment in the grid.

Such improvements are also supported by regional planning guidelines and county development plans in the area. The Western Regional Planning Guidelines specifically refer to improvements to the grid to Bellacorick by the provision of either a 220 or 400kV transmission line. The Mayo Renewable Energy Strategy notes that improvements to the grid are essential for the development of renewable energy sources in the area.

In short, adopted policy at national, regional and county level is strongly supportive of the principle of improved grid infrastructure in the area.

5 STUDY AREA IDENTIFICATION AND RATIONALE

5.1 STUDY AREA IDENTIFICATION AND DESCRIPTION

The initial task, in the planning of the spatial aspects of this project, was to define an appropriate study area. The identified study area extends over parts of five counties, Mayo, Galway, Sligo, Leitrim and Roscommon covering approximately 10,300 km², as shown in Figure 5.1 Study Area Map. Reference can be made to the Grid West project website for the *Grid West Study Area and Rationale Report* (which includes the Study Area Map) on http://www.eirgridprojects.com/projects/gridwest/overview

The identified study area in the vicinity of Bellacorick extends to the coast itself, excluding the Mullet and Corraun peninsulae and Achill Island, as this allows the largest reasonable study area, in the hinterland of Bellacorick, to be examined in order to find a preferred substation site location.

The study area follows the coastline southwards to Clew Bay and towards the town of Westport. The edge of the study area between Westport and Galway City follows the N59 national secondary route, between the Partry Mountains and Mweellrea Mountains (Sheeffry Hills); it follows a county road (R336), keeping to the west of Lough Mask and Lough Corrib until it meets Galway Bay. The Lakes of Corrib and Mask, and the Partry Mountain and blanket peat terrain which lies southwest of a line from Partry to Westport, form a natural geographical barrier which, even at the outset of this project, could be reasonably considered to heavily constrain potential route corridor options for the likely nature and extent of this project to the east of a line from Galway City to Westport. However, such circumstances and constraints in this area should be allowed to be confirmed through the constraints mapping process, and therefore, the study area extends from Westport to Leenane (at the head of the Killary), from there to the western extremity of Lough Corrib at Maam, and southwards to the coastline in Connemara near Rossaveal.

The study area boundary extends along the northern shoreline of Galway Bay (R336), south of Galway City. From here it runs along the N18, south of the town of Athenry and the village of Craughwell. A 15km buffer zone is included within the study area around the substation site at Cashla, in order to ensure that all constraints (including visual impact), potentially relevant to any approach to the Cashla Substation can be assessed.

The study area boundary extends northwards along a local road to the north west of the town of Loughrea and follows local roads (R348, R359 and R358) west of the town of Ballinasloe and east of Tuam, through New Inn, Castleblakeney, Moylough and Dunmore in east County Galway.

The study area boundary continues towards the Galway-Mayo-Roscommon border following the N83 and N60 to Cloonfad-Ballinlough, where it turns eastwards towards Strokestown (N5) in County Roscommon.

From Strokestown, the study area meets the River Shannon at Rooskey (R371) and follows an arc to the east of Flagford, at a distance of approximately 15km from Flagford Substation, to include the constraints context of any angle of approach to the substation at Flagford.

The study area boundary extends northwards, east of the town of Boyle and west of Lough Allen along the R280 before turning westwards, passing just south of Lough Gill along the R289 and R290 towards Sligo Bay.

The study area continues along the Sligo and Mayo coast line, around Killala Bay, closing the study area again at Broadhaven.

5.2 STUDY AREA RATIONALE

This section details the rationale for the defined study area, in the knowledge that definition of the study area necessarily precedes the work of studying and developing constraints within it. This rationale therefore considers why some areas, even though they appear particularly constrained, were nonetheless included within the original study area.

It was considered that south Connemara, west of a line from Galway City, to Lough Corrib and Lough Mask, should be included within the study area, even though it departs significantly from the line-of-sight between Bellacorick and Cashla. In discussions on the study area boundary, it was recognised that many constraints, such as the Partry Mountains, the steep sided, closed valleys of the Maamturks, blanket peat terrain, and environmentally designated areas would be present, and would combine to weigh against optimum route corridor options in this area. Nevertheless, a precautionary principle was observed, so that the study area is not restricted, by any preconception in these respects at the outset of this project. This also permits the spatial constraint context of any potential corridors to be readily understood in order to confirm that no better options are available nearby.

Westport, Galway City and Castlerea are each situated within the study area, thus ensuring that the study area considers the constraints within all reasonable potential route corridors, as well as ensuring that the general public within these communities have an opportunity to take part in the consultation process.

The furthest limits of east Galway and the part of County Roscommon south of a line from Castlerea to Strokestown are not included within the study area because, given the defined end nodes for this project, it is correctly considered that none of the route corridors from Bellacorick to Flagford or Bellacorick to Cashla would reasonably extend so far into the south east from the direct line of sight between these defined end nodes.

Areas north east of Lough Allen have been omitted from the study area because it is considered at the outset that a potential Bellacorick to Flagford line would not be routed so far to the north east of the existing Flagford Substation as it would mean an unreasonably long deviation in the direct route corridor.

6 IDENTIFICATION AND MAPPING OF CONSTRAINTS

6.1 IDENTIFICATION OF CONSTRAINTS

Following the identification of the study area, environmental and other constraints were identified and assessed. Always having regard to best practice, the Project Team has also had regard to the approach to constraints analysis adopted by the National Roads Authority (NRA) in its 2010 Project Management Guidelines, publically available at www.nra.ie. Accordingly, for the purpose of this Constraints Report, the key environmental constraints are summarised under the following headings:

Natural Constraints (naturally occurring landscapes and features)

- Ecology
- Landscape
- Geology
- Water

Artificial Constraints (forming part of the built environment)

- Settlements
- Cultural Heritage
- Utilities & Infrastructure

It is accepted that the landscape constraints may fall under both the headings of Natural and Artificial Constraints (e.g. in the case of designed landscapes). In addition to the above, engineering (physical) constraints are also detailed in this report and are represented in Figure 14.1 Engineering Constraints Map.

The specific approach to identifying each constraint type, by each respective specialist, is outlined in the following chapters. Figure 6.1 Constraints within the Study Area Map, highlights all constraints that are detailed in this Constraints Report on one composite map.

6.1.1 Environmental Datasets

The determination of constraints within the defined study area is based on the nature and location of the project, the general topography and the key features which dominate the study area. The first step in the determination of constraints is to compile all possible relevant datasets, for each of the specialist areas. This is completed in conjunction with the relevant specialists who have significant expertise and experience for similar type projects.

There are over 150 different and overlapping datasets, of potential constraints information, available to the Grid West project. These datasets are divided into eight separate themes, the largest of which is ecology. Datasets were collected from existing available data relating to the study area through consultation with statutory bodies, the local authorities, state and semi state bodies. Data produced or gathered by EirGrid under the Grid25 Implementation Programme (IP) SEA was also utilised.

A number of these datasets define areas with statutory designations, or are declared proposals for such status, and such constraints were considered primary and strategic. Other datasets have been captured that are not of a kind which would influence the locations of strategic corridor options, but they will be brought into consideration in comparing indicative corridor options, and later in choosing an indicative line route within a corridor.

The Project Team has also gathered valuable datasets which relate to species, or habitat, or areas which are sensitive, and which by their nature are more '*granular*' than formally designated sites. For example, in addition to general habitat mapping, specific habitat mapping, and species mapping, there may be datasets covering nutrient sensitive areas, geology vulnerability mapping, source protection areas, or groundwater protection schemes, which are not considered constraints for this stage of the project.

Accordingly, this more detailed and site specific information along with other issues, such as planning, legal, technical and landuse will be used when considering the features of potential indicative route corridors or when positioning a line route within a corridor. This information will be assessed in detail in the Environmental Impact Statement (EIS) which will be carried out as part of Stage 3 *Confirm Design* and Stage 4 *Prepare Planning Application* of the Roadmap for this project.

Some constraints are more influential than others when identifying potential indicative corridors as they are afforded legal protection, these include ecologically designated sites, national and international landscape designations, world heritage sites and national monuments. Other sites or features which, although they may not have formal legal protection, have also been considered as part of this Constraints Report, these include settlements, demesnes landscapes, and the candidate Coillte Wilderness Area in County Mayo.

The decision on which constraints to use for Stage 1 *Information Gathering* was made by each specialist as they have the required expertise and experience to judge what the differentiation factors are for the identification of potential indicative route corridors.

Refer to Appendix 6.1, which details the full list of Constraints.

6.2 CONSTRAINTS MAPPING

Each individual constraint layer is separately illustrated in the suite of Constraints Maps, where they are seen in the context of the study area and the existing substation sites.

The following is a list of the Constraints Mapping, developed for the Constraints Report and presented in Volume 2:

- Figure 5.1 Study Area Map
- Figure 6.1 Constraints within the Study Area Map
- Figure 7.1 Ecology Constraints Map

- Figure 8.1 Landscape Constraints Map
- Figure 9.1 Geology Constraints Map
- Figure 10.1 Water Constraints Map
- Figure 11.1 Cultural Heritage Constraints Map
- Figure 12.1 Population Density Map
- Figure 13.1 Utilities & Infrastructure Constraints Map
- Figure 14.1 Engineering Constraints Map

Figure 6.1 Constraints within the Study Area Map, highlights all constraints that are detailed in this Constraints Report on one composite map. This tends to crowd the map from a visibility viewpoint, but it shows nonetheless how little of the study area is completely free of one kind of constraint or another.

7 ECOLOGY

7.1 INTRODUCTION

The ecological constraints chapter, together with Figure 7.1 Ecological Constraints Map, have been prepared in order to identify the key ecological constraints, which include designated sites and features of ecological significance (non designated sites), which may influence the identification of substation site options, and potential indicative corridors, and ultimately an indicative line route along which the proposed Grid West project will be sited.

This chapter was informed by a detailed desktop assessment of available ecological databases and mapping within the study area and a meeting with National Parks and Wildlife Service (NPWS) of the Department of the Arts, Heritage and the Gaeltacht (DAHG). Further site specific field studies and ongoing desk studies will be executed as the project progresses in order to add to this information. Also detailed in this chapter is key legislation which requires consideration for all stages of the proposed project. Any guidance relating to ecological impact that may emerge from the ongoing EirGrid Evidence-Based Environmental Studies will be incorporated into the environmental impact assessment.

The main aim of this ecology chapter is therefore to highlight the most important areas of significant ecological importance, so that they can be avoided in as far as possible and to inform the selection process of potential indicative route corridors.

7.2 METHODOLOGY

The approach for the constraints stage follows that detailed in the EirGrid *'Ecology Guidelines'* (2011)[12]. In addition, the Environmental Protection Agency (EPA); '*Integrated Biodiversity Impact Assessment, Streamlining AA, SEA and EIA Processes Best Practice Guidance'* (2012)[13] was reviewed to confirm that the assessment approach is based on current best practice.

7.2.1 Legal Framework

The following legislation is relevant to the project and will be considered as the project progresses:

- Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna, commonly known as the Habitats Directive;
- Council Directive 2009/147/EC on the conservation of wild birds, commonly known as the Birds Directive (codified version of Council Directive 79/409/EEC);
- European Communities (Natural Habitats) Regulations 1997, S.I. No. 94 of 1997, as amended by S.I. No. 233 of 1998 and S.I. No. 378 of 2005;
- European Communities (Birds and Natural Habitats) Regulations 2011;
- Wildlife Act, 1976 [Wildlife (Amendment) Act, 2000]; and

[12] Ecology Guidelines for Electricity Transmission Projects: A Standard Approach to Ecological Impact Assessment of High Voltage Transmission Projects (EirGrid 2011).
[13] http://www.epa.ie/downloads/pubs/research/biodiversity/name,33395,en.html

- Flora Protection Order 1999 (SI No. 94 of 1999).

7.2.2 Information Sources

For the constraints stage, a significant number of ecological datasets and associated mapping were used to delineate the most relevant areas for the constraints mapping. The full list of ecological datasets considered is included in Appendix 7.1 Ecological Datasets.

The datasets utilised include:

- Information on designated sites (legally protected under EU and Irish legislation); and
- Other features likely to be of ecological significance (non designated); these include areas with high potential for habitats listed on Annex 1 of the EU Habitats Directive (including priority habitats) and known important bird areas.

Other ecological receptors not detailed in this chapter will be further considered at later stages of the project e.g. breeding birds of conservation concern, protected flora etc. These are not mapped as part of Figure 7.1 Ecology Constraints Map as they occur at a much more localised scale and are therefore of assistance for strategic corridor identification. An outline of the key data sources, including both mapped and unmapped features, is provided herein.

Mapped Ecological Receptors

Designated Sites

All designated sites within the study area, including Natura 2000 sites, which includes Special Areas of Conservation (SAC), Special Protection Areass (SPA) and nationally designated sites such as Natural Heritage Areas (NHA) are shown in Figure 7.1 Ecology Constraints Map. In addition all currently undesignated proposed Natural Heritage Areas (pNHA) are also illustrated on this Map.

The NPWS database of designated nature conservation areas was reviewed to identify any designated sites lying within the study area. Sites can be designated for their nature conservation interest under European and Irish legislation. The four principal forms of designation are as follows:

- *Special Area of Conservation (SAC)*
  These are sites that have been designated under the EU Habitats Directive and transposed into Irish law in the European Communities (Birds and Natural Habitats) Regulations, 2011. The Directive lists (Annex I) certain habitats that must be protected within SACs. There is also a list (Annex II) of species that must be afforded protection by designation of areas of land as SACs. Sites are designated as candidate sites (cSACs) until they have formally been ratified by the Minister though cSACs have the same legal status as SAC's.

- *Special Protection Area (SPA)*
  The EU Birds Directive came into force in 1979, it details lists of birds, which require particular conservation measures (Annex I), and also species, which may be hunted, and species, which may be sold. Annex I species include Hen Harrier, Whooper Swan, Greenland White-fronted Goose, Peregrine Falcon, Corncrake and Terns. Member States are also required to protect

sites (SPA), which are important for Annex 1 species and other migratory species such as ducks, geese and waders.

- *Natural Heritage Areas (NHA)*
  These are areas that have been designated under Irish legislation, the Wildlife (Amendment) Act 2000. Prior to statutory designation, sites are known as proposed Natural Heritage Areas (pNHA) and are still afforded some level of protection including recognition of their ecological value by planning and licensing authorities.

- *National Parks and Nature Reserves*
  As per the International Union for the Conservation of Nature (IUCN) description, National Parks are '*areas not materially altered by human exploitation and occupation; where plant and animal species, geomorphological sites and habitats are of special scientific, educational and recreational interest or which contain a natural landscape of great beauty; where the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment'.*

  A Nature Reserve is an area of importance to wildlife, which is protected under Ministerial Order. Most are owned by the State, however, some are owned by organisations or private landowners.

Features of Ecological Significance (Non Designated)

In addition to those which are designated sites under the above categories, the following key features of ecological significance have also been mapped, (refer to Figure 7.1 Ecology Constraints Map) and are hence considered in this constraints chapter, namely:

- Fens;
- Irish Wetland Bird Survey (I-WeBS) Site – international, national and notable wintering bird sites in particular;
- Turloughs and Potential Turloughs;
- Coastal Lagoon;
- Salt Marsh;
- Limestone Pavement;
- Semi Natural Woodland Habitat;
- Semi Natural Grasslands;
- Intact Raised Bog;
- Raised Bog (un-surveyed) – vegetated;
- Wetland;
- Blanket Bog;
- Wet Heath;
- Lakes and Rivers; and
- Freshwater Pearl Mussel River Catchments.

7.2.3 Consultation

A meeting was held with NPWS in June 2012. The purpose of this meeting was to introduce the project and the methodology to the Regional Management and Divisional Ecologists of NPWS relevant to the study area. The aim was to obtain feedback on approach, and more specifically what should be considered at the constraints stage and future stages of the project. The outcomes of this meeting provided the Project Team with information on:

- What information sources should be reviewed (for all project stages);
- Confirmation on the key ecological constraints requiring consideration for the project; and
- Approaches to minimising ecology related issues at later stages of the project.

These comments are fully considered in this ecology chapter and will continue to inform our approach in further reports throughout each stage of this project.

It is expected that additional consultation will be held with the following organisations in future stages of the project, these include:

- National Parks and Wildlife Service (NPWS);
- Inland Fisheries Ireland (IFI);
- BirdWatch Ireland (BWI);
- Bat Conservation Ireland (BCI);
- The Irish Wildlife Trust; and
- Relevant local authorities.

7.3 EXISTING ENVIRONMENT

This section of this chapter details the key ecological constraints and receptors identified in the study area. These include designated sites of known international and national importance, and other (non designated) features of ecological importance. These other (non designated) features of ecological importance include priority habitats for protection under EU Habitats Directive (e.g. raised bogs and turloughs), important bird areas (I-WeBS Sites) and a range of other recognised habitats likely to be of significant ecological importance. These key ecological constraints and receptors are delineated in Figure 7.1 Ecology Constraints Map.

Other potential ecological constraints and receptors will be identified in Stage 2 *Corridor Evaluation a*nd Stage 3 *Confirm Design* (which includes the environmental impact assessment) of the Roadmap, particularly as the area of study is narrowed into corridors at a more localised level.

7.3.1 Designated Sites

Special Area of Conservation (SAC)

These are sites which are considered to be of international importance. There are 74 areas designated as SACs within the study area. These numerous sites are key ecological receptors in the study area because of the recognised qualifying features (habitats/species) which have informed their selection for designation as SAC. Key habitats in these SAC sites include raised bog, blanket bog, wet heath, fens, turloughs, limestone pavement, calcareous grasslands and rivers and lakes. Key species in these sites

include Freshwater Pearl Mussel, Atlantic Salmon, Lamprey (species), Otter, Lesser Horseshoe Bat and a range of protected flora species e.g. Marsh saxifrage (*Saxifraga hirculus*).

Special Protection Area (SPA)

These are sites which are also considered to be of international importance. There are 18 areas designated as SPA's within the study area. Key qualifying groups of species and individual species in these SPA's include; wintering flocks of Greenland White Fronted Geese, breeding Golden Plover and Merlin in boglands of North West Mayo. Also requiring consideration are wintering flocks of wildfowl and waders in numerous wetland sites and clusters of sites throughout the study area. As many of these species are highly mobile and may move outside the SPA areas, further studies may potentially be required to determine their movements. Many of these sites also have non qualifying species listed which nevertheless may be of high conservation concern e.g. Red Grouse.

Natural Heritage Areas (NHA)

Many NHA sites are included also in Natura 2000 (SAC/SPA) sites, hence they are considered to be internationally important for example the Carrowmore Lake Complex. Other NHA sites are not included in SAC/SPA sites, and are hence considered to be of national importance. NHAs in the study area generally consist of wetland/bog type habitats (blanket bog / raised bog / associated wetlands). There are 24 areas designated as NHAs within the study area.

National Parks and Nature Reserves

Ballycroy National Park occurs within the Owenduff/Nephin Complex Special Area of Conservation (SAC) and Special Protection Area (SPA) and is hence considered to be internationally significant. No other Nature Reserves occur within the study area.

Proposed Natural Heritage Areas (pNHA)

These areas were published on a non statutory basis in 1995. With the arrival of the Habitats Directive legislation some of these areas were included in the list of SAC/ SPA and therefore are of international importance. However most of these sites have not progressed with any further formal designation under National or European legislation. These undesignated pNHA are nonetheless recognised by NPWS and at a county level e.g. in relevant county development plans. They are also legally protected (Wildlife Act 2000) from damage from the date they are formally proposed for designation. It is likely that these will be designated on a phased basis in coming years. There are 179 areas designated at pNHA within the study area.

Further information on designated sites are included in Appendix 7.2 Description of Designated Sites by county(s), with a brief summary of the key ecological features provided and also highlighted in Figure 7.1 Ecology Constraints Map.

7.3.2 Features of Ecological Significance

Based on assessments to date it is determined that a number of non designated sites should be considered in the constraints study as they have potential to be of national, regional and possibly international significance. Many of these habitats will be particularly sensitive to impacts from

development generally. These potential key ecological receptors, and general areas where they are located, are discussed herein and highlighted in Figure 7.1 Ecology Constraints Map.

- **Fens**
  This category of wetland includes a variety of specific peatland habitats which are particularly sensitive to development impacts. These include the EU Annex 1 priority habitat '*Calcareous fens*'. They also include poor fen and flush and potentially associated habitats e.g. transition mire and other peat forming habitats. This habitat is very scattered in the study area with North West Mayo, east of Lough Corrib and east Roscommon having noteworthy examples.

- **Winter Bird Sites**
  Figure 7.1 Ecology Constraints Map includes a large number of vantage points (445) from which Birdwatch Ireland (BWI) conduct I-WeBS winter bird counts of the wintering bird sites immediately adjacent to these points. It should be noted that these are vantage points and are not individual sites; hence the actual number of wintering bird sites is much less. An evaluation exercise was conducted of wintering bird sites surveyed from these points based on criteria in Crowe (2006)[14] so as to highlight more important areas and these were subdivided into sites of international, national, notable (likely county value) and other (likely locally important sites). The key areas as determined and delineated in Figure 7.1 Ecology Constraints Map are sites of international, national and notable value.

  Key areas outside SPA (designated) sites include the area south of the existing Flagford substation, County Roscommon, Balla Turlough area, south of Castlebar, the River Moy east of Castlebar (Whooper Swans), and turloughs and lakes south of Claremorris, County Mayo. Further assessments will be required to determine the more significant sites, particularly those where concentrations of bird species potentially at risk from the proposed development are most likely to occur.

- **Turloughs**
  This habitat is listed as an EU Annex 1 priority habitat. Many have been damaged by past drainage works though are still of significant conservation importance (EU priority habitats for protection). Areas where concentrations of undesignated examples occur include east of Lough Corrib. There is also a cluster of potential turloughs within a 10km radius of the existing Cashla substation. Potential turloughs are sites which have not been fully confirmed as turlough habitat, however they are treated as turloughs at this stage until further survey work is undertaken to evaluate their importance.

- **Coastal Habitats – Coastal Lagoon and Salt Marsh**
  While included in the study as constraints, these areas are unlikely to be significant to the Grid West project as a subsea element which would necessitate a route in coastal areas, is considered unreasonable, given the geographical location of the connection nodes in Bellacorick, Cashla and Flagford, hence these are not discussed further. As noted in Chapter

[14] Ireland's Wetlands and their Waterbirds: Status and Distribution, Crowe 2006

14 *Engineering Constraints* , the emerging preferred technology for the project is 400kV high voltage alternating current (HVAC) overhead line. Reference should be made to this chapter of the report for further details.

- **Limestone Pavement**
  This habitat is listed as an EU Annex 1 priority habitat. Other habitats of conservation significance generally occur in association with this habitat including important orchid sites, calcareous springs (both habitats listed as EU Annex 1 priority habitat), fens and turloughs. This habitat is patchily distributed west of Lough Corrib, on the eastern Lough Mask shoreline (most extensive area) and south of the existing Cashla substation.

- **Semi Natural Woodlands**
  The National Survey of Native Woodlands (NSNW) surveyed 108 woodland sites within the study area during the period 2003 to 2008, with each site assigned an individual site code (Perrin *et al*. 2008). As part of the NSNW, a conservation score was applied to each woodland based on a wide range of data collected during field surveys. Those sites that attained a score of 40% or higher are regarded as being of moderate conservation importance (Perrin *et al* 2008). An output of the NSNW is a shapefile (*NSNW_Woodland_Habitats_2010_clip*) showing the distribution of woodland habitats. By referring to the final report it is possible to extract from the habitat shapefile, those sites that attained a conservation score of 40% or higher, and these 'Moderate' or greater value sites are therefore included in the constraints mapping.

  Given the scarcity of even moderate value habitat of this type nationally, and also its relative sensitivity to development, these areas are deemed suitable for inclusion in this constraints study at this stage of the project.

  Within the study area there are very extensive areas of plantation forestry (not mapped). While these areas are not considered internationally or nationally significant, they will require consideration at later stages of the project especially regarding potential water quality risks, for example if tree clearance works are required.

- **Semi Natural Grasslands**
  As part of the Irish Semi-Natural Grassland Survey (ISGS), a large number of grassland sites within the study area were surveyed during both 2007 (Roscommon) and 2010 (Sligo) (Martin *et al.* 2007; O'Neil *et al.* 2009 & 2010). As part of the ISGS, a conservation score was applied to each grassland based on a wide range of data collected during field surveys. Those sites that attained a score of 40% or higher are regarded as being of high conservation value (O'Neil *et al* 2009 & 2010) and are therefore included in the constraints mapping.

- **Raised Bog**
  This habitat includes relatively intact surveyed areas and un-surveyed vegetated areas. Active Raised bog and degraded raised bog occur within these areas mapped. These habitats are listed on Annex 1 of the EU Habitat Directive, with active raised bog a priority habitat for

protection. Surveyed relatively intact (at least in large parts); habitat is indicated as 'intact raised bog' in Figure 7.1 Ecology Constraints Map. Potential Annex 1 habitat also occurs in the raised bog (un-surveyed) area detailed separately on this Ecology Map. This Raised Bog (un-surveyed) area and associated habitats (e.g. poor fen, bog woodland and transition mires) may potentially be of significant ecological importance. This habitat is common in east Mayo and south east Galway.

- **Wetland**
  A detailed wetland survey was conducted in County Sligo which included an evaluation of general wetland habitat significance. The extent of these wetlands is indicated in Figure 7.1. Ecology Constraints Map. Given that wetlands generally are relatively sensitive habitats, all sites of high local ecological value or greater specified in this study, are detailed in the mapping.

- **Wet Heath/ Upland Blanket Bog**
  These generally associated habitats are listed on Annex 1 of the EU Habitats Directive. Active blanket bog is a priority habitat for protection. Much of the best examples of this habitat are included in designated sites. Non designated areas of wet heath and blanket bog are also detailed in Figure 7.1 Ecology Constraints Map. At this stage it is likely that the vast majority of these habitats of conservation significance are mapped, though some other areas may occur. These habitats dominate the landscape of north west Mayo.

- **Lakes and Rivers**
  Lakes and rivers are detailed on both Figure 7.1 Ecology Constraints Map and Figure 10.1 Water Constraints Map. For the purposes of the constraints stage no further categorisation of lakes (e.g. based on trophic status) is detailed, as lakes will be avoided. Some rivers may be crossed and further information will be detailed as the project progresses.

- **Freshwater Pearl Mussel River Catchments (FWPM)**
  Key Freshwater Pearl Mussel (FWPM) River Catchments are mapped based on sensitive catchment area information available from NPWS[15]. These catchments include river catchments supporting populations of FWPM in rivers protected as SAC and under Statutory Instrument S.I. 296 of 2009. The mapping also includes other recognised catchments with significant extant populations and those with pre-1970 live records, where populations may still occur. SAC catchments are evaluated as internationally important with other catchments not currently evaluated. This species is a key receptor for any development in all catchments mapped as these areas are highly sensitive to potential impacts associated with water quality risks.

7.3.3 Other Ecological Receptors

It is acknowledged that there may be a number of other ecological receptors which will occur throughout the study area but are not addressed for the purposes of this constraints chapter. These aspects are more relevant to later stages of the project and will be addressed in Stage 2 *Corridor Evaluation* and Stage 3 *Confirm Design* (which includes the environmental impact assessment) of the

[15] http://www.npws.ie/mapsanddata/habitatspeciesdata/

Roadmap, when more localised, site specific impacts are considered. These potential ecological receptors include, but may not be limited to the following:

- Protected mammals e.g. bat roosts (particularly lesser horseshoe bat *Rhinolophus hipposideros*), Otter, Badger, Red Squirrel, Pine Marten etc;
- Amphibians and reptiles;
- Protected and rare flora;
- Breeding bird sites of significant conservation concern;
- Potential significant Wintering Bird flightlines;
- Aquatic and riparian habitats and associated fisheries;
- Locally significant habitats;
- Protected invertebrates e.g. Marsh Fritillary sites; and
- Other Freshwater Pearl Mussel populations (not detailed above).

7.4 CONCLUSIONS

In conclusion, the ecological constraints within the study area for this stage of the project have been identified and mapped. Based on this assessment, it is clear that the study area has a large number of important ecological sites and receptors.

A detailed desk study of available datasets, mapping and literature sources has been conducted. In addition a meeting has been conducted with NPWS to discuss ecological constraints. A map detailing designated and other non designated features of ecological significance has been produced, refer to Figure 7.1 Ecology Constraints Map.

This chapter with accompanying appendices and mapping identifies the international and nationally important sensitive ecological areas and other key ecological receptors within the study area. The most important ecological constraints are those of international and national significance with the remainder of the constraints varying in their importance, and in the nature of their sensitivity.

At this stage avoidance should be prioritsed, where possible, of all designated sites in particular Natura 2000 sites (SAC/SPA), Ballycroy National Park, NHA sites, designated freshwater pearl mussel catchments (in rivers protected as SACs) and lakes.

It is also recommended that other features of ecological significance detailed in this report be avoided as much as possible at the corridor selection stage or, if this is not possible, be fully considered at a more localised scale at later stages in the project i.e. Stage 2 *Corridor Evaluation*, based on more detailed studies. Other important ecological receptors include pNHAs, other freshwater pearl mussel catchments, fens, turloughs, bogs, wet heath, semi natural woodland, wintering bird sites and semi natural grassland. This approach is recommended given their importance in a national context and the commitments of the National Biodiversity Plan (2011-2016) which includes conservation of ecosystems, habitats and species particularly high value habitats as detailed herein.

Whilst this information will inform the next stage of the project, which is Stage 2 *Corridor Evaluation*, it is also acknowledged that other ecological receptors will arise as the project proceeds. Further desk and field assessments will be conducted and more detailed site specific mapping of key ecological receptors will be provided in these future stages.

8 LANDSCAPE

8.1 INTRODUCTION

The most effective way to minimise the landscape and visual impact of a transmission line is to avoid the parts of the landscape most likely to be adversely affected by the development. This chapter identifies the parts of the landscape that should be avoided, where possible, in order to minimise landscape and visual effects.

Landscape constraints are dynamic, not static, and the landscape, or values placed on the landscape, can change over the course of a project. Therefore, the landscape constraints database will be updated as the project progresses. Any guidance relating to visual impact which is currently underway that may emerge from the ongoing EirGrid Evidence-Based Environmental studies will also be incorporated into the Environmental Impact Statement (EIS).

The draft Guidelines of the '*Landscape Institute for Landscape and Visual Impact Assessment*'[16] advise that at the initial stages of a project *'the primary aim is to identify key issues and constraints*'. For this purpose, the Guidelines state *'a fairly broad-brush preliminary site appraisal may be adequate, based primarily, for example, on landscape designations, existing landscape character assessments, information about historic landscapes, mapped areas of ancient woodland and known sites of recreational interest'.*

A combination of desktop study and windscreen[17] survey (carried out in April 2012) was used to ascertain the potential landscape constraints within the study area. These constraints are mapped in Figure 8.1 Landscape Constraints Map, which illustrates key areas, which may be most sensitive to the proposed development. The individual constraints are also listed in Appendix 8.1 Desktop Identified Landscape Constraints. This chapter also describes other constraining elements within the landscape such as aspects of topography, landscape scale, landscape complexity and rarity, open or horizontal landscapes and areas of wilderness.

8.2 METHODOLOGY

This chapter is based on a desktop study of all the available landscape inventories and cartographic sources and a windscreen survey of the study area.

8.2.1 Information Sources

A number of information sources were used to gather information on the existing landscape constraints within the study area. All desktop identified constraints are mapped in Figure 8.1 Landscape Constraints Map and listed in Appendix 8.1 Desktop Identified Landscape Constraints. Following this desktop exercise, a windscreen survey was carried out to assess the accuracy of the key desktop findings and to ascertain the broad baseline characteristics of the wider landscape.

[16] Draft Guidelines for Landscape and Visual Impact Assessment, Landscape Institute, 2012
[17] This refers to survey completed while driving in the study area and recording observations

County Development Plans

The county development plans and County Landscape Character Assessments (LCA) were the main sources of information for the desktop study, refer to Table 8.1. Key features identified in these documents were checked and verified on the ground for accuracy and relevance. The windscreen survey, for example, identified the extent and nature of key protected views, and the nature of the boundaries to areas designed for landscape significance. Landscape designated areas were compared to the wider landscape to ascertain relative significance.

Table 8.1 County Development Plans

County Development Plan	Date	County Landscape Character Assessment	Date
Galway County Development Plan	2009-2015	Galway Landscape Character Assessment	2002
Mayo County Development Plan	2008-2014	Mayo Landscape Appraisal	2002
Roscommon County Development Plan	2008-2014	Roscommon Landscape Character Assessment	2007
Sligo County Development Plan	2011-2017	Policy commitment in Development Plan (O-LCAP-1)	n/a
Leitrim County Development Plan	2009-2015	Leitrim Landscape Character Assessment	2002

Refer to Appendix 8.1 Desktop Identified Landscape Constraints for a list of landscape features taken from the relevant county development plans.

In the absence of legislation or formal national guidelines for landscape assessment, there is variance in the approach to County Landscape Character Assessment in Ireland[18]. There is also significant variance in the approach to identification of landscape features of importance in county development plans.[19] Each county has developed its own terminology and methodology for identifying landscapes or landscape features that are considered important. For example, Mayo identifies Highly Scenic Vistas, while Galway identifies Focal Points and Views. Both Mayo and Sligo mark their ridgelines as Vulnerable Features/Areas, while Leitrim has identified Major Public Amenity Areas. The current baseline County Landscape Assessments have not been updated by the local authorities since their completion and therefore the dates of the survey work informing the designations are stated for clarity. Two maps have been prepared showing the landscape categorisation applied by each county where a landscape character assessment has been carried out, i.e. in Mayo, Galway, Roscommon and Leitrim. These maps are contained in Appendix 8.3 Landscape Categorisation Maps.

[18] Landscape Character Assessment (LCA) in Ireland, Baseline Audit and Evaluation, The Heritage Council, 2006
[19] Feasibiltiy Study to Identify Scenic Landscapes in Ireland, Failte Ireland, 2007

Other Information Sources

A number of other sources provided information on the existing landscape for the desktop assessment:

- Walking Routes information derived from county development plans and National Trails Office;
- Candidate Wilderness Area from Coillte;
- National Parks boundary from the Department of Arts, Heritage and the Gaeltacht (DAHG);
- United Nations Educational, Scientific, and Cultural Organisation (UNESCO) World Heritage Candidate Sites from the Department of Environment, Community and Local Government (DoECLG);
- Walking routes, uplands, lakes, coastline and major rivers from OSI Discovery Series mapping; and
- Designed Landscapes from the National Inventory of Architectural Heritage (NIAH) (Gardens).

Windscreen Survey

A windscreen survey was carried out in April 2012 to verify key constraints identified during the desktop assessment and to ascertain the general character of the landscape within the study area. This survey involved driving through the study area and visiting the areas with key landscape constraints which were identified during the desktop assessment.

Interrelationships

Sites designated for ecological purposes would generally be considered to also have landscape sensitivities. They will be assessed on a case by case basis as to the nature of their landscape sensitivities, i.e. an open expanse of bog may be more sensitive in terms of landscape effects than areas of regenerating scrub. There is also a strong interrelationship with cultural heritage constraints, particularly cultural heritage features that directly contribute to landscape character such as buildings, ruins, graveyards, visible prehistory, historic buildings or designed landscapes. The interrelationships between landscape, ecology and cultural heritage constraints will be assessed at each stage of the project.

8.2.2 Consultation

Consultation to date has taken place with Coillte in relation to the Candidate Wilderness Area. Further consultation will take place with this stakeholder as the project progresses.

It is expected that additional consultation will be held with the following organisations in future stages of this project:

- The Heritage Council;
- An Taisce;
- Bord na Móna;
- Coillte;
- Fáilte Ireland;
- Local authorities;
- Regional Authorities;

- Department of the Environment, Community and Local Government (DoECLG); and
- Department of Arts, Heritage and the Gaeltacht (DAHG).

8.3 EXISTING ENVIRONMENT

8.3.1 National and International Landscape Designations

There is one national landscape designation within the study area; Ballycroy National Park in County Mayo. The extent of the National Park within the study area is mapped in Figure 8.1 Landscape Constraints Map.

Two national landscape designation mechanisms are laid out in the Planning and Development Act 2000: Landscape Conservation Area and Special Amenity Area Order. These are available for use by local authorities and the Minister for the Environment, Community and Local Government to protect areas or features that are considered of significant importance. There are no Landscape Conservation Areas within the study area and no Special Amenity Area Orders have been made within the study area.

Two sites within the study area were nominated by the State in 2010 to a Tentative List for UNESCO World Heritage Site status; Céide Fields and North West Mayo Boglands and the Rathcroghan Complex in County Roscommon. Both of these sites are important archaeological landscapes. Candidate sites remain on this list for at least a year during which consultation must take place with relevant stakeholders before possible inscription on the World Heritage List.

Table 8.2 National and International Landscape Designations within the Study Area

County	UNESCO World Heritage Sites – Tentative list	National Parks	Landscape Conservation Areas	Special Amenity Area Orders
Mayo	Tentative list 2010 – Céide Fields and North West Mayo boglands	Ballycroy National Park	none	none
Galway	None	none	none	none
Roscommon	Tentative list 2010 – Rathcroghan Complex	none	none	none
Leitrim	none	none	none	none
Sligo	none	none	none	none

8.3.2 County Landscape Designations

In the absence of finalised national guidelines for landscape assessment, each local authority uses its own terminology to describe parts of the landscape considered to be of significant aesthetic or recreational value on a county scale. The landscape constraints contained in the county development plans and County LCAs considered relevant to this study are summarised in Table 8.3 herein using each council's terminology. A more detailed breakdown of the constraints listed in the development

plans is provided in Appendix 8.1 Desktop Identified Landscape Constraints. The constraints are mapped in Figure 8.1 Landscape Constraints Map.

Table 8.3 Landscape Designations as contained in County Development Plans

County Development Plan/LCA	Views	Routes	Landscape Value	Year of survey work
Mayo (2008-2014)	Highly Scenic Vistas	Scenic Routes	Vulnerable Features (coastline, lakeshores, rivers, headlands estuaries, skylines, ridges, promontories)	2002
Galway (2009-2015)	Focal Points and Views		Areas of Outstanding Landscape Value Areas of Unique Sensitivity	2002
Roscommon (2008-2014)	Scenic Views	Scenic Routes Driving Routes Walking Routes Cycling Routes	Areas of Exceptional Value Places of Interest and Visitor Attractions	2007
Leitrim (2009-2015)	Outstanding (protected) Views and Prospects	Long Distance Routes	Areas of High Visual Amenity	2002
Sligo (2011-2017)	Scenic Views to be Preserved	Scenic Routes	Sensitive Rural Landscapes Visually Vulnerable Areas (coastline, lakeshores, rivers, headlands estuaries, skylines, ridges, promontories)	1998

County Development Plans - Designated Views

All scenic views, as identified in the county development plans or County LCAs, have been included in the landscape constraints mapping. While all designated scenic viewpoints are listed as constraints for information gathering purposes, key viewpoints were assessed for relative sensitivity during the windscreen survey carried out in April 2012. It is clear that the characteristics and significance of these views vary greatly within the study area with some featuring localised, short distance views, and some encompassing long distance panoramas. Some viewpoints are accessible and signposted, while others are brief glimpses from roads where it is impossible to stop. Some viewpoints have been obscured by commercial forestry or other vegetation. Some views take in areas of mountain and bog, while some are of densely inhabited or agricultural landscapes. It will not be assumed therefore that all designated views are of equal significance.

County Development Plans - Landscape Value

Some County LCAs have ascribed sensitivity or value ratings to Landscape Character Areas, e.g. Galway has identified '*Areas of Outstanding Landscape Value'* and Leitrim has identified '*Areas of Exceptional Value'.* Where areas within a county have been assigned a very high sensitivity or value, (for example Lough Key, or the areas around Lough Corrib) this has been included in Figure 8.1 Landscape Constraints Map. Parts of these designated areas may be more sensitive than others, but generally these areas will be considered sensitive to the proposed development.

County Development Plans - Designated Routes

All scenic routes, driving routes, walking routes and cycling routes as identified in the county development plans or County LCAs have been included in Figure 8.1 Landscape Constraints Map. These are included as they contribute to the amenity of particular areas. It should be noted that the characteristics of these routes vary greatly within the study area, some travel through landscape of great drama and rarity, while some travel through relatively ubiquitous agricultural and inhabited landscape. Therefore, while these are listed as constraints for information gathering purposes, they will be assessed for sensitivity on a case by case basis. A designated route would be much more sensitive to an overhead line running in parallel, than to an overhead line crossing over in a perpendicular manner.

County Development Plan Landscape Policies, Objectives and Development Management Standards/Guidelines

A listing of relevant landscape policies of the relevant county development plans is contained in Appendix 8.2 Landscape Policies. The development plans also contain broader policies which refer to the protection of specific landscape features such as hedgerows or policies in relation to tourism which incorporate landscape issues. The policies listed in Appendix 8.2 Landscape Policies are those directly concerned with the relationship between the landscape and significant infrastructure projects.

8.3.3 Significant Recreational and Heritage Landscape Features

Aside from the designations in the county development plans, there are a number of landscape features of recreational value such as marked walking and cycling routes and designed landscapes with significant heritage value. These are mapped in Figure 8.1 Landscape Constraints Map and listed in Table 8.4 herein.

Table 8.4 Features of Significant Recreation and Heritage Value

County	Main Walking Routes	Main Cycling Routes	Designed Landscapes with significant heritage value	Other
Mayo	Western Way Bangor Trail Foxford Way Pilgrim's Walk (Tóchar Phádraig) Croagh Patrick Heritage Trail National Looped Walks Lough Lannagh Shoreline Walk	Great Western Greenway Westport Cycle Hub	Historic Gardens and Designed Landscapes – with main landscape features substantially present as defined in NIAH Inventory	Candidate Wilderness Area (Coillte)
Galway	Western Way National Looped Walks	Derroura Mountain bike trail	Historic Gardens and Designed Landscapes – with main landscape features substantially present as defined in NIAH Inventory	
Roscommon	Suck Valley Way Miner' s Way & Historical Trail National Looped Walks	The Kingfisher Cycle Trail The Táin Cycling Route The Lough Ree and Shannon Cycling Tour	Historic Gardens and Designed Landscapes – with main landscape features substantially present as defined in NIAH Inventory	
Leitrim	North West Trail (Walking & Cycling) Leitrim Way Miner's Way & Historical Trail National Looped Walks		Historic Gardens and Designed Landscapes – with main landscape features substantially present as defined in NIAH Inventory	
Sligo	Miner' s Way & Historical Trail Sligo Way National Looped Walks		Historic Gardens and Designed Landscapes – with main landscape features substantially present as defined in NIAH Inventory	

8.3.4 General Landscape Constraints

Apart from the constraints listed above, more general landscape factors are discussed herein and will feed into the iterative route design process. These factors include topography, landscape scale, landscape complexity, rarity, open or horizontal landscapes, and areas of wilderness. Lakes, the

coastline, major rivers and ridgelines are generally considered landscape constraints due to their sensitive qualities, although it may not be possible to avoid impact on such landscape features completely.

Undulating landscapes are less constraining than open flat landscapes, as topography can provide screening and backdrop, although higher ground should be avoided, where possible. Some types of undulating landscapes are more sensitive, for example, parts of Sligo, or the pattern of onshore and drowned drumlins of the Clew Bay area. Landscapes with a network of hedgerows are less constraining than landscapes with low vegetation. While very flat and open landscapes are generally considered a constraint, the nature of the study area may necessitate the crossing of such landscape at least in the vicinity of Bellacorick and the existing Cashla substation. In such cases, the benefits of utilising existing infrastructure corridors will have to be weighed against the potential for cumulative impact[20].

The relationship between plains and mountains will be taken into consideration, for example the extent of visual influence of the Nephin and Partry Mountain ranges. The extent of views across lakes will also be a consideration, for example views eastwards from the western shores of Lough Mask or westwards across Lough Conn.

Many areas, particularly to the west and in elevated areas, exhibit characteristics of wilderness with very little evidence of human impact. These areas would be sensitive to the inclusion of new elements in the landscape. Other parts of the study area display patterns of human habitation and agriculture that may also be sensitive to the inclusion of electricity infrastructure.

Parts of the study area already contain significant electricity infrastructure including transmission lines and substations. These locations are noted and will be assessed on a site by site basis in terms of the potential for cumulative effects of overhead lines.

8.4 CONCLUSIONS

The main international, national and county level landscape designations have been identified and mapped. In the absence of finalised national guidelines for landscape assessment, each local authority uses its own terminology to describe parts of the landscape considered to be of significant aesthetic or recreational value on a county scale. This desktop study has been supplemented by a windscreen survey which verified the key constraints and ascertained the characteristics of the wider landscape. The most important constraints are those of international (candidate World Heritage Sites) and national significance. The remainder of the constraints vary in their importance, and in the nature of their sensitivity.

[20] The addition of many small impacts to create one larger, more significant, impact.

9 GEOLOGY

9.1 INTRODUCTION

This geological constraints chapter together with Figure 9.1 Geology Constraints Map have been prepared in order to identify the geologically sensitive areas that that may influence the identification of substation site options and potential indicative corridors and ultimately an indicative line route along which the proposed transmission line will be sited. This chapter identifies the areas that should be avoided, where possible, in order to minimise geological effects.

A review of relevant local, regional and national geological datasets was carried out as part of the constraints study for the purpose of highlighting any areas or individual sites that may have statutory or legislative protection. With regard to geological features, there are no statutory or legislative restrictions with the exception of areas of peatland which are designated as ecological Natural Heritage Areas (NHAs), and as such these areas are included in Chapter 7 *Ecology*.

In general, soils and geology constraints are more relevant to Stage 2 *Corridor Evaluation* and Stage 3 *Confirm Design* (which includes the environmental impact assessment) of the Roadmap, as geological features are often quite localised and of more significance locally, for example at identification of the indicative line design, than at regional level. Any guidance relating to soils and geology that may emerge from the EirGrid Evidence-Based Environmental studies will be incorporated into the environmental impact assessment.

9.2 METHODOLOGY

9.2.1 Information Sources

This chapter details the potential constraints associated with soils and geology which are considered for the constraints stage of this project and in particular Irish Geological Heritage Sites which include proposed Natural Heritage Areas (pNHA's) and County Geological Sites (CGS). It is also recommended that quarry and mine sites (historical and active), areas of peat and bedrock outcrop and areas where there is a significant number of recorded karst features (e.g. caves, springs) are avoided. The reasons for avoiding these features are detailed herein.

As part of the Irish Geological Heritage Programme (IGHP), which is managed by the Geological Survey of Ireland (GSI), a list of geological sites has been compiled which are proposed for designation as pNHAs. These geological heritage areas are provisionally designated due to a specific geological interest (e.g. active quarries) and are referred to as geological pNHA sites and should not be confused with ecological pNHA sites. These pNHAs are still a designation of national importance to consider, however, the GSI has no indication as to when geological pNHAs will be promoted to 'designated' status.

To address this situation, the GSI's priority in relation to geological heritage sites designation has been to focus on CGS, as per the National Heritage Plan, which puts the onus on local authorities to protect

geological heritage sites identified by the GSI's Irish Geological Heritage Programme (IGHP). The documentation of sites is done through county audits of geological heritage based on an original list provided by the GSI. Through the audit, CGS are documented and delineated. According to the GSI, the assessments are limited but reports and some surveys for counties completed to date are available. Some CGS will eventually be recommended for NHA designation. It is therefore recommended that these features are assessed in further detail at Stage 2 *Corridor Evaluation.*

Following an initial consultation with the GSI (April 2012), it was reported that a full survey of County Sligo geological heritage areas has been carried out, however surveys for Galway, Mayo, Roscommon and Leitrim have either not been carried out or have been partially completed and therefore geological heritage sites in these counties are indicated by a single point grid reference instead of a polygon which delineates the extent of each individual feature. For this reason, the GSI has requested that '*both CGS and NHA/pNHA should be considered in this constraints study*'. The GSI has recommended that the Project Team consult with them as the project progresses, in order for them to carry out a detailed desktop study for each identified location to estimate the extent of the buffer zone to be recommended for each site.

It is also recommended to avoid, where possible, quarries, mines, rock outcrop and areas of karstified rock. Activity within a quarry or mine site may impact on an operational transmission line as an abandoned quarry or mine may be unstable as a location for transmission towers. Geologically, rock outcrop should be avoided, where possible, as there will be a direct impact on the bedrock during the construction phase of the proposed development. Karstified rock is unpredictable as the proposed location for a structure, such as a tower, may overlie a large fracture or cave that has the potential to be geotechnically unstable.

Peat has the potential to be geotechnically unstable and where it occurs on sloping ground there is a greater risk of slope instability. Detailed engineering design can be used as a mitigating measure where it is not possible to avoid large areas of peat.

A number of datasets are recommended for review in order to identify any potential geological constraints within the study area.

Geological datasets reviewed as part of this constraints study include:

- Geological Survey of Ireland (GSI) - Geological Heritage Sites (pNHA and CGS);
- GSI, Irish Mining and Quarrying Society (IMQS) and local authority datasets relating to commercial geological sites within the study area including quarries and mines;
- Peat, bedrock outcrop and potentially karstified rock (as sourced from the GSI Soil and Subsoil datasets);
- NPWS Turlough database; and
- GSI Karst features database.

A more detailed desktop study and site assessment (site visits to areas of interest) will be carried out at Stage 2 *Corridor Evaluation* and Stage 3 *Confirm Design* (which includes the environmental impact assessment) of the Roadmap. This desktop study will include the following studies:

- Bedrock classification to highlight the various geological bedrock formations underlying the study area. This information will be sourced from the GSI bedrock formation dataset and will also include information on recorded faults within the study area;
- Soils and subsoils classification to identify local areas, for example karst areas, peatlands, areas of rock outcrop etc., that may not be ideal for siting a transmission line and that may result in additional engineering requirements in the construction phase of the proposed development relating to infrastructure stability. In summary, it is recommended to avoid these areas but potential impacts can be mitigated against with the careful siting of towers and substations and the use of geotechnical and engineering design at the construction stage. The soils and subsoils of the area will be identified using the GSI soil and subsoil maps; and
- Aquifer classification to identify local and regionally important aquifers within the study area. Any potential impacts will be considered with respect to the aquifer classification maps sourced from the GSI and appropriate mitigation measures proposed where required.

9.2.2 Consultation

Preliminary consultation relating to Geological Heritage Sites (pNHA and CGS) has taken place with the GSI (April 2012).

It is anticipated that the following organisations will be contacted for feedback during future stages of the project:

- Geological Survey of Ireland (GSI);
- Environmental Protection Agency (EPA);
- Relevant local authorities (Environment Officers);
- Irish Peatland Conservation Council (IPCC);
- The Irish Mining and Quarrying Society (IMQS);
- An Taisce;
- Bord na Móna;
- Coillte;
- Department of Agriculture, Food & the Marine (DAFM); and
- Irish Farmer's Association (IFA).

9.3 EXISTING ENVIRONMENT

9.3.1 Geological Heritage Sites (pNHA and CGS)

As detailed above, as part of the IGHP, which is managed by the GSI, a list of geological sites have been compiled which are proposed for designation as pNHA. The GSI has also determined a secondary list of CGS which may be considered for protection at local authority functional control level. These geological heritage sites are designated due to a specific geological interest (e.g. active quarries, moraines, eskers) and are referred to as geological pNHA sites and should not be confused with ecological pNHA sites.

Using the GSI data, geological pNHA and CGS were identified as constraints within the study area and are presented in Figure 9.1 Geology Constraints Map. There are pNHA and CGS located within each county of the study area and these sites can be summarised as shown in Table 9.1 herein with the detailed records included in Appendix 9.1[21] Geological Heritage Areas. Note the GSI has stated that the current pNHA and CGS locations are indicative and that more detailed surveys will be carried out by the GSI IGHP as the study area becomes more defined in Stage 1 *Information Gathering* and Stage 2 *Corridor Evaluation* of this project. It is generally recommended that these features are avoided.

Table 9.1 Geological proposed Natural Heritage Areas (pNHAs) and County Geological Sites (CGSs) within the Study Area

County	No. of pNHA sites currently identified	No. of CGS sites currently identified
Galway	18	10
Mayo	33	17
Sligo	6	2
Leitrim	2	3
Roscommon	5	2

9.3.2 Commercial Geological Sites (Quarries and Mines)

There are a number of historical and operational quarries and mines located within the study area. It is important to identify these locations, as potential indicative corridors may be located adjacent to these quarries, or above old or operational mine sites (albeit the mine sites may be a considerable depth below the proposed infrastructure).

Using all available relevant data, the locations of historical and operational quarries and mines were identified within the study area and are presented in Figure 9.1 Geology Constraints Map. It is recognised that not all historical and operational sites have been registered with the relevant local authorities or have been identified on national databases, such as those of the GSI Quarry Register or the IMQS database. Therefore the desktop study for this chapter should not be considered as a full assessment of all quarry and mine locations within the study area. As the project proceeds, further studies will be carried out to identify historical mines, quarries and operational sites within the study area. At a local level, the potential extension of quarry and mine operations will also be considered.

There are a number of these sites within each county of the study area but it should be noted that through a combination of careful siting of towers and substation and the use of geotechnical and engineering design at construction stage, the presence of quarries and mines should not restrict the location of the proposed development. However, it is recommended that these sites are avoided, if possible.

[21] 'Note: Appendix 9.1 includes all GSI geological heritage sites and potential (unidentified) sites within Counties Galway, Mayo, Sligo, Leitrim and Roscommon

9.3.3 Peat and Rock Outcrop

As the study area is located in the West of Ireland, there is a high occurrence of peat which is highlighted in Figure 9.1 Geology Constraints Map. This map highlights that specific areas of blanket peat are recorded along the coastal areas of Counties Galway, Mayo, Sligo and Leitrim with larger extents of cutover peat further inland within Counties Galway, Mayo, Sligo, Leitrim and Roscommon.

Peat has the potential to be geotechnically unstable and where it occurs on sloping ground or in areas of steep topography, there is a greater risk of instability, particularly where there is long linear disturbance of the peat. Where non standard soil conditions (e.g. peat) are encountered, a site specific geotechnical investigation will be completed pre-construction, following which a site specific tower foundation design will be undertaken.

Rock outcrop is not a significant constraint but should be avoided where possible as exposed bedrock will need to be excavated in order to allow for the construction of the tower and this will increase the vulnerability of any underlying aquifer. Areas of rock outcrop are shown in Figure 9.1 Geology Constraints Map.

9.3.4 Potentially Karstified Areas/Karst Features

Bedrock that is prone to extensive karstification may result in weaknesses below the ground surface and hence lead to fractures, faults and caves. These areas may cause subsidence if placed under pressure from the construction of towers. At the environmental impact assessment stage, the very low risk of subsidence will be taken account of and will be considered in the design of the tower foundation.

In order to identify areas within the study area where there is a risk of encountering karstified bedrock, the GSI karst database was consulted and the karst features within the study area were noted.

All GSI recorded karst features are shown in Figure 9.1 Geology Constraints Map. From this figure it can be seen that there is a significant number of karst features within the study area. In particular, there is a higher incidence of karst features in the southern section of the study area (in the area from Ballinrobe to Craughwell) than in the northern section of the study area. There is also a cluster of karst features to the east of Castlerea and south east of the town of Boyle.

It is recommended that karst areas are avoided but as they are primarily localised features, additional assessments of recorded karst features and areas of potentially karstified rock will be carried out as the project proceeds to Stage 2 *Corridor Evaluation* and Stage 3 *Confirm Design* (which includes the environmental impact assessment) of the Roadmap.

9.4 CONCLUSIONS

In conclusion, the most relevant geological constraints within the study area for this stage of the project have been identified and mapped. It is recommended that the Irish Geological Heritage Sites (pNHA

and CGS) are avoided, where possible. In addition, it is recommended that areas of peat, bedrock outcrop and karstified rock, are also avoided, where possible, to reduce the potential for unfavourable construction conditions in areas of steep topography and to reduce the requirement for specialised geotechnical input at the construction design phase.

It should also be noted that additional studies and site assessments will be carried out as the project progresses, since geological features are often quite localised, of more significance locally, and can be more effectively considered at later stages of the project when decisions are made with regard to the design of the transmission line.

10 WATER

10.1 INTRODUCTION

This water constraints chapter, together with Figure 10.1 Water Constraints Map, have been prepared in order to identify the water related hydro geologically sensitive areas which may influence the identification, of both substation site options and potential indicative corridors, and which may ultimately influence an indicative line route along which the proposed transmission line will be routed. This chapter identifies the areas that should be avoided, where possible, in order to minimise water related effects.

A review of relevant local, regional and national water datasets was carried out as part of the constraints study for the purpose of highlighting any areas or individual sites that may have statutory or legislative protection.

Additional assessments will be completed through the various stages of this project, as the potential impact on local water features will be more readily identified as the project progresses. Any guidance relating to water that may emerge from the EirGrid Evidence–Based Environmental Studies will be incorporated into the environmental impact assessment (EIA).

10.2 METHODOLOGY

10.2.1 Information Sources

A number of datasets were reviewed in order to identify any potential water constraints within the study area. It is recommended that major surface water features e.g. lakes and rivers (including freshwater pearl mussel catchments), turloughs, flood plains and estuaries (transitional waters)/coastal water bodies' are avoided, where there is potential for development to impact on the quality or integrity of a feature. In addition, the extent of a water feature may be a physical constraint, (depending on the size of the feature), to the development of a transmission line.

Relevant water datasets reviewed as part of this constraints study include the following:

- Flooding Data - Office of Public Works (OPW) and River Basin District (RBD) Flood Maps and Floodplains;
- Environmental Protection Agency (EPA) datasets including:
    - Rivers;
    - Lakes;
    - Estuaries and Coastal Waters;
    - Hydronet (EPA digital map which includes RBD information); and
    - Turloughs.
- NPWS dataset for Freshwater Pearl Mussel Catchments; and
- Forestry area dataset (source Coillte).

A more detailed desktop study and site assessment (site visits to areas of interest) will be carried out as the project progresses to Stage 3 *Confirm Design* of the Roadmap (which includes the environmental impact assessment). The desktop study will include the following studies:

- Identification of groundwater wells of local or regional importance (EPA and GSI datasets) and Groundwater Source Protection Zones that should be avoided, where possible, to reduce the risk of potential contamination of supply;
- Identification of Water Quality Status with respect to the Water Framework Directive as provided by the EPA through Water Maps ('Water Matters') on www.wfdireland.ie;
- Review of the GSI Aquifer Classification underlying the study area in order to identify local and regionally important aquifers. This assessment will be carried out in conjunction with the soils and geology assessments. Any potential impacts will be considered with respect to the aquifer classification maps sourced from the GSI and appropriate mitigation measures proposed where required. The GSI Groundwater Vulnerability Maps will also be reviewed and mapped; and
- A review of Nutrient Sensitive Areas (in conjunction with the Project Ecologist).

Any additional information that is made available as the project progresses, such as flood risk maps from the relevant Catchment Flood Risk Assessment and Management Studies (CFRAMS), will be reviewed and incorporated into any relevant reports and associated mapping as the project proceeds.

10.2.2 Consultation

It is anticipated that the following organisations will be contacted for feedback during future stages of the project.

- Geological Survey of Ireland (GSI);
- Environmental Protection Agency (EPA);
- Office of Public Works (OPW) (Flood Risk Management Section);
- Relevant local authorities (Water Services Department and Environment Officers);
- Inland Fisheries Ireland (IFI);
- Department of Agriculture, Food & the Marine (DAFG);
- Shannon River Basin District (SRBD);
- Western River Basin District (WRBD);
- Shannon Catchment Flood Risk Assessment and Management Study (CFRAMS);
- Western Catchment Flood Risk Assessment and Management Study (CFRAMS);
- Waterways Ireland;
- Irish Water & Fish Preservation Society; and
- Roscommon Eco Network.

10.3 EXISTING ENVIRONMENT

10.3.1 Flooding/Floodplains

The OPW provided data for the flood event locations within the study area as displayed on www.floodmaps.ie in March 2012. This data was reviewed and mapped as shown in Figure 10.1 Water Constraints Map. As this data is regularly updated by the OPW, the flood event locations and associated data will be reviewed on a regular basis as the project proceeds.

Within the study area, there is a significant network of surface water features. Floodplain data, indicating areas where there is a history of flooding, is included in Figure 10.1 Water Constraints Map in order to identify areas that would not be ideal for the construction of a transmission line, due to potential access, instability and geotechnical issues.

As shown in Figure 10.1 Water Constraints Map, the floodplain areas that should be avoided primarily include those located along the River Shannon and its principal tributaries. These floodplains are located to the north east of the study area near the Roscommon and Leitrim county boundaries and to the east of the existing Flagford substation. Additional minor floodplains are also identified at the southernmost boundary of the study area, to the west of Lough Rea.

10.3.2 Rivers

There is a significant network of surface water features within the study area, which are shown in Figure 10.1 Water Constraints Map.

In general, there is a high drainage density (rivers) throughout the study area with a particular concentration of surface water channels in the Ballina/Castlebar/Swinford area of County Mayo which is located slightly north of the centre of the study area. The drainage density decreases, as the relief and the number of lakes increase, as is evident in the western region of the study area which includes Counties Galway and Mayo and immediately to the north west of the existing Flagford substation near Boyle, County Roscommon. The major rivers within the study area include the River Shannon, the River Boyle, the Owenbeg River, the River Moy, the Owenmore River, the Clydagh River, the Castlebar River, the River Clare, the Easkey River, the River Erriff and the Owenboliska River as detailed in Table 10.1 herein.

It should also be noted that there are two catchments within the study area that are designated as Special Areas for Conservation (SAC) under EU Habitats Directive legislation, for freshwater Pearl mussel. These catchments are shown in Figure 10.1. Water Constraints Map and are also included in Figure 7.1 Ecology Constraints Map. They include the following:

- The Newport Freshwater Pearl Mussel catchments, which is associated with the Newport River and is in the vicinity of Lough Beltra, County Mayo; and
- The Owenriff Freshwater Pearl Mussel catchments, which is associated with the Owenriff River, near Lough Corrib, County Galway.

It is important to be aware of the locations of freshwater pearl mussel catchments as this species is critically endangered across its global range and is protected in Ireland and Europe through being listed in Annex II to the EU Habitats Directive (92/43/EEC). A number of candidate Special Areas of Conservation (cSACs) have been designated in Ireland to help maintain or restore populations of freshwater pearl mussel. For further details on freshwater pearl mussel, refer to Chapter 7 *Ecology*.

Table 10.1 Major Rivers within the Study Area

Watercourse/River	Catchment	Receiving Waters
Shannon	Shannon	Shannon Estuary, Atlantic Ocean
Boyle	Boyle	Lough Key/ Shannon
Easkey	Boyle	Boyle
Owenbeg	Ballisodare	Ballisodare Bay, Sligo
Owenmore	Owenmore	Tullaghan Bay, Atlantic Ocean
Moy	Moy	Killala Bay, Atlantic Ocean
Clydagh	Moy	Moy
Castlebar	Moy	Moy
Clare	Clare (Corrib catchment)	Lough Corrib, River Corrib, Galway Bay
Erriff	Erriff	Killary Harbour, Atlantic Ocean
Owenboliska	Owenboliska	Galway Bay, Atlantic Ocean

It is recommended that best practice is implemented when crossing major river, in order to mitigate against the potential impact of construction works and maintenance on the quality of the waters and the integrity of the river banks. In particular, where rivers are recognised as salmonid waters (protected under S.I. 293/1988), as discussed in the Chapter 7 *Ecology*, mitigation from the potential impacts of construction and operational works is recommended. In addition, there will be specific access and geotechnical requirements, if it is proposed that the transmission line crosses wide river channels. A number of rivers are also designated as Natura 2000 sites as discussed in Chapter 7 *Ecology*. It may not be possible to avoid crossing all rivers, and best practice construction methodologies are recommended in these instances.

The study area is located primarily within the Western River Basin District (WRBD), with an area to the east of the study area located within the Shannon River Basin District (SRBD) as shown in Figure 10.1 Water Constraints Map.

10.3.3 Lakes

There are a large number of lakes within the study area, as shown in Figure 10.1 Water Constraints Map.

In general, there are a number of large lakes located to the west of the study area, within counties Galway and Mayo (e.g. Lough Conn, Lough Corrib and Lough Mask) and a number of smaller lakes located in the north eastern region of the study area. The major lakes/loughs within the study area are set out in Table 10.2.

Table 10.2 Major Lakes within the Study Area

Lake/Lough	Location
Carrowmore	County Mayo
Feeagh	County Mayo
Beltra	County Mayo
Conn	County Mayo
Cullin	County Mayo
Easkey	County Sligo
Arrow	County Sligo
Key	County Roscommon
Gara	County Sligo
Corrib Upper	County Galway/ part Mayo
Corrib Lower	County Galway
Mask	County Mayo/part Galway
Carra	County Mayo

It is recommended that larger lakes are avoided as they represent a design constraint and, in any case, in order to mitigate against the potential impact of construction works and maintenance on the quality of the waters and the integrity of the lakeshores. In addition, there will be specific access and geotechnical requirements if it is necessary for the proposed transmission line to cross lakes. Similar to the rivers detailed above, a number of lakes are also designated as Natura 2000 sites as discussed in the Chapter 7 *Ecology*.

10.3.4 Estuarine (Transitional Waters) and Coastal Waters

A number of estuarine (transitional waters) and coastal areas are located within or immediately adjacent to the study area including those along the boundaries of southern Galway, west and north Mayo and north Sligo. It is recommended that estuarine and coastal areas are avoided in order to mitigate against the potential impact of construction works on the quality of the estuarine and coastal waters, on shellfish communities and to avoid the potential for coastal erosion.

10.3.5 Turloughs/Potential Turloughs

Turloughs are annually flooding karstic depressions, which constitute ecologically important and geographically restricted groundwater dependent ecosystems, identified as priority habitats under the EU Habitats Directive. Turlough conservation is also driven by the EU Water Framework Directive.

According to the EPA, there are a significant number of turloughs located within the study area. The EPA data has been drawn from NPWS archives on Special Areas of Conservation (SACs), Special

Protection Areas (SPAs), the GSI karst database, Trinity College Dublin research archives on turloughs and Ordnance Survey 1:50,000 topographic data.

Within the study area, the highest number of turloughs has been recorded in southern County Mayo and in central and southern County Galway. There are very few turloughs recorded in the northern region of the study area with the exception of a minor cluster of turloughs near Tubbercurry, County Sligo. There are no turloughs identified along the western and northern coastal areas.

There is also a cluster of potential turloughs within a 10km radius of the existing Cashla substation, with additional potential turloughs located between the existing Cashla substation and Bellacorick substation, and also in the area to the west and north west of the existing Flagford substation. These sites may be highly modified, however they are treated as turloughs at this stage until further survey work is undertaken to evaluate their significance.

It is recommended that turloughs are avoided as they are sensitive habitats, listed as a priority habitat for protection under the EU Habitats Directive. Turloughs are further discussed within the Chapter 7 *Ecology.* References to karst features (including turloughs) within the study area are also included in Chapter 9 *Geology* of this report.

10.3.6 Forestry

Extensive areas of forestry dominated by non native conifer trees have been planted in recent decades in upland parts of the study area. Most relevant areas have been planted by Coillte and these are mapped. Other unmapped areas have been planted by private operators. Upland forestry areas are particularly sensitive to water pollution, during tree clearance due to high rainfall and associated high risks of peat soil runoff. Thus, these forestry areas are deemed relevant for consideration at the constraint stage, as tree clearance required for potential development works, will be linked to downstream water quality and pollution control management requirements. Figure 10.1 Water Constraints Map highlights the Coillte forestry area located in the study area.

10.4 CONCLUSIONS

In conclusion, the most relevant water related constraints within the study area for this stage of the project have been identified and mapped. It is recommended that larger lakes are avoided, where possible, and that floodplains in the vicinity of rivers are avoided. In addition, it is also recommended to avoid areas where there is a high occurrence of turloughs, estuarine and coastal areas. Major rivers may be a physical constraint but where there is a requirement to cross rivers, best practice should be incorporated into project design and construction so as to minimise pollution risks particularly for freshwater pearl mussel catchments.

Additional studies and site assessments will be carried out as the project progresses. In addition more specific information on water features, water quality baseline studies, water status under the Water Framework Directive may influence the selection of the indicative line route for the proposed transmission line.

11 CULTURAL HERITAGE

11.1 INTRODUCTION

This cultural heritage constraints chapter, together with Figure 11.1 Cultural Heritage Constraints Map details the recorded cultural heritage resource which may influence the identification, of both substation site options and potential indicative corridors, and which may ultimately influence an indicative line route, along which the proposed transmission line will be routed. This chapter identifies the areas that should be avoided, where possible, in order to minimise impacts on the cultural heritage resource.

This study provides an appreciation of the legal framework and the levels of protection afforded to the archaeological, architectural and cultural heritage resource in an international, national and regional context. In 2002, the Government published the National Heritage Plan which set out strategies for the conservation and management of Irelands' heritage. A key element of the plan is an enhanced role for local authorities in heritage awareness and management, to be given effect through the preparation and implementation of County Heritage Plans. As part of this initial study, all relevant documentation including the entire relevant county, town and local development plans, as well as Heritage Plans were reviewed. Any guidance relating to cultural heritage sites that may emerge from the EirGrid Evidence–Based Environmental Studies will be incorporated into the environmental impact assessment (EIA).

11.1.1 Legal Framework

This section summarises Ireland's obligations as a signatory to a number of international and european conventions relating to the protection and conservation of cultural heritage sites. Also included is a synopsis of existing national legislation, governing the care and protection of our cultural heritage resource. More detail on the legal framework is provided in Appendix 11.1 Legal Framework.

The European Convention on the Protection of the Archaeological Heritage (Valletta Convention), 1997

In 1997 the Republic of Ireland ratified the Council of Europe, European Convention on the Protection of the Archaeological Heritage (the 'Valletta Convention'). Obligations under the Convention include provision for statutory protection measures, including the maintenance of an inventory of the archaeological heritage and the designation of protected monuments and areas.

The European Convention on the Protection of the Architectural Heritage (Granada Convention), 1997

Under this convention the Republic of Ireland is obliged to maintain inventories of architectural heritage, to protect the architectural heritage and adopt conservation policies as integrated planning objectives.

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Convention, 1972

This Convention provides for the identification, conservation and preservation of cultural and natural sites of outstanding universal value for inclusion in a World Heritage list. The World Heritage status is a non statutory designation and no additional statutory controls result from this designation. However the

impact of the proposed development upon a World Heritage Site will be a key material consideration in determining planning applications.

ICOMOS Xi'an Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas, 2005

Ireland is a signatory to an international declaration sponsored by the International Council on Monuments and Sites (ICOMOS) that endeavours to ensure the safeguard and conservation of the World's cultural heritage as part of its sustainable and human development. Refer to Appendix 11.1 Legal Framework for further details.

EIA Directive 85/337/EEC as amended

In order to assist planning and other consent authorities, in deciding if significant effects on the environment are likely to arise in the case of development below the national mandatory EIS thresholds, the Minister for the Environment, Heritage and Local Government published a Guidance document in August 2003.

The European Landscape Convention 2000

In 2002 Ireland ratified the European Landscape Convention - also known as the Florence Convention, which promotes the protection, management and planning of European landscapes and organises European co-operation on landscape issues. It is the first international treaty to be exclusively concerned with all dimensions of European landscape.

The National Monuments Act 1930 to 2004

Irish legislation for the protection of archaeological heritage is based on the National Monuments Acts 1930 and amendments of 1954, 1987, 1994 and 2004. These acts are the principal statutes governing the care of monuments in the Irish Republic. They provide for the protection of national monuments through the use of preservation orders. The overall state archaeological service is provided by the Department of Arts, Heritage and the Gaeltacht (DAHG) and delivered through the Planning and Heritage Section of the DAHG and the National Museum of Ireland (Irish Antiquities Division) on behalf of the Minister. Refer to Appendix 11.1 Legal Framework for further details.

Monuments are protected under the National Monuments Acts in a number of ways:

- National Monuments in the ownership or guardianship of the Minister or a local authority;
- National Monuments, which are subject to a preservation order;
- Historic monuments or archaeological areas recorded in the Register of Historic Monuments; and
- Monuments recorded in the Record of Monuments and Places (RMP).

The Planning and Development Act 2000-2011

The Planning and Development Act 2000 (as amended) ensures the protection of the archaeological heritage resource by requiring that all applications under this Act are accompanied by an EIS including

information on material assets, including the architectural and archaeological heritage, and the cultural heritage.

The Planning and Development Act 2000

Under arrangements which came into operation on the 1st of January 2000 (the Planning and Development Act 2000), the system of listing buildings was replaced with strengthened procedures for the preservation of protected structures and structures in Architectural Conservation Areas (ACA).

The Architectural Heritage and Historic Properties Act, 1999

This Act provides for the establishment of a National Inventory of Architectural Heritage (NIAH) it is used by local authorities to inform the compilation of their Record of Protected Structures (RPS) which, under the Planning and Development Act 2000, affords legal protection.

11.1.2 Other Policy Contexts and Guidelines

The National Inventory of Architectural Heritage (NIAH)

The NIAH is a state initiative that forms the basis for recommendations by the Minister of Arts, Heritage and the Gaeltacht for inclusion in the Record of Protected Structures (RPS) under the Planning and Development Act 2000.

The Framework and Principles for the Protection of the Archaeological Heritage Guidelines, 1999

This document sets out the basic principles of national policy on the protection of the archaeological heritage. A key principle set out in these guidelines is that, there should always be a presumption in favour of avoidance of developmental impacts on the archaeological heritage, and preservation in-situ of archaeological sites and monuments must be presumed to be the preferred option.

The Code of Practice between the DoEHLG[22] and EirGrid, April 2009

This Code provides a framework within existing legislation, policy and practice to enable EirGrid to progress with its programme of work within the framework of Government policy, whilst carrying out appropriate archaeological mitigation, having regard to a set of principles and actions agreed by both parties.

The Code of Practice between the DoEHLG and ESB Networks, April 2009

Similar to the above, this code sets out a number of principles to enable ESB Networks to progress with its programme of work within the framework of Government policy.

County Development Plans

The legal basis for the process of making and adopting development and local area plans is set out in the Planning and Development Act 2000. Development plans work within the framework of both the National Spatial Strategy (NSS) and Regional Planning Guidelines. Development plans play a central role in the identification and protection of the natural and built environment and provide general policies

[22] This is now known as the Depatment of Arts, Heritage and the Gaeltacht (DAHG)

on the same. For the purposes of this chapter all relevant county, city and local area plans were reviewed and assessed in relation to their cultural heritage policies and objectives. All relevant county development plans were reviewed as part of this study.

A more recent instrument used by local authorities to indicate heritage areas of particular sensitivity is the adoption of a **Landscape Conservation Area** (LCA's). This designation is provided for in Section 204 of the Planning and Development Act 2000 (as amended). While there are no LCA's within the study area, both Roscommon and Sligo County Council have prepared Conservation Plans for certain high value heritage areas including Rathcroghan, Rindoon (County Roscommon), the Cuillarra Peninsula, Carrowkeel and Inishmurray (County Sligo). All these sites are recognised as being of national significance and there are policy objectives in the respective county development plans that promote their protection. Sligo County Council has a stated commitment over the life of their current development plan to explore the preparation of either a Local Area Plan (LAP) and/or a designation of a Landscape Conservation Area to protect the rural character of the Cuilllarra Peninsula including the archaeological sites at Knocknarea, Carrowmore and Carns. Other sites that have Conservation Management Plans in place or pending include St. Brendan's Cathedral, Clonfert, County Galway and the Inishkea Islands, County Mayo. All the above named sites should be considered as being especially sensitive to development.

11.2 METHODOLOGY

This chapter is based on a desktop study of all the available cultural heritage inventories and cartographic sources that are considered relevant for this chapter. This information is included in light of the legislative protection afforded to the archaeological resource under the various National Monuments Acts (1930-2004) and the architectural resource under the Planning and Development Act 2000. Utilising the following information sources this chapter presents an overall assessment of the archaeological, architectural, cultural and historical datasets referenced within the study area.

11.2.1 Information Sources

All known cultural heritage sites were mapped along with Ordnance Survey Ireland (OSI) First Edition Mapping (Circa 1830). The following information sources were used for this chapter:

- UNESCO World Heritage Sites including the tentative list of candidate sites;
- National Monuments in State Care;
- Potential National Monuments in the Ownership of a Local Authority – a list made available from the Department of Arts Heritage and the Gaeltacht (DAHG);
- Sites subject to Preservation Orders - a list available from the Department of Arts Heritage Gaeltacht (DAHG);
- Walled towns, information derived from www.archaeology.ie;
- Record of Monuments & Places (RMP's) database from www.archaeology.ie;
- Architectural Conservation Areas (ACA's), information received from the various county development plans;
- Record of Protected Structures (RPS's) from Galway, Mayo, Roscommon, Sligo and Leitrim County Councils;

- National Inventory of Architectural Heritage (NIAH) from www.buildingsofireland.ie;
- Designed Landscapes and Historic Gardens indicated on the OSI First Edition Mapping;
- Designated Landscapes, information received from the various county development plans; and
- Mayo County Council's Phase 1 NIAH mapping (unpublished[23]).

All churches and graveyards which have the potential to be in the ownership of the local authorities were highlighted as Potential National Monuments.

Both county development plans and local area plans for the study area were reviewed and several other documentary and literary sources were assessed to ascertain a comprehensive understanding of the cultural heritage of the study area.

Based upon the above information, the sites were mapped in Figure 11.1 Cultural Heritage Constraints Map on which significant sites, regions and cultural heritage landscapes were highlighted.

11.2.2 Consultation

During this constraints study, contact was made with all the Heritage Officers in the local authorities within the study area requesting information on Architectural Conservation Areas (ACA's) and other relevant documentation. It is anticipated that this consultation will be part of an ongoing process.

A meeting was held with the Development Applications Unit (DAU) of the DAHG in July 2012. At this meeting, the Project Team provided a background to the project and discussed the methodology employed for the Cultural Heritage Constraints Chapter and associated Constraints Mapping.

Future consultation will take place with the following:

- Development Applications Unit (DAU) of the DAHG;
- Local Authority Heritage Officers/Conservation Officers/Archaeologists;
- National Museum of Ireland; and
- The Heritage Council.

11.3 EXISTING ENVIRONMENT

The following section examines both the archaeological and architectural heritage of the study area and provides an introduction to the various information sources and inventories highlighted in Figure 11.1 Cultural Heritage Constraints Map as well as pertinent references from county development plans.

11.3.1 The Study Area

There have been multiple phases of history which have left their mark on the landscape and which are evident today as a patchwork of elements including Mesolithic midden sites along the coast, megalithic cemeteries in south Sligo, the Neolithic farms of the Céide Fields in north Mayo and the Celtic Royal assembly complex at Rathcroghan County Roscommon. In the historic period, within the study area

[23] Relevant data for the other counties within the study area was obtained from the NIAH, but as the survey for County Mayo has not yet been completed, draft maps were obtained directly from Mayo County Council.

there are a significant number of ruins, of early Christian churches, followed by the later ecclesiastical buildings of new monastic orders, including the Cistercians at Boyle and the Franciscan's at Ross Errily and Moyne. The Norman Conquest has left a rich legacy of medieval earthworks, castles and walled settlements (Athenry, Rindoon, Roscommon and Galway) many of which laid the foundation for our present towns and cities. From the Post Cromwellian Period, through to the Protestant Ascendancy (17th to 19th Century), the loss and acquisition of property have resulted in the field patterns that are familiar to us today and the development of many big houses with their associated gardens and demesnes (Strokestown House, Moore Hall etc). A more detailed archaeological and historical background is provided in Appendix 11.2 Archaeological and Historical Background.

11.3.2 Archaeological Heritage

World Heritage Sites

Although not formally recognised in Irish legislation, impacts on World Heritage Sites will nonetheless be a material consideration for developments in their vicinity. There are no World Heritage Sites in the study area but there are two sites that are contained in the tentative list of candidate sites (2010). These two sites are the Rathcroghan complex in County Roscommon as part of the Royal Sites of Ireland and the Céide Fields, as part of the north west boglands of Mayo. Rathcroghan is particularly sensitive as it occupies a central location in relation to the study area. This site is near the village of Tulsk and is associated with royal inauguration, ceremony and assembly for the Kings of Connaught.

Within the Mayo and Roscommon County Development Plans these tentative sites receive limited discussion primarily because the majority of these documents were prepared prior to the compilation of the tentative list of candidate World Heritage Sites. In the county development plans for Sligo and Leitrim there are no references to the candidate World Heritage Sites. The Galway County Development Plan however comments on the unique cultural significance of Clonmacnoise as a heritage site and supports the DAHG's bid for UNESCO World Heritage Site status for this site. Despite these omissions World Heritage Sites are afforded the highest levels of protection and their setting and context should be considered highly sensitive. The dataset contains location information on both Irelands World Heritage Sites (Skellig Micheal and Brú Na Boinne) and the seven sites contained in the tentative list of World Heritage Sites, two of which are located within the study area.

National Monuments in State Care

On a national level the highest degree of protection granted to archaeological monuments are those afforded National Monument status protected under the National Monuments Act of 1930 and its various amendments, these are the pre-eminent archaeological sites in Ireland. These sites are either in state ownership or guardianship or are the subject of protection orders and include Walled Towns (e.g. Rindoon, County Roscommon and Athenry Town, County Galway). Generally National Monuments in state care are numbered amongst the best preserved and most impressive monuments in the country and examples within the study area include Ross Errily Abbey and Athenry Castle in County Galway, Ballymacgibbon Cairn and Ballintubber Abbey in County Mayo and Boyle Abbey and Islands and the Rathcroghan Complex in County Roscommon.

Each National Monument is given a specific number and this number can represent a single monument or a group of recorded sites - for example Boyle Abbey, National Monument No. 167, contains 13 individual recorded monuments. Typically all of the county development plans define the legal framework for the care and protection of National Monuments and feature an appendix with an inventory of Monuments in their functional area. Furthermore in the case of Galway and Mayo there is a commitment by both councils to facilitate public access to these sites.

The dataset is based on a PDF document '*National Monuments in State Care: Ownership & Guardianship*' (25 Feb 2010) obtained from the DAHG which lists all such sites located within the Republic of Ireland. The list contains the 'SMR Number' for each site and this unique identifier was linked to data downloaded from the Site and Monuments Database, on the www.archaeology.ie website, to obtain grid coordinates for each site. All sites located within Counties Galway, Leitrim, Mayo, Roscommon and Sligo are included in the dataset. There are 173 National Monuments in State Care within the study area.

Monuments in the Ownership of a Local Authority

Under the National Monuments Act of 1930 and its various amendments, any archaeological monument in the ownership of a local authority is a National Monument. Although there are no formal registers of archaeological monuments that are in the ownership of local authorities, they predominantly consist of churches and/or graveyards that were transferred into the ownership of the Burial Boards by the Church Temporalities Commission during the latter half of the 19th century. With the foundation of the State the Burial Boards were incorporated into the local authorities, thus becoming Potential National Monuments or sites which may require Ministerial Consent for any works in their vicinity. A number of counties are in the process of undertaking graveyard surveys which clarify whether such sites are in the ownership of the local authority. For the purposes of the constraint study religious sites that were contained in a dataset obtained from the Sites and Monuments Database have been extracted and highlighted as Potential National Monuments which may be in the Ownership of a local authority. This list includes early ecclesiastical complexes, chapels, churches and cathedrals as well as friaries, abbeys and convents. There are 1,017 such Potential National Monuments in Local authority Ownership featured in Figure 11.1 Cultural Heritage Constraints Map for the study area

Sites Subject to Preservation Orders

National Monuments that are the subject of Preservation Orders or sites that were in danger of actually being destroyed, injured, or removed and are therefore listed for protection; works can only take place on or in the vicinity of these monuments with the consent of the Minister of the Arts, Heritage and the Gaeltacht. The dataset is based on a PDF document 'Preservation Orders' (1 Feb 2010) obtained from the DAHG which lists all such sites located within the Republic of Ireland. The following disclaimer is noted:

'*These data sets are based on records many of which date to the late nineteenth or early twentieth centuries. Research to clarify the number and exact extent of some of the monuments that are covered by a preservation order/temporary preservation order is on-going. Consequently, the information*

presented here should be considered as a work in progress and changes will be implemented from time to time. While every effort has been made in preparing this data no responsibility is accepted by or on behalf of the State for any errors, omissions or misleading statements on these pages or any website to which these pages connect.'

The list contains the 'SMR Number' for each site and this unique identifier was linked to data downloaded from the Site and Monuments Database on www.archaeology.ie website to obtain grid coordinates for each site. All sites located within Counties Galway, Leitrim, Mayo, Roscommon and Sligo are included in Figure 11.1 Cultural Heritage Constraints Map.

When linking the data, it was noted that there were 13 sites that had no SMR numbers listed and therefore no grid coordinates could be derived. These sites were reviewed and it was found that four related to sites in Galway City, two related to sites outside the study area, one related to a shipwreck and six relate to Crannógs located at Lough Gara. Lough Gara is located within the study area and due care will be taken in the vicinity of this site when identifying potential indicative corridors. There are 81 sites within the study area that are subject to Preservation Orders.

Walled Towns

The importance of walled towns was formalised by the Department of Environment, Heritage & Local Government in their '*National Policy on Town Defences'* (2008), in which it is states:

'*The known and expected circuits of the defences (both upstanding and buried, whether of stone or embankment construction) and associated features of all town defences are to be considered a single national monument and treated as a unit for policy and management purposes. There should be a presumption in favour of preservation in-situ of archaeological remains and preservation of their character, setting and amenity.*'

The dataset is based on the data from the Sites and Monuments Database available on www.archaeology.ie website and includes all recorded monuments located within Counties Galway, Leitrim, Mayo, Roscommon and Sligo that have the classification 'Town Defences'. Within the study area there are a total of 12 sites with this classification located within the following towns/cities: Dunmore, Loughrea, Athenry, Ardrahan, Galway, Ballintober, Rindoon, Sligo and Jamestown.

Record of Monuments and Places (RMP)

Sites that are not in state care are listed in the Record of Monuments and Places. This inventory consists of a nationwide set of 6 inch maps with an accompanying index which shows all the sites, monuments and zones of archaeological potential, recorded to date. The inventory concentrates on pre 1,700 AD sites. Monuments and places included in the record are protected as follows:

'*When the owner or occupier (not being the commissioners) of a monument or place which have been recorded under subsection (1) of this section or any person proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such monument or place, he shall give notice in writing*

of his proposal to carry out the work to the Commissioners, commence the work for a period of two months after having given the notice'.

It should be noted that RMP's are protected by the National Monuments Act but that the care and preservation of these features depends largely on the interests and respect of the individual landowners. All of the county development plans have policies asserting the protection and preservation of archaeological sites, which have been identified in the Record of Monuments and Places (RMP's).

It should be noted that all of the National Monuments discussed above are a subset of sites that are contained in the Sites and Monuments Database on the www.archaeology.ie website. The dataset available for download from the website includes a unique identifier for each site, a Sites and Monuments Record (SMR) Number. It has been noted that there are several designations/terms that cover archaeological monuments, including the SMR, Record of Monuments and Places (RMP) and Register of Historic Monuments (RHM). For the purposes of this project archaeological monuments will be referred to as SMR sites as the Sites and Monuments Database contains the most up to date list of sites, including sites that are not contained in either the RMP or RHM.

Within Counties Galway, Leitrim, Mayo, Roscommon and Sligo there are approximately 39,400 archaeological monuments listed in the Sites and Monuments Database, 20,056 of which lie within the study area. Given the different environmental constraints within the study area the complete avoidance of impacts on the settings of archaeological monuments is improbable. Notwithstanding this, a considered attempt has been made to gauge the sensitivity of particular classifications of monuments to impacts on setting in the interest of providing a useful framework to minimising these impacts.

Tables 11.1 provides an indication of the scale of the archaeological resource found within the study area. There are two candidate World Heritage Sites that should be regarded as being of international significance. There are 173 national monuments in state care representing sites of national historical and archaeological importance; in addition there are 1,098 Potential National Monuments, sites and sites subject to preservation orders that have the same level of statutory protection. In the majority of cases these additional sites represent churches and graveyards inherited by the state from the Church Temporalities Commission. By far the most numerous monument type appears on the Sites and Monuments Record, comprising 20,056 individual features. It should be noted that there is a degree of overlapping in the above inventories.

Table 11.1 Inventory and Count of Archaeological Sites located within the Study Area

Archaeological Sites	Count
Candidate World Heritage Sites	2
National Monuments - In State Ownership or Guardianship	173
Monuments in Local Authority Ownership (Religious Sites)	1,017
National Monuments - Archaeological Monuments Subject to Preservation Orders	81
Walled Towns/Town Defences	12
Sites & Monuments Record	20,056

11.3.3 Architectural Heritage

Architectural Conservation Areas

Section 81 of the Planning & Development Act 2000 allows for the designation of Architectural Conservation Areas (ACA). An ACA is a place, area, group of structures or townscape, taking account of building lines and heights, that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or that contributes to the appreciation of a protected structure, and whose character it is an objective of a development plan to preserve. There are 63 ACA's within the study area. Maps of the ACA's as they appear on the various county development plans are highlighted in Figure 11.1 Cultural Heritage Constraints Map.

Record of Protected Structures (RPS)

The importance of our built heritage is enshrined in the Planning and Development Act, 2000 (Part II, Section 10) which places a statutory obligation on local authorities to include in their development plans objectives for the protection of structures, or parts of structures, which are of special interest. The principal mechanism for the protection of these structures is through their inclusion on the Record of Protected Structures (RPS). This list provides recognition of the structures importance, protection from adverse impacts and potential access to grant aid for conservation works. The Record of Protected Structures (RPS) is an ongoing process and can be reviewed and added to. In considering additions to the Record of Protected Structures (RPS), local authorities have recourse to the National Inventory of Architectural Heritage (NIAH) which provides a source of guidance on the significance of buildings in their respective areas. For example Sligo County Council intend to add a further 172 structures to their present list of 253 RPS's. All of the county development plans within the study area feature the legal context pertaining to Protected Structures and provide an inventory for these sites in Appendix 11.1 Legal Framework. There are 1,155 RPS's listed within the study area.

National Inventory of Architectural Heritage (NIAH)

These county surveys, established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999 provides an index of structures deemed to be of architectural, historical, archaeological, artistic, cultural, social, scientific or technical interest. The database is being undertaken in three Phases; Phase 1 and 2 have been fully completed and involved initially identifying the sites using OS 6 inch First Edition mapping.

This was followed by a desk based assessment of the sites utilising aerial photography to prepare individual survey reports that include a Statement of Condition. The last phase involves a more detailed survey using a standard field recording form with bibliography and a summary description with accompanying photographic records. Only two counties, Louth and Donegal, have completed Phase 3. The NIAH inventory also provides valuable information to local authorities on the rich heritage of the country's demesnes, parks, gardens and designed landscapes.

The results of the NIAH surveys are available on the www.buildingsofireland.ie website. Each entry comprises a site description and appraisal providing a qualitative account of why the building is an important part of Irish architectural heritage justifying its inclusion. The inventory also rates the structures on a scale ranging from local, regional, national to international. This information should ensure that the structures with the highest ratings can be avoided.

Note: The NIAH Survey for County Mayo has not yet been made available on the www.buildingsofireland.ie website. However the Planning Section of Mayo County Council has provided hard copies of annotated OS maps from which 702 further NIAH sites have been reviewed and added to the overall NIAH dataset.

Designed Landscapes & Historic Gardens

The Architectural Section of the DAHG is in the process of a multi-phase study looking at Designed Landscapes and Historic Gardens that appear as shaded areas on the First Edition Ordnance Survey Maps, circa. 1830.

'*The objective of this survey is to begin a process of understanding of the extent of Ireland's historic gardens and designed landscape. Sites were identified using the 1st edition Ordnance Survey maps. These were compared with current aerial photography to assess the level of survival and change*.'

The initial survey was carried out in two phases. Phase 1 commenced in 2003 with a search to identify sites followed by Phase 2, which involved a desk-based initial assessment of condition and survival. Phases 1 and 2 have been completed for all counties and the results are available under the Garden Surveys section of the www.buildingsofireland.ie website. Phase 3 involves a more detailed site inventory and assessment with specific Statements of Significance for each site, this final phase is underway but to date has only been completed for Counties Louth and Donegal.

This data has been digitised from the www.buildingsofireland.ie website along with a Statement of Condition regarding the integrity of each historic garden and designed landscape based on the Phase 1 and 2 assessments. The NIAH inventory classifies historic gardens and designed landscapes into five possible options referred to as a 'Statement of Condition' (refer to Table 11.2). This statement provides a general overview of a sites status but as noted in their Project Methodology the findings are *'not an indication of a site's heritage importance and should not be used to justify statements about the site's importance or merit'.*

Table 11.2 provides a summary count of the NIAH's inventory of historic gardens and designed landscapes for the counties within the study area.

Table 11.2 Statement of Condition for Historic Gardens and Designed Landscape and subsequent Sensitivity to Impacts on Setting rating

Statement of Condition for Historic Gardens and Designed Landscapes	Count
Main features substantially present - no loss of integrity	3
Main features substantially present - some loss of integrity	29
Main features substantially present - peripheral features unrecognisable	155
Main features unrecognisable - peripheral features visible	308
Virtually no recognisable features	169

Mindful that the NIAH county by county surveys of historic gardens and designed landscapes were not entirely comprehensive, the Project Team undertook a full review of all the relevant First Edition sheets for the various counties within the study area, and mapped all the 'grey tone' areas that were used by cartographers to indicate notable properties and demesnes. This research added considerably to the database. Notwithstanding this review, it should be acknowledged that the First Edition Maps do not indicate all the demesnes within the study area, as these properties continued to be developed post 1842 on the completion of the first survey. For this reason, the NIAH lists some demesnes that appear on later map editions. The combination of the information available in the existing NIAH inventory, together with the more recent data derived from the review of the First Edition Maps, provides an expansive catalogue of all the significant gardens, designed landscapes and demesnes within the study area.

In addition to the work being carried out by the Architectural Section of the DAHG, the various county councils within the study area have incorporated policies and objectives concerning the preservation and conservation of historic gardens and designed landscapes within their functional area. For example Roscommon County Council recognises Strokestown House, Rockingham Demesne, Lough Key, and Mote Park as amenities with future potential. They have a policy to '*seek the conservation and enhancement of historic gardens and parks, where appropriate and to use the designation of Architectural Conservation Area where considered appropriate to preserve the character of a designed landscape'*. Similarly Galway County Council has a stated objective to identify potential demesnes to designate as ACA's. Sligo County Council has a general policy to protect important non structural elements of the built heritage, including historic gardens, stone walls, landscapes, demesnes and curtilage features. Mayo County Council has specific plans for the development of Westport House and Demesne and likewise Leitrim County Council have identified the Lough Rynn demesne as a potential tourism and leisure facility.

Designated Landscapes

Although Section 204 of the Planning and Development Act allows for the designation of important landscapes as Landscape Conservation Areas (LCA's), to date none have been designated. There are however a number of landscapes within the study area, which are mentioned in the various county development plans, which have strong archaeological, architectural and cultural heritage associations and which are mapped accordingly. Within Roscommon, the Royal site of Rathcroghan has been highlighted and Sligo County Council recognises the special importance of the archaeological complexes at Knocknarea, Carrowmore and Carns. No other landscape designations were noted within the study area. Reference should be made to Table 11.3 which details the count of Architectural sites within the study area.

With regard to the architectural resource, there are 63 ACA's within the study area, all located in urban centres. There are also 4,644 listed NIAH structures, a figure that would include the majority of the 1,067 RPS's. In a review of the first edition maps, 457 'grey toned' houses were noted with 434 associated demesnes and historic gardens within the study area. These demesnes and gardens have no statutory protection and can vary considerably in their condition. Using First Edition mapping, and the NIAH inventory's site survey reports, all the demesnes and gardens will be reviewed in more detail as the project progresses.

Table 11.3 Inventory and Count of Architectural Sites located within the Study Area

Architectural Sites	Count	Notes
Architectural Conservation Areas	63	
Record of Protected Structures	1,155	
National Inventory of Architectural Heritage	4,644	
Designed Landscapes & Historic Gardens - Demense Extents	434	
Garden Survey Point Data-Houses	457	
Other Designations	**Count**	**Notes**
Other Designations	1	Rathcroghan

Note: The figures in Table 11.3 pertain to both demesnes and houses that appear on the NIAH inventory in addition to data compiled by the Cultural Heritage consultant in a review of First Edition mapping.

11.4 CONCLUSIONS

Based on the above research, it is clear that the study area has a rich and varied archaeological and historical past, with multi period monuments, ranging from humble sites of local interest, to large complexes of international significance. All of the features, from a prehistoric megalith, to a 19th century gate pier, have varying degrees of statutory protection but the primary principle should be their preservation *in situ.* Given the nature of the project, and the relative flexibility in designing transmission lines, this initial goal is achievable, thus the emphasis will be on reducing any potential impacts from the proposed development on the settings of monuments, structures and areas of cultural heritage significance.

The following advice notes are provided to inform the statutory protections and sensitivities afforded the various cultural heritage site classifications.

11.4.1 Archaeological Heritage

Candidate World Heritage Sites

Every attempt should be made to ensure that the proposed development does not impact on these internationally important sites.

National Monuments -in the Ownership or Guardianship of the State

The pre-eminent archaeological sites in the Republic of Ireland, which are afforded statutory protection of all their amenities, including visual, often with public access, facilitated many of these sites are particularly sensitive to impacts on their setting. It is therefore recommended that any impacts on the setting of these sites be avoided.

Potential National Monuments - in the Ownership of a Local Authority

Not all of these sites will be National Monuments, but a significant number may be. The National Monuments Service does not recognise any difference between these sites and National Monuments in the Ownership or Guardianship of the State, as they have the same level of statutory protection. Many will consist of publicly accessible churches (many ruinous) and graveyards that are particularly sensitive to impacts on setting and avoidance is recommended.

Sites Subject to Preservation Orders

The National Monuments Service does not recognise any difference between sites subject to Preservation Orders and National Monuments in the Ownership or Guardianship of the State as they have the same level of statutory protection. Preservation Orders are issued to protect sites that have been damaged or are in the process of being damaged, to prevent further harm. These sites in many instances will not be publicly accessible. Given their protected status, efforts should be made to avoid impacts on the settings of these sites.

Walled Towns

Mostly located in urban areas, it is unlikely that these sites will be impacted on, but they should be avoided as they are afforded the same protection as National Monuments in the Ownership and Guardianship of the State.

Record of Monuments and Places (RMP)

Although the settings of archaeological sites are not formally protected in Irish legislation, most county development plans offer protection through their policies and/or objectives. During the identification of potential indicative corridors, as far as is practicably possible, efforts should be made to avoid impacts on the settings of these sites.

11.4.2 Architectural Heritage

Architectural Conservation Areas (ACA)

The character of ACA is afforded protection under Irish legislation. The ACA designation is not only used to protect the character of urban environments but potentially can be used to protect rural landscapes, such as demesnes. Every effort should be made to avoid impacts on the character and/or setting of these areas.

Record of Protected Structures

Although the settings of Protected Structures are not formally protected in Irish legislation, most county development plans offer protection through their policies and/or objectives. As protected structures are generally upstanding features within the landscape, efforts should be made to avoid impacts on these structures.

National Inventory of Architectural Heritage

Structures within the NIAH have been rated as being of local, regional, national or international importance. During the selection of preliminary route corridors the designers should use this rating information as a guide to ensure that the most important structures do not experience impacts on their setting.

Demesne Landscapes & Historic Gardens

Demesnes historically were the part of the manorial estate retained for its owner's own pleasure, use and occupation. By the 19th century, they usually incorporated walled gardens, terraces, tree-lined avenues, ornamental woods and water features. Demesnes currently have no general statutory protection, however many county councils have stated policy objectives requiring their preservation. The NIAH provides local authorities with information on the extant and condition of the estates in their functional area. As part of the constraint process all the demesnes within the study area were mapped, refer to Figure 11.1 Cultural Heritage Constraints Map. They have been rated as being of low, moderate or high sensitivity, as listed in Table 11.2. This data, together with the site fact sheet available on the Survey of Historic Gardens and Designed Landscapes, should assist the designers in avoiding any significant features.

Landscape Designations

As previously stated Section 204 of the Planning and Development Acts 2000 - 2007 allows for the designation of Landscape Conservation Areas (LCA's). There are no LCA's within the study area however conservation plans for certain high value heritage areas including Rathcroghan, Rindoon in County Roscommon, The Cuillarra Peninsula, Carrowkeel and Inishmurray, County Sligo have all been prepared and may in future receive this status.

12 SETTLEMENTS

12.1 INTRODUCTION

The study area covers a substantial part of the province of Connaught, an area that is mostly rural, though the city of Galway and some major towns such as Castlebar, Ballina and Tuam are included. Most of the study area has a relatively low population density, but with a tendency towards ribbon development along county roads, and scattered rural housing.

12.2 METHODOLOGY

12.2.1 Information Sources

The information for this preliminary investigation of settlement has involved the identification and mapping of the main towns, villages and settlements within the study area. The main sources of information include the following:

- The Census of Ireland as published by the Central Statistics Office (CSO) in 2011, to identify the principle settlements and population density for individual District Electoral Divisions (DED's). All population data in this chapter is from the 2011 Census of Ireland unless otherwise stated.
- The Ordnance Survey Ireland 1:50,000 Discovery map series, which was used to identify smaller villages and settlements. This included recording of any human settlement marked on the maps (other than townlands).
- The settlement strategies of the various county development plans to identify any other settlements regarded as significant by the relevant county councils, these include:
    - Galway County Development Plan 2009-2015;
    - Mayo County Development Plan 2008-2014;
    - Sligo County Development Plan 2011-2017;
    - Roscommon County Development Plan 2008-2014; and
    - Leitrim County Development Plan 2009-2015.
- The Geodirectory database as supplied by An Post and the Ordnance Survey Ireland.

12.2.2 Consultation

The preparation of this chapter has included consultation with the relevant local authority planning departments in order to identify any major or strategic developments, likely to impact the proposed development. The local authorities consulted include:

- Mayo County Council;
- Galway County Council;
- Sligo County Council;
- Leitrim County Council; and
- Roscommon County Council.

This consultation has also included confirming the status of development plans and local area plans published on local authority websites as well as identifying any other strategic infrastructure or developments (existing or proposed) outside of identified settlements.

12.3 EXISTING ENVIRONMENT

The region covered by the study area is mainly rural in nature and therefore has a relatively low population density. Towns are scattered throughout the study area, and are mainly moderately small in size. Many of them, including the only city (Galway), are located at the fringe of the study area.

Settlements identified in the study area are shown in Figure 12.1 Population Density Map and Tables 12.1 and 12.2 provide a list of names of all these settlement.

Within the study area, the only city is Galway which is located at the study area's extreme southern fringe. The city has a population of 76,778 and extends over a significant geographical area. It is a county borough and a designated 'Gateway' in the National Sustainable Strategy. The city is covered by the Galway City Development Plan, 2011-2017.

The next tier of settlements consists of the three designated 'Hub' towns from the National Spatial Strategy; Castlebar with a population of 12,318, Ballina with a population of 11,086 and Tuam with a population of 8,242. These three towns also cover significant geographical areas and, unlike Galway City, are quite centrally located within the study area and therefore more likely to impact on the proposed development. Given that they are designated 'Hubs', they also have considerable potential for future growth. Ballina and Castlebar are Town Council areas and so are planning authorities in their own right and publish their own development plans (Ballina and Environs Development Plan, 2009-2015 and Castlebar Development Plan, 2008-2014). Tuam is covered by a Local Area Plan (LAP) published by Galway County Council (Tuam Local Area Plan, 2011-2017).

Table 12.1 provides a list of the more significant towns and villages in the study area. It includes all of the larger census towns (population in excess of 1,000), accompanied by their populations, county identification and current development plan. It also includes any smaller towns that have a specific development plan.

Table 12.1 Census Towns and Settlements with Development Plans

Town	County	Population (2011)	Current Development Plan
Galway City	Galway	76,778	Galway City Development Plan 2011-2017
Tuam	Galway	8,242	Tuam LAP 2011-2017
Oranmore	Galway	4,799	Oranmore Local Area Plan 2006-12 (2012 draft plan published)
Athenry	Galway	3,950	Athenry LAP 2005-2011 (Expired, 2012 draft plan published)
Bearna	Galway	1,878	Bearna LAP 2007-2013
Oughterard	Galway	1,333	Oughterard LAP 2006-12 (will expire shortly, no new draft yet published)
Maigh Cuilinn	Galway	1,559	Maigh Cuilinn LAP 2005-2012 (will expire shortly, no new draft yet published)
Baile Chlair (Claregalway)	Galway	1,217	Claregalway LAP 2005-2011 (expired, no new draft yet)
Headford	Galway	889	Headford LAP 2005-2011 (expired, no new draft yet)
Craughwell	Galway	665	Craughwell LAP 2009-2015
Clarinbridge	Galway	389	Clarinbridge LAP 2007-2013
Gaeltacht	Galway	[24]	Galway Gaeltacht LAP 2008-2014
Carrick on Shannon	Leitrim	3,980	Carrick on Shannon LAP 2010-2016
Castlebar	Mayo	12,318	Castlebar Development Plan 2008-2014
Ballina	Mayo	11,086	Ballina and Environs Development Plan 2009-2015
Westport	Mayo	6,063	Westport Development Plan 2010-2016
Claremorris	Mayo	3,412	Claremorris LAP 2006-2012 (will expire shortly)
Ballinrobe	Mayo	2,704	Ballinrobe LAP 2010-2016
Ballyhaunis	Mayo	2,312	Ballyhaunis LAP 2010-2016
Swinford	Mayo	1,435	Swinford LAP 2009-2015
Foxford	Mayo	1,326	None
Kiltimagh	Mayo	1,127	Kiltimagh LAP 2010-2016
Crossmolina	Mayo	1,061	None
Charlestown/Ballaghy	Mayo/Sligo	914	Charlestown/Bellaghy LAP 2010-2016[25]
Ireland West Airport	Mayo		Ireland West Airport Knock Draft LAP 2012-2018
Boyle	Roscommon	2,588	(Draft LAP published 2012, recently adopted)
Castlerea	Roscommon	1,965	(Draft LAP published 2012 recently adopted)
Ballaghderreen	Roscommon	1,822	(Draft LAP published 2012)
Strokestown	Roscommon	814	Strokestown LAP 2010-2016
Elphin	Roscommon	613	Elphin LAP 2009-2015
Roosky	Roscommon	523	Roosky LAP 2009-2015
Lough Key	Roscommon		Lough Key LAP 2009-2015
Tubbercurry	Sligo	1,747	Draft plan under preparation

[24] Includes the town of An Spidéal, and na Forbacha
[25] Covers Charlestown County Mayo and Bellaghy County Sligo

Town	County	Population (2011)	Current Development Plan
Ballymote	Sligo	1,539	Ballymote LAP 2005-2011
Collooney	Sligo	1,369	Covered by Sligo County Development Plan 2011-2017
Ballisodare	Sligo	1,344	Covered by Sligo County Development Plan 2011-2017
Enniscrone	Sligo	1,223	Enniscrone LAP 2004-2010 (expired)

Table 12.2 includes a list of smaller settlements and villages. This includes all settlements identified from the 1:50,000 Ordnance Survey map series, as well as settlements identified in county development plan settlement strategies.

Table 12.2 Smaller Settlements in the Study Area

County Galway	**County Leitrim**	**County Mayo (Continued)**	**County Roscommon**
Abbeyknockmoy	Dromahaire	Cross	Arigna
An Fhairce (Clonbur)	Drumkeeran	Crossboyne	Ballinameen
An Mám	Drumsna	Cushlough	Ballinlough
An Spidéal	Drumod	Fahy	Ballyfarnon
Ardrahan	Killarga	Glenamoy	Bellanagare
Attymon	Leitrim Village	Glencorrib	Carrick on Shannon (see
Balie na hAbhann	Mohill	Glenhest	Leitrim)
Ballyglunin	Roosky	Gweesalia	Castleplunkett
Barnaderg		Hollymount	Cloonfad
Bearna	**County Mayo**	Irishtown	Cootehall
Belclare	Aghagower	Keenagh	Croghan
Briarfield	Aghamore	Kilasser	Elphin
Brownsgrove	An Mhala Raithní	Kilkelly	Frenchpark
Caherlistrane	(Mallaranny)	Kilmovee	Keadue
Castleblakeney	An tInbhear (Inver)	Killala	Knockvicar
Cluain Bú (Clonboo)	Ardagh	Killavally	Hillstreet
Conga (Cong)	Attymas	Kilmaine	Loughglynn
Cooloo	Balla	Kincon	Moore
Cor an Dula	Ballindine	Knock	Roosky (see Leitrim)
(Corrandula)	Ballintober	Knockmore	Scramoge
Corofin	Ballycastle	Lahardaun	Tulsk
Cór na Mona	Ballyglass	Lisnamoyle	
(Cornamona)	Ballyhean	Manulla	**County Sligo**
Corrandulla	Banagher,	Mayo	Achonry
Craughwell	Carrowmore/Lacken	Midfield	Aclare
Derrydonnell	Bangor Erris	Moyna	Ballinafad
Dunmore	Barr na Trá (Barnatra)	Moygownagh	Ballintogher
Eanach Dhuin	Beal Dearg (Belderg)	Mayo Abbey	Ballygawley
(Annaghdown)	Beckan		Ballynacarrow

Esker	Belcarra	Neale	Ballysadare
Indreabhán	Bellacorick	Newport	Banada
Kilcolgan	Bellavary	Park	Beltra
Kilconly	Bofeenaun	Partry	Bunanaddan
Kiltullagh	Bohola	Poll an Tómais	Castlebaldwin
Lackaghbeg	Breaghwy	(Pollatomish)	Charlestown/Bellaghy (see
Laragh More	Brickeens	Port an Chlóidh	Mayo)
Lennane	Bun na hAbhna	(Portacloy)	Cloonacool
Maam Cross	(Bunahowen)	Port Durlainne (Porturlin)	Collooney
Menlough	Bunnyconlon	Rathlackan	Coolaney
Milltown	Carnacon	Ross Dumhach	Cuilfadda
Monivea	Carracastle	(Rossport)	Curry
Mountbellew	Ceathrú Thaidhg	Roundfort	Dromore West
Moylough	Cloghans	Shrule	Easkey
Na Forbacha	Clogher	Strade	Geevagh
Rosscahill	Cong (see Galway)	Tooreen	Gurteen
Sylane	Cooneal	Tuar Mhic Éadaigh	Iniscrone
Turloughmore		Turlough	Monasteraden
			Riverstown
			Templeboy
			Tourlestraun

It should be noted that development plans are in the process of being amended in order to meet the requirements of the Planning and Development Act, 2010 which required the adoption of a core strategy. The core strategies will be used, amongst other matters, to assess the extent of lands zoned for development. In effect, zoning must now be evidence based and the extent of land zoned should reflect the need for such zoning. There has in the past been extensive overzoning of land:

> *'This led to a peak of 42,058 hectares of land zoned for housing by 2009 representing an oversupply of 4.5 times actual need'.*
>
> (Statement issued by Jan O'Sullivan TD, Minister of State for Housing and Planning, 4/4/2012)

Most county development plans have already been updated. However, many Local Area Plans (LAPs) including some of the towns listed herein, have not yet been updated. It is likely that this process will see a reduction in the extent of identified development land and therefore a likely reduction in the planned geographical areas of these towns.

In addition to the towns and settlements detailed herein, there are proposals for the development of *strategic corridors* in the Western Regional Planning Guidelines and in the Galway County Development Plan. These *corridors* are ill-defined but could lead to urban development within areas that are as yet rural and are not zoned.

The Regional Planning Guidelines (Western Region) 2004-2016 set out a Strategic Framework for the region (Section 6). This includes a statement on a proposed *Strategic Corridor*, as follows:

> *'In line with NSS objectives the IDA has articulated proposals, following consultation with Galway County Council, Galway City Council and other relevant bodies, for the development of a new linked International Standard Science and Technology Park over the medium/long term. This proposal involves the possible acquisition of up to 400 acres of land contained within a proposed economic corridor stretching from Oranmore out towards Athenry, County Galway'.* (Section 6.5).

The Galway County Development Plan, 2009 (Variation No. 1) provides for an '*Eastern Strategic Corridor*' that extends eastwards from the city. This is defined as comprising the lands approximately 2km north and south of the Dublin/Galway railway line from Oranmore to Attymon. It is intended to *'address the need to accommodate Regionally Strategic industrial Sites'.* The framework is indicative only and no lands have been zoned in connection with this '*corridor*' and there are no current proposals to do so. Refer to Figure 13.1 Utilities & Infrastructure Constraints Map for details of the indicative Strategic Corridor.

It is noted that the Industrial Development Authority (IDA) has recently purchased the Teagasc property near Athenry County Galway (consultations Catherine McConnell of Galway County Council Planning Department). These lands are not zoned for development in any development plan but they are within the strategic corridor discussed above. Given that fact, and the fact that the purchaser is the state agency responsible for industrial development, it is considered likely that such lands will be zoned for development in the near future.

In addition to the above, there are also some major centres and infrastructure located in what are otherwise rural areas. The most significant, derived from local knowledge of the area and from discussions with staff within each of the relevant local authorities planning departments are:

- Ireland West Airport (Knock, County Mayo), an international airport with its own Local Area Plan (detailed herein);
- Lough Key Forest Park (Boyle, County Roscommon), a major lakeside amenity (also with its own Local Area Plan (detailed herein);
- Airport at Indreabhán which serves the Aran Islands;
- Galway Airport, Carnmore, Galway;
- There is a major planning application on a site east of Claremorris County Mayo for a mixed development including a biomedical facility, Combined Heat and Power Plant (CHP) power station, and other related developments (reg. ref. P12/64);
- The Gaeltacht areas cover parts of west Galway and Mayo and some specific provisions with regard to Irish language issues apply. There is a specific local area plan for the Galway Gaeltacht (refer to Table 12.1 herein); and
- It is also noted that there is an industrial complex (C & F Tooling Ltd.) and a quarry close to the existing Cashla substation near Athenry in County Galway.

Otherwise, within rural areas, there is extensive scattered rural housing, often aligned along road frontages and usually occupying 0.2ha sites. In places, this can form significant barriers to the development of transmission lines, when the housing sites link up to form a more or less continuous ribbon.

Figure 12.1 Population Density Map is based on the Census of Ireland 2011. It uses population data for individual District Electoral Divisions (DEDs) and demonstrates the significant variation in density across the study area[26]. The following are noted in particular:

- There are generally lower densities in the western (Mayo and Galway) and eastern (northern Roscommon and southern Sligo) parts of the study area, with a higher density band through the centre stretching from Ballina in the north to Galway City in the south. This higher density belt also includes the four main towns (Galway, Tuam, Castlebar and Ballina);
- There are '*doughnuts'* of higher density in the rural areas surrounding the towns. This is particularly marked around the larger towns (especially Galway City) but is also evident around some of the smaller towns (for example the DED's adjoining Claremorris and Ballaghaderreen show a markedly higher density than other DED's in the vicinity);
- Densities are generally higher in the vicinity of the existing Cashla substation, which is close to Galway City, than in the vicinity of the existing Flagford substation; and
- There are some corridors of lower density stretching west from the existing Flagford substation.

12.4 CONCLUSIONS

The study area includes within it, a wide range of settlements, one national Gateway Centre (Galway City) and three designated Hubs (Castlebar, Ballina and Tuam). There are otherwise a wide range of smaller towns and villages but generally the population density of this part of Ireland is relatively low and well below the national average.

The detailed plans for these settlements are in the process of amendment to reflect the provisions of the Planning and Development Act 2010, which is likely to result in a reduction in the extent of zoned land. These amendments will be monitored throughout all stages of this project. In addition to the towns there are some major rural developments. The most important of these is Ireland West Airport at Knock which lies quite centrally within the study area and is the most important airport within the region. There is also a significant chance of development arising in areas as yet ill-defined through the proposals contained in the Western Regional Planning Guidelines and Galway County Development Plan for strategic corridors of development.

The lists provided of settlements are comprehensive including many very minor settlements to which there is reference in county development plan settlement strategies.

[26] Such a map needs to be interpreted with some caution. A single DED might, for example, have an area of very high density and another or very low density. The overall density will be averaged thereby giving a misleading impression. However, they provide an overall view which can be elaborated later with reference to more detailed Geodirectory information.

Some rural areas have seen significant levels of development including extensive ‘one-off’ housing, these may present significant difficulties for the eventual delineation of any route corridors. There is a band of higher density development running in a north south direction through the centre of the study area from Ballina towards Galway. Generally densities are lower on the western and eastern parts of the study area and generally lower in the vicinity of the existing Flagford substation than in the vicinity of the existing Cashla substation.

13 UTILITIES & INFRASTRUCTURE

13.1 INTRODUCTION

The utilities and infrastructural constraints chapter together with Figure 13.1 Utilities & Infrastructure Constraints Map have been prepared in order to identify all known utilities and infrastructural constraints that may influence the identification of substation site options and potential indicative corridors and ultimately an indicative line route along which the proposed transmission line will be sited.

13.2 METHODOLOGY

A desktop study of all of the known utilities and infrastructure within the study area has been completed. Figure 13.1 Utilities & Infrastructure Constraints Map has been prepared in order to map all of this information. Consideration will be taken of the location of any planned or existing utilities and infrastructure that could potentially impact upon potential indicative corridors and substation site selection.

13.2.1 Information Sources

The following sources have been used in the compilation of this chapter:

- Transmission and distribution lines;
- Road infrastructure including future road schemes;
- Airports;
- Railway lines;
- Gas pipelines; and
- Wind farm generators from EirGrid and ESB published material.

There are a number of existing and planned generators located within the study area. These are spilt into both wind farm generators and other types of generators i.e. gas, hydro etc. The connection status of a generator is detailed as follows:

- *Queue*: applicants seeking connection to the Transmission System;
- *Live*: applicants in receipt of a Connection Offer from the Transmission System Operator (TSO) or Distribution System Operator (DSO);
- *Contracted*: generators which have signed a connection agreement with the TSO or the DSO and are committed to connecting to the distribution or transmission system at a future date;
- *Energised*: generators with electrical connection to the network which are not yet permitted to export; and
- *Connected*: installed generators with electrical connection to the network which are permitted to export.

A list of queued, live and contracted generators from the DSO and TSO was provided by EirGrid. This list included grid connection points for each of the generators. A list of connected generators was obtained from the DSO[27] and TSO[28] lists provided on the EirGrid website www.eirgrid.com, with a

[27] http://www.esb.ie/esbnetworks/en/generator-connections/Connected-Contracted-Generators.jsp

search of the EirGrid Archive for Completed Generation Applications also completed to identify grid connection points for each of the connected generators. Furthermore a list of operational wind farms in Ireland was provided by ESB International (ESBI).

For the constraints stage of the project, the grid connection points for each of the wind farm generators located within the study area have been identified and mapped in Figure 13.1 Utilities & Infrastructure Constraints Map. For future stages in the project, wind farm generators within the study area will be contacted regarding information on site layout boundaries and turbine co-ordinates where available.

Further consultation and assessment may identify additional wind farm generators within the study area. Therefore this information is accurate based on the information obtained to date.

13.2.2 Consultation

Information has been obtained from the following bodies:

- Electricity Supply Board (ESB);
- EirGrid;
- National Roads Authority (NRA);
- Iarnróid Eireann; and
- Bord Gáis Energy (BGE).

These organisations will be consulted with further during future stages of the project.

13.3 EXISTING ENVIRONMENT

13.3.1 Road Network

The study area is dissected by a network of existing regional roads, national roads and motorways including the M6 motorway, national primary roads including the N6, N59, N5, N26, N18 and N17 and national secondary roads including the N58, N60 , N61 , N63, N83 , N84.

There is also a significant amount of road development activity within the study area. Information obtained to date is included in Figure 13.1 Utilities & Infrastructure Constraints Map. This information has been received from both the NRA, local authorities within the study area and the Project Team's local knowledge of the study area.

13.3.2 Electricity Infrastructure

The study area hosts a network of several high and medium voltage transmission lines (38kV, 110kV, 220kV) and approximately 18 substations. There is approximately 748km of 38kV, 692km of 110kV and 163km of 220kV transmission lines within the study area.

[28] http://www.eirgrid.com/customers/gridconnections/listofconnectedandcontractedgenerators/

13.3.3 Railway Infrastructure

The main railway lines running through the study area include the Galway to Athlone, Westport to Athlone, Ballina to Athlone and Sligo to Dublin railway lines. The Western Railway Corridor (WRC) which is a mostly disused railway line also runs through the study area. This passes through the towns of Athenry, Tuam, Claremorris and Cooloney, with the only section of the line that currently sees regular service from Sligo to Collooney.

13.3.4 Airport Infrastructure

There are two licensed aerodromes located within the study area, Knock and Galway Airports. Within the study area, there are also 12 unlicensed aerodromes, listed in Table 13.1.

Table 13.1 Unlicensed Aerodromes within the Study Area

Unlicensed Aerodromes within the Study Area
Ballina Airfield
Ballinavarry
Bunnyconlon
Castlehacket
Cloongoonagh
Crossmollina
Dunmore
Gortgarrow
Ironpool
Kilmovee
M. White
Tibohine

This information has been obtained from the Visual Flight Rules (VFR) Flight Guide[29]. Further consultation and assessment may identify additional unlicensed aerodromes within the study area.

13.3.5 Gas Infrastructure

A network of gas transmission pipelines, approximately 182km in length exist within the study area, stretching from Bellacorick in County Mayo to Galway City and further on to Ballinasloe in County Galway.

13.3.6 Wind Farm Developments

The study area is dotted with wind farm developments mainly located in Counties Mayo and Sligo. From the list of generators obtained from the DSO and TSO, the number of wind farms located within the study area, are presented in Table 13.2.

[29] VFR Flight Guide, Kevin Glynn (June 2011)

Table 13.2 Number of Wind Farms identified within the Study Area

Status	No. identified within the Study Area
Queue	35
Live	23
Contracted	10
Energised/Connected	26

For the constraints stage of the project, the grid connection points[30] for the wind farm generators obtained from the DSO and TSO have been identified and mapped in Figure 13.1 Utilities & Infrastructure Constraints Map. For future stages in the project, wind farm generators within the study area will be contacted regarding information on site layout boundaries and turbine co-ordinates where available. Further consultation and assessment may identify additional wind farm generators within the study area. Therefore this information is accurate based on the information obtained to date.

13.3.7 Eastern Strategic Corridor

Section 2 of the Galway County Development Plan sets out a Spatial Planning Strategy for the county. This includes proposals for an '*Eastern Strategic Corridor'* an area with a high concentration of valuable infrastructure, refer to Figure 13.1 Utilities and Infrastructure Constraints Map. One of its objectives is to facilitate the upgrading and increase of such facilities. Overhead powerlines '*will be considered'* and the corridor will '*support activities which would not be appropriate in proximity to centres of population or sensitive environments*'. For further information on this Strategic Corridor refer to Chapter 4 *Strategic Planning Context* and Chapter 12 *Settlements.*

13.4 CONCLUSIONS

In conclusion, all of the known utilities and infrastructure within the study area for this stage of the project have been identified and mapped.

The identified utilities and infrastructure are a constraint in that the route of any proposed corridor will have to take due consideration of the location of these existing utilities and infrastructure. In addition, the utilities and infrastructure identified will have an impact on the location of the new Bellacorick substation site. This substation location will be further influenced by the location of wind farm generators near Bellacorick, which require connections to the new substation at Bellacorick.

It should be noted that additional studies and consultation will be carried out as the project progresses to Stage 2 *Corridor Evaluation* and Stage 3 *Confirm Design* of the Roadmap.

[30] Generators point of connection to the transmission/distribution system

14 ENGINEERING CONSIDERATIONS

As noted in Chapter 2 of this report, some technical considerations are important in the identification of corridors, while other considerations comprise issues for the later stages in the project development and therefore require understanding at this early stage of project development.

14.1 ENGINEERING DESIGN PRINCIPLES

The engineering design principles adopted for this project are aimed at delivering a transmission solution which will reflect EirGrid's mandate to provide for a safe, secure, reliable, economical and efficient transmission system while giving due regard to Ireland's natural environment, stakeholders and the public.

All transmission systems are influenced by a number of technical and physical limitations, practical construction and operational needs as well as the environmental constraints discussed herein. In considering transmission circuits, the design needs to address these influencing factors and offer the best compromise between different constraints, with the most effective mitigation of those that are unavoidable. The engineering design will be undertaken in accordance with international best practice.

14.2 SUMMARY OF TECHNOLOGIES

There are two primary high voltage power transmission technologies, alternating current (AC) and direct current (DC), normally referred to as high voltage AC or DC (HVAC / HVDC). For each of these primary technologies it is possible to construct an overhead line or an underground cable solution. Thus the four main technologies that can be considered for the Grid West project are:

- HVAC overhead line;
- HVAC underground cable;
- HVDC overhead line; and
- HVDC underground cable.

Each of the above technologies were considered during the early stages of the Grid West project after which HVAC overhead line was identified to provide the most balanced and favourable option and thus was identified as the most preferred technology. The following summarises each of the technologies reviewed.

HVAC overhead line systems are the traditional technology used for high voltage electrical transmission, using steel lattice towers, metallic conductors and air insulation to transfer power. The technology has been successfully utilised in locations across the globe primarily due to its high power transmission capabilities, easy system integration, and flexibility to cross rugged and unstable terrain with minimal impact to ecology, cultural heritage and proven reliability. The Irish electricity grid is predominantly of this technology.

HVAC underground cable technology allows the transmission of electrical energy below ground. There are significant technical constraints to the use of this HVAC technology for lines of long length, making it impractical to use this technology for the entire length of the Grid West circuit. Although this is not the preferred technology along the full length of the route, the use of partial underground cable, in combination with overhead lines, offers an additional level of flexibility to any overhead line solution in the mitigation of environmental and other constraints. However it should be recognised that any underground installation does cause significant disruption to the environment during construction and to a lesser extent during operation.

HVDC offers a solution that can be used as either an overhead or underground solution for the full length of a route. This rapidly developing technology has been considered for the Grid West project. HVDC transmission is not limited by the same physical parameters as AC transmission, thus it can be used for underground transmission over distances comparable to that required for the Grid West project. An interconnector between the Irish and UK transmission grids, currently under construction, has been designed to use HVDC technology owing to the requirements to connect independent transmission systems and to transmit power over a very long distance (approximately 260km) under the sea. These requirements could not be feasibly met by utilising HVAC technology. However, HVDC technology:

- Has currently been applied only to end to end connections (i.e. future tapping into the lines is not feasible);
- Is not as efficient as overhead HVAC;
- Requires large and expensive electrical equipment to allow the conversion from the standard AC to DC; and
- Is difficult to incorporate into a predominantly AC system.

System requirements and project specific considerations present a number of technical challenges which has led to the identification of 400kV HVAC overhead line technology as the preferred engineering technology. This was initially determined by EirGrid in the identification of the project need and was verified by the Consultants following further study and reporting.

14.3 GEOTECHNICAL REQUIREMENTS AND CONSTRAINTS

The geology of the study area will have a major impact on the engineering design, influencing the selection of substations sites, potential indicative corridors, line technology, site access and the level of associated civil engineering required. Refer to Figure 14.1 Engineering Constraints Map.
Geological constraints include:

- Soil type and structure: The soil type and structure determines the type of structure that can be placed above it. Where soil conditions are poor, additional civil engineering will be required, resulting in additional costs. In the study area, areas of karstified rock (*refer to* Chapter 9 *Geology*) will impose constraints on route selection, particularly for underground cable systems.
- Transmission systems use reinforced concrete foundations or cable ducts, which are designed to transfer the weight and forces acting upon them to the surrounding earth. The ability of the

soil to take this weight determines size and suitability of the foundations and potentially the technology.

- Substations incorporate heavy equipment, particularly the power transformers, and the presence of karstified rock would make the design of the substation foundations more complex and costly.
- Potential requirement for access roads for both construction and subsequent maintenance. The design and construction of these roads to accommodate the loads imposed will be very dependent on the soil structure. Generally poor soil conditions will make the construction of both the permanent works and temporary works more costly.
- Peat and unstable ground (refer to Chapter 9 *Geology*) is found extensively in the study area; Peat can pose difficulties in the construction and maintenance of transmission lines and substations, particularly for underground technologies. Unstable ground, subject to either lateral or vertical movement can cause unacceptable forces to act upon underground cables which can result in increased risk to the integrity of the cable. The construction of access roads will need careful consideration in areas of peat.
- Thermal Resistivity is a measure of the soils' ability to resist the flow of heat. For an underground cable installation, this ability is one determining factor in the amount of power that can be transmitted along the cable. As current flows through the cable, the resistance of the conductor impeding this current flow, generates heat within the cable that has to be dissipated to the surrounding ground. The surrounding soil acts as a blanket restricting the dissipation of this heat build up; and if the rate of heat generation exceeds the rate of heat dissipation, the cable heats up. All cables have a rated maximum operating temperature, which, if exceeded, will significantly reduce the reliability and operational life of the cable. Hence areas of soil with lower thermal resistivity are preferred as they enable more power to be transferred in the same sized cable.
- Flooding (refer to Chapter 10 *Water*): All substation sites must be located away from flood plains or known areas that are at high risk of flooding. It is also preferred that the sites for transmission towers are not subject to flooding as this tends to damage foundations, increases corrosion and impairs earthing systems efficiency. Substation and transmission assets have an expected operational life spanning decades, and as such, the probability of them being exposed to an extreme weather event during this period, is significant.
- Topology: Substations need to be located on level ground for construction and operational reasons. Sloping sites require substantial civil works to achieve a level site before construction of the substation can begin. The installation of underground cables in rugged or mountainous terrain imposes severe construction difficulties, which needs to be avoided wherever possible. While it is preferable to avoid rugged and mountainous terrain for overhead lines, their construction limitations are not as severe and this type of terrain can be useful as a background to reduce their visual impact.

14.4 TECHNICAL CONSIDERATIONS FOR HIGH VOLTAGE TRANSMISSION SYSTEMS

The technology to be used for the Grid West project will be reviewed over the course of the project. As each of the technologies has different technical requirements and constraints, some of the key issues of each are set out in this section herein.

14.4.1 *Overhead lines*

Overhead line technologies, whether HVAC or HVDC, offer the highest level of flexibility in terms of routing, allowing constraints to be overcome by design. However as they are also the most visible (post installation), their design and location must attempt to minimise the visual impact by integration into the landscape.

The possible location of any overhead line will reflect the environmental and social constraints, however additional technical selection criteria such as access, foundation and tower type selection, crossings and tower positions will further benefit the construction, operation and maintenance, as well as aim to reduce the visual impact of the transmission line.

Overhead lines are constructed so as to allow the safe transfer of electrical power. This requires that the conductors carrying the power be installed on pylons or towers of sufficient height and strength to accommodate the forces imposed and achieve the safe clearances necessary at the extra high voltages involved. The towers require that appropriate foundations can be constructed according to the ground conditions at each location that need to be erected, which in turn requires access for heavy equipment and machinery.

The transmission lines will be routed in corridors selected so as to minimise the impact of the various environmental and other constraints within the limitations imposed by the technical considerations or criteria. Routes selected (at later stages in the project) will aim to minimise environmental impact and will have regard to the Holford Rules, the Cigré and other best practice guidelines. These guidelines can be applied to both HVAC and HVDC overhead lines and are widely used internationally by major utilities such as National Grid in the UK.

14.4.2 *Underground Cables*

Underground cables offer a solution with a lower visual impact, but as attested by the fact that no underground AC cable circuits of the length required for the Grid West project are in operation anywhere in the world, many issues prevent the development of such a circuit.

Underground cables require a compromise on power transfer and have a greater impact on the land, as the cables are installed in a trench that needs to be excavated along the whole route length. This has a number of negative environmental impacts, as a large corridor of natural habitat is permanently modified by both the cable and station installations.

Construction methods are similar for both HVAC and HVDC underground cables routes, although typically an HVAC cable circuit will require a wider trench than the equivalent HVDC cable circuit because each HVDC circuit only requires two cables whereas a HVAC circuit requires three cables.

The cables are typically joined every 500 to 800 metres within specially constructed joint bays which are specially constructed underground chambers. The length between cable joints reflects the maximum length of cable that can be produced or practically transported to site.

HVAC cable is further limited by cable capacitance, a phenomenon which restricts the amount of usable power reaching its destination and raises the overall power being pushed down the cable. This increases the heating effects to the point where, in extreme cases, the total power transfer capacity of the cable is used up, just by getting the power from one end to the other. Cable capacitance can be reduced by introducing reactive compensation to counteract the capacitance. Reactive compensation needs to be located in above ground compounds (similar to small substations), which impacts on the required land take, with consequential environmental impacts.

Where possible, cables can be installed in existing roadways, however for the Grid West project there are limited road options available. The majority of the roads in the study area are narrow regional roads, where installation would require road closures and/or deviations impacting heavily on the local communities. This is particularly the case around the existing Bellacorick substation site.

Cable corridor selection will be determined by the terrain that it crosses, however consideration of the following technical limitations will determine the feasibility of any solution:

- Soil thermal resistivity directly affects the thermal capacity of the cable and hence can determine the total transfer power capacity of the system;
- Cable construction access and installation of the cables will be by access tracks running along the route, rated for the cable loads being carried. Typical weights for these trucks range between 20-40 tonnes;
- Underground cables require that maintenance vehicles and excavation equipment are able to have permanent access so that any fault can be found and repaired in the shortest time;
- In instances where the cable route will utilise existing infrastructure such as roads, due regard will need to be given to disruption of these during construction and maintenance; and
- The route will need to remain free of tree and vegetation during the life of the cable this will mean that any route will need to be cleared of all vegetation before construction can begin.

Interface compounds are used where underground cables connect to overhead lines. If a line is totally underground they are required at both ends and would be located within the connecting substations. Where partial undergrounding is used, interface compounds are required at the end of each section of cable. Interface compounds include cable terminations, high voltage switchgear, housing for cable protection and control equipment, a terminal structure and other ancillary equipment. The attributes of preferred sites would comprise:

- Sufficient space for the interface compound;

- Subsoil conditions with sufficient strength to allow normal foundation designs to be utilised;
- Be removed from flood prone areas with minimal erosion; and
- Have sufficient land for a terminal tower to allow connection to the overhead lines.

14.4.3 *Substations*

Substations are an integral part of any transmission network. They comprise of specially designed switchgear which allows the systems and its operator to control and maintain the stability and safety of the power system network. Power is transmitted though a transmission network at high voltage levels at which transmission losses are reduced, to the substation where it is transformed to a voltage level that can be supplied to the end user or redirected to other locations where it is needed.

HVAC substation technologies being considered for the Grid West project include outdoor Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS). AIS is predominantly located outdoors and utilises air as an insulator to prevent electricity flowing to earth. As air insulation requires large clearance distances to maintain integrity, the substation size and its associated structures are larger than the alternative GIS option. Historically EirGrid has used AIS substations. However recent developments and trends in GIS equipment, mean that GIS is increasingly being used in new developments.

GIS uses highly insulating gases such as SF_6. This allows a much more compact design that can be located within buildings. GIS substations are used when there is limited space available and AIS technology is considered not feasible.

The selection of the substation technologies and sites will reflect the availability of land while presenting the best and most balanced of the following criteria:

- The site should be flat and offer sufficient space to accommodate the required substation equipment and any expected future expansion;
- The site should provide sufficient soil bearing strength to maintain the weight of power transformers. Piled foundations can be applied if a site with suitable ground bearing capacity cannot be found;
- The site would ideally be well serviced by existing roads to allow delivery of the heavy substation equipment;
- The site location should be away from areas which are prone to flooding;
- The site should enable easy integration into the existing network;
- The site should be free of other infrastructural services;
- A naturally draining site and soils are preferential to reduce civil works; and
- The site should provide natural screening to reduce the visual impact of the new substation.

All Flagford, Cashla and Bellacorick substation layouts and locations present unique technical characteristics to allow expansion of and connection to the existing equipment. These characteristics present constraints to both the substation site location and the corridor selection and will be continually evaulated as both are developed.

14.5 CONCLUSION

Based on studies carried out to date, HVAC overhead line technology is the preferred technology for the Grid West project. The engineering design will be undertaken in accordance with international best practice. It is important that the technology selection is kept under constant review, such that both the technology and the design can be adjusted if the constraints and consultation indicate that this is necessary.

15 CONCLUSION

This Constraints Report has identified the key environmental and other constraints within the defined study area, which may influence the identification of both substation site options and potential indicative corridors, and which may ultimately define an indicative line route along which the proposed transmission line will be routed.

Guiding principles will be applied to ensure that the corridors and substation site options chosen take into account technical and environment considerations. The starting point for this is the SEA strategic environmental objectives for the Grid25 IP.

During this constraints study, over 150 different and overlapping datasets of potential constraints were identified within the study area. A number of these datasets define areas with statutory designations, or are declared proposals for such status, and such constraints were considered primary and strategic. Other datasets are not in this category of constraint, and are not of a kind which would define the locations of strategic corridor options, but they will be brought into consideration in comparing potential indicative options, and later in choosing an indicative line route within a corridor.

As part of this study, these datasets have been plotted and categorised by theme, and have been mapped in thematic maps which are available in Volume 2 of this report. These themes include ecology, landscape, geology, water, settlements, cultural heritage, utilities & infrastructure and engineering constraints.

The identified datasets have been debated thoroughly in the Constraints Workshop attended by the Project Team and EirGrid. The Project Team has met with stakeholders which are considered strategic for this Constraints Report, which include the NPWS, the DAU of the DAHG and the relevant planning authorities. The constraints databases have been discussed, where appropriate with the strategic stakeholders, (particularly ecology and cultural heritage). Relevant information from these meetings has been incorporated into this report and will be taken into consideration for future stages of the project.

The Project Team are therefore confident, that all of the relevant recorded constraints have been identified and mapped which may influence the identification of both the substation site at Bellacorick and the potential indicative corridors and ultimately an indicative line route along which the proposed 400kV transmission line will be sited.

While the Project Team is confident that an extensive database of all ‘recorded constraints’ has been gathered, it is also recognised how important local knowledge is in identifying unrecorded constraints that may be of folkloric or local importance and which are often left undocumented. This information is very often only garnered from dialogue with local people living in the area. One of the objectives of consultation with the public is to allow such dialogue to take place.

With the publication of the Constraints Report, we are now in a position to consult on this report and associated Constraints Mapping. This Constraints Report is available to stakeholders (public, statutory and non statutory agencies) in order to seek their input, so that any comments can be taken into consideration at an early stage in the project development. This consultation is being undertaken in line with the EirGrid Project Development & Consultation Roadmap and involves:

- Face to face meetings with stakeholders;
- A series of Open Days for the public, widely advertised in the study area;
- The production of a 'Guide to Constraints Report';
- Making the material available in the project Information Centre in Castlebar; and
- Publishing the Constraints Report on the dedicated project website.

Any additional constraints identified during this and further consultation stages as well as other considerations identified at this stage, but more relevant to future stages of the project development process, will be documented and taken into account.

The next stage of the project will be to develop route corridors and substation sites. All route corridor options and substation sites proposed must be technically feasible from a planning, environmental, legal, engineering and economic perspective as they represent the starting point for detailed route development hence the need for these considerations to be addressed early on.

16 ABBREVIATIONS

AIS	Air Insulated Switchgear
AC	Alternating Current
AA	Appropriate Assessment
ACA	Architectural Conservation Areas
BCI	Bat Conservation Ireland
BGE	Bord Gáis Energy
BMW	Border, Midlands and Western Regions
cSAC	candidate Special Area of Conservation
CFRAMS	Catchment Flood Risk Assessment and Management Studies
CSO	Central Statistics Office
CHP	Combined Heat and Power Plant
CGS	County Geological Sites
DAFM	Department of Agriculture, Food and the Marine
DAHG	Department of Arts, Heritage and the Gaeltacht
DCMNR	Department of Communications, Marine and Natural Resources
DoECLG	Department of Environment, Community & Local Government
DAU	Development Applications Unit
DC	Direct Current
DSO	Distribution System Operator
DED	District Electoral Divisions
ESB	Electricity Supply Board
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESBI	ESB International
EEC	European Economic Community
EU	European Union
FWPM	Freshwater Pearl Mussel
GIS	Gas Insulated Switchgear
GSI	Geological Survey of Ireland
GHG's	Green House Gases
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IDA	Industrial Development Authority
IFI	Inland Fisheries Ireland
ICOMOS	International Council on Monuments and Sites
IUCN	International Union for the Conservation of Nature
IFA	Irish Farmers Association
IGHP	Irish Geological Heritage Programme
IPPC	Irish Peatland Conservation Council
ISGS	Irish Semi-natural Grassland Survey
I-WeBS	Irish Wetland Bird Survey
LCA	Landscape Character Assessments
LCA	Landscape Conservation Areas
LAP	Local Area Plans
NDP	National Development Plan
NIAH	National Inventory of Architectural Heritage
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NSS	National Spatial Strategy

NSNW	National Survey of Native Woodlands
NHA	Natural Heritage Area
OPW	Office of Public Works
OSI	Ordnance Survey Ireland
pNHA	proposed Natural Heritage Areas
RPS	Record of Protected Structures
RMP	Records of Monuments and Places
RHM	Register of Historic Monuments
RPGs	Renewable Power Generators
RBD	River Basin District
SIOS	Sensitivity to Impacts on Setting
SRBD	Shannon River Basin District
SMR	Site and Monuments Record
SAC	Special Area of Conservation
SPA	Special Protection Area
SEA	Strategic Environmental Assessment
IMQS	The Irish Mining and Quarrying Society
TSO	Transmission System Operator
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
WRC	Western Railway Corridor
WRBD	Western River Basin District

TOBIN

Patrick J. Tobin & Co. Ltd.

NATIONAL NETWORK

Galway
Fairgreen House
Fairgreen Road
Galway
Ph +353 (0)91 565211
Fax +353 (0)91 565398
E-mail galway@tobin.ie

Dublin
Block 10-4
Blanchardstown Corporate Park
Dublin 15
Ph +353 (0)1 803 0406
Fax +353 (0)1 803 0409
E-mail dublin@tobin.ie

Castlebar
Market Square
Castlebar
County Mayo
Ph +353 (0)94 902 1401
Fax +353 (0)94 902 1534
E-mail castlebar@tobin.ie

Poland
Ul. Cystersów 9
31-553 Kraków

Ph +48 12 353 8646
Fax +48 12 353 7329
E-mail biuro@tobin.pl

United Kingdom
CAB International
Nosworthy Way
Wallingford
Oxfordshire OX10 8DE
Ph +44 1491 829327
Fax +44 1491 833508
E-mail brian.allum@tobin-uk.com