

# Onshore Constraints Report

Celtic Interconnector Project - Step 3



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## Celtic Interconnector Project - Step 3

April 2019

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# Executive Summary

EirGrid develops, manages and operates the electricity transmission grid. As part of its role EirGrid is mandated to explore and develop opportunities to interconnect the transmission grid with the transmission grids in other countries. EirGrid has been working with their counterpart in France, Réseau de Transport d'Électricité, to investigate the feasibility of an interconnector between our two countries (The Celtic Interconnector). At this stage, no decision has been made to build the Celtic Interconnector. It is expected that a final decision to commence construction would be made in 2021. The interconnector would then go live in 2025 / 2026.

The Celtic Interconnector is a proposed electrical link which will enable the movement of electricity between Ireland and France. The project is following EirGrid's six-step *Framework for Grid Development* as outlined in EirGrid's *Have your Say* document.<sup>1</sup> This approach facilitates engagement and consultation with stakeholders and the public which helps to explore options fully and make more informed decisions.

Since 2011 a series of joint studies and assessments, both onshore and offshore, have been carried out by EirGrid and RTE. Through these studies EirGrid has brought the Celtic Interconnector project through Step 1 (*How do we identify the future needs of the electricity grid?*), Step 2 (*What technologies can meet this need?*) and part of Step 3 (*What's the best option and what area may be affected?*) of their *Framework for Grid Development*.

The project is primarily a submarine cable connection between France and Ireland, facilitating the transfer of 700MW of electrical power between the two transmission grids. Approximately 500 kilometres of the connection will be installed along the seabed and approximately 30-40 kilometres of the connection will be installed underground in Ireland to bring the interconnector from the landfall on the East Cork coast to the grid connection point at Knockraha 220kV station completing the connection.

Mott MacDonald has been appointed by EirGrid to complete the onshore elements of Step 3 of the framework and to progress the project through Step 4 (*Where exactly should we build?*) and Step 5 (*the Planning Process*). Wood Group PLC has been engaged separately by EirGrid to carry out marine route investigations and to assess and evaluate the submarine cable route options from a technical and environmental perspective, including the landfall location.

The Celtic Interconnector will use High Voltage Direct Current (HVDC) technology for the subsea transfer of electricity. A converter station will be required to convert the electricity from HVDC to High Voltage Alternating Current (HVAC), which is used on the transmission grid.

Converter Station Location Zone(s), CSLZ, represent general area(s) within which a converter station could be located. The converter station will be located within a compound with indicative overall dimensions of 300m x 150m. The converter station will include an AC (Alternating Current) switchyard, transformers, house generator, cooling system, control building and converter building (typical building height of 25 metres).

The HVDC land circuit between the landfall and the converter station will be underground. The HVAC land circuit between the converter station and the connection point can be underground but due to particular constraints associated with the HVAC circuit this can only be confirmed once the converter station location has been confirmed and feasible routes have been

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<sup>1</sup> [http://www.eirgridgroup.com/\\_uuid/7d658280-91a2-4dbb-b438-ef005a857761/EirGrid-Have-Your-Say\\_May-2017.pdf](http://www.eirgridgroup.com/_uuid/7d658280-91a2-4dbb-b438-ef005a857761/EirGrid-Have-Your-Say_May-2017.pdf)

identified. It is EirGrid's current preference, given that the project is underground over most of its length, to explore underground cable options in the first instance. Should an underground option prove not to be feasible, an overhead solution will be examined at that stage. On this basis, assessment at this stage has considered underground cable installed in the road network for the HVAC circuit.

Onshore constraints associated with the identified CSLZs options under consideration have been characterised and are summarised below:

Reference	Location	Key Constraints / Considerations
1	Ballyadam	<ul style="list-style-type: none"> <li>Approximately 7 kilometres straight line distance from Knockraha 220kV station, longer by road route. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha 220kV station will be challenging due to railway and bridge crossings.</li> <li>Partially zoned for industry but surrounded by Prominent and Strategic Metropolitan Greenbelt Areas. Potentially limited flexibility in terms of micro-siting.</li> <li>Encompasses the N25 Route Protection Corridor.</li> <li>Includes karst features within areas of extreme aquifer vulnerability.</li> <li>Potential drainage issues.</li> <li>Low lying site within High Value Landscape.</li> <li>Significant number of cultural heritage features on site.</li> </ul>
2	Water Rock	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 9 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha 220kV station will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha 220kV station.</li> <li>Encompasses built-up area of mixed commercial, retail and residential use.</li> <li>Potentially limited flexibility in terms of micro-siting. Encompasses the N25 Route Protection Corridor. Partially zoned for residential and enterprise uses. Also, partially located within Prominent and Strategic Metropolitan Greenbelt Areas.</li> <li>Includes a Geological Heritage Site and karst features.</li> <li>Low lying within High Value Landscape.</li> <li>Potential connectivity to proximate Natura 2000 sites.</li> <li>Close proximity to a significant number of sensitive receptors.</li> </ul>
3	Curragh	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 7 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha 220kV station will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha 220kV station.</li> <li>Potentially limited flexibility in terms of micro-siting. The majority of the zone forms part of Prominent and Strategic Metropolitan Greenbelt Areas. The section to the south east is classed as a Built-Up area, zoned for residential development. The zone also incorporates part of a golf course.</li> <li>Within a High Value Landscape.</li> <li>Low lying and potentially overlooked by the R626 Leamlara to Midleton scenic route.</li> </ul>
4	Elfordstown	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 9 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha. Steep sections pose additional challenge.</li> <li>Potentially limited flexibility in terms of micro-siting. The majority of the zone forms part of Prominent and Strategic Metropolitan Greenbelt Areas and is located within High Value Landscape.</li> </ul>

Reference	Location	Key Constraints / Considerations
		<ul style="list-style-type: none"> <li>Prominent and elevated zone. Includes National Space Centre which may limit screening potential.</li> <li>Steep elevations to the east and west sloping down towards a ridge and a valley (with rock outcrops and a river flowing through it).</li> </ul>
5	Lisgoold East	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 5 kilometres straight line distance from Knockraha 220kV station, longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.</li> <li>AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha.</li> <li>An elevated zone in proximity to a scenic route and partially located within a High Value Landscape.</li> <li>Located in proximity to the Lisgoold Development Boundary.</li> </ul>
6	Leamlara	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 4 kilometres straight line distance from Knockraha 220kV station, however longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.</li> <li>Limited road network in the zone could result in both AC and DC circuits routes in the same road - adequate space may not be available.</li> <li>Incorporates part of the Leamlara Development Local Area Plan Boundary</li> <li>An elevated zone. The forested area may offer screening but change of land use consent would be required.</li> <li>Potential for ecological and cultural heritage impacts associated with tree felling.</li> </ul>
7	Ballynaglough	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 3 kilometres straight line distance from Knockraha 220kV station. In terms of cable route length, it is very likely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>The road network in the area appears to offer opportunities for independent routes for both AC and DC cable routes.</li> <li>Majority of zone elevated and exposed.</li> <li>Includes an area of forestry which may offer screening potential (considered under CSLZ 14).</li> <li>Potential for ecological and cultural heritage impacts associated with tree felling.</li> </ul>
8	Monatooreen	<ul style="list-style-type: none"> <li>Boundary is approximately 2 kilometres straight line distance from Knockraha 220kV station. In terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>The road network in the zone is narrow however appears to offer opportunities for establishing AC and DC cable routes.</li> <li>Majority of zone is elevated and exposed with potentially limited flexibility in terms of micro-siting.</li> <li>Includes an area of forest which may offer screening potential (considered under CSLZ 14).</li> <li>Potential for ecological and cultural heritage impacts associated with tree felling.</li> </ul>
9	Knockraha	<ul style="list-style-type: none"> <li>Incorporates Knockraha 220kV station. An underground AC circuit will not require reactive compensation.</li> <li>The length of the wider cable trench (AC) is short and the associated risk of establishing a route is low.</li> <li>Existing infrastructure may limit flexibility in terms of micro-siting opportunities.</li> <li>Elevated and exposed zone with potentially limited screening opportunities.</li> </ul>
10	Pigeon Hill	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 1 kilometre straight line distance from Knockraha 220kV station. In terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>Independent routes for the AC and DC circuits appear to be available within the local road network.</li> </ul>



Reference	Location	Key Constraints / Considerations
11	Moanbaun	<ul style="list-style-type: none"> <li>Elevated and exposed zone but potential opportunities for screening within the forested area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
		<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 4 kilometres straight line distance from Knockraha 220kV station, longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.</li> <li>Independent routes for the AC and DC circuits appear to be available within the local road network.</li> <li>Elevated areas within the zone with rock outcrops.</li> <li>Potential opportunities for screening within the forested area but micro-siting options may be limited.</li> <li>Adjacent to Maonbaun Woods amenity area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
12	Kilquane	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 2 kilometres straight line distance from Knockraha 220kV station, however longer by road. In terms of cable route length, it is unlikely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>Establishing independent routes for the AC and DC circuits will be challenging within the local road network.</li> <li>Potential opportunities for screening within the forested area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
		<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 12 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha. Steep sections pose additional challenge.</li> <li>Potential opportunities for screening within the forested area.</li> <li>Existing Irish Distillers site adjacent to forested area.</li> <li>Children's burial grounds recorded within the zone.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
13	Ballynona	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 12 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha. Steep sections pose additional challenge.</li> <li>Potential opportunities for screening within the forested area.</li> <li>Existing Irish Distillers site adjacent to forested area.</li> <li>Children's burial grounds recorded within the zone.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
		<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 3 kilometres straight line distance from Knockraha 220kV station, in terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>The road network in the zone is narrow however appears to offer opportunities for establishing AC and DC cable routes.</li> <li>Potential opportunities for screening within the forested area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>

Onshore constraints associated with the identified landfall point location options under consideration have been characterised and are summarised below:

Landfall Options	Location	Key Constraints
1	Inch Beach	<ul style="list-style-type: none"> <li>Limited space available for a construction laydown area .</li> <li>The route will need to cross an existing gas main and Ballycroneen Bay Geological Heritage Area.</li> <li>Potential to cause damage and disturbance to habitats and species (including protected birds).</li> <li>A number of sensitive receptors to temporary nuisance and disturbance impacts associated with the installation of a cable.</li> </ul>
		<ul style="list-style-type: none"> <li>Small suitable space for a construction laydown area at the landfall.</li> <li>Proposed route to Ballycroneen beach passes a section of tree lined roadway.</li> <li>Proposed route from Inch Beach/Ballycroneen beach passes through Cloyne Conservation Area.</li> </ul>

Landfall Options	Location	Key Constraints
		<ul style="list-style-type: none"> <li>Potential to cause damage and disturbance to habitats and species (including protected birds)</li> <li>Approximately 960 metres from Ballycroneen Bay Geological Heritage Area.</li> </ul>
3	Ballinwilling Strand	<ul style="list-style-type: none"> <li>There is limited space at the proposed landfall area for a construction laydown area but some space may be available in the carpark.</li> <li>The route to Ballinwilling will need to pass over a number of bridges with limited deck space along the route.</li> <li>Potential to cause damage and disturbance to habitats and species (including protected birds).</li> <li>Approximately 3 kilometres from Ballycotton Bay Geological Heritage Area.</li> <li>Proximate to Ballycotton, Ballymona and Shanagarry pNHA (site code 000076).</li> <li>Approximately 2 kilometres from Ballycotton Bay SPA / Ramsar Site.</li> <li>Approximately 6.5 kilometres from Ballycotton Islands pNHA.</li> <li>Sparsely populated and undeveloped.</li> </ul>
4	Redbarn Beach	<ul style="list-style-type: none"> <li>Limited space for a construction laydown area at the proposed landfall area.</li> <li>The cable route to Redbarn beach will need to pass along narrow and winding roads with a number of bridges with limited deck space along the route.</li> <li>Potential to cause damage and disturbance to protected habitats and species (including birds).</li> <li>Bounded to the rear (north west) by sand dunes. Ballyvergan Marsh pNHA to the northeast.</li> <li>Proximate to Ballymacoda Bay SPA.</li> <li>Approximately 2.5 kilometres from Ballymacoda (Clonpriest and Pillmore) SAC/(p)NHA.</li> <li>Ballymacoda Bay is a Shellfish Designated Area, licensed for clams, oysters and mussels.</li> <li>Approximately 3 kilometres from Ballycroneen Bay Geological Heritage Area.</li> <li>Potential site of medium archaeological potential, associated with a possible sub-surface depression identified in the geophysical survey at Redbarn Beach.</li> </ul>
5	Claycastle Beach	<ul style="list-style-type: none"> <li>Space for a construction laydown area may be available at the car park, but this may require permissions.</li> <li>A narrow road leading to the beach complicated by railway crossing which may require works in a pNHA.</li> <li>Potential to cause damage and disturbance to protected habitats and species (including birds).</li> <li>Bounded to the east and west by Ballyvergan Marsh pNHA.</li> <li>Ballymacoda Bay SPA (site code 004023) / Ramsar site located approximately 2 kilometres to the south.</li> <li>Ballymacoda Bay SAC (site code 000077) and Ballymacoda (Clonpriest and Pillmore) pNHA (site code 000077) located approximately 4.5 kilometres to the south.</li> <li>Blackwater Estuary SPA / Ramsar Site located approximately 3 kilometres to the northeast.</li> <li>Blackwater River SAC and Blackwater River and Estuary pNHA are located approximately 2 kilometres to the northeast.</li> <li>An area of peat deposits (including a submerged forest), of archaeological potential, have been recorded at Claycastle Beach.</li> <li>Densely populated and popular resort with a number of particularly sensitive receptors.</li> </ul>

The findings of this constraints report and ongoing studies, including those being undertaken by Wood Group PLC (the marine consultant on the project), will be collated into a set of enhanced

performance matrices, which will be made available separately to this report. The matrices will evaluate each of the options detailed in this report and compare them relative to each of the other options with the aim of identifying general areas / zones where the proposals could be best located, taking account of criteria defined under the following headings:

- Economic Performance;
- Technical Performance;
- Deliverability Performance;
- Environmental Performance; and
- Socio-economic Performance.

EirGrid aims to consult on these general areas / zones with the aim of:-

- Confirming a short list of converter station location zones;
- Confirming the technology type (underground cable or overhead line) for the AC land circuit; and
- Narrowing down the short list of the five landfall locations previously identified.

Feedback received from these consultations will be considered as part of the ongoing assessment and detailed as part of a Step 3 Best Performing Options Report.

Steps 4 and 5 are scheduled to be carried out between 2019 and 2020.

# Glossary and Abbreviations

AC	Alternating Current
ACA	Architectural Conservation Area
CDP	County Development Plan
CENLEC	European Committee for Electrotechnical Standardisation
CFRAM	Catchment Flood Risk Assessment and Management
CGS	County Geographical Sites
Cork CoCo	Cork County Council
CSLZ	Converter Station Location Zone
CSO	Central Statistics Office
DC	Direct Current
DTM	Digital Terrain Mapping
ED	Electoral Division
EMF	Electric and Magnetic Fields
ESBI	Electricity Supply Board International
GIS	Geographic Information System
GSi	Geological Survey of Ireland
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicles
HV	High Voltage
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IDA	Industrial Development Authority

IEC	International Electrotechnical Commission
IPPC	Industrial Pollution Prevention and Control
IRWC	Irish Ramsar Wetlands Committee
kV	kilo Volt (1kV = 1,000V)
L	Locally Important (Aquifer)
LAP	Local Area Plan
Lg	Sand and gravel
LI	Bedrock which is Moderately Productive only in Local Zones
Lk	Bedrock which is karstified to a limited degree or limited area
Lm	Bedrock which is Generally Moderately Productive
MW	Mega Watt (1MW = 1,000,000W)
NHA	Natural Heritage Area
NIAH	National Inventory of Architectural Heritage
NPWS	National Parks and Wildlife Service
P	Poor (Aquifers)
PI	Bedrock which is generally unproductive except for Local Zones
pNHA	proposed Natural Heritage Area
Pu	Bedrock which is generally Unproductive
R	Regionally Important (Aquifers)
Rf	Fissured bedrock
Rg	Extensive sand and gravel
Rk	Karstified bedrock
RNLI	Royal National Lifeboat Institution
RMP	Records of Monuments and Places

RPS	Records of Protected Structures
RTÉ	Réseau de Transport d'Électricité
SAC	Special Areas of Conservation
SPA	Special Protected Area
TII	Transport Infrastructure Ireland
WFD	Water Framework Directive
WMS	Web Mapping Services

## **Glossary**

### **Alternating Current Electricity (AC)**

A type of power used to deliver electrical power to businesses and residences and where the electric charge reverses direction at regular intervals.

### **Birds of Conservation Concern in Ireland (2014 – 2019)**

Birds on the Red List are those of highest conservation concern, Amber List birds are of medium conservation concern and the Green List birds are not considered threatened.

### **Converter Station**

A special type of station that converts direct current to alternating current or the reverse. Direct current is used in undersea cables or long stretches of overhead lines that connect electricity between two points. Converting direct current into alternating current means the electricity can be used in local electricity networks.

### **Direct Current Electricity (DC)**

Direct Current (DC) is used for sending electricity long distances, frequently underground or beneath the sea and often between countries. In direct current, the flow of electric charge reverses direction only with the direction of power flow.

### **Electoral Division**

The smallest legally defined administrative areas in the State for which Small Area Population Statistics (SAPS) are published from the CSO.

### **Grid Infrastructure**

The physical structures which make up the transmission grid. These include the cables and lines used to transmit electricity, the pylons that hold the lines, and the substations used to convert the electrical current and raise or lower the voltage of that current.

### **Interconnector**

A high voltage transmission link connecting the national electricity grids of two countries.

### **Industrial Pollution Prevention and Control Licence**

Operating licence issued by the EPA (Environmental Protection Agency).

### **Kilovolt (kV)**

Operating voltage of electricity transmission equipment. One kilovolt is equal to one thousand volts. The highest voltage on the Irish transmission system is 400kV.

### **Megawatt (MW)**

A megawatt is 1,000,000 watts. A watt is the standard unit of power.

### **Reactive Power**

Power produced in AC systems when the current and voltage are not in phase. This is not useful power and can sometimes result in operational difficulties for the AC Transmission System

### **Reactive Compensation**

Equipment that reduces the amount of unwanted reactive power in the system.

### **Voltage**

Voltage is a measurement of the potential strength of the flow of electricity – similar to ‘pressure’ in a water system. Voltage is the measure of electrical charge or potential between two points (in an electrical field) such as between the positive and negative ends of a battery. The greater the voltage, the greater the potential flow of electrical current.

### **Watt**

A watt is the standard unit of power in the international System of Units (SI). A watt measures the rate at which energy is produced or consumed. For example, a high-watt electrical appliance will consume more energy than a low-watt appliance.



# 1 Introduction

## 1.1 Who is EirGrid?

EirGrid is responsible for a safe, secure and reliable supply of electricity – now and in the future.

EirGrid develops, manages and operates the electricity transmission grid. This brings power from where it is generated to where it is needed throughout Ireland.

EirGrid uses the grid to supply power to industry and businesses that use large amounts of electricity. The grid also powers the distribution network. This supplies the electricity used every day in homes, businesses, schools, hospitals and farms.

As part of its role EirGrid is also mandated to explore and develop opportunities to interconnect the transmission grid with the transmission grids in other countries.

## 1.2 Who is Réseau de Transport d'Électricité?

The project is being jointly developed by EirGrid and its French counterpart Réseau de Transport d'Électricité (RTE), with both parties sharing the costs of the current phase of the project equally.

RTE is the French Transmission System Operator (TSO), responsible for the operation, maintenance and development of the high voltage grid. RTE also manages the interconnections between the French Transmission Grid and those of other European countries.

## 1.3 What is the Celtic interconnector Project?

The Celtic Interconnector is a proposed electrical link which will enable the movement of electricity between Ireland and France. EirGrid has been working with their counterpart in France, RTE, to investigate the feasibility of an interconnector between our two countries. At this stage, no decision has been made to build the Celtic Interconnector. Should the project proceed, a final decision to commence construction would happen in around 2021. The interconnector would then go live in 2025/26.

The Celtic Interconnector will use High Voltage Direct Current (HVDC) technology for the subsea transfer of electricity. The main elements of the Celtic Interconnector are presented below and illustrated overleaf:

- A submarine circuit, approximately 500km in length placed on or beneath the seabed between France and Ireland;
- A landfall point where the submarine circuit comes onshore;
- A HVDC land circuit between the landfall and a converter station. As this will be HVDC, it is proposed to use an underground cable for this element;
- A converter station, to convert the electricity from HVDC to High Voltage Alternating Current (HVAC), which is used on the transmission grid;
- A HVAC land circuit between the converter station and the connection point to the grid; and
- A connection point to an existing substation on the transmission grid.

The HVAC land circuit can be underground cable or overhead line. However, as it is HVAC there are limits to the length of cable that can be installed underground. It is EirGrid's current

preference, given that the project is underground over most of its length, to explore underground cable options in the first instance. Should an underground option prove not to be feasible, an overhead solution will be examined at that stage. On this basis, assessment up to this point of project development has considered underground cable installed in the road network for the HVAC circuit.

**Figure 1: Celtic Interconnector Project Elements**



Source: <http://www.eirgridgroup.com/site-files/library/EirGrid/Celtic-Interconnector-Project-Update-Brochure.pdf>

## 1.4 Framework for Grid Development

The Celtic Interconnector project is following EirGrid's six-step *Framework for Grid Development* as outlined in EirGrid's *Have your Say* document, as illustrated in Figure 2 overleaf. This approach facilitates engagement and consultation with stakeholders and the public which helps to explore options fully and make more informed decisions.

In 2009 EirGrid identified a link with France as a potential opportunity for interconnection with the greater European transmission grid. Since 2011 a series of joint studies and assessments of both onshore and offshore have been carried out by EirGrid and RTE. Through these studies EirGrid have brought the Celtic Interconnector project through Steps 1, 2 and part of Step 3 of their Framework for Grid Development.

EirGrid produced a (Step 2) Project Update Brochure in May 2017 which outlined the findings of the various studies that were carried out during the Feasibility Phase of the project, which was published on the EirGrid website (<http://www.eirgridgroup.com/the-grid/projects/celtic-interconnector/the-project/>).

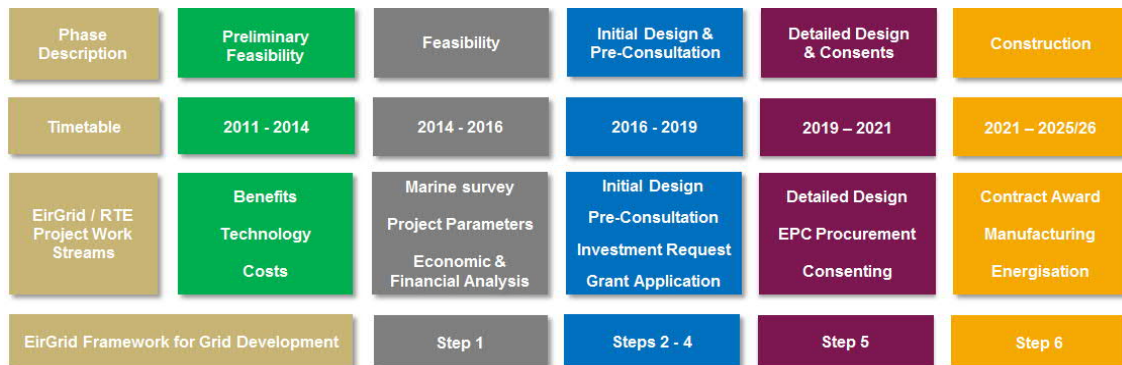
EirGrid carried out stakeholder engagement and consultation throughout the second half of 2017. Following the completion of the Step 2 process, EirGrid confirmed in early 2018 that East Cork was the most suitable location for the project in Ireland with a connection point at the existing Knockraha 220kV station.

**Figure 2: EirGrid's Six-Step Framework for Grid Development**



Source: [http://www.eirgridgroup.com/\\_uuid/7d658280-91a2-4dbb-b438-ef005a857761/EirGrid-Have-Your-Say\\_May-2017.pdf](http://www.eirgridgroup.com/_uuid/7d658280-91a2-4dbb-b438-ef005a857761/EirGrid-Have-Your-Say_May-2017.pdf)

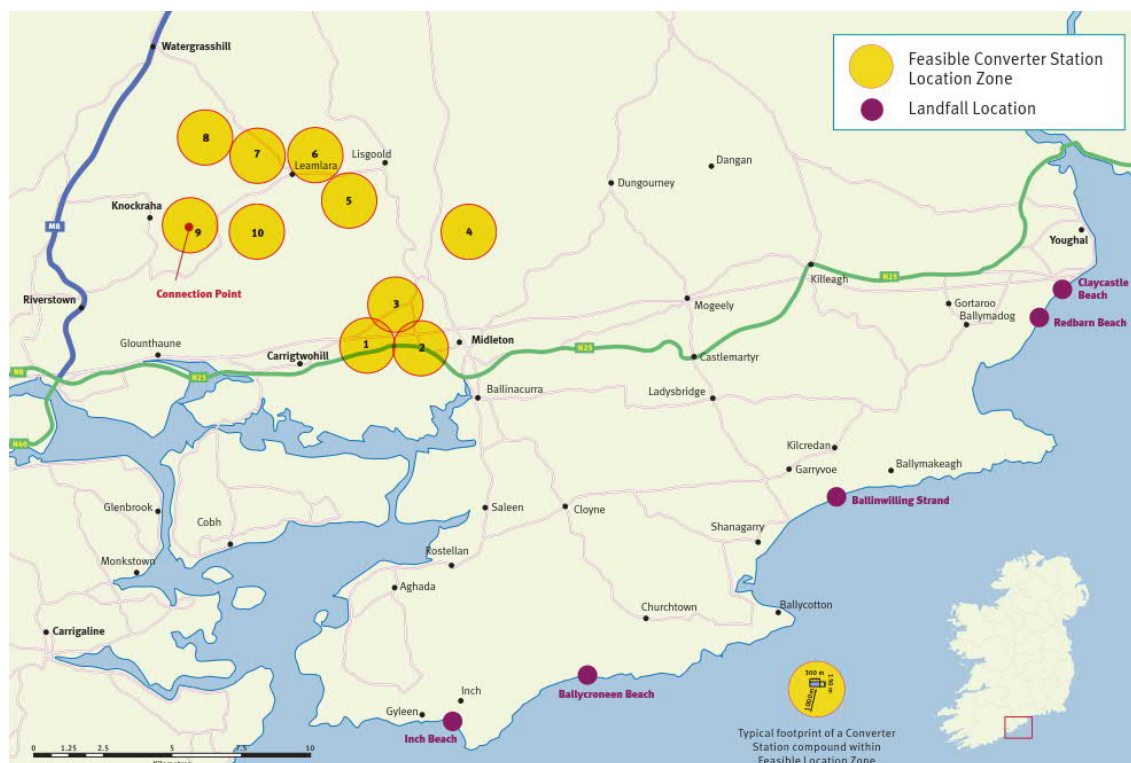
**Figure 3: Project Roadmap**



Source: EirGrid

EirGrid produced a (Step 3) Project Update Brochure in 2018 which identified ten feasible converter station location zones and a short list of five landfall locations in East Cork, as shown below.

**Figure 4: Feasible Converter Station Location Zones and Short List of Landfall Locations in East Cork**



Source: <http://www.eirgridgroup.com/site-files/library/EirGrid/Celtic-Interconnector-Project-Update-Brochure-2018.pdf>

Mott MacDonald has been appointed by EirGrid to complete the onshore elements of Step 3 of the framework and to progress the project through Step 4 and Step 5.

Wood Group PLC has been engaged separately by EirGrid to carry out marine route investigations and to assess and evaluate the submarine cable route options from a technical and environmental perspective, including the landfall location.

### 1.5 What Step is the Celtic Interconnector Project at?

The project is currently at the end of Step 3 of EirGrid's six-step Framework for Grid Development. This step involves building on the work completed by EirGrid and their consultants, as detailed in the 2018 (Step 3) Project Update Brochure, refining the shortlist of options to meet the needs of the project.

### 1.6 What is the Aim of this Constraints Report?

A constraint can be described as any physical, technical, legal, social, environmental, topographical or other consideration that may potentially affect, limit, restrict or confine the location or other aspect of the project within the study area.

This broad description of constraint thereby incorporates two strands: it includes factors which could comprise potential obstacles in the identification of locations for the various elements of the project, and it also includes considerations which will assist in defining the final nature of the project.

Examples of constraints include designated and protected areas (such as ecologically designated sites and protected archaeological and heritage sites), elevated topography, water bodies, and physical obstacles such as existing infrastructure.

Constraints, such as those above, are identified to ensure a comprehensive understanding of the study area.

This onshore constraints report, and associated mapping, presents a baseline report of the identified constraints associated with the converter station location zones and the landfall point locations presented in Figure 4 above. Additional zones within the study area, that may be suitable for the development of a converter station, have also been identified and considered, further to a review of the datasets referenced in this report.

In completing the constraints report, the project team undertook a desk-based study of the East Cork area and acquired data from various relevant authorities. Further information on the methodology applied, and the publicly available datasets reviewed, to inform this report are outlined in *Chapter 4 Approach to this Constraints Report*.

The findings of this constraints report and ongoing studies, including those being undertaken by Wood Group PLC (the marine consultant on the project), will be collated into a set of enhanced performance matrices, which will be made available separately to this report. The matrices will evaluate each of the options detailed in this report and compare them relative to each of the other options with the aim of identifying general areas / zones where the proposals could be best located, taking account of criteria defined under the following headings:

- Economic Performance;
- Technical Performance;
- Deliverability Performance;
- Environmental Performance; and
- Socio-economic Performance.

EirGrid aims to consult on these general areas / zones in Spring 2019 with the aim of:-



- Confirming a short list of converter station location zones;
- Confirming the technology type (underground cable or overhead line) for the AC land circuit; and
- Narrowing down the short list of the five landfall locations previously identified.

Feedback received from these consultations will be considered as part of the ongoing assessment and detailed as part of a Step 3 Best Performing Options Report.

Steps 4 and 5 are scheduled to be carried out between 2019 and 2020. Step 4 comprises of further analysis and micro-siting of the identified best performing options. Step 5 comprises the statutory consenting process, including preparation of environmental and technical documents to assist the consenting authorities in making their decision on the proposed development.

### 1.7 What is in this Constraints Report?

**Chapter 2 The Project:** This chapter describes the physical and technical features of the project and outlines the key project elements and design principles the converter station, landfall and HVDC/HVAC cable routes.

**Chapter 3 Constraints Considered:** This chapter outlines the environmental, socio-economic, technical, deliverability and economic constraints criteria that inform this constraints report and the regulatory framework within which the project will be developed.

**Chapter 4 Approach to this Constraints Report:** This chapter sets out the approach to the identification and mapping of constraints and the preparation of this report.

**Chapter 5 Converter Station Location Zone Constraints:** This chapter details the key identified constraints associated with the ten converter station location zones illustrated in Figure 4 above and considers four additional zones in the East Cork area.

**Chapter 6 Landfall Location Option Constraints:** This chapter details the key identified onshore constraints associated with the five landfall locations.

**Chapter 7 Summary and Next Steps:** Chapter 7 summarises the key constraints associated with each option under consideration. The next steps in the development of the project and the consultation approach are also detailed.

**Appendix:** The appendix to this report includes constraints maps prepared to present a spatial representation of the key constraints identified in this report. I-WeBs data of wintering birds which occur within the SPA's in the vicinity of the five landfall locations is also summarised.

## 2 The Project

### 2.1 Introduction

EirGrid has been working with RTE to investigate the feasibility of an interconnector between Ireland and France (The Celtic Interconnector). The Celtic Interconnector is a proposed electrical link which will enable the movement of electricity between Ireland and France. The following sections provide an overview of the key project elements and design principles the converter station, landfall and HVDC/HVAC circuit routes.

### 2.2 Design Principles

The underlying principle of the design is to provide a safe, constructible, operational and maintainable solution that is both reliable and economical whilst giving due regard to our natural environment, to stakeholders and to the public. The engineering design and installation will comply with the relevant national and international standards and will be undertaken in accordance with international best practice, including all relevant safety standards such as those from the European Committee for Electrotechnical Standardisation (CENELEC). Materials will comply with IEC or CENELEC standards.

There are a number of technical factors that influence the design of the interconnector and these will be discussed further in this section. The technical factors need to be assessed with the environmental constraints in order to arrive at a solution that upholds the underlying design principles.

The constraints associated with the four main elements of the project as listed below, are discussed further in the following sections:

- Connection Point (to the existing AC Transmission System);
- Converter Station;
- Land Circuits:
  - Alternating Current (AC) Land Circuit Route from Converter Station to Connection Point;
  - Direct Current (DC) Land Circuit Converter Station to Landfall Point; and
- Landfall Point.

### 2.3 High Voltage Direct Current (HVDC)

The Interconnector will use High Voltage Direct Current (HVDC). HVDC is used for the transmission of electrical power over large distances where High Voltage Alternating Current (HVAC) is not technically or economically feasible. The primary reason for using HVDC as a solution is that it offers economical transmission of bulk electrical energy over long distances via underground cable with reduced losses. This is because inductive and capacitive effects associated with AC transmission are greatly reduced in DC transmission and thus do not impact on the power transfer capacity or limit the maximum length of the DC circuit. HVDC underground cable circuits require the installation of two power cables.

The transmission grids in both Ireland and France are operated at HVAC. Connection to both systems will require a converter station at both French and Irish ends.

## 2.4 Connection Point

The HVAC transmission system (the “grid”) provides for the bulk transfer of power from sources of power generation such as windfarms, hydroelectric and conventional power generation plants to load or demand centres such as large urban or industrial areas, or to support the local distribution network.

The HVAC system consists of many high voltage (HV) substations, connected via overhead line and underground cable circuits. These substations operate as a three phase system at different voltage levels, 400kV, 220kV and 110kV, throughout the system in Ireland. For this interconnector project, the existing Knockraha 220kV station has been confirmed as the connection point to the existing HVAC Transmission System.

Typically, an HVAC underground cable circuit consists of a three cable installation driven by the need for three phases at AC. Where the link is high capacity, as in this case, two cables are required for each phase.

All options under consideration will terminate at Knockraha 220kV station. This will likely entail the fit-out of an existing spare bay within the substation with equipment similar visually to that currently installed.

## 2.5 Converter Station

The converter station is the point at which power conversion from AC to DC and vice versa takes place. The HVDC circuit from the landfall terminates at the converter station and at the other side of the conversion process, the HVAC circuit connects the converter station to the transmission system. The station is an unmanned installation and control is managed remotely. EirGrid operate a similar scheme, the East West Interconnector, a 500MW link between the transmission grids of the islands of Ireland and Great Britain.

The converter station is an industrial type building and outdoor compound with typical overall compound dimensions of 300m x 150m. The station will include an AC switchyard, transformers, house generator, cooling system, control building and converter building (typical building height of 25 metres). Typically, converter stations take an appearance of an industrial type building with an outdoor compound as indicated in Figure 5 overleaf.

The following sections outline the main technical considerations that require assessment when siting the converter station.

### 2.5.1 Footprint

The site will be required to have sufficient size to accommodate the expected converter station footprint. Depending on the orientation and layout of the site, additional laydown and site set-up areas may be required during the construction phase.

### 2.5.2 Distance from AC Connection Point

Underground AC cables can produce substantial quantities of reactive power. This is not useful power and can sometimes result in operational difficulties for the AC Transmission System. The amount of reactive power produced increases with the length of the cable.

Specialised equipment (Reactive Power Compensation) may be required at each end of the circuit to compensate for this. Figure 6 shows an example of a reactive compensation device.



**Figure 5: Example of an HVDC converter station with an outdoor compound**



Source: EirGrid

**Figure 6: Example of a typical reactive compensation device**



Source: EirGrid

### 2.5.3 HVAC Cable Study

A technical study was carried out of the proposed underground AC cable connecting the Ireland end of the Celtic HVDC interconnector to Knockraha 220kV station in order to inform the selection of feasible cable routes. The study found that:

- A single cable per phase would not meet the power transfer capacity required for the interconnector. At a minimum two cables per phase (six cables in total) of 1,600mm<sup>2</sup> copper conductor would be required;
- Deeper burial results in a de-rating of the cable. Obstacles such as river and railway crossings, services (such as gas transmission, water supply, waste or storm water) may require a deeper burial for a short distance. Two cables of 1,600mm<sup>2</sup> copper may be buried up to 3m in depth without limiting the transfer capacity of the cable;
- A cable route of 4.6km length would not require reactive support; and
- Cable routes over 4.6km in length would require reactive support split equally at both ends of the circuit (up to 70MVar at each end for a 20km length).

Where reactive power compensation is required, normal practice would be to install the equipment at each end of the circuit, which in turn will require sufficient additional space within the footprint of the planned connection point at the existing Knockraha 220kV station, and also at the converter station site.

### 2.5.4 Noise

During operation, the converter station will produce levels of noise. This noise may emanate from the power transformers (commonly associated with a humming noise) and the cooling system equipment. Noise associated with the converter station equipment will be designed out or mitigated against to ensure that noise levels are within acceptable limits. Consideration will be given to the proximity of existing buildings/dwellings and to the capacity for the surrounding environment to screen noise when siting the converter station.

### 2.5.5 Utilities

The converter station will need to be designed such that there is suitable utility provision associated with power demand, water demand and wastewater treatment infrastructure.

### 2.5.6 Access

Heavy/abnormal load vehicles are required to transport HV equipment such as transformers. Consideration of the road network leading to any proposed converter station location is required to ensure that it can accommodate these vehicles without significant additional civil works such as local road widening or bridge strengthening.

### 2.5.7 AC and DC Circuit Connections

The converter station will be connected by land circuits to Knockraha 220kV station (at AC) and to the Landfall (at DC). It is EirGrid's preference and practice to install HV underground cables within the existing public road network. The capacity of the road network in the area of the converter station to accommodate both an AC cable circuit and a DC circuit will be a factor in the selection of the preferred location.

### 2.5.8 Fibre Optic Connections

The converter station in Ireland and the converter station in France will need to be able to communicate with each other in real time in order to enable control of the link and as such a fibre optic will be installed along the entire route between both converter stations.

### 2.5.9 Soil Resistivity

Soil resistivity is a key factor for the converter station earth grid design. The earth grid is a mesh of electrical conductor installed below ground level. Its primary purpose is to ensure the safe dissipation of any fault current within the station. In order to optimise the converter station installation a site with low soil resistivity is an advantage. Where possible the converter station should be located in areas of low soil resistivity, this would ideally be an area with cohesive soil of loamy or clay composition, with a high organic or moisture content. The lower the soil resistivity, the more advantageous it is to provide a suitable earthing system. At this stage of the studies, desktop assessments of available datasets have been carried out to identify the soil types in the study area.

### 2.5.10 Karstified Rock

Karstified rock presents a number of engineering challenges due to its irregular bedrock surface, the potential for large voids, underground drainage and need for specific design measures and provision for unknown risks. The converter station will house large transformers and other heavy equipment which will also require hardstanding areas for installation works. Locations containing karstified rock should be avoided as complex and challenging foundation works could be required under those circumstances.

### 2.5.11 Soil Type and Structure

In order to avoid complex and challenging foundation works, converter stations need to be located in areas of good soil conditions, away from unstable conditions and peat areas of significant extent and depth where possible.

### 2.5.12 Terrain

The terrain for the converter station footprint should be as flat as possible to minimise earthworks and to avoid terraced type designs. Terracing across the site would introduce complexity and cost across the design, construction and operational stages of the project.

## 2.6 Landfall

The landfall is the location where the submarine cable is brought ashore. There is limited enduring infrastructure at the landfall comprised of the transition joint chamber to facilitate the jointing of the onshore and offshore cables. This infrastructure will be located underground and is described below.

The submarine cable will be laid along the seabed and brought ashore underground. Nearshore approaches will determine how the cable will be brought ashore using either open-cut trench (Figure 7: Example of an Open Cut Trench) or horizontal directional drill (HDD) techniques (Figure 8: The HDD Process).

Figure 7 illustrates a typical open cut trenching method, working above the water level, using mechanical excavators. Typically, the trench is then cut or dredged to meet the nearshore approach using barge mounted equipment or vehicles suitable for use at depth in water. The cables are then floated offshore and pulled onshore by a winch, usually located at the transition

joint bay. Other solutions include burial techniques where the cable is floated offshore, pulled onshore and positioned into a narrow trench.

**Figure 7: Example of an Open Cut Trench**

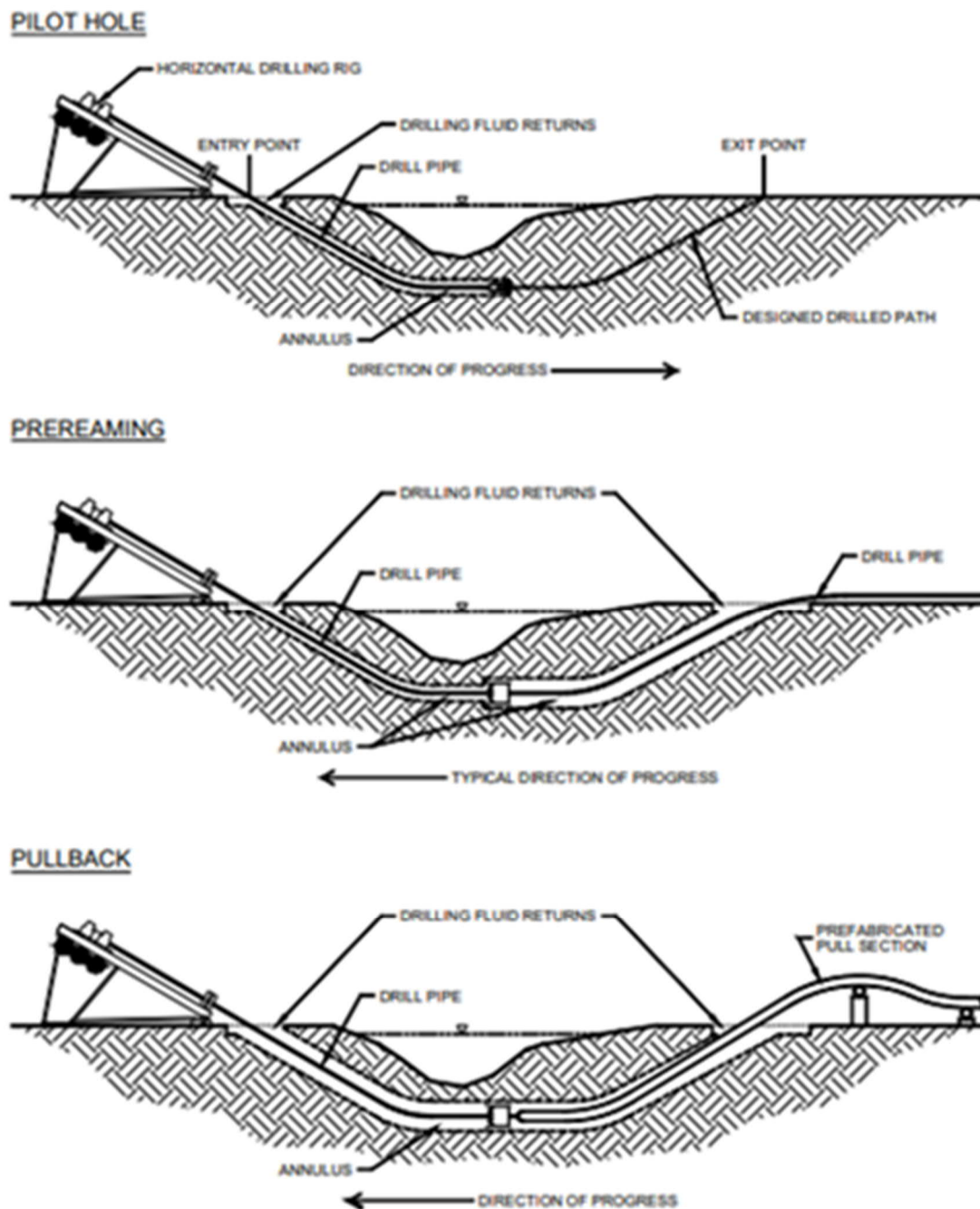


Source: EirGrid

In the case of horizontal directional drilling, a launch pit would be required at the landfall area. The drill equipment creates a shallow arc bore which would require a number of passes to establish the bore, widen it and finally pass through casing structure through which the cable would be pulled. In the case of HDD, the trench would not be opened for the full length of the beach however a significant laydown and works area would still be required.



**Figure 8: The HDD Process**



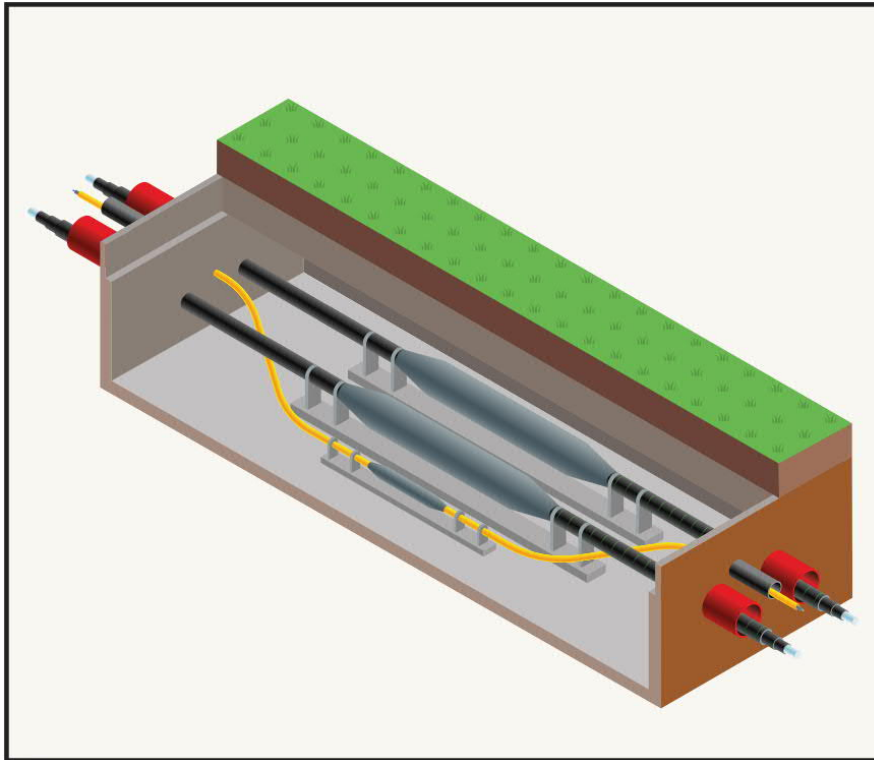
Source: Mott MacDonald

Once ashore, the submarine cable will be jointed with the land cable in an underground transition joint chamber. This will be an underground chamber of approximately 10 metres by 3 metres and will be installed underground behind the landfall area. This chamber is likely to be a pre-cast concrete structure. Installation of the chamber would typically take approximately 2 weeks and would be scheduled to coincide with the installation of the landside cable duct and co-ordinated with the offshore cable installation.

During construction, the landfall area will require access for equipment associated with both the construction of the joint chamber and the pulling of the cable.

From the transition joint chamber, the land circuit will be installed as described in Section 2.7  
Figure 9 shows a typical configuration of the transition joint at a landfall.

**Figure 9: Indicative Structure of a Landfall Point**



Source: EirGrid

### 2.6.1 Topography and Road Access

Flat terrain is preferred for the landfall with gradual gradients minimising earthworks and for ease of access. Also, high voltage electrical cable cannot tolerate sharp changes in direction, horizontally or vertically. Due to the nature of the materials involved and the composition of the cable, a minimum bending radius will be a feature of any cable. This means that straight runs and gradual changes in direction are necessary.

The landfall location will require road access that will accommodate both the construction traffic which will typically comprise 2-3 excavators, a bulldozer, pulling equipment, deliveries of the precast chamber, lengths of ducting and drums of land cable. The road network will also be required to have sufficient capacity to accommodate the cable trench as described in section 2.7 below.

### 2.6.2 Works Access

Sufficient space is required to allow for the pulling in of the submarine cable i.e. a laydown area for heavy vehicles, equipment and winches, and, potentially, the setting up of horizontal directional drilling (HDD) equipment if necessary.

### 2.6.3 Underground Transition Joint Pit

Sufficient space is required to facilitate the installation of a cable joint pit. This is required where the submarine cable is connected to the land cable. The joint pit will take the form of a buried pre-cast concrete chamber with typical dimensions of 10m x 3m.

## 2.7 HVAC and HVDC Circuit Routes

### 2.7.1 General

It is EirGrid's preference and practice to install high voltage cables in the public road network. The cable is installed in ducts within a trench in the road. The duct arrangement, number of individual cables and separation between them varies between the HVAC and HVDC sections and is described in more detail below. The trench required for the HVAC cable route is significantly larger (approximately 2m wide) than is required for the HVDC cable route (approximately 0.8m wide), driven mainly by the number of cables per phase and the need for three phases at HVAC as compared to two poles at HVDC. The HVAC circuit requires six power cables plus a fibre optic cable (two cables per phase required to achieve power transfer capacity associated with interconnector) and HVDC requires two power cables plus a fibre optic cable. In addition to the width of the trench required to be accommodated in a road, obstacles and constraints will be more difficult to surmount for an HVAC system with six power cables than a HVDC system with only two power cables.

Installation of the ducts requires the opening of a trench in the road. The ducts are installed in the correct arrangement and the trench backfilled with suitable back fill material, marker tape and marker boards for protection.

The road above is reinstated following duct installation. Prior to installation of the cable, the ducts are proven, cleaned and sealed from the joint chambers.

Cable is manufactured and delivered to site on drums, in lengths of approximately 500 metres. Typically, the cable is pulled through the ducts and each section is jointed at a joint chamber. The joint chamber is a precast concrete underground chamber approximately 6 metres long and 2.5 metres wide. The ducts are brought to each end of the chamber, the cable pulled into both ends and the joint made within the chamber.

Tree roots along the cable route may be damaged to allow a clear route for the ducting system and further, have the potential to cause damage to the cable if allowed to grow around the ducting installation.

High voltage cable is a highly specialised product and must be installed within specific tolerances. The cable will not tolerate sharp bends in the route, with a minimum bending radius of approximately 3 metres before damage is caused to the cable. Further, maximum pulling tensions will also apply to the cable and any bends in a duct section will add tension to the cable when it is pulled into the duct installation. For this reason, HV cable routes are preferred to be straight with slow, managed bends where necessary.

The installation conditions of the cable, including depth, affect its performance. The standard duct arrangements for the HVDC cable and the HVAC cable, as shown in Figure 10 and Figure 14 are the optimum and preferred arrangements providing sufficient depth for protection and cover but not such that performance is affected.

The sections below outline the main technical considerations when assessing the route options for the HVAC and HVDC cable circuits. The considerations presented below have been

separated into three subsections: general aspects common to both, aspects particular to HVDC and finally aspects particular to HVAC cable circuits.

### 2.7.2 Technical Considerations common to HVAC and HVDC Cable Routes

#### Underground Utilities

Conflicts with existing buried services should be avoided and the required separation distance to the identified services should be maintained.

#### Obstacles

Any obstacles identified along the routes which cause the cable to deviate from its standard depth and width will need to be factored in when assessing the route options. These obstacles include, but are not limited to, culverts, bridge crossings, river/stream crossings, railway crossings, ditches (in the case of routing across land), trees (root systems), marsh land and retaining walls.

#### Traffic Management

Due to the nature of the local road network and the space required for cable trench excavation works, the possibility of temporary road closures should be factored in when assessing the cable route options.

#### Gradients and Bends

Given that there will be a certain bending radius associated with the cable, steep gradients and sharp bends should be avoided where possible to ensure feasible installation of the cable along the route.

#### Thermal Resistivity of Soil

Cables generate heat that needs to be dissipated in the surrounding soil in order to achieve the required power transfer. The higher the thermal resistivity of the soil, the more difficult it is for the cable to dissipate the heat, and the lower the power transfer capacity will be (due to the derating of the cables). The thermal resistivity of the soil along the routes is a necessary consideration in the overall design of the cable system. Areas with known high soil thermal resistivity should be avoided.

#### Soil Type and Structure

The cables will be laid in trenches and the surrounding soil needs to be stable to support the cable weight and to prevent any mechanical stress on the cables.

#### Hours of Work During Construction

There may be limitations placed on the hours of work and during particular seasons through the construction period.

#### Construction Access

Access to construction sites will be required by construction vehicles and plant. This access may be constrained by low bridges, availability of laydown areas and suitable areas for the site compound and will need to be considered during assessment of the route options.



### Excavation Works

Excavation of the route is required for cable installation. The cable route should avoid flood prone areas or areas with high rock content. The route should be accessible for heavy excavators and tipper trucks.

### Maintenance

Twenty-four hour access will be required to the cable route for maintenance and/or repair during operation.

### Electric and Magnetic Fields (EMF)

The cable circuits will need to be arranged in a manner so as to maintain EMF levels below 100µT as per EirGrid requirements.

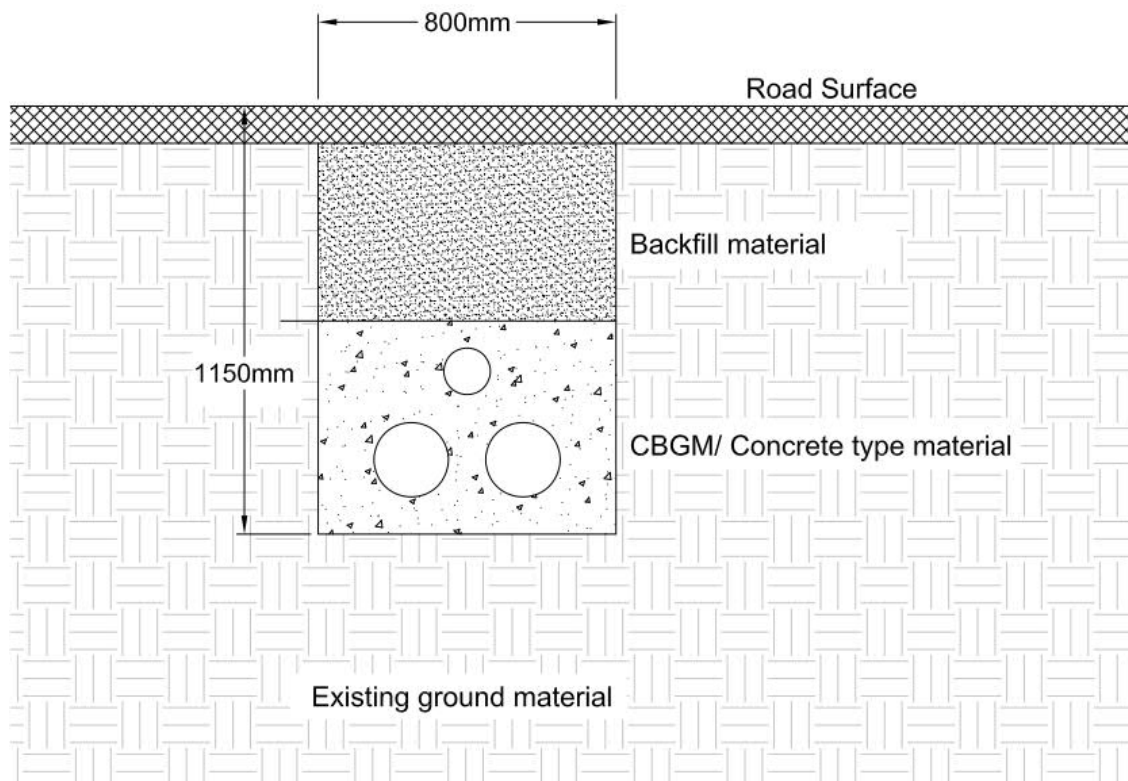
## 2.7.3 HVDC Cable Route – Technical Considerations

### Road Network

As it is EirGrid's preference to install the HVDC cables in the existing road network, sufficient space should be available in the existing road network to accommodate the required width of the HVDC cable trench. The road surface would be fully re-instated following installation. The total length of this circuit is expected to be between 30 and 40 kilometres. For the DC cable circuit, two HV cable ducts and a communication duct will be installed in the cable trench. In general, this would give a typical trench width of 0.9m at a standard depth of 1.15 metres. An image of a typical trench is shown in Figure 10 below. The trench is approximately 1.15m in total depth and contains:

- Two large ducts for the HVDC main power cables;
- One smaller duct above for telecoms / fibre cable; and
- Marker tape and/or boards to provide warning and protection to the cables below.

**Figure 10: Indicative HVDC Cable Standard Duct arrangement - Cross-section**



Source: Mott MacDonald

Figure 11 shows a typical trench for a pair of HVDC cables after installation of ducts, back fill, marker tape and marker boards. Marker boards can be seen within the trench prior to final reinstatement.

An example of the shelter used during the jointing of the cable can be seen in Figure 12. The chamber will be filled with concrete and the ground above reinstated after construction.

An example of HVDC cable pulling into ducts along a road can be seen in Figure 13.

**Figure 11: HVDC Cable Trench in Road**



Source: EirGrid

**Figure 12: HVDC Cable Jointing Bay Shelter**



Source: EirGrid

**Figure 13: HVDC Cable Laying**



Source: EirGrid

### Interference

Interference between HV cables and copper communication cables needs to be considered. This is mitigated during the design phase by spacing the cables sufficiently far apart.

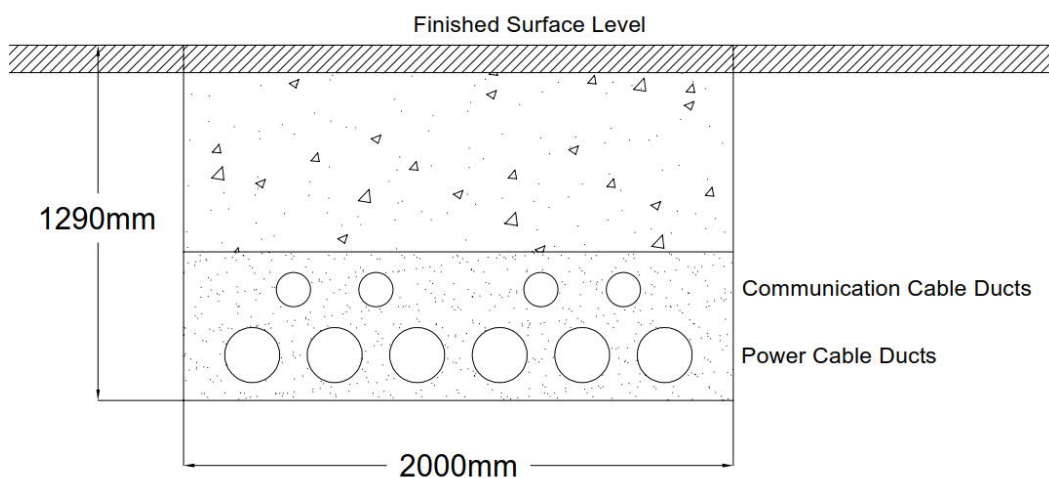
#### 2.7.4 HVAC Cable Route – Technical Considerations

As noted in section 1.3, for the circuit between the connection point (Knockraha 220kV station) and the converter station, underground cable options have been explored in the first instance. As an underground cable, the circuit will be installed in ducts under the road network with cognisance taken of the following technical aspects.

## Road Network

It is EirGrid's preference to install the HV cables in the existing road network, in order to facilitate access for installation, maintenance and fault repair, limit the risk of accidental damage and potential for future development on the route. At this stage, a 1,600mm<sup>2</sup> cable with two cables per phase has been considered. In general, this would give a typical trench width of 2m at an indicative depth of 1.29m (shown in Figure 14 below). As such, sufficient space may not be available in the existing road network to accommodate the required width of the HVAC cable trench. The trench dimensions and the capability of the road network to accommodate the required trench width will be refined as the project progresses. The road will be fully re-instated after installation of the cable.

**Figure 14: Indicative HVAC Cable Standard Duct arrangement with two 1600mm<sup>2</sup> cables per phase - Cross Section**



Source: Mott MacDonald

Figure 15 shows a typical trench for a set of three HVAC cables during installation of ducts, back fill, marker tape and marker boards. The trench width required for the HVAC cables on the Celtic Interconnector will need to accommodate six power cables (with similar spacing between the ducts as shown below) and as such the excavation would require a greater road width.

Figure 16 and Figure 17 show a HVAC joint chamber both in preparation for and with one of the cables pulled. These figures show one cable per phase:

## Underground Utilities – Specific to AC circuits

In the case of the AC cable circuit, specific consideration should also be given to induced voltages on existing metal pipes/ducts installed underground.

## Route Length between Knockraha 220kV station and the Converter Station

As described previously in Section 2.5, without reactive compensation equipment, the length of the AC cable may be constrained.



**Figure 15: HVAC Cable Trench in Road (showing one cable per phase)**



Source: EirGrid

**Figure 16: Example of a HVAC joint chamber in preparation for pulling of cable**



Source: Mott MacDonald

**Figure 17: HVAC joint chamber with one cable pulled in preparation for jointing**



Source: Mott MacDonald

## 3 Constraints Considered

### 3.1 Introduction

The aim of this report is to present a baseline of the constraints associated with the identified converter station location zones and landfall locations. The following sections outline the environmental, socio-economic, technical, deliverability, economic, constraints criteria that inform this constraints report.

The environmental and socio-economic constraints criteria that inform this constraints report and the regulatory framework within which the project will be developed, are presented in the table below. In reading this report it should be noted that, for the converter station location zones, environmental and socio-economic considerations relate to potential for both temporary (construction phase) and permanent impacts. As outlined in Section 2.5, the converter station will have the appearance of an industrial type building and compound with indicative dimensions of approximately 300m x 150m and a typical building height of approximately 25 metres.

The landfall is the location where the submarine cable is brought ashore. The connection between the onshore and offshore cable will be underground and the landfalls will be fully re-instated following installation. Therefore, impacts associated with the installation of the cable at the landfall are, in general, expected to be temporary in nature.

The themes selected reflect the identified key considerations, constraints, risks and sensitivities as they relate to environmental and socio-economic issues such as land use planning, proximity to sensitive ecological and cultural heritage features, nuisance impacts and proximity to settlements and community and recreational facilities and amenities. In general terms, socio-economic themes relate to population and communities, recreation and tourism. There are however interactions and inter-relationships between environmental and socio-economic themes. For example; nuisances, such as noise, and land use and visual impacts can be considered as both environmental and socio-economic considerations, however, for the purposes of this report the environmental and socio-economic themes have been separated as described in Table 1 below.

**Table 1: Environmental and Socio-economic Themes**

Environmental Themes	Socio-economic Themes
Land Use (compatibility, forestry, farmland, tourism, obstructions)	Settlements (population)
County Development Plans / Local Area Plans (land use planning policies and objectives)	Communities, recreation and Tourism [way of life of communities, residents, workers and visitors, recreational activities (e.g. fishing, sports) and tourism, including temporary construction phase sensitivities that are not included in the other theme headings]
Soils and Geology and Groundwater (geology, groundwater, Geological Heritage Sites etc)	
Topography (slope and elevation)	
Landscape and Visual (visual impact, landscape constraints and designations)	
Biodiversity (sensitive and protected habitats and species)	
Waterbodies (surface water quality and flood risk etc.)	
Cultural Heritage (archaeology and architectural heritage)	
Nuisance [air quality (dust), noise and traffic]	

Source: Mott MacDonald

In terms of technical, deliverability and economic onshore constraints, the themes selected reflect the identified key considerations, constraints and risks as they relate to the technical development of the project such as compliance with required standards, operational risk of the proposed option and capacity of the road network to accommodate the cable infrastructure, as detailed in the Table 2 below.

**Table 2: Technical and Deliverability Themes**

Technical Themes	Deliverability Themes	Economic Themes
Compliance with System Reliability, Security Standards:	Implementation Timelines	Civil Works
Average Failure Rates	Project Plan Flexibility	Reactive Compensation
Headroom	Dependence on other Projects	HVDC land circuit length
Expansion/extendibility	Risk of Untried Technologies	HVAC land circuit length
Repeatability	Supply Chain Constraints	
Technology Operational Risk	Permits and Wayleaves	
	Water Impact during Development	
	Air Quality Impact during Development	
	Traffic and Noise Impact during Development	

Source: Mott MacDonald

## 3.2 Environmental Constraints

The following sections outline the environmental constraints criteria that inform this constraints report and the regulatory framework within which the project will be developed, as described in Table 1.

### 3.2.1 Land Use

Historic, established, current and proposed land uses are relevant considerations in the context of the proposals. The potential for encountering contaminated land and / or sub-optimum ground conditions, physical constraints and obstacles, incompatible neighbouring land use(s) and land use practices are key considerations when determining opportunities for the siting of proposals.

Specifically, in relation to development within commercial forestry, it should be noted that change of land use planning is likely to be required.

### 3.2.2 County Development Plan / Local Area Plans

County Development Plans set out a strategic framework for the proper planning and sustainable development of the administrative area of a local authority.

County Development Plans and Local Area Plans detail development objectives and policies that influence the siting of projects at county and local level. These objectives and policies may relate to constraints such as land use zoning, biodiversity, flood risk, cultural heritage, landscape designations and characterisations, protection corridors, amenity and residential land use.

### 3.2.3 Soils and Geology

With regard to geological features, there are no statutory or legislative restrictions with the exception of geological heritage sites.



County Geological Sites (CGS) do not receive statutory protection like proposed Natural Heritage Areas (refer to section 3.2.6 below) but are considered for protection at local authority level. There is a statutory requirement placed on local authorities to have due regard for conservation of geological heritage features under planning and development regulations.

The Planning and Development Act 2000, as amended, and the associated regulations in particular, place responsibility on Local Authorities to ensure that geological heritage is protected. The conservation of geological heritage is considered an important aspect of conserving the natural heritage at a national and county level.

Karst limestones can provide important sources of water and support rare ecological habitats and species. Karst features may offer connectivity to protected and / or sensitive ecological receptors and watercourses and may be protected in their own right. Karst features, including swallow holes such as the Water Rock sink near Midleton, may drain surface water from adjacent elevated areas. Development within areas of karst may therefore result in flood risk to surrounding areas. Excavations in caves have also encountered previously unidentified archaeological features. Developments within karst limestones can have potential for significant environmental impacts.

In addition, particular soil types and structures, for example peat, alluvium deposits and karst features, may necessitate extensive civil works to ensure stability and these works may result in additional resource usage and potential for increased pollution risk and noise and traffic impacts.

#### 3.2.4 Topography

The topography, in terms of both elevation and slope, will influence the constructability and visual impact and the potential for flood risk associated with a development. The slope will influence the accessibility of the site, the civil works likely to be required and vehicular access for large and potentially heavy loads during the construction period.

#### 3.2.5 Landscape and Visual

The Planning and Development Act, 2000 as amended, introduced requirements for the preservation of the character of the landscape and made statutory provision for areas of special amenity and landscape conservation areas.

Ireland signed and ratified the European Landscape Convention (2000) in 2002 with the Convention entering into force in Ireland in 2004. The aims of the Convention include: to conserve and maintain the significant or characteristic features of a landscape, justified by its heritage value derived from its natural configuration and/or from human activity; to harmonise changes in the landscape which are brought about by social, economic and environmental processes, and to enhance landscapes.

International, national and county level landscape designations are key considerations when determining the sensitivity of locations for development opportunities.

#### 3.2.6 Biodiversity

Developments within sites and areas of ecological significance should be avoided where possible.

These are considered below under the following headings:

- Designated Sites of International Importance;
- Designated Sites of National Importance; and

- Other Sites/Features.

### Designated Sites of International Importance

Sites identified as sites of international importance include the following:

#### *Natura 2000 Sites*

##### *Special Areas of Conservation (SAC)*

SACs are areas where habitats and species are protected under the Habitats Directive (92/43/EEC), as amended. The Habitats Directive has become the single most important piece of legislation governing the conservation of biodiversity in Europe.

The main aim of the Habitats Directive is to achieve and maintain favourable conservation status for habitats and species listed on the Annexes to the Directive. These annexes list habitats (Annex I) and species (Annexes II, IV and V) which are considered threatened in the EU territory. These Annexes are summarised below.

- Annex I: Habitat types whose conservation requires the designation of Special Areas of Conservation. Priority habitats, which are in danger of disappearing within the EU territory, are highlighted with an asterisk.
- Annex II Animal and plant species whose conservation requires the designation of Special Areas of Conservation.
- Annex IV: Animal and plant species in need of strict protection.
- Annex V: Animal and plant species whose taking in the wild and exploitation may be subject to management measures.

Wild Birds are protected under Annex I of the EU Directive on the Conservation of Wild Birds (79/409/EEC). The Habitats Directive was transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations, 2011 and the Planning and Development (Amendment) Regulations 2011.

##### *Special Protection Areas (SPA's)*

SPAs are sites designated for the protection of habitats used by Annex I bird species. These areas are designated under the Birds Directive (2009/147/EC), the codified version of 79/409/EEC as amended.

According to National Parks and Wildlife Service (NPWS), every summer 24 species of seabird, numbering over half a million individuals, seek out suitable breeding habitat principally on mainland cliffs and on marine islands. These breeding sites are in close proximity to the rich foraging habitat of continental shelf waters.

Over 50 species of waterbird migrate to Ireland either on passage to more southerly resorts or to spend the entire winter here. They seek out the relatively undisturbed wetland areas for ice-free feeding conditions and for safe roosting opportunities. In some cases, significant proportions of the biogeographic populations of waterbird overwinter here (e.g. Light-bellied Brent Goose, Black-tailed Godwit, Whooper Swan, Greenland White-fronted Goose and Ringed Plover).

Ireland's SPA Network encompasses over 570,000 hectares of marine and terrestrial habitats. The marine areas include some of the productive intertidal zones of our bays and estuaries that provide vital food resources for several wintering wader species including Dunlin, Knot and Bar-

tailed Godwit. Marine waters adjacent to the breeding seabird colonies and other important areas for sea ducks, divers and grebes are also included in the network.

### *Ramsar Sites*

These are wetlands of international importance designated under the Ramsar Convention 1971. This is an intergovernmental treaty which provides the framework for national action and international commitments of its member countries to maintain the ecological character of their wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories.

### *Shellfish Waters*

These waters are designated under the Shellfish Waters Directive (2006/113/EC) in order to protect or improve shellfish waters to support shellfish life and growth.

### *Designated Sites of National Importance*

At a national level, the basic unit of conservation is the Natural Heritage Area (NHA). NHAs are designated to protect habitats, flora, fauna and geological sites of national importance. The legislative framework for NHAs is provided by the Wildlife Act, 1976 and the Wildlife (Amendment) Act, 2000. The Geological Survey of Ireland (GSI) have also compiled a list of geological/geomorphological sites in need of protection through NHA designation. In addition, there are over 600 proposed NHA (pNHA), which were published in 1995, but have not since been statutorily designated. These sites are of significance for wildlife and habitats. Prior to statutory designation, pNHA are subject to limited protection, however for the purposes of this project all pNHA will be treated as fully protected.

### *Other Sites/features*

Other sites/features likely to be of ecological significance need to be considered at this stage of the project. These include sites with identified Annex 1 type habitats and/or Red List species.

## **3.2.7 Waterbodies**

Waterbodies can act as constraints, both in terms of physical barriers to proposed infrastructure and in terms of separation distances from development and works areas to ensure that water quality is not impacted. Careful consideration should therefore be given to water crossings and the siting of any proposed infrastructure to ensure, where possible, that it does not impact on the water status of any waterbody, during construction and / or operation.

The Water Framework Directive 2000/60/EC (WFD) requires the prevention of any deterioration of the status of all waters – surface, ground, estuarine and coastal and to protect, enhance and restore all waters with the aim of achieving “good status”. Water quality management is centred on river basins, which are natural geographical areas that occur in the landscape. River Basin Management Plans set out policies, operations and measures to achieve the Directive objectives for each River Basin District.

### *Flood Risk*

Flooding is a natural process that can result in loss of human life and destruction of and damage to property, assets and the environment. Flooding can be exacerbated by development by accelerating and increasing surface water run-off, altering watercourses and removing floodplain storage.

The EU Directive 2007/60/EC on the assessment and management of flood risks, referred to as the 'Floods' Directive, was transposed into law in Ireland by the European Communities (Assessment and Management of Flood Risks) Regulations 2010, S.I. 122 of 2010.

CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme, including mapping of areas identified as being at risk of flooding, commenced in Ireland in 2011 to deliver on the requirements of the EU Floods Directive.

Pluvial flooding results from rainfall-generated overland flows which arise before run-off enters any watercourse or sewer. The intensity of rainfall can be such that the run-off totally overwhelms surface water and underground drainage systems. Fluvial flood risk results from flooding from a river or other watercourse. Areas at risk of pluvial flooding are typically identified based on high level models of digital terrain mapping and rainfall events. While pluvial flood risk is a consideration during the micro-siting and civil design of a project, development on a site identified as being at risk of fluvial flooding, groundwater flooding and / or potentially in a flood plain, is considered to be a significant project risk.

### Hydrogeology

Aquifers are rocks that contain sufficient voids to store water and are permeable enough to allow water to flow through them in significant quantities. An aquifer which is considered to be vulnerable is one which is closer to the surface or where a low permeability drainage path exists to the aquifer below.

The overburden geology defines the vulnerability of the aquifer to pollution and a vulnerability rating is based on the subsoil type and thickness.

Significant alterations to hydrogeology could result in contamination or drainage of groundwater, leading to pollution or loss of groundwater dependant habitats such as alkaline fens, turloughs, and bogs.

The GSI categorises aquifer in terms of both resource potential (Regionally or Locally important, or Poor) and groundwater flow type and attenuation potential (through fissures, karst conduits or intergranular) as follows:

- Regionally Important (R) Aquifers:
  - Karstified bedrock (Rk)
  - Fissured bedrock (Rf)
  - Extensive sand and gravel (Rg)
- Locally Important (L) Aquifers:
  - Sand and gravel (Lg)
  - Bedrock which is Generally Moderately Productive (Lm)
  - Bedrock which is karstified to a limited degree or limited area (Lk)
  - Bedrock which is Moderately Productive only in Local Zones (LI)
- Poor (P) Aquifers:
  - Bedrock which is Generally Unproductive except for Local Zones (PI)
  - Bedrock which is Generally Unproductive (Pu)

### 3.2.8 Cultural Heritage (Archaeological and Architectural Heritage)

Cultural heritage in Ireland is safeguarded through both national and international policy and is undertaken in accordance with the provisions of the European Convention on the Protection of the Archaeological Heritage (Valletta Convention), ratified by Ireland in 1997.

Cultural heritage can be divided loosely into the archaeological resource covering sites and monuments from the prehistoric period to the 18<sup>th</sup> century, and the built heritage resource, encompassing standing structures and sites of cultural importance of a post-18<sup>th</sup> century date.

The Archaeological Survey of Ireland (ASI) is a unit of the National Monuments Service. The Sites and Monuments Record (SMR) contains details of all monuments and places (sites) where it is believed there is a monument known to the ASI pre-dating AD 1700 and also includes a selection of monuments from the post-AD 1700 period.

Archaeological features may, in some situations, be considered as architectural heritage and therefore, may appear on both the Records of Monuments and Places (RMP) and the Record of Protected Structures (RPS). This means that these features are protected by both the National Monuments Act 1930, as amended and the Planning and Development Act 2000, as amended.

#### Archaeological Heritage

The National Monuments Act 1930, as amended; the Heritage Act 1995, as amended and relevant provisions of the National Cultural Institutions Act 1997 are the primary means of ensuring the satisfactory protection of archaeological remains, which are held to include all man-made structures of whatever form or date except buildings habitually used for ecclesiastical purposes.

A national monument is 'a monument or the remains of a monument, the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (National Monuments Act 1930).

There are a number of mechanisms under the National Monuments Act, which are applied to secure the protection of archaeological monuments. These include the following;

- Ownership and Guardianship of National Monuments: National monuments may be acquired by the Minister whether by agreement or by compulsory order;
- Register of Historic Monuments: Section 5 of the 1987 Act states that the Minister is required to establish and maintain a Register of Historic Monuments. This list was largely replaced by the RMP following the 1994 Amendment Act. All registered monuments are now included in the Record of Monuments and Places;
- Preservation Orders and Temporary Preservation Orders: Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act; and
- Record of Monuments and Places: Section 12 (1) of the 1994 Act provides for the Minister for Arts, Heritage, Gaeltacht and the Islands (now the minister for Arts, Heritage and the Gaeltacht) to establish and maintain a record of monuments and places.

#### Architectural Heritage and Built Heritage

Architectural and built heritage is protected under a number of separate pieces of legislation, including the Heritage Act 1995, the Architectural Heritage (National Inventory) and National Monuments (Miscellaneous Provisions) Act 1999, and the Planning and Development Act 2000, as amended.

All heritage buildings owned by a local authority are protected from damage and destruction by the 1995 Heritage Act. Under the above-mentioned legislation, there are a number of ways in which elements of architectural heritage are afforded protection, which are described below;

- Record of Protected Structures: Structures of architectural, cultural, scientific, historical or archaeological interest can be protected under the Planning and Development Act, 2000. The Act provides for the inclusion of protected structures into the planning authorities' development plan;
- Architectural Conservation Areas: An Architectural Conservation Area (ACA) is defined as an area, place or group of structures or townscapes that are of special architectural, historical, archaeological, artistic, cultural scientific, social or technical interest/value or contribute to the appreciation of Protected Structures. ACAs and candidate ACAs are listed in every County Development Plan, Town Development Plan and/or Local Area Plan; and
- National Inventory of Architectural Heritage: The National Inventory of Architectural Heritage (NIAH) records all built heritage structures within specific counties in Ireland.

### 3.3 Socio-economic Constraints

The following sections outline the socio-economic constraints criteria that inform this constraints report, as described in Table 1: *Environmental and Socio-economic Themes* above.

#### 3.3.1 Settlements

Population classifications are set out by the Central Statistics Office (CSO) as follows:

- Small Towns: Population of less than or equal to 1,000
- Medium Towns: Population of 1,001 – 9,999
- Large Towns: Population of 10,000 – 30,000

Development of the type proposed generally aim to avoid concentrations of population in order to reduce actual and perceived environmental effects.

Settlements within the study area have been categorised in Table 3 below in line with the above Central Statistics Office population classifications. The larger municipalities within East Cork are also listed.

**Table 3: Settlement Hierarchy and Municipalities**

Small Towns	Medium Towns	Large Towns	Municipalities
Ballymacoda	Youghal	Midleton	East Cork Municipal District
Killeagh		Cobh	Cobh - Glanmire Municipal District
Ladysbridge	Glanmire		Fermoy Municipal District
Ballycotton	Castlemartyr		
Shanagarry	Cloyne		
Dungourney	Whitegate		
Ballinacurra	Aghada		
Rostellan	Glounthaune		
Knockraha	Watergrasshill		
Mogeely			
Garryvoe			

Small Towns	Medium Towns	Large Towns	Municipalities
Lisgoold			
Leamlara			
Ballincurrig			
Inch			
Ballymadog			
Ballymakeagh			
Kilcredan			
Glyeen			
Glenbrook			
Clonmult			
Churchtown			

Source: CSO

### 3.3.2 Communities, Recreation and Tourism

Communities, recreation and tourism resources can be impacted by proposals of the nature proposed, in particular during the construction phase of the project.

In line with Step 2 of the Framework for Grid Development and EirGrid's Draft Social Impact Assessment Methodology, EirGrid carried out Early Baseline and Screening for Social Impact Assessment (SIA) which consisted of a SIA Baseline Report and a formal screening for SIA (Step 2 Social Baseline Report, EirGrid, April 2017<sup>2</sup>).

Having regard to the nature and extent of the proposed Celtic Interconnector Project, it was concluded that the potential for the project to have a social impact could not be ruled out. It was therefore concluded that the Celtic Interconnector project should proceed to Social Impact Assessment (SIA) in future steps of the project, in accordance with EirGrid's Draft SIA Methodology. At this stage of the project Scoping for Social Impact Assessment is being prepared which will summarise the issues identified in the baseline studies to inform the Social Impact Assessment of the proposals.

### 3.3.3 Nuisance (Traffic and Noise and Air Quality)

Nuisance, in the context of this report, relates to the type and number of sensitive receptors to potential traffic, noise and air quality (dust) nuisance impacts.

## 3.4 Technical Constraints

Proposed developments on the transmission system are assessed under the following technical considerations. For the criteria immediately below, all options under consideration either meet the minimum level required under these criteria or offer the same performance. Those which vary across the options are described for each location in the relevant individual sections in Chapter 5 and Chapter 6.

<sup>2</sup>Step 2 Social Baseline Report, EirGrid, April 2017 (<http://www.eirgridgroup.com/the-grid/projects/celtic-interconnector/related-documents/index.xml>)



### 3.4.1 General Compliance with System Reliability, Security Standards

EirGrid's reliability and security standards are defined in the Transmission System Security and Planning Standards and their Operation Security Standards. All options under consideration will be designed to comply with these as a minimum requirement.

### 3.4.2 Headroom

This is the amount of additional capacity each option offers that would be available for the future without requiring further upgrade. The options under consideration are required to connect the Celtic Interconnector to the main transmission grid. These will be required to provide a minimum power transfer capacity of 700MW. As this project is an interconnector and not a part of the meshed network, there will not be a requirement for future additional capacity.

### 3.4.3 Expansion / Extendibility

This considers the ease with which the solution option can be expanded, for example it may be possible to uprate an overhead line to a higher capacity or a new voltage in the future. However as noted under Headroom, the Celtic Interconnector will be designed for a specific power transfer level. The submarine element will also be designed to that level and expansion of the system will require the addition of a new link.

### 3.4.4 Technology Operational Risk

This criterion aims to capture the risk of operating different technologies on the network. For example, HVAC technology is very well known in terms of its operation, but there is less experience and fewer skills available around the operation of HVDC technology. Celtic Interconnector is a HVDC project, however EirGrid currently operates the East West Interconnector (EWIC) and the proposed technology will be similar. All options under consideration here share the same technology.

### 3.4.5 Average Failure Rates

Industry data indicates that cable failures on a statistical basis are related to cable length. As the AC cable installation has 2 cables per phase (6 power cables in all) compared to the DC circuit, which has a single cable per phase, it can reasonably be deduced that the expected failure rate will be lowest for an option with least AC cable.

### 3.4.6 Repeatability

"Repeatability" means whether a proposal can be readily repeated in the transmission network. As there is a limit to the amount of underground HVAC cable in each area of the network, the length of AC cable within the proposals will influence the level of restriction on the future use of cable in the area.

## 3.5 Deliverability Constraints

Proposed developments on the transmission system are assessed under the following deliverability considerations. For the criteria immediately below, all options under consideration either meet the minimum level required under these criteria or offer the same performance. Those which vary across the options are described in the sections below:



### 3.5.1 Dependence on other Projects

As a single link between the transmission grids of France and Ireland, the Celtic Interconnector will not be dependent on the completion of any other projects. None of the options under consideration will differ from this.

### 3.5.2 Risk of Untried Technologies

This criterion asks if the technology has been used by EirGrid and ESBN in the past. As noted above, Celtic Interconnector is a HVDC project which has limited use on the network however EirGrid currently operates the East West Interconnector (EWIC) and the proposed technology will be similar. All options under consideration here share the same technology.

### 3.5.3 Supply Chain Constraints

This criterion aims to capture any constraints that would affect the procurement of materials or to complete the project. A project of this nature has a limited number of suppliers / installers for aspects such as the converter station however as this affects all options equally, this has not been explored further at this stage.

### 3.5.4 Water Impact and Air Quality Impact during Development

These aspects have been captured under Environmental considerations.

### 3.5.5 Implementation Timelines

This captures the differences in programmes in terms of the relative length of time until energisation which is reasonably expected between the options under consideration.

Although the complexity of the cable route may impact on the relative construction timelines by comparison to other options under consideration, the construction of the land-based installation will not affect time to energisation when considered in the overall construction programme.

### 3.5.6 Project Plan Flexibility

When considering options for development, the availability of alternatives or flexibility within the proposal is important to allow for unforeseen issues which may arise during design and construction. In the case of the options under consideration, flexibility can be measured by aspects including the availability of alternative routes for the cable, particularly where the routes available pose challenges such as width of the road, sharp bends / junctions or water / rail or underground service crossings.

### 3.5.7 Permits and Wayleaves

This captures two particular aspects:

- areas where it can be expected that the cable route leaves the road and will require additional wayleaves; and
- any risks to particular permits or consents.

### 3.5.8 Traffic and Noise Impact during Development

Traffic and noise are assessed under nuisance impacts within the Environmental Considerations section below however the required level of traffic management, including the need for and extent of road closures are considered for each option.

### 3.6 Economic Constraints

The assessments detailed in this report are desk-based only and have not been informed by the requisite studies or agreements required to accurately estimate the cost of a project of this nature and scale. The determination of the onshore elements of the project, including the converter station location, landfall location and HVAC / HVDC land circuit routes, will be subject to further assessments, including detailed surveys and studies as appropriate, during Step 4, to establish operational, physical and technical constraints and obstacles and their feasibility and constructability in consultation with key stakeholders and landowners.

Further, site investigations, surveys and studies will be required to micro-site the individual project elements within the area(s) selected for development and to define the activities related to the project, for example required civil works.

The actual costs of the project will be project / site specific and will be dependent on the findings of studies, negotiations and consultations as detailed above, however, at this early stage in the project, and with reference to Section **Error! Reference source not found.** of this report, it can be stated that the development of a converter station within an area of karst is likely to require significant and challenging foundation works which will incur additional project costs over and above those associated with the construction of a converter station compound. The investigative works and civil engineering costs associated with such a development will require detailed and specialised consideration.

In addition, the distance of the HVAC and HVDC land circuits will influence the overall cost of the project, over and above the standard costs associated with the construction of the converter station compound. Based on per unit cost estimates, (as provided by EirGrid and Mott MacDonald's internal cost database) the indicative costs for the supply and installation of HVDC / HVAC land circuits in a public road are as outlined below:

- HVAC 220kV (2 x 1,600mm<sup>2</sup> per phase): €3.2 million per km
- HVDC 320kV (1 x 2,000 mm<sup>2</sup> per pole): €1 million per km

In addition, as outlined in Section **Error! Reference source not found.**, the need for specialised equipment to compensate for reactive power will be dependent on the length of the HVAC land circuit. Based on Mott MacDonald's internal cost database, the indicative cost for this specialist equipment is in the order of €4.6 million.

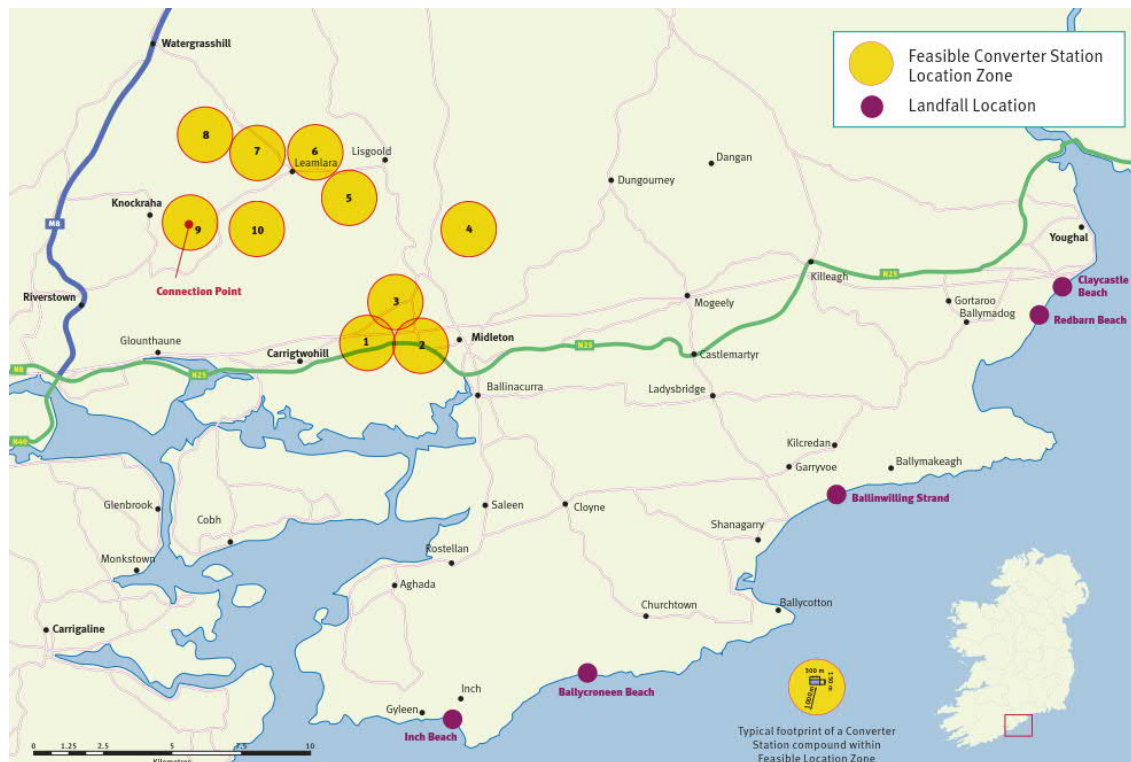
As such, based on the level of information currently available, the main constraints at this early stage of the project, in terms of onshore economic considerations are the ground conditions for the siting of the converter station and the length of the HVAC land circuit between the converter station site location (once known) and the connection point at Knockraha 220kV station.

## 4 Approach to this Constraints Report

### 4.1 Introduction

As detailed in Section 1.6 *What is the Aim of this Constraints Report?* this constraints report will examine the converter station location zones and landfall locations identified during the Feasibility Phase of the project, and presented in Figure 18 below, in greater detail.

**Figure 18: Feasible Converter Station Location Zones and Short List of Landfall Locations in East Cork**



Source: <http://www.eirgridgroup.com/site-files/library/EirGrid/Celtic-Interconnector-Project-Update-Brochure-2018.pdf>

Each converter station location zone (CSLZ) represents a general area or areas within which a converter station could be located. The development opportunities were identified further to high level assessments of environmental consideration of the feasible locations for a converter station, circuit and landfall options under the following headings<sup>3</sup>:

- Ecology;
- Cultural Heritage;
- Hydrology and Hydrogeology;

<sup>3</sup> Feasibility Study - Converter Station Site and Route Identification in Ireland (ESBI, 2016 <http://www.eirgridgroup.com/site-files/library/EirGrid/PE424-F0000-R000-038-001.pdf>)

- Soils and Geology;
- Human Beings;
- Landscape and Visual Impact; and
- Infrastructure and Utilities.

Additional zones within the study area, that may be suitable for the development of a converter station, have also been identified and considered, further to a review of the datasets referenced in this report. The findings of this desk-based baseline constraints report, ongoing studies and consultations will inform subsequent short-listing of converter station location zones and landfall locations and the technology type for the AC land circuit.

The following sections outline the approach taken in preparing this desk-based baseline constraints report.

## 4.2 Preparation of Constraints Report

The identified constraints associated with the converter station location zones and the landfall point locations are considered under the following headings:-

- Location;
- Land Use;
- County Development Plan / Local Area Plans;
- Soils and Geology;
- Topography;
- Landscape and Visual;
- Biodiversity;
- Watercourses;
- Flood Risk;
- Cultural Heritage (Archaeological and Architectural Heritage);
- Settlements;
- Communities, Recreation and Tourism;
- Nuisance (Traffic and Noise and Air Quality); and
- Technical considerations as appropriate, including:-
  - Capacity for road network to accommodate cable routes and the risk associated with establishing a cable route due to obstacles or complexity;
  - Access for construction traffic;
  - Available laydown area; and
  - Available utilities.

At this early stage in the project potential cable route options are considered at a high level only, based on the information currently available and in advance of consultations with Cork County Council, Transport Infrastructure Ireland (TII) and utility providers. Route lengths noted are indicative and relate to the routes associated with each project option:

- Converter station: HVAC circuit route from the converter station location zone to the Knockraha 220kV station and the HVDC circuit route from each converter station location zone to where the routes to the landfalls converge close to Midleton; and
- Landfall: HVDC circuit route from each landfall point to where the routes to the converter station location zones converge close to Midleton.

#### 4.2.1 Information Gathering

The constraints identified are, in general, based on a review of publicly available datasets. The following County Development Plan (CDP) and Local Area Plans and mapping were reviewed.

- Cork County Development Plan 2014 – 2020 (<http://corkcocodevplan.com/>).
- Cork County Council Mapping (<http://corkcoco.maps.arcgis.com/apps/Viewer/index.html?appid=da57dce5b97747e6bc962902248836fb> ).
- Municipal District Local Area Plans for East Cork and Cobh (<http://corklocalareaplans.com/> ).

The following online resources were also referenced between November 2018 and January 2019 to inform this report:

- Cork County Council (<https://www.corkcoco.ie/> )
- Myplan.ie Mapping (<http://www.myplan.ie/webapp/>)
- Central Statistics Office, CSO (<http://census.cso.ie/sapmap/>)
- Cork County Public Participation Network (<http://corkcountypnpn.com/> )
- National Parks and Wildlife Services, NPWS (<https://www.npws.ie/> )
- Biodiversity Ireland (<https://maps.biodiversityireland.ie/> )
- Irish Ramsar Wetland Committee (<http://www.irishwetlands.ie/> )
- Environmental Protection Area (EPA) mapping (<https://gis.epa.ie/EPAMaps/AAGeoTool/>)
- Geological Survey Ireland, GSI (<https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbd e2aaac3c228> )
- National Monuments Service (<https://www.archaeology.ie/> )
- National Inventory of Archaeological Heritage (<http://www.buildingsofireland.ie/> )
- Heritage Mapping (<https://www.heritagemaps.ie/WebApps/HeritageMaps/index.html>)
- Irish Wetland Bird Survey, i-WeBS (<https://www.birdwatchireland.ie/?tabid=111>)
- Project Related Documents (<http://www.eirgridgroup.com/the-grid/projects/celtic-interconnector/related-documents/index.xml> )
- The Karst of Ireland (GSI, Geotechnical Society of Ireland, International Association of Hydrologists, Irish Association of Economic Geology, 2000, <https://www.gsi.ie/en-ie/publications/Pages/The-Karst-of-Ireland.aspx> )

Corine 2018 and 2012 data (sourced from the EPA) was reviewed to inform this constraints report. It was noted however that the datasets did not accurately reflect land uses evident from a review of aerial imagery and Discovery mapping, in particular in relation to potential opportunities for the screening of a converter station. Land use has therefore been considered from a review of publicly available aerial imagery and Corine data supplemented with datasets obtained directly from other sources covering the East Cork area.

NPWS data on Rare and Threatened Species of the study area (up to 10 kilometre accuracy) was also obtained and reviewed to inform this report.

Digital terrain mapping was sourced by EirGrid from the Ordnance Survey Ireland (OSI) for the study area. An aeronautical chart of the study area, sourced from OSI, was also reviewed. As all of the identified zones are located within the control zones for Cork and / or Shannon airport, consultation with the Irish Aviation Authority will be required for any of the zones currently under consideration. No defence installations have been identified within the onshore study area.

Onshore constraints associated with the landfall locations are detailed in Chapter 6 *Landfall Location Option Constraints* of this report. It should be noted however that shortlisting of the five landfall locations will be further informed by separate off-shore route investigations currently being undertaken to evaluate the submarine cable route options.

#### 4.2.2 GIS Mapping

Geographic information system (GIS) mapping has been used to display the key datasets that inform this report. Both Constraints Mapping and Heat Mapping are included in Appendix A of this report.

##### Data Collation and Quality Checking

GIS datasets were collated from a variety of sources including direct data downloads from open source authority sites and data imports from Web Mapping Services (WMS) and ArcGIS Feature Services. A number of datasets were also held by Mott MacDonald and the wider project team.

These were checked as appropriate to ensure they were up to date and a copy was imported into the HVDC Celtic Interconnector project databases.

All data licences were checked to ensure they were available for use. Each dataset then went through a technical check to ensure they were complete, correct and relevant. All datasets were re-projected to IREN95 Irish Transverse Mercator projection system (EPSG:2157). Where possible, ArcGIS layer files were then used to ensure each dataset was symbolised in line with the authoritative body it was sourced from. The data sourced for constraints mapping is detailed below.

**Table 4: Constraints Mapping Datasets**

Name of dataset	Type	Supplier of data
Raster_Dataset_ING_50K_2012	Base map	Discovery
_20180423_ENV_EPA_Corine_Landcover_2018_Ply	Environment	EPA
_20180423_ENV_NPWS_NHA_ITM_2018_08_Ply	Environment	NPWS
_20180423_ENV_NPWS_pNHA_ITM_2015_11_Ply	Environment	NPWS
_20180423_ENV_NPWS_SAC_ITM_2018_08_Ply	Environment	NPWS
_20180423_ENV_NPWS_SPA_ITM_2018_09_Ply	Environment	NPWS
_20180423_CCC_High_Value_Landscape_Cork_Ply	Environment	Cork CoCo
_20180423_CCC_Landscape_Character_Type_Cork_Ply	Environment	Cork CoCo
_20180423_CCC_Route_Protection_Ply	Environment	Cork CoCo
_20180423_ENV_NPWS_ALEW09_Woodland_Inventory_Ply	Environment	NPWS
_20180423_CCC_Existingbuiltupareas_Ply	Environment	Cork CoCo
_20180423_CCC_Strategiclandreserve_Ply	Environment	Cork CoCo
_20180423_CCC_LAP2017_Landusezoning_R2_A_Ply	Environment	Cork CoCo
_20180423_CCC_LAP2017_Landusezoning_R2_B_Ply	Environment	Cork CoCo
_20180423_ENV_CCC_Route_Protection_Ply	Environment	Cork CoCo
_20181213_ENV_CCC_HighValueLandscape_Ply	Environment	Cork CoCo
_20181213_ENV_CCC_ScenicRoutes_Ply	Environment	Cork CoCo
_20190108_Coillte_EirgridBioclassAreas_Ply	Environment	Coillte
_20190108_ENV_Coillte_Old_Woodland_Ply	Environment	Coillte
_20190108_ENV_Coillte_Properties_Ply	Environment	Coillte
_20190117_DoF_ShellfishLicenceandOrders_Ply	Environment	DAFM

Name of dataset	Type	Supplier of data
_20180423_GEO_GSI_Landslide_Susceptibility_Map_Ireland	Geology	GSI
_20180423_GEO_GSI_Bedrock_Outcrop_ITM_2018_Ply	Geology	GSI
_20180423_GEO_GSI_Groundwater_Karst_Features_Pt	Geology	GSI
_20180423_GEO_GSI_Groundwater_Rock_Unit_2017_Ply	Geology	GSI
_20180423_GEO_GSI_Subsoils_Ply	Geology	GSI
_20180423_GEO_GSI_RockUnit_Ply	Geology	GSI
_20190108_GEO_GSI_Pitsandquarries_Pt	Geology	GSI
_20180423_NIAH_NIAH_Sites_Pt	Heritage	NIAH
_20180423_NIAH_SMR_Sites_All_Merged_Pt	Heritage	NIAH
_20180423_HER_CCC_ACA_2014_Ply	Heritage	CCC
_20180518_Coillte_Internal_Roads_PI	Highways	Coillte
_20181213_HYD_CCC_FloodZoneA_PI	Hydrology	CCC
_20190107_HYD_EPA_LakeSeg_Ply	Hydrology	EPA
_20190107_HYD_EPA_RiverNet_PI	Hydrology	EPA
_20180423_MAR_INFOMAR_Shipwreck_Locations_Pt	Marine	INFOMAR
_20181206_ENG_Wood_Ire_LandfallLocations_PI	Route	Wood Group

Source: Mott MacDonald

## Heat Mapping

GIS heatmapping analysis involved two steps, initial data preparation and then a weighted overlay.

- Initial data preparation assigned criteria specific fields and weightings as outlined in the table overleaf. This was done by converting an excel file containing the respective weightings for each layer and buffer distance.
- The final step involved running the outputs through a weighted overlay tool designed by Mott MacDonald which calculates statistics relative to weightings and the overlap of constraints. The output was then assigned a colour as shown below.

The collated datasets referred to below were stored within project specific ArcGIS File Geodatabases. All data was thoroughly checked and converted to the appropriate co-ordinate system prior to use.

The following tables list the heat mapping constraints applied to the converter station location zones and the landfall locations. The mapping constraints reflect the characteristics of the project elements i.e. a permanent structure in the case of the converter station and, in general temporary impacts in terms of the installation of the underground DC cable. Buffers were applied to the constraints to ensure avoidance. The buffer distances applied reflect the potential level of risk / significance / sensitivity associated with each constraint. The colour weighting applied is shown below.

Colour Key	Level of Risk/Significance/Sensitivity
Yellow	Low
Green	Low-Moderate
Dark Green	Mid-Level / Moderate
Blue	Moderate-High
Dark Blue	High



**Table 5: Heat Mapping Constraints Applied (Converter Station Location Zones)**

ID	Name	Buffer (m)	Colour Key
1	NPWS_(c)SACs	200	Dark Blue
2	NPWS_SPA's	200	Dark Blue
3	NWPS_NHAs	50	Blue
4	NWPS_(p)NHAs	50	Blue
5	Cork CoCo_Ancient and Long Established Woodland	100	Dark Blue
6	EPA_Watercourses (Rivers and streams and lakes)	100	Dark Green
7	CFRAMS_Fluvial_High_Risk_Ply	50	Dark Blue
8	Cork CoCo_LAP 2017_Flood Risk A	50	Dark Blue
9	Cork CoCo_LAP 2017_Flood Risk B	50	Blue
10	HER_NMS_NIAHSites_Pt	50	Blue
11	Cork CoCo_RPS_2014	50	Blue
12	NIAH_NIAH_Sites_Pt	100	Blue
13	NIAH_SMR_Sites_All_Merged_Pt	50	Blue
14	Cork CoCo_ACA_2013	50	Blue
15	Cork CoCo_High value landscape	1	Blue
16	Cork CoCo_ScenicRoutes	1000	Blue
17	Cork CoCo_Route_Protection_Corridors (CPD 2014)	1	Dark Green
18	Cork CoCo_U_Zone_Roads_and_Walkways	100	Dark Green
19	Cork CoCo_LAP 2017_Land_Use_Zoning_R2_Airside uses/Community/ Greenbelt 1and2/Openspace/Residential/ Special Policy Area/Terminal Landscape Uses/Town Centre/ residential	500	Dark Blue
20	Cork CoCo_LAP 2017_Land_Use_Zoning_R2_Business/Enterprise/Industry/Utility	1	Yellow
21	Cork CoCo_Existing Built Up Areas	100	Dark Green
22	Cork CoCo_Strategic Land Reserve	100	Blue
23	GSI_Geological Heritage Sites	200	Dark Blue
24	GSI_Landslide Susceptibility_High	100	Dark Blue
25	GSI_GEO_GSI_RockUnit_Ply	100	Dark Green
26	GSI_GEO_GSI_Bedrock_Outcrop_Ply	100	Dark Green
27	EPA_ENV_EPA_CorineLandCover_Barerocks_Ply	100	Dark Green
28	GSI_GEO_GSI_GwKarst_Pt	100	Blue
29	GEO_GSI_Subsoils_Peat_Ply	100	Blue
30	Cork CoCo_Quarries	200	Blue
31	GSI_Active_Quarries	200	Blue
32	GSI_Abandoned Mines	200	Blue
33	GSI_historic pit	200	Blue
34	Existing overhead transmission lines	50	Dark Blue
35	CORINE - Forestry	1	Yellow
36	Coillte Land	1	Yellow

Source: Mott MacDonald



**Table 6: Heat Mapping Constraints Applied (Landfall Locations)**

ID	Name	Buffer (m)	Colour Weighting
1	NPWS_(c)SACs	200	Dark Blue
2	NPWS_SPA's	200	Dark Blue
3	NWPS_NHAs	50	Blue
4	NWPS_(p)NHAs	50	Blue
5	Cork CoCo_Ancient and Long Established Woodland	100	Dark Blue
6	EPA_Designated Shellfish Areas	100	Dark Blue
7	Department of Fisheries_Shellfish Orders/Licences	100	Dark Blue
8	EPA_Watercourses (Rivers and streams and lakes)	100	Dark Green
9	CFRAMS_Fluvial_High_Risk_Ply	50	Dark Blue
10	Cork CoCo_LAP 2017_Flood Risk A	50	Dark Blue
11	Cork CoCo_LAP_2017_Flood Risk B	50	Blue
12	HER_NMS_NIAHSites_Pt	50	Blue
13	Cork CoCo_RPS_2014	50	Blue
14	NIAH_NIAH_Sites_Pt	100	Blue
15	NIAH_SMR_Sites_All_Merged_Pt	50	Blue
18	Cork CoCo_ACA_2013	50	Blue
19	Cork CoCo_Route_Protection_Corridors (CPD 2014)	1	Dark Green
20	Cork CoCo_LAP 2017_Land_Use_Zoning_R2_Airside uses/Community/Greenbelt 1and2/Openspace/Residential/ Special Policy Area/Terminal Landscape Uses/Town Centre/ residential	1	Dark Green
21	Cork Coco LAP 2017_Land_Use_Zoning_R2_Business/Enterprise/Industry/Utility	1	Dark Green
22	Cork CoCo_Existing Built Up Areas	1	Dark Green
23	Cork CoCo_Strategic Land Reserve	1	Blue
24	GSI_Geological Heritage Sites	200	Dark Blue
25	GSI_LandslideSusceptibility_High	100	Dark Blue
26	GSI_GEO_GSI_RockUnit_Ply	1	Dark Green
27	GSI_GEO_GSI_Bedrock_Outcrop_Ply	1	Dark Green
28	EPA_ENV_EPA_CorineLandCover_Barerocks_Ply	1	Dark Green
29	GSI_GEO_GSI_GwKarst_Pt	1	Blue
30	Cork CoCo_Quarries	200	Blue
31	GSI_Active_Quarries	200	Blue
32	GSI_Abandoned Mines	200	Blue
33	GSI_historic pit/quarry	200	Blue

Source: Mott MacDonald

### Constraints Mapping

Initial constraints mapping involved overlaying various datasets using OSI Discovery mapping as a base map. The constraints were split into categories including Environmental, Hydrological, Geotechnical and Land Use planning. Once the initial overlay was carried out, adjustments were made to layer ranking and symbology to maximise the clarity of each dataset.

The following maps are presented in Appendix A of this report.

**Table 7: Constraints Map List (Appendix A)**

Drawing Number
229100428-MMD-00-XX-DR-N304-0001- Step 3 Converter Station Location Zones: Environmental Constraints Map
229100428-MMD-00-XX-DR-N304-0002- Step 3 Converter Station Location Zones: Landuse Planning Constraints Map
229100428-MMD-00-XX-DR-N304-0003- Step 3 Converter Station Location Zones: Watercourses and Flood Risk Constraints Map
229100428-MMD-00-XX-DR-N304-0004- Step 3 Converter Station Location Zones: Geological Constraints Map
229100428-MMD-00-XX-DR-N304-0005- Step 3 Converter Station Location Zones: Bedrock Geology Constraints Map
229100428-MMD-00-XX-DR-N304-0006- Step 3 Converter Station Location Zones: Teagasc Soils Constraints Map
229100428-MMD-00-XX-DR-N304-0007- Step 3 Converter Station Location Zones: Groundwater Aquifers Constraints Map
229100428-MMD-00-XX-DR-N304-0008- Step 3 Converter Station Location Zones: Groundwater Vulnerability Constraints Map
229100428-MMD-00-XX-DR-N304-0009- Step 3 Converter Station Location Zones: Landuse Corine 2018 Constraints Map
229100428-MMD-00-XX-DR-N304-0010- Step 3 Landfall Locations: Environmental Constraints Map
229100428-MMD-00-XX-DR-N304-0011- Step 3 Landfall Locations: Landuse Planning Constraints Map
229100428-MMD-00-XX-DR-N304-0012- Step 3 Landfall Locations: Watercourses and Flood Risk Constraints Map
229100428-MMD-00-XX-DR-N304-0013- Step 3 Landfall Locations: Geological Constraints Map
229100428-MMD-00-XX-DR-N304-0014- Step 3 Landfall Locations: : Bedrock Geology Constraints Map
229100428-MMD-00-XX-DR-N304-0015- Step 3 Landfall Locations: Teagasc Soils Constraints Map
229100428-MMD-00-XX-DR-N304-0016- Step 3 Landfall Locations: Groundwater Aquifers Constraints Map:
229100428-MMD-00-XX-DR-N304-0017- Step 3 Landfall Locations: Groundwater Vulnerability Constraints Map
229100428-MMD-00-XX-DR-N304-0018- Step 3 Landfall Locations: Landuse Corine 2018 Constraints Map:
229100428-MMD-00-XX-DR-N304-0019- Step 3 Converter Station Location Zones - DTM:
229100428-MMD-00-XX-DR-N304-0020- Step 3 Converter Station Location Zones - Slope Angle Map
229100428-MMD-00-XX-DR-N304-0021 – Step 3 Converter Station Location Zones - Heat Map Overview
229100428-MMD-00-XX-DR-N304-0022 — Step 3 Converter Station Location Zones Heat Map incl Slope Angle Overview
229100428-MMD-00-XX-DR-N304-0023 – Step 3 Converter Station Location Zones Heat Map incl DTM Overview
229100428-MMD-00-XX-DR-N304-0024 – Step 3 Landfall Locations- - Heat Map Overview
229100428-MMD-00-XX-DR-N304-0025 – Step 3 Landfall Locations- Heat Map incl Slope Angle Overview
229100428-MMD-00-XX-DR-N304-0026 – Step 3 Landfall Locations- Heat Map incl DTM Overview
229100428-MMD-00-XX-DR-N304-0027- Step 3 Landfall Locations- DTM:
229100428-MMD-00-XX-DR-N304-0028- Step 3 Landfall Locations: - Slope Angle Map

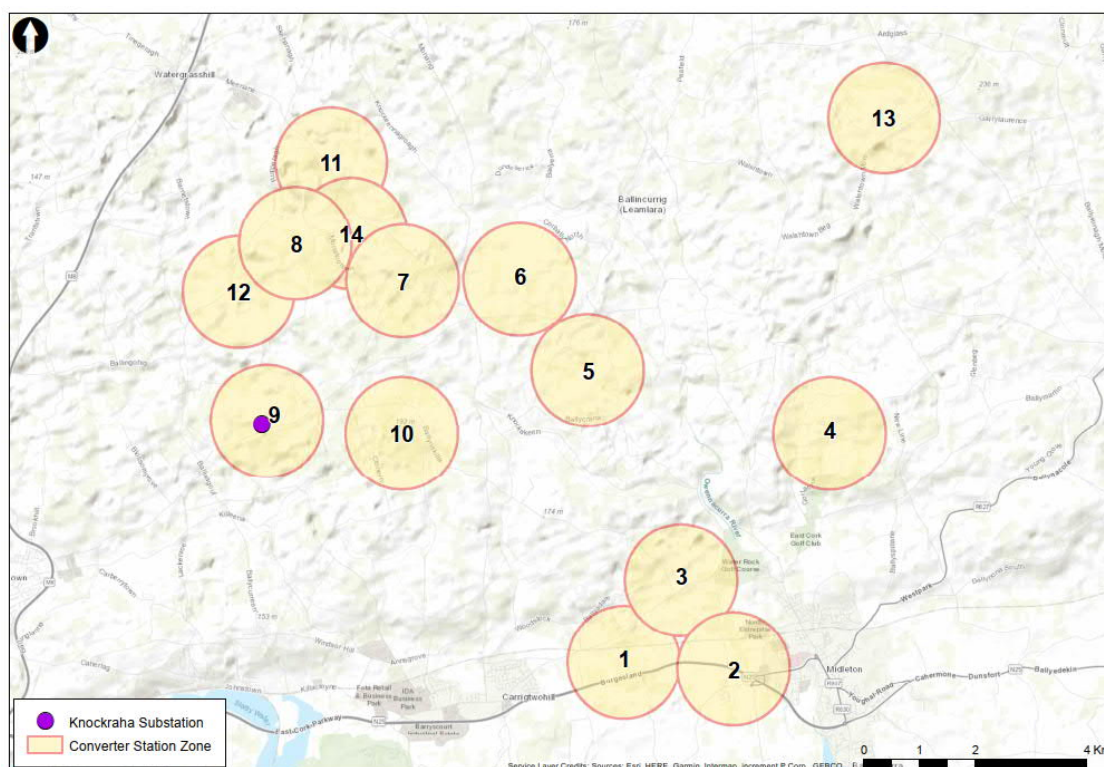
Source: Mott MacDonald

## 5 Converter Station Location Zone Constraints

### 5.1 Introduction

The following sections present the key identified constraints associated with the converter station location zones (CSLZs), as presented in Figure 19 below. The areas shown are located in East Cork, in the general area between Midleton and Watergrasshill.

**Figure 19: Converter Station Location Zones**



Source: Mott MacDonald

The CSLZ's are indicative in nature and have been identified further to initial feasibility assessments for the siting of a converter station and have not taken account of land ownership at this stage. Ten CSLZ's were identified initially (named CSLZ 1 to CSLZ 10). On appointment, Mott MacDonald identified a further four CSLZ's (named CSLZ 11 to CSLZ 14), further to a review of the datasets referenced in this report, with particular reference to visual screening opportunities.

Watergrasshill Business Park is located within the study area, however, the park is exposed with limited potential for screening. The proposed converter station would be significantly larger in scale than the existing structures on the site. Watergrasshill Business Park, and the immediate surrounding area have therefore not been considered further in this report.

As detailed previously, the findings of this onshore constraints report and ongoing studies, including offshore constraints studies, will be collated into a set of enhanced performance matrices. The matrices will evaluate each of the options detailed in this report and compare them relative to each of the other options with the aim of identifying general areas / zones where the proposals could be best located. The options identified in this report may, subject to the findings of the enhanced performance matrices, be found to be practically constrained.

The appendix to this report includes more detailed constraints maps prepared to present a spatial representation of the key constraints identified in this report.

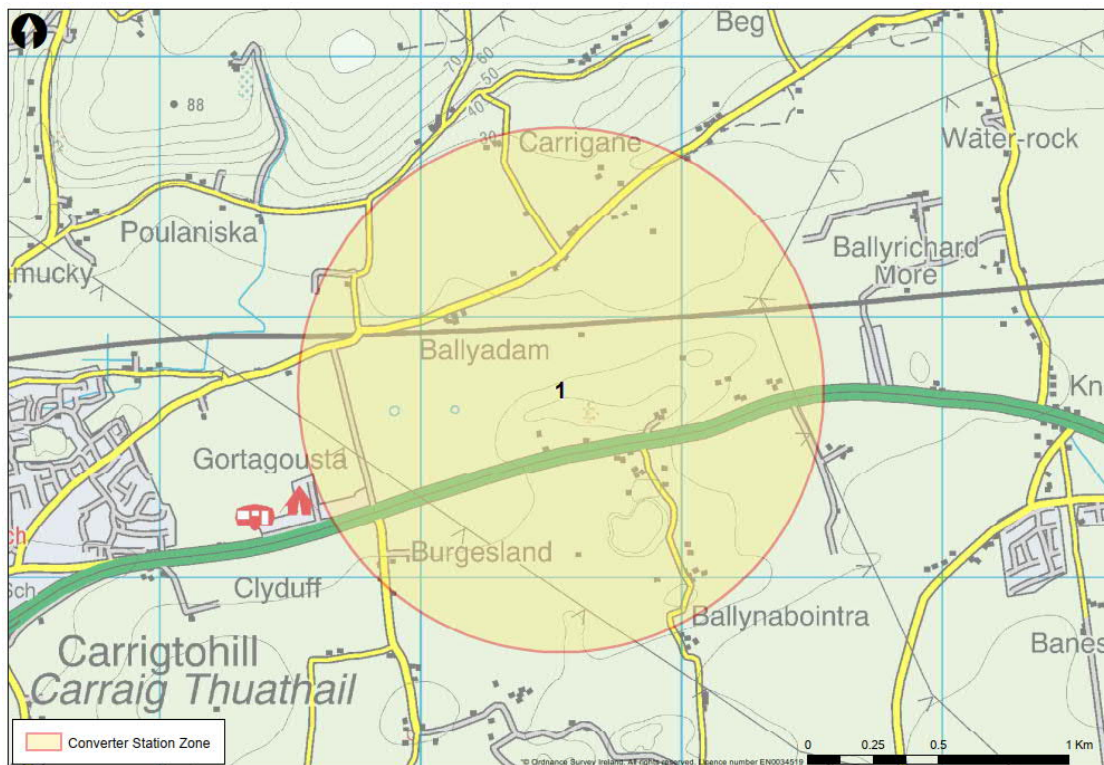
## 5.2 Converter Station Location Zone 1 - Ballyadam

### 5.2.1 Location

CSLZ 1, presented in Figure 20 below, is located approximately 7 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone). CSLZ 1 slightly overlaps with both CSLZ 2 and 3.

The zone includes the N25 Cork to Waterford road and is centred on an industrial site. The site is located in the townland of Ballyadam, the Electoral Division (ED) of Carrigtwohill and the Municipal District of Cobh-Glanmire.

**Figure 20: Converter Station Location Zone 1 (Ballyadam)**



Source: Mott MacDonald

### 5.2.2 Land Use

The industrial site is bounded to the north by the Cork / Midleton rail line and to the south by the N25 Cork to Waterford road. It is understood that ownership of the site reverted to the Industrial Development Authority (IDA) in 2010 after Amgen, a biotechnology company, abandoned plans to develop it. From a review of aerial imagery (Bing aerial and Google Satellite), it would appear that while there may be some hardstanding areas, there are no above ground structures other than overhead transmission lines that traverses the zone to the south west and east.

Milebush quarry is located to the south of the N25 within CSLZ 1. John A. Wood Quarry is located outside of the zone, directly to the south.

### 5.2.3 County Development Plan / Local Area Plan Objectives

According to Carrigtwohill Local Area Plan 2017, the IDA site is zoned for industry. A significant part of CSLZ 1, including land to the south and south east of the IDA site, along the N25, forms part of a route protection corridor.

According to the Volume 4 'Maps' of the *Cork County Development Plan 2014*, the land to the north, south and west of the IDA site is within 'Prominent and Strategic Metropolitan Greenbelt Areas', MBG1.

Cork County Development Plan 2014 states that Prominent and Strategic Metropolitan Greenbelt Areas require the highest degree of protection because they are made up of the prominent open hilltops, valley sides and ridges that give Metropolitan Cork its distinctive character and the strategic, largely undeveloped gaps between the main Greenbelt settlements.

It is a stated objective of the Cork County Development Plan to protect those prominent open hilltops, valley sides and ridges that define the character of the Metropolitan Cork Greenbelt and those areas which form strategic, largely undeveloped gaps between the main Greenbelt settlements. These areas are labelled MGB1 and it is an objective to preserve them from development.

This objective suggests that there may be limited flexibility for the siting of a converter station within the general area of CSLZ 1, notwithstanding this however, the site is zoned for 'industry' and was previously earmarked for significant industrial development now comprising of a brownfield site.

### 5.2.4 Soils and Geology

There are no Geological Heritage Sites in proximity to CSLZ 1.

According to Teagasc subsoils mapping, sections of the industrial site are identified as having karstified limestone bedrock at surface. In general, the subsoil is sandstone till.

Karst features, including a swallow hole, enclosed depressions and turloughs have been identified within and adjacent to the IDA site. Developments within karst limestones can have potential for significant environmental impacts on water resources, drainage, ecology and archaeology.

It is noted that the records associated with archaeological investigations on the site refer to wet ground and an infilled pond. The potential for soil and / or groundwater contamination associated with the infill material and / or development at the IDA site cannot be ruled out without further investigation.

The aquifer is classified as a Regionally Important Aquifer - Karstified (diffuse). The groundwater vulnerability under the IDA site is classified as Extreme, due to the overburden geology.

### 5.2.5 Topography

CSLZ 1 is low lying and appears to be relatively flat.

According to DTM, the zone is at an elevation of approximately 20 - 30 metres AOD (Malin Head).

### 5.2.6 Landscape and Visual

CSLZ 1 is located within 'City Harbour and Estuary' landscape character area.



According to the Volume 4 'Maps' of the *Cork County Development Plan 2014*, converter station CSLZ 1, and the surrounding area, are located in an area identified by Cork County Council as High Value Landscape. The site is low lying and is potentially overlooked by scenic routes to the west (S42: Road at Cashnagariffe, N.W. Carrigtwohill and Westwards to Caherlag) and to the north east (R626 Leamlara to Middleton road).

Views of the eastern section of the site would be taken in the context of the surrounding developed land uses. Notwithstanding this, there are landscape and visual constraints associated with the zone with potentially limited opportunities for effective screening.

#### 5.2.7 Biodiversity

CSLZ 1 is not located within any ecologically designated sites. The partially developed IDA site may offer limited breeding and roosting and foraging opportunities for protected species, however a site visit is required to establish the level of development on site.

The karst features, in particular swallow holes and turloughs may provide connectivity to Natura 2000 sites, for example Great Island Channel SAC and Cork Harbour SPA located approximately 3.4 kilometres from the zone.

#### 5.2.8 Watercourses

No surface watercourses are evident within CSLZ 1.

#### 5.2.9 Flood Risk

According to CFRAM mapping, the area around the IDA site is identified as being at risk of pluvial flooding.

#### 5.2.10 Cultural Heritage (Archaeological and Architectural Heritage)

A number of cultural heritage sites were recorded within the zone in 2007 during archaeological monitoring carried out in advance of construction of the Amgen facility on the IDA site, as listed below. It is noted that the records refer to wet ground and an infilled pond.

- Fulacht fia (record number CO076-120----
- Fulacht fia (record number CO076-121----
- Burnt Mound (record number CO076-122----
- Fulacht fia (record number CO076-123----

Development at the IDA site has potential to impact known archaeological sites. There is also potential to encounter previously unrecorded archaeological finds on the site.

#### 5.2.11 Settlements

According to the CSO, the population of Carrigtwohill (ED) in the 2016 census was 7,334. The total housing stock was 2,657, of which vacant households (excluding holiday homes) numbered 147.

The area of CSLZ 1 itself however is sparsely populated.

#### 5.2.12 Communities, Recreation and Tourism

Jasmine Villa Caravan and Camping Park is located directly west of CSLZ 1, along the N25. Development within the zone itself however, based on information currently available at this stage of the project, does not appear to represent any significant direct risks in terms of

recreation and tourism due to the limited number of social / community facilities located within the converter station location zone.

Community associations, facilities and organisations in the area include:-

- Carrigtwohill Community Council;
- Cul Ard Residents Association;
- Fota Rock Residents Association; and
- Carrigtwohill United FC.

It can also be expected that facilities and organisations in the wider Midleton area are utilised, including those listed for CSLZ 2.

#### 5.2.13 Nuisance (Traffic and Noise and Air Quality)

The N25 traverses the zone. Background noise levels within CSLZ 1 are likely to be elevated due to traffic associated with the N25.

According to EPA Noise mapping of the N25 (<https://gis.epa.ie/EPAMaps/>, accessed 26 November 2018), the noise level in proximity to the N25 is in the order of 55-59dB. There do not appear to be sensitive noise and / or dust receptors in the immediate vicinity of the IDA site.

Based on information available at this stage of the project there do not appear to be any significant risks associated with traffic and noise and air quality at CSLZ 1.

#### 5.2.14 Potential AC/DC Circuit Route Options

As detailed previously, a significant section of CSLZ 1 encompasses a route protection corridor.

Two potential circuit routes cross through the zone. The N25 Route Protection Corridor referred to above overlaps these routes. Consultation with Cork County Council and TII and service providers would be required to determine the feasibility of these routes in Step 4.

#### 5.2.15 Technical Constraints

The N25 passes through CSLZ 1 from east to west which should potentially provide adequate space for the connection of both the AC and DC cable circuits to the converter station. The AC cable route to Knockraha 220kV station could pose challenges due to the length of the wider trench required and the width of the local road to the north of the zone. Furthermore, the length of the AC cable route exceeds the maximum length of underground cable without the requirement for reactive compensation. Challenges along this route include crossing the railway line and a number of shallow deck bridges along the narrow road between the zone and Knockraha 220kV station. Crossing the railway with the AC circuit will require 10 ducts to pass under the railway.

The N25 passes through the zone indicating adequate access for construction traffic.

From a review of aerial imagery, there appears to be electrical distribution infrastructure in the area for supply of the converter station. The area within the zone is also serviced by water mains and foul sewerage which run along the N25 and Carrigane Road. Available underground services mapping indicates the presence of a gas transmission line running along the south of the zone.



## Average Failure Rates

Based on the likely routes available, the combined length of cable associated with this option can be expected to be approximately 13km for the AC cable and 6km for the DC cable. Cigre 379 XLPE cable circuit failure indicates 1.7<sup>4</sup> cable faults over a 40 year life.

## Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.

### 5.2.16 Deliverability

#### Project Plan Flexibility

Potential route options for the AC cable include a number of rail and bridge crossings which require further examination. The emerging preferred route to Knockraha 220kV station from the zone travels north from Carrigtwohill, however there are limited alternatives for this route should issues be identified during further examination. Obstacles encountered (such as railway crossings) will be considerably more challenging for an AC cable route versus a DC. All potential routes from this zone will present challenges at the rail crossing as the bridge decks are shallow and will not accommodate the full depth of the trench. Also, the zone is bisected by high pressure gas pipeline to the south which both limits micro-siting of the converter station and has the potential to require another service crossing to be navigated.

#### Permits and Wayleaves

The zone is relatively flat however a number of karst features and a quarry site have been identified posing risks or challenges to the constructability of the converter station within the zone. Proximity to environmentally designated sites coupled with evidence of karst poses a risk to achieving permits and consents.

The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to re-construct bridges, reinstate or re-construct roads or the use of horizontal directional drilling and the potential impact on trees along the roads also pose a risk to achieving consents. Further, the road network is narrow with steep sections and sharp angles which cannot be accommodated by the minimum bend radius of the cable will require that the route deviates from the road network in many places. This will require additional wayleaves.

#### Traffic and Noise Impact during Development

With the wider trench required for the AC cable circuit, the AC cable route will require increased traffic management and road closures between the converter station site and the connection point.

### 5.2.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:

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<sup>4</sup> The AC cable is treated as two cable systems to allow for the two cables per phase.

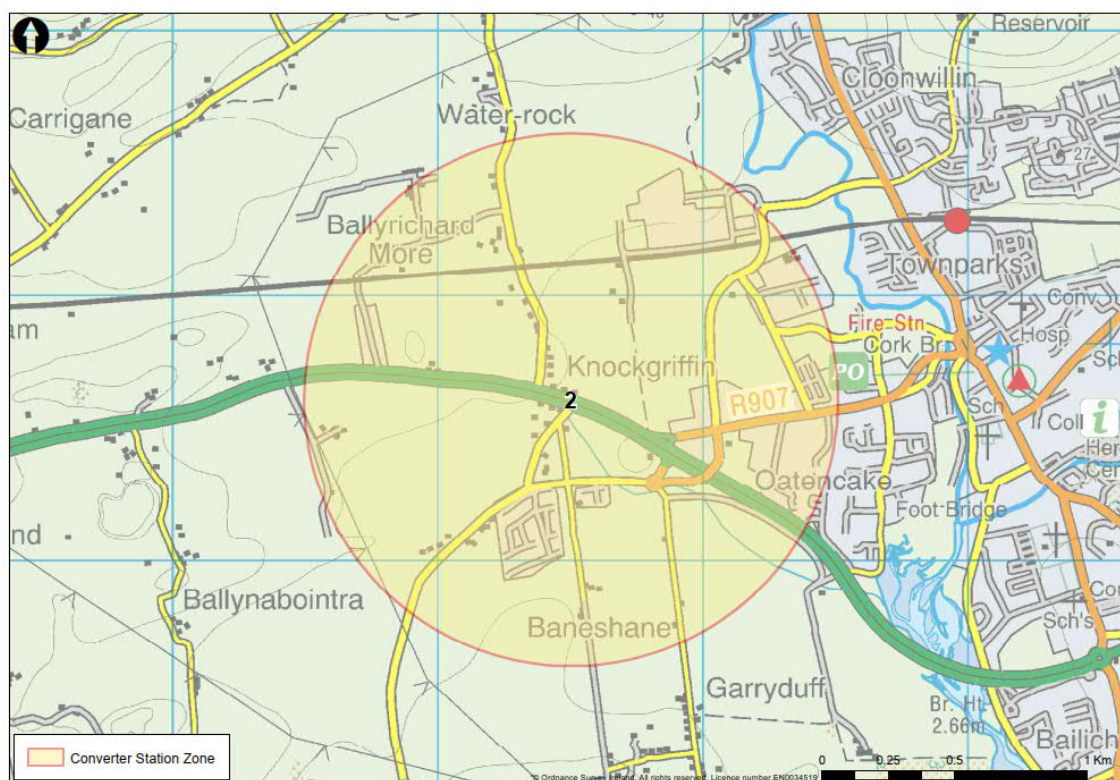
- Approximately 7 kilometres straight line distance from Knockraha 220kV station, longer by road route. This exceeds the indicated maximum length of AC cable without reactive compensation.
- AC cable route to Knockraha 220kV station will be challenging due to railway and bridge crossings.
- Partially zoned for industry but surrounded by Prominent and Strategic Metropolitan Greenbelt Areas. Potentially limited flexibility in terms of micro-siting.
- Encompasses the N25 Route Protection Corridor.
- Includes karst features within areas of extreme aquifer vulnerability.
- Potential drainage issues.
- Low lying site within High Value Landscape.
- Significant number of cultural heritage features on site.

## 5.3 Converter Station Location Zone 2 - Water Rock

### 5.3.1 Location

CSLZ 2, presented in Figure 21 below, is located approximately 9 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone), directly west of Midleton town and includes the townlands of Water-Rock, Baneshane Knockgriffin (Barrymore), and Knockgriffin (Imokilly). The zone includes the ED's of Midleton Rural and Carrigtwohill and is traversed by the N25 Cork to Waterford road.

**Figure 21: Converter Station Location Zone 2 (Water Rock)**



Source: Mott MacDonald

### 5.3.2 Land Use

The zone includes Nordic Business Park, Owenacurra Business Park Europa Business Park and Market Green Retail Park, Water Rock Golf Course and a number of residential developments. The Dawn Meats facility is located in the north eastern section of CSLZ 2. The zone is traversed by a 110kV overhead transmission line to the west and the Cork / Midleton rail line to the north.

In general, the surrounding land uses can be characterised as improved agricultural grassland with the exception of land to the east. Midleton is a built-up area of mixed commercial, retail and residential use.

### 5.3.3 County Development Plan / Local Area Plans

CSLZ 2 is located within Midleton Rural ED and Carrigtwohill ED.

According to the Volume 4 'Maps' of the *Cork County Development Plan 2014*, the eastern section of the zone is identified as a built-up area and the area to the west forms part of the Prominent and Strategic Metropolitan Greenbelt Areas. The zone also incorporates the N25 Route Protection Corridor to the south.

The zone incorporates lands zoned for residential and Strategic Land Reserve (Midleton West) and a 37 hectare area zoned for Enterprise. The Water-Rock Framework Masterplan Study (4<sup>th</sup> August 2015) refers to a proposal that includes the provision of up to 2,500 housing units, 2 primary school sites and 1 post primary school site, a neighbourhood centre and amenity areas to include a green corridor and a linear park along the Owenacurra River.

#### 5.3.4 Soils and Geology

CSLZ 2 includes the Geological Heritage Site boundary of Baneshane Quarry.

The bedrock is limestone with karst features. A swallow hole, a spring and a cave are located within the townland of Water Rock. Water Rock spring, according to the GSI, is apparently fed by castle rock stream sink.

The Karst of Ireland (GSI, 2000) identifies Water Rock sink near Midleton as a swallow hole that drains surface water from adjacent hills.

The GSI further identifies three openings in the limestone crag. The stream flows into the most easterly cave normally. The spring is 'apparently fed by castle rock stream sink,' and the cave has three openings in the north face of the limestone crag. The most easterly cave has a stream permanently flowing into it. In wet periods, the water overflows into the other two cave openings. Fluvial cobbles and pebbles are found on the cave floor.

Developments within karst limestones can have potential for significant environmental impacts on water resources, drainage, ecology and archaeology.

The aquifer is classified as a Regionally Important Aquifer - Karstified (diffuse). The groundwater vulnerability of the zone is classified as Extreme in places.

#### 5.3.5 Topography

CSLZ 2 is low lying. According to DTM, the zone is relatively flat at an elevation of approximately 10 - 20 metres.

#### 5.3.6 Landscape and Visual

CSLZ 2 is located within an area designated by Cork County Council as High Value Landscape within the 'City Harbour and Estuary' landscape character area.

The zone is low lying and is potentially overlooked by the R626 Leamlara to Midleton scenic route. Given the developed nature of the surrounding area, views of the eastern section of the zone in particular would be taken in the context of the existing built up areas.

#### 5.3.7 Biodiversity

Great Island Channel SAC and Cork Harbour SPA are located approximately 180 metres from the boundary of the zone. Great Island Channel SAC is designated for mudflat and sandflat habitat which contain benthic communities. The release of sediment and pollution during the construction phase has the potential to impact these benthic communities. Similarly, the release of sediment and pollution has the potential to impact on feeding resources of the protected waterfowl which forage downstream of Cork Harbour SPA.

The zone includes a number of karst features and potentially underground streams. The zone is also traversed by the Owenacurra\_40 (IE\_SW\_19O30500) watercourse which discharges approximately 320 metres downstream of CSLZ 2 to Great Island Channel SAC and Cork Harbour SPA.

### 5.3.8 Watercourses

The zone is traversed by the Owenacurra\_40 (IE\_SW\_19O30500) watercourse. The Owenacurra\_40 is classified as being of Moderate status. As detailed above the river discharges to Natura 2000 sites approximately 320 metres downstream of the boundary of CSLZ 2.

### 5.3.9 Flood Risk

According to CFRAM mapping, the northern sections of the zone in particular have been identified as being at risk of pluvial flooding. The area to the south east has been identified as being at risk of fluvial flooding.

### 5.3.10 Cultural Heritage (Archaeological and Architectural Heritage)

A lime kiln (CO076-018---) is located to the north of the rail line, a Designated landscape – tree (CO076-017---) is located along the western perimeter of the zone and a linear earthwork (CO076-092---) is located to the south. There do not appear to be any other known archaeological finds within the zone. Given the finds within adjacent CSLZ 1 however the potential for encountering previously unrecorded archaeological finds in previously undeveloped lands could be considered to be high.

There are a number of NIAH heritage houses within the townland of Knockgriffin (Barrymore) in the eastern section of the zone.

### 5.3.11 Settlements

There are a number of densely populated areas within this zone.

According to the CSO, the total population of Midleton Rural (ED) in 2016 was 8,922. The total housing stock was 3,261, of which vacant households (excluding holiday homes) numbered 155.

The total population in Carrigtwohill (ED) in 2016 was 7,334. The total housing stock was 2,657, of which vacant households (excluding holiday homes) numbered 147.

### 5.3.12 Communities, Recreation and Tourism

Situated along the urban fringe of northern and western Midleton, CSLZ 2 encompasses a range of social organisations and community facilities both in the zone and within approximately 1 kilometre of the zone including:-

- Midleton Community Forum Ltd (Family Resource Centre)
- Midleton MY PLACE Limited
- Midleton GAA Club
- Midleton Golf Society
- Midleton Football Club
- Midleton Rugby Football Club
- St. John the Baptist Catholic Church

- The Holy Rosary Church
- Midleton Baptist Church Office
- Gaelscoil Mhainistir Na Coran
- Darling Buds pre-school Midleton
- St John the Baptist National School
- Midleton College
- St. Colmans Community College
- St. Mary's High School
- Christian Brothers Secondary School
- Little Angels Creche
- Midleton Educate Together National School
- Midleton Post Office
- Midleton Garda Station
- Midleton Medical Centre
- Midleton Health Centre
- East Cork Counselling
- Cope Foundation
- Midleton Community Hospital
- Southdoc Midleton
- Midleton Dental Care
- Midleton Holistic Health Centre
- Midleton Veterinary Hospital

There are a number of recreational activities and amenities in the area as detailed below. Of particular note is FEAST – The East Cork Food and Drink Festival which is held in Midleton and surrounding areas in September and the Midleton Arts Festival, held in Midleton in Mid-May.

- Midleton Pitch and Putt Club
- Crafts on the Mall
- Midleton Farmers Market
- Midleton Country Market
- Angling Roxboro River
- Jameson Distillery Midleton
- Jungle World, Midleton
- Nellie Cashman Monument
- Irish Whiskey Academy
- Ballyannan Woods - Midleton Forest Walk
- FEAST - The East Cork Food and Drink Festival (Midleton and surrounding areas, September)
- Midleton Arts Festival (Midleton, Mid-May)

### 5.3.13 Nuisance (Traffic and Noise and Air Quality)

Background noise levels within CSLZ 2 are likely to be elevated due to traffic associated with the N25.

According to EPA Noise mapping of the N25 (<https://gis.epa.ie/EPAMaps/>, accessed 26 November 2018), the noise level proximity to the N25 is in the order of 55-59dB.

There would appear to be a number of receptors within the zone that would be sensitive to traffic, noise and dust nuisance impacts.

### 5.3.14 Potential AC/DC Circuit Route Options

A potential circuit route within CSLZ 2 aligns with the N25 Route Protection Zone. Consultation with Cork County Council and TII and service providers would be required to determine the feasibility of these routes.

### 5.3.15 Technical Constraints

The N25 passes through zone 2 from east to west which should potentially provide adequate space for the connection of both the AC and DC cable circuits to the converter station. The local roads in the south of the zone may provide some constraints to bringing a route in and out of the converter station, given their relatively narrow width. The AC cable route from the converter station location zone to the connection point will require a wider trench than the DC route from the landfall. The area north of Carrigtwohill presents a number of obstacles including shallow deck bridges, crossing of a live railway and narrow winding roads which will be challenging, particularly for the wider AC cable trench.

The N25 passes through the zone which is likely to provide adequate access for construction traffic.

The area within the zone is serviced by water mains and foul sewerage. There is some electrical distribution infrastructure in the area for supply of the converter station, however, this is limited to the western side of the zone. Available underground services mapping indicates the presence of a gas distribution line running along the south of the zone.

A 110kV single circuit overhead line runs through the western side of the zone.

### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 33km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.7 cable faults over 40 year life.

### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.



### 5.3.16 Deliverability

#### Project Plan Flexibility

Potential route options for the AC cable include a number of rail and bridge crossings which require further examination. The emerging preferred route travels west and then north from Carrigtwohill however there are limited alternatives for this route should issues be identified during further examination. Obstacles encountered will be considerably more challenging for an AC route versus a DC. All potential routes from this zone will present challenges at the rail crossing as the bridge decks are shallow and will not accommodate the full depth of the trench. The zone is bisected by high pressure gas pipeline, limiting micro-siting of the converter station.

#### Permits and Wayleaves

The zone is relatively flat however a number of karst features have been identified posing risks or challenges to the constructability of the converter station within the zone. Proximity to environmentally designed sites coupled with evidence of karst poses a risk to achieving permits and consents.

The zone is bisected by high pressure gas pipeline, limiting micro-siting of the converter station and potentially requiring permissions for construction work in proximity.

The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to re-construct bridges, reinstate or re-construct roads or the use of horizontal directional drilling and the potential impact on trees along the roads also pose a risk to achieving consents. Further, the road network is narrow with steep sections and sharp angles which cannot be accommodated by the minimum bend radius of the cable route will require that the route deviates from the road network in many places. This will require additional wayleaves.

#### Traffic and Noise Impact during Development

With the wider trench required for the AC cable circuit, the AC cable route will require increased traffic management and road closures between the converter station site and the connection point.

### 5.3.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:

- CSLZ boundary is approximately 9 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.
- AC cable route to Knockraha 220kV station will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha 220kV station.
- Encompasses built-up area of mixed commercial, retail and residential use.
- Potentially limited flexibility in terms of micro-siting. Encompasses the N25 Route Protection Corridor. Partially zoned for residential and enterprise uses. Also, partially located within Prominent and Strategic Metropolitan Greenbelt Areas.
- Includes a Geological Heritage Site and karst features.
- Low lying within High Value Landscape.
- Potential connectivity to proximate Natura 2000 sites.
- Close proximity to a significant number of sensitive receptors.

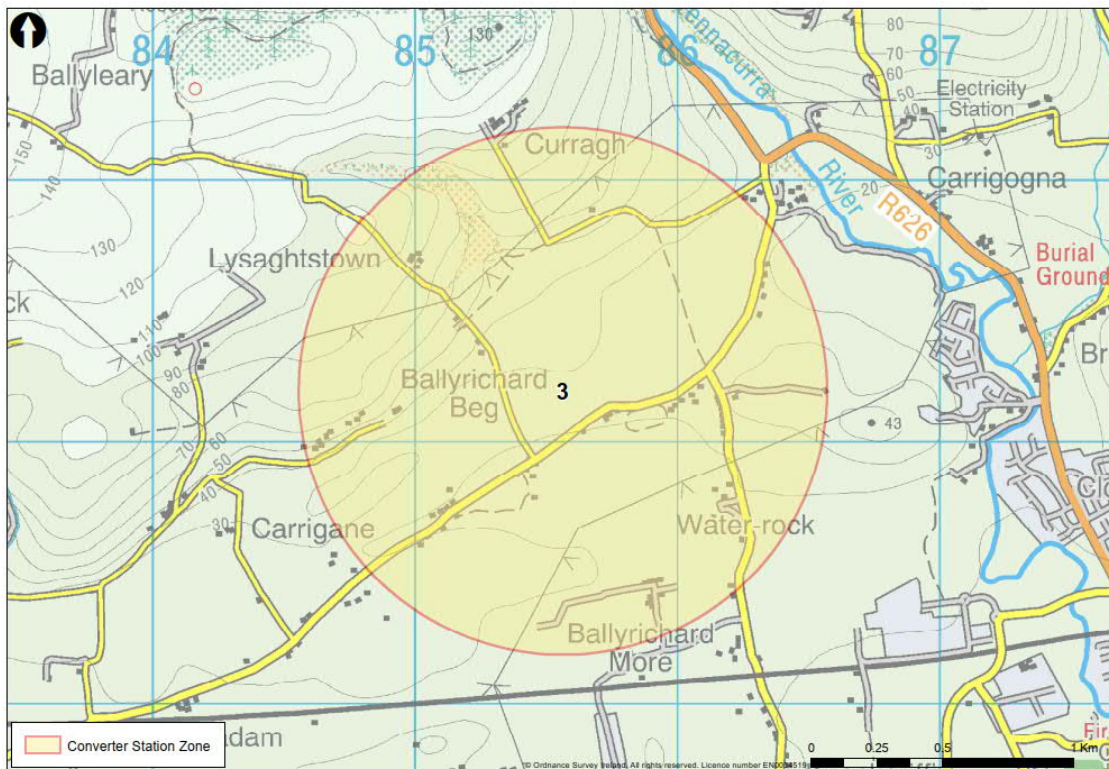
## 5.4 Converter Station Location Zone 3 - Curragh

### 5.4.1 Location

CSLZ 3, presented in Figure 22 below, is located approximately 7 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone) and approximately 3 kilometres north west of Midleton.

Zone 3 is within the townlands of Carrigane, Lysaghtstown, Ballyrichard Beg, Curragh, Water-Rock and Ballyrichard More and Carrigtwohill ED.

**Figure 22: Converter Station Location Zone 3 (Curragh)**



Source: Mott MacDonald

### 5.4.2 Land Use

CSLZ 3 can be characterised as improved agricultural grassland with ribbon development along the local roads that traverse the zone. Two 110kV overhead transmission lines traverse the zone.

CSLZ 3 includes Water Rock Golf Course. The former IPPC licence boundary of the Dawn Meats facility (P0176-01) is located within the south eastern section of the zone.

### 5.4.3 County Development Plan / Local Area Plans

According to the Volume 4 'Maps' of the *Cork County Development Plan 2014*, the majority of CSLZ 3 forms part of Prominent and Strategic Metropolitan Greenbelt Areas. The section to the south east is classed as a Built-Up area, zoned for residential development. As outlined in section 5.3.3 for CSLZ 1, the Water-Rock Framework Masterplan Study (4<sup>th</sup> August 2015) refers

to a proposal that includes the provision of up to 2,500 housing units, 2 primary school sites and 1 post primary school site, a neighbourhood centre and amenity areas to include a green corridor and a linear park along the Owenacurra River.

#### 5.4.4 Soils and Geology

According to GSI mapping, sections of CSLZ 3 are identified as having bedrock at surface. In general, the subsoil is sandstone till and gravel derived from sandstone.

The aquifer is classified as a Regionally Important Aquifer - Karstified (diffuse) to the south and a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones.

The groundwater vulnerability is classified as Extreme in places.

#### 5.4.5 Topography

CSLZ 3 is low lying to the south-east but the land rises steeply in elevation to the north-west.

According to DTM, the zone rises in elevation a north westerly direction from approximately 20 metres to 90 metres across CSLZ 3.

#### 5.4.6 Landscape and Visual

CSLZ 3 is located within an area designated by Cork County Council as High Value Landscape.

CSLZ 3 is located within 'City Harbour and Estuary' landscape character area.

The zone is low lying and is potentially overlooked by the R626 Leamlara to Middleton scenic route to the east.

#### 5.4.7 Biodiversity

Great Island Chanel SAC (Site Code 001058) and Cork Harbour SPA (Site Code 004030) are located approximately 3 kilometres to the south-east of CSLZ 3.

Ballydesmond Wood, an Ancient Long-Established Woodland according to Biodiversity Ireland mapping, is located approximately 1.9 kilometres north west of CSLZ 3. There is also a tree ring within Ballyrichard More which is a designated landscape feature.

#### 5.4.8 Watercourses

No surface watercourses are evident within CSLZ 3.

#### 5.4.9 Flood Risk

According to CFRAM mapping, the southern and eastern sections of the zone have been identified as being at risk of pluvial flooding. The area directly east of CSLZ 3 has been identified as being at risk of fluvial flooding. Cork County Council mapping also identifies the area north of Zone 3 as being at risk of fluvial flooding.

#### 5.4.10 Cultural Heritage (Archaeological and Architectural Heritage)

There do not appear to be any known archaeological finds within CSLZ 3. The potential for encountering previously unrecorded archaeological finds in previously undeveloped lands could be considered to be high however due to the number and type of finds in the surrounding areas.

#### 5.4.11 Settlements

There is limited ribbon development along the local roads that traverse the zone. According to the CSO, the total population in Carrigtwohill (ED) in 2016 was 7,334. The total housing stock was 2,657, of which vacant households (excluding holiday homes) numbered 147.

#### 5.4.12 Communities, Recreation and Tourism

Community associations, facilities and organisations in the area include:-

- Midleton Community Forum Ltd (Family Resource Centre)
- Midleton MY PLACE Limited
- Midleton Educate Together National School

CSLZ 3 encompasses part of Water Rock Golf Course. Festivals held in the area include FEAST – The East Cork Food and Drink Festival which is held in Midleton and surrounding areas in September and the Midleton Arts Festival, held in Midleton in Mid-May.

Other recreational activities and amenities in the general area are detailed below:

- Curragh Wood Walk
- Hilltop Enclosure Scenic View
- Glenview House

It can also be expected that facilities and organisations in the wider Midleton area are utilised, including those listed for CSLZ 2.

#### 5.4.13 Nuisance (Traffic and Noise and Air Quality)

There are a limited number of sensitive receptors within the zone in the context of traffic, noise and dust nuisance impacts.

#### 5.4.14 Potential AC/DC Circuit Route Options

Two potential circuit routes along relatively straight local roads were identified by ESBI in their Feasibility Study. One of the routes passes alongside the entrance to Water Rock Golf Course. Consultation with Cork County Council and TII and service providers would be required to determine the feasibility of these routes.

#### 5.4.15 Technical Constraints

CSLZ 3 encompasses local roads with a mix of single and double lanes. There appears to be potential routes for both the AC and DC cable circuits. However, further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase.

The area within the zone is serviced by water mains with no evidence of foul sewerage from available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. It is concentrated outside of the zone and to the east around Midleton. There doesn't appear to be any gas infrastructure within the zone.

A 110kV single circuit overhead line runs through the south eastern side of CSLZ 3.

### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 31km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.6 cable faults over 40 year life.

### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.

#### 5.4.16 Deliverability

##### Project Plan Flexibility

Sloped land to the north and north west of the zone which could impact the volume of civil/enabling works required for construction and which may limit the micro-siting of the converter station.

Potential route options for the AC cable include a number of rail and bridge crossings which require further examination. The emerging preferred route travels south west towards Carrigtwohill however there are limited alternatives for this route should issues be identified during further examination. Routes to the north of this zone present narrow winding tree lined lanes with steep sections and bridge crossings with shallow deck space and sharp crossing angles. Obstacles encountered will be considerably more challenging for an AC route versus a DC route. All potential routes from this zone will present challenges at the rail crossing as the bridge decks are shallow and will not accommodate the full depth of the trench.

##### Permits and Wayleaves

The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to re-construct bridges, reinstate or re-construct roads or the use of horizontal directional drilling and the potential impact on trees along the roads also pose a risk to achieving consents. Further, the road network is narrow with steep sections and sharp angles which cannot be accommodated by the minimum bend radius of the cable route will require that the route deviates from the road network in many places. This will require additional wayleaves.

##### Traffic and Noise Impact during Development

With the wider trench required for the AC cable circuit, the AC cable route will require increased traffic management and road closures between the converter station site and the connection point.

#### 5.4.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- CSLZ boundary is approximately 7 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.
- AC cable route to Knockraha 220kV station will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha 220kV station.

- Potentially limited flexibility in terms of micro-siting. The majority of the zone forms part of Prominent and Strategic Metropolitan Greenbelt Areas. The section to the south east is classed as a Built-Up area, zoned for residential development. The zone also incorporates part of a golf course.
- Within a High Value Landscape.
- Low lying and potentially overlooked by the R626 Leamlara to Midleton scenic route.

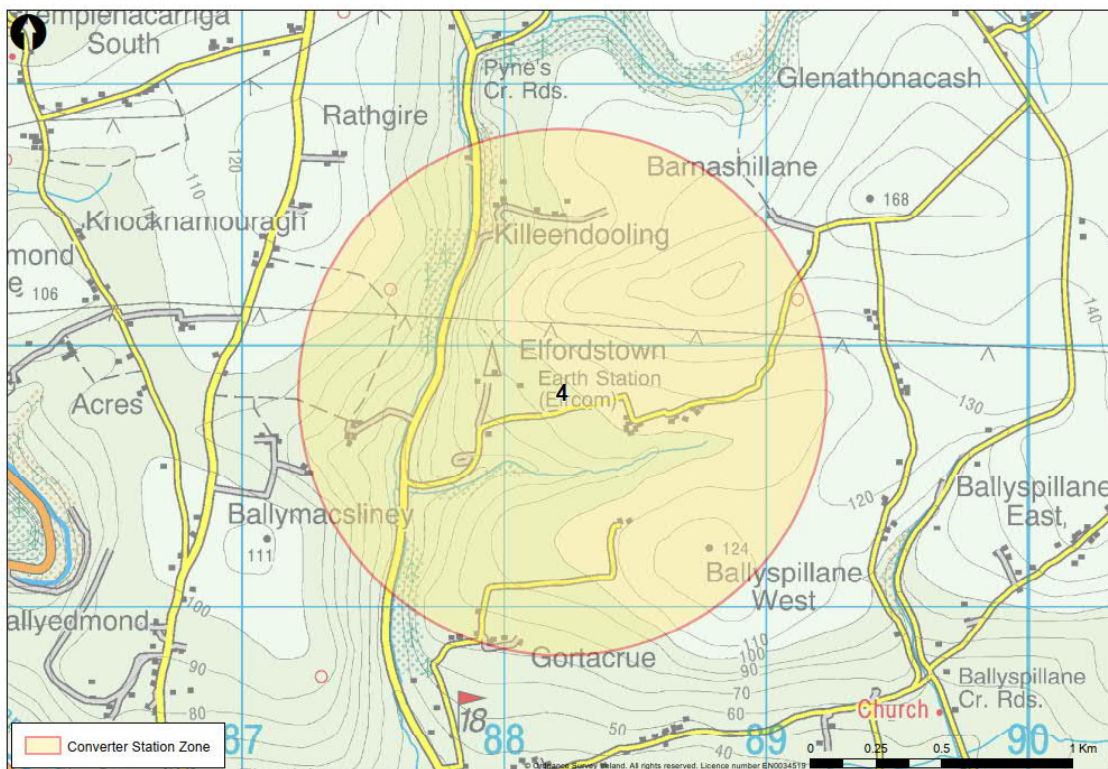


## 5.5 Converter Station Location Zone 4 - Elfordstown

### 5.5.1 Location

CSLZ 4, presented in Figure 23 below, is located in the townlands of Rathgire, Ballymacsliney, Gortacruce, Elfordstown, Killeendooling, Barnashillane within Templenacarriga ED and Ballyspillane ED, approximately 2.5 kilometres north of Midleton and east of the R626 Midleton to Rathcormack road. CSLZ 4 is located approximately 9 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone).

**Figure 23: Converter Station Location Zone 4 (Elfordstown)**



Source: Mott MacDonald

### 5.5.2 Land Use

CSLZ 4 can be characterised as improved agricultural grassland, although it does include Elfordstown earth station, a teleport operated by the National Space Centre.

A 220kV overhead transmission line runs in an east-west direction through the zone.

### 5.5.3 County Development Plan / Local Area Plans

According to the Volume 4 'Maps' of the *Cork County Development Plan 2014*, southern section of the zone is within Prominent and Strategic Metropolitan Greenbelt Areas.



#### 5.5.4 Soils and Geology

A ridge of rock outcrop runs in a north-south direction along the local road that traverses the zone. The surrounding area comprises sandstone and mudstone.

The aquifer across the majority of the zone is classified as a Regionally Important Aquifer - Karstified (diffuse). The groundwater vulnerability is classified as Extreme across the majority of the zone.

#### 5.5.5 Topography

There are steep elevations to the east and west of the zone that slope down towards a ridge and a valley/river that flows in a north-south direction through the western section of the zone.

According to DTM data for the zone, the elevations to the east slope from approximately 100 metres to 50 metres, while the westerly section slopes from approximately 130 metres to 50 metres. The National Space Centre is at an elevation of approximately 80 metres.

#### 5.5.6 Landscape and Visual

The National Space Centre potentially limits opportunities to screen a converter station. The zone is elevated and prominent. The majority of the zone is within an area designated by Cork County Council as High Value Landscape within the City Harbour and Estuary Landscape Character Type. The zone is also potentially overlooked by the S43 scenic route between Leamlara and Midleton (the R626).

#### 5.5.7 Biodiversity

Zone 4 is traversed by the Owennacurra\_040 (IE\_SW\_19O030500, Lee Cork Harbour and Youghal Hydro area) 3<sup>rd</sup> order river which runs parallel to a local road, approximately 4.6 kilometres upstream of Great Island Channel SAC and Cork Harbour SPA.

#### 5.5.8 Watercourses

As detailed above the zone is traversed by the Owennacurra\_040 (IE\_SW\_19O030500), within the Lee Cork Harbour and Youghal Hydro area, which flows through a valley parallel to a local road. The Owennacurra\_40 is classified as being of Moderate status.

#### 5.5.9 Flood Risk

Cork County Council mapping identifies the Owennacurra\_040 to the south of the zone as being at risk of fluvial flooding. The area corresponds to contours at approximately 55 metres.

#### 5.5.10 Cultural Heritage (Archaeological and Architectural Heritage)

A number of cultural heritage sites have been recorded within zone 4 including those listed below.

- Ringfort – rath (record number CO065-035----
- Enclosure (record number CO065-074----
- Ringfort – rath (record number CO065-069----
- Rath (record number CO065-070----
- Ringfort – rath (record number CO065-073----
- Ringfort – rath (record number CO065-075----
- Ringfort – rath (record number CO065-076----

- Rath (record number CO065-081----

It is considered that there is a significant risk of encountering previously unrecorded archaeological finds within this zone.

#### 5.5.11 Settlements

There are a small number of one-off houses within CSLZ 4.

According to Census 2016 data the total population in Templenacarriga ED in 2016 was 596. The total housing stock was 211, of which vacant households (excluding holiday homes) numbered 9.

According to Census 2016, the total population in Ballyspillane ED in 2016 was 352. The total housing stock was 129, of which vacant households (excluding holiday homes) numbered 9.

#### 5.5.12 Communities, Recreation and Tourism

The zone encompasses the National Space Centre and the East Cork Golf Club to the south. The Paddocks Holiday Village is located approximately 1 kilometre to the south of the zone.

#### 5.5.13 Nuisance (Traffic and Noise and Air Quality)

There are limited sensitive receptors within the northern section of this zone in the context of traffic, noise and dust nuisance impacts.

#### 5.5.14 Potential AC/DC Circuit Route Options

The road through the centre of this zone runs through a valley, the Owennacurra River flows adjacent to this road. A section of this river has been identified by Cork County Council as being at risk of flooding. Consultation with Cork County Council and TII and service providers would be required to determine the feasibility of routes through this zone.

#### 5.5.15 Technical Constraints

The road network in this zone is comprised of local roads. The potential routes for the AC and DC cable circuits are constrained by the difficulties in routing the circuits both through and around Middleton, as well as from the converter location zone to the connection point at Knockraha 220kV station. In particular, the local roads between the zone and Knockraha are narrow, tree lined lanes which are considered challenging to establish a route due to the width of the required trench, the presence of tree root systems which would be threatened by and could potentially damage the cable system and also, steep inclines which pose a difficulty to the cable installation, requiring additional bracing of the cabling to ensure it is supported.

The area within the zone does not appear to be serviced by water mains or foul sewerage, according to the available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station, however, there appears to be evidence electrical infrastructure in the area of the satellite and communications mast in the centre of the zone. According to the gas networks mapping, there are two gas transmission lines running through the zone.

A 220kV single circuit overhead line runs through the zone from east to west.

### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 44km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 2.3 cable faults over 40 year life.

### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.

#### 5.5.16 Deliverability

##### Project Plan Flexibility

The zone includes sloped land to the north, north west and south, and bedrock outcrop to the west of the zone which could impact the volume of civil/enabling works required for construction and the zone is also bisected by two high pressure gas pipelines all of which may limit the micro-siting of the converter station.

Potential route options for the AC cable include a number of river and bridge crossings which require further examination. The zone is located away from the main road routes between Midleton and Knockraha and it may therefore be difficult to establish a cable route for both AC and DC circuits with potential construction of new roads required. Routes to the west of this zone present narrow winding tree lined lanes with steep sections and bridge crossings with shallow deck space and sharp crossing angles. Obstacles encountered will be considerably more challenging for an AC route versus a DC. However, there are also limited routes available both through and around Midleton for the DC cable.

##### Permits and Wayleaves

The lack of route options for the AC cable circuit from the converter zone to the connection point and the potential requirement to construct new roadways will require additional wayleaves. The width of the AC cable route to the connection point, the potential re-construction of roads and bridges and possible HDD sections where that is not feasible for crossing of rivers all pose a risk to achieving consents.

The zone is bisected by two high pressure gas pipelines, limiting the siting of the converter station and potentially requiring permissions for construction work in proximity

Further, the road network is narrow with steep sections and sharp angles which cannot be accommodated by the minimum bend radius of the cable route will require that the route deviates from the road network in many places. This will require additional wayleaves.

##### Traffic and Noise Impact during Development

With the wider trench required for the AC cable circuit, the longer AC cable route and the potential additional civil works for any new roads will require increased construction traffic, traffic management and road closures between the converter station site and the connection point.

#### 5.5.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

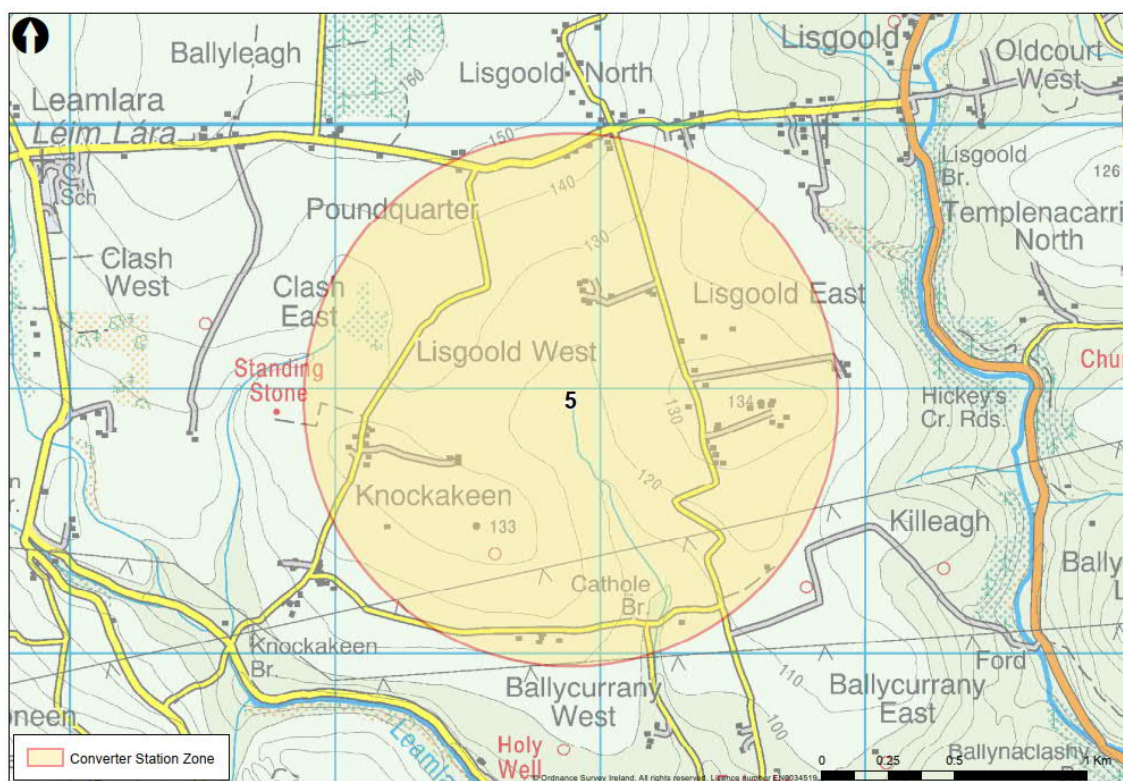
- CSLZ boundary is approximately 9 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.
- AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha. Steep sections pose additional challenge.
- Potentially limited flexibility in terms of micro-siting. The majority of the zone forms part of Prominent and Strategic Metropolitan Greenbelt Areas and is located within High Value Landscape.
- Prominent and elevated zone. Includes National Space Centre which may limit screening potential.
- Steep elevations to the east and west sloping down towards a ridge and a valley (with rock outcrops and a river flowing through it).

## 5.6 Converter Station Location Zone 5 - Lisgoold East

### 5.6.1 Location

CSLZ 5, presented in Figure 24 below, is located within the townlands of Lisgoold North, Lisgoold West, Lisgoold East, Poundquarter, Knockakeen and Ballycurrany West within Lisgoold ED, approximately 5 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone).

**Figure 24: Converter Station Location Zone 5 (Lisgoold East)**



Source: Mott MacDonald

### 5.6.2 Land Use

The zone can be characterised as improved agricultural grassland. Two overhead transmission lines traverse the southern section of this zone. Plans to re-open a quarry (Lackenbehy Quarry) in the area of Leamlara and the Watergrasshill-Carrigtwohill road were approved by Cork County Council on 2<sup>nd</sup> October 2018. It is understood however that the plans are currently under appeal to An Bord Pleanála.

### 5.6.3 County Development Plan / Local Area Plans

CSLZ 5 is located just outside of Lisgoold Development Boundary, as identified in the Local Area Plan for East Cork.

### 5.6.4 Soils and Geology

According to GSI mapping, the zone is underlain by Sandstones and Mudstones with bedrock outcrops and groundwater of extreme vulnerability in areas around the perimeter of the zone.

In general, the aquifer is categorised as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones.

#### 5.6.5 Topography

Zone 5 is elevated with what appear to be relatively gentle slopes across the area.

According to DTM data the zone is at an elevation of approximately 140 metres to the north, 120 metres to the south and through the centre of the zone dropping in a south eastly direction to approximately 100 metres to the south east towards Midleton. There is also a small elevated area up to 130 metres to the east.

#### 5.6.6 Landscape and Visual

This elevated zone is located approximately 400 metres to the west of the R626 Leamlara to Midleton scenic route. Micro-siting within the zone may however offer sufficient screening from the route. The southern section of this zone is within City harbour and Estuary Landscape Character Type, a High Value Landscape. The northern section is within Fissured Fertile Middleground, Landscape Character Type outside of the High Value Landscape.

#### 5.6.7 Biodiversity

CSLZ 5 is traversed by the Owenacurra River. The boundary of CSLZ 5 is located approximately 6 kilometres straight line distance from Great Island Chanel SAC/Cork Harbour SPA.

#### 5.6.8 Watercourses

The Owenacurra River (IE\_SW\_19O030400) flows through CSLZ 5 approximately 7 kilometres upstream of the Great Island Chanel SAC/Cork Harbour SPA. The river is classified as being of Good status.

#### 5.6.9 Flood Risk

There is no evidence of flood risk associated with the zone, further to a review of CFRAMs mapping.

#### 5.6.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are a significant number of archaeological sites within CSLZ 5 including

- Ringfort – rath (record number CO065-010----
- Ringfort – rath (record number CO065-011----
- Ringfort – rath (record number CO065-012----
- Ringfort – rath (record number CO065-046----
- Ringfort – rath (record number CO065-015----
- Ringfort – rath (record number CO065-013001-)
- Ringfort – rath (record number CO065-013002-)
- Lime Kiln (record number CO65-095---

The potential for encountering previously unrecorded archaeological finds in previously undeveloped lands could be considered to be high.



### 5.6.11 Settlements

The area within CSLZ 5 is sparsely populated.

According to CSO data, the total population in Lisgoold ED in 2016 was 996. The total housing stock was 331, of which vacant households (excluding holiday homes) numbered 26.

### 5.6.12 Communities, Recreation and Tourism

Community associations, recreational activities and amenities, facilities and organisations in the area include:-

- Lisgoold Community Centre Committee
- Lisgoold/Leamlara Community Council
- Lisgoold GAA Club
- St. John the Baptist Church
- Lisgoold Community Childcare Centre
- Brookfield Care Centre

### 5.6.13 Nuisance (Traffic and Noise and Air Quality)

There appear to be limited sensitive receptors in this zone, and in particular in the western section of this zone in terms of nuisance impacts.

### 5.6.14 Potential AC/DC Circuit Route Options

The route to the south is parallel to the Owenacurra River, passes through Leamlara Woods pNHA (site code 001064) and by Glenview House (RPS ID – 01022). A relatively straight road in the eastern section of CSLZ 5 may be a feasible connection route, however, consultation with Cork County Council and TII and service providers would be required to determine the feasibility of routes through this zone.

### 5.6.15 Technical Constraints

The road network at this zone is comprised of local roads. Potential routes for the AC cable circuit, in particular, may be constrained by the width of these roads towards the connection point at Knockraha 220kV station.

The area within the zone appears to be serviced by a water main with no foul sewerage, according to the available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. According to the gas networks mapping, there is no gas infrastructure within the zone.

Both a 220kV and 110kV single circuit overhead line runs through the south of the zone.

### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 30km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.6 cable faults over 40 year life.

### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area



in the future. Further, the length of the AC route is at the limit at which installation of reactive compensation equipment will not be required. Should the route length increase, reactive compensation equipment will be necessary.

### 5.6.16 Deliverability

#### Project Plan Flexibility

Potential route options for the AC cable routes present narrow winding tree lined lanes with steep sections, sharp bends and bridge crossings with a sharp crossing angle which requires further examination. The emerging preferred route travels north at Leamlara and turns south before Ballinaglogh to the connection point from the north of the zone, however, part of this route is tree lined and narrow in places. Obstacles encountered will be considerably more challenging for an AC route versus a DC. All potential DC routes to this zone will present challenges at the rail crossing as the bridge decks are shallow and will not accommodate the full depth of the trench.

#### Permits and Wayleaves

The zone is located away from the main road routes and it may therefore be difficult to establish a cable route for both AC and DC circuits given the lack of roads within the zone which may require construction of new roads and additional wayleaves as a result. The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to reinstate or re-construct roads and the potential impact on trees along the roads also pose a risk to achieving consents.

#### Traffic and Noise Impact during Development

The wider trench required for the AC cable circuit, the long DC cable route and the potential additional civil works for any new roads will require increased construction traffic, traffic management and road closures to the converter station site and the connection point.

### 5.6.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

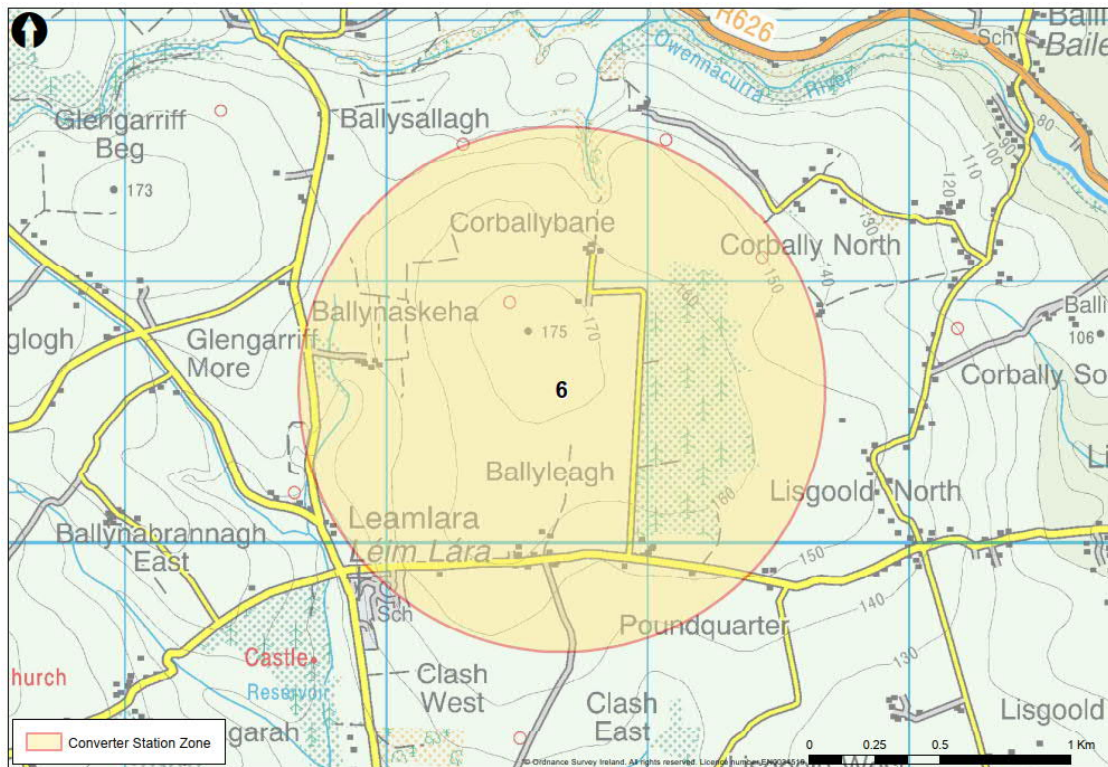
- CSLZ boundary is approximately 5 kilometres straight line distance from Knockraha 220kV station, longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.
- AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha.
- An elevated zone in proximity to a scenic route and partially located within a High Value Landscape.
- Located in proximity to the Lisgoold Development Boundary.

## 5.7 Converter Station Location Zone 6 - Leamlara

### 5.7.1 Location

CSLZ 6, presented in Figure 25 below, is located within the townlands of Ballyleagh, Corballybane and Ballynaskena within Lisgoold ED, approximately 4 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone).

**Figure 25: Converter Station Location Zone 6 (Leamlara)**



Source: Mott MacDonald

### 5.7.2 Land Use

The zone includes a large area of forestry (conifer plantation). The surrounding area can be characterised as improved agricultural grassland/pastures.

### 5.7.3 County Development Plan / Local Area Plans

The south western section of CSLZ 6 incorporates the Leamlara Development Local Area Plan (LAP) Boundary for up to 10 dwellings. This LAP boundary is also identified as being partially at risk of fluvial flooding.

### 5.7.4 Soils and Geology

According to GSI mapping, a band of sandstone with mudstone and siltstone runs through the centre of the zone with mudstone and sandstone to the north and south and bedrock outcrops along the western perimeter.

The aquifer is categorised as a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones. Groundwater of extreme vulnerability is located around the perimeter of the zone.

#### 5.7.5 Topography

According to DTM data, this zone rises in elevation from a height of approximately 130 metres to a peak of 170 metres in the approximate centre of the zone. The zone includes a forested area to the east which appears to be relatively flat at an elevation of approximately 160 metres. The zone drops steeply in elevation in a northerly direction from approximately 160 metres to 130 metres.

#### 5.7.6 Landscape and Visual

The elevated zone is located approximately 1.5 kilometres to the west of the Leamlara to Middleton scenic route, which rises in elevation from approximately 80 metres to 110 metres in proximity to the zone. While the forested area may offer sufficient screening, it is noted that the surrounding area drops in elevation toward the R626 Leamlara to Middleton scenic route, approximately 1.9 kilometres to the east of the forested area. CSLZ 6 is within Fissured Fertile Middleground, Landscape Character Type.

#### 5.7.7 Biodiversity

CSLZ 6 is located approximately 1.7 kilometres north of Leamlara Wood pNHA. Two tributaries of the Owenacurra River traverse CSLZ 6.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation.

#### 5.7.8 Watercourses

Two tributaries of the Owenacurra River traverse CSLZ 6. One flows in a north/south direction parallel to the local road in the western section of the zone (IE\_SW\_19O030400) and is classified as being of Good status. The second tributary (IE\_SW\_19O030220) flows in a south/north direction to the north of the zone and is classified as being of High status.

#### 5.7.9 Flood Risk

There is no evidence of flood risk associated within the zone, further to a review of CFRAMs mapping, although the area along the south-western perimeter has been identified as being at risk of fluvial flooding.

#### 5.7.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are a number of archaeological sites within CSLZ 6 including

- Ringfort – rath (record number CO064-038----
- Ringfort – rath (record number CO064-039----
- Ringfort – rath (record number CO064-040----

The potential for encountering previously unrecorded archaeological finds in previously undeveloped lands should be considered to be high.

In addition to construction works, tree felling operations have potential for direct or indirect disturbance or impact to archaeological sites and monuments.

### 5.7.11 Settlements

CSLZ 6 is sparsely populated with ribbon type development along local roads.

According to CSO data, the total population in Lisgoold ED in 2016 was 996. The total housing stock was 331, of which vacant households (excluding holiday homes) numbered 26.

### 5.7.12 Communities, Recreation and Tourism

Community associations, recreational activities and amenities, facilities and organisations in the area include:-

- Lisgoold Community Centre Committee
- Lisgoold/Leamlara Community Council
- Lackenbehy Action Group
- Sacred Heart Church and Grotto
- Leamlara Montessori School
- Bishop Aherne National School
- Brookfield Care Centre
- Lisgoold GAA pitch is located outside of the zone to the immediate east.

### 5.7.13 Nuisance (Traffic and Noise and Air Quality)

This zone potentially includes a number of sensitive receptors in terms of nuisance impacts.

### 5.7.14 Potential AC/DC Circuit Route Options

There are a number of roads within this zone which may be suitable for circuit routes, however, consultation with Cork County Council and TII and service providers would be required to determine the feasibility of routes through this zone.

It is noted that there appears to be an access route adjacent to the forested area, approximately 5.4 kilometres from Knockraha 220kV station along a relatively straight road, which includes a number of water crossings. The area around the forest access route and the forest itself do not include any recorded cultural heritage sites.

### 5.7.15 Technical Constraints

The road network at this zone encompasses local roads. The potential routes for the AC and DC cable circuits are constrained by the lack of roads within the zone. There is a risk that both the AC and DC circuits would have to share the same road and adequate space for both trenches may not be available.

The zone appears to be serviced by a water main to the south of the zone with no foul sewerage, according to the available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. According to the gas networks mapping, there is no gas infrastructure within the zone.

There are no HV overhead lines in the area.

### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 30km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.6 cable faults over 40 year life.

### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.

### 5.7.16 Deliverability

#### Project Plan Flexibility

Potential route options for the AC cable routes present narrow winding tree lined lanes with steep sections, sharp bends and bridge crossings with a sharp crossing angle which require further examination. The emerging preferred route travels north at Leamlara and turns south before Ballinaglogh to the connection point from the north of the zone, however, part of this route is tree lined and narrow in places. Obstacles encountered will be considerably more challenging for an AC route versus a DC. All potential DC routes to this zone will present challenges at the rail crossing as the bridge decks are shallow and will not accommodate the full depth of the trench.

#### Permits and Wayleaves

The zone is located close to roads that may offer opportunities to establish a cable route. However, it may be difficult to establish a cable route for both AC and DC circuits given the lack of roads within the zone which may require construction of new roads and additional wayleaves as a result.

Accessibility of construction traffic to the zone may be limited and challenging due to the local road network, which will need further examination.

The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to reinstate or re-construct roads and the potential impact on trees along the roads also pose a risk to achieving consents.

#### Traffic and Noise Impact during Development

The wider trench required for the AC cable circuit, the longer DC cable route and the potential additional civil works for any new roads will require increased construction traffic, traffic management and road closures to the converter station site and the connection point.

### 5.7.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- CSLZ boundary is approximately 4 kilometres straight line distance from Knockraha 220kV station, however longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.
- Limited road network in the zone could result in both AC and DC circuits routes in the same road - adequate space may not be available.
- Incorporates part of the Leamlara Development Local Area Plan Boundary
- An elevated zone. The area of forestry may offer screening but change of land use consent would be required.
- Potential for ecological and cultural heritage impacts associated with tree felling.



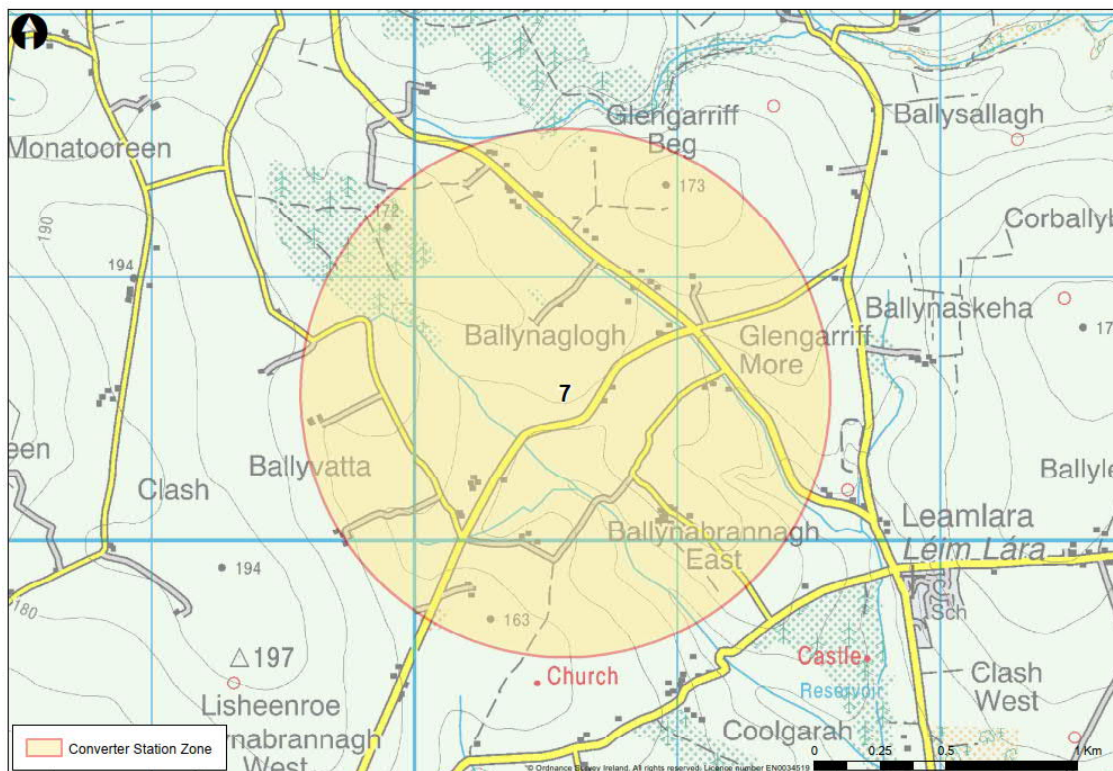
## 5.8 Converter Station Location Zone 7 - Ballynaglough

### 5.8.1 Location

CSLZ 7, presented in Figure 26 below, is located within the townlands of Ballyvatta, Ballynaglough, Glengarriff More and Ballynabrannagh East within Lisgoold ED.

CSLZ 7 is located a straight-line distance of approximately 3 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone).

**Figure 26: Converter Station Location Zone 7 (Ballynaglough)**



Source: Mott MacDonald

### 5.8.2 Land Use

CSLZ 7 can be characterised as improved agricultural grassland/pastures with an area of forestry (conifer plantation) in the north-western section. A school is located immediately outside of the zone in Leamlara.

CSLZ 14, refer to Section 5.15, wholly encompasses the area of forestry referred to above.

### 5.8.3 County Development Plan / Local Area Plans

CSLZ 7 is located north west of the Leamlara Development Local Area Plan Boundary for up to 10 dwellings and within the Municipal District of East Cork.

No area specific policies were identified further to a review of Municipal District LAP mapping for the zone.

#### 5.8.4 Soils and Geology

According to GSI mapping, the zone is located within Sandstone Tills underlain by a Locally Important Aquifer with bedrock which is Moderately Productive only in Local Zones. There are areas of extreme vulnerability across the majority of the zone with bedrock outcrops indicated along sections of the road network within the zone.

#### 5.8.5 Topography

CSLZ 7 is elevated and sloping. According to DTM data, the zone rises in elevation in a north westerly direction from approximately 140 metres to approximately 170 metres across the zone.

#### 5.8.6 Landscape and Visual

CSLZ 7 is located within the Fissured Fertile Middleground Landscape Character Area. The majority of this zone appears to be elevated and exposed in terms of potential visual impacts.

#### 5.8.7 Biodiversity

The zone is located approximately 6.8 kilometres straight line distance from Cork Harbour SPA and Great Island Chanel SAC.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation. The area of forestry is wholly encompassed under CSLZ 14 and is discussed in further detail in Section 5.15.

#### 5.8.8 Watercourses

The zone is traversed by three tributaries of the Owenacurra River (IE\_SW\_19O030400) that are classified as being at Good status.

#### 5.8.9 Flood Risk

Cork County Council has identified the northernmost tributary in the eastern section of the zone as being at risk of fluvial flooding, up to an elevation of approximately 155 metres.

#### 5.8.10 Cultural Heritage (Archaeological and Architectural Heritage)

CSLZ 7 includes three Ringforts / Rathes (CO064-032---- and CO064-035---- and CO064-037---). Leamlara Castle (CO064-109002-) is located outside of the zone to the south east. The potential for encountering previously unrecorded archaeological finds in previously undeveloped lands could be considered to be high.

#### 5.8.11 Settlements

There are ribbon type developments along the local roads within CSLZ 7.

According to CSO data, the total population in Lisgoold ED in 2016 was 996. The total housing stock was 331, of which vacant households (excluding holiday homes) numbered 26.

#### 5.8.12 Communities, Recreation and Tourism

Community associations, recreational activities and amenities, facilities and organisations in the area include:-



- Lisgoold Community Centre Committee
- Lisgoold/Leamlara Community Council
- Sacred Heart Church and Grotto
- Leamlara Montessori School
- Bishop Aherne National School
- Brookfield Care Centre

#### 5.8.13 Nuisance (Traffic and Noise and Air Quality)

Background noise levels are expected to be low in this area. This zone potentially includes a limited number of sensitive receptors in terms of nuisance impacts.

#### 5.8.14 Potential AC/DC Circuit Route Options

There are a number of local roads traversing the zone. Consultation with Cork County Council and TII and service providers would be required to determine the feasibility of routes through this zone.

#### 5.8.15 Technical Constraints

The road network in this zone encompasses local roads with a mix of single and double lanes which bisects the zone. There appears to be potential routes for both the AC and DC cable circuits. However, further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase.

The area within the zone does not appear to be serviced by a water main, however, water mains are installed outside the zone in the Leamlara village to the east. There appears to be some electrical distribution infrastructure in the area for supply of the converter station. According to the gas networks mapping, there is no gas infrastructure within the zone.

There are no HV overhead lines in the area.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 23km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.2 cable faults over 40 year life.

#### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will not require the installation of reactive compensation equipment.

#### 5.8.16 Deliverability

##### Project Plan Flexibility

The land slopes to the south and the severity of the slopes is greater in the southern area of the zone, and there is a small amount of bedrock outcrop in the east and west of the zone which may impact the volume of civil/enabling works required for construction and which may limit the micro-siting of the converter station.

There are narrow tree lined roads to the south east of the zone however this route could be used for the narrower DC circuit.

With a wider trench required for the AC cable circuit, the proximity of the converter station to Knockraha 220kV station is advantageous in terms of a shorter AC cable route with the emerging preferred route heading south west into the connection point which is tree lined in a limited number of places.

#### Permits and Wayleaves

This zone is bisected by a local road which may reduce the amount of additional road needed within the zone to accommodate the cable routes, thereby potentially reducing the number of wayleaves required.

#### Traffic and Noise Impact during Development

The wider trench required for the AC cable circuit, the longer DC cable route will require increased traffic management and road closures to the converter station site and the connection point.

#### 5.8.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

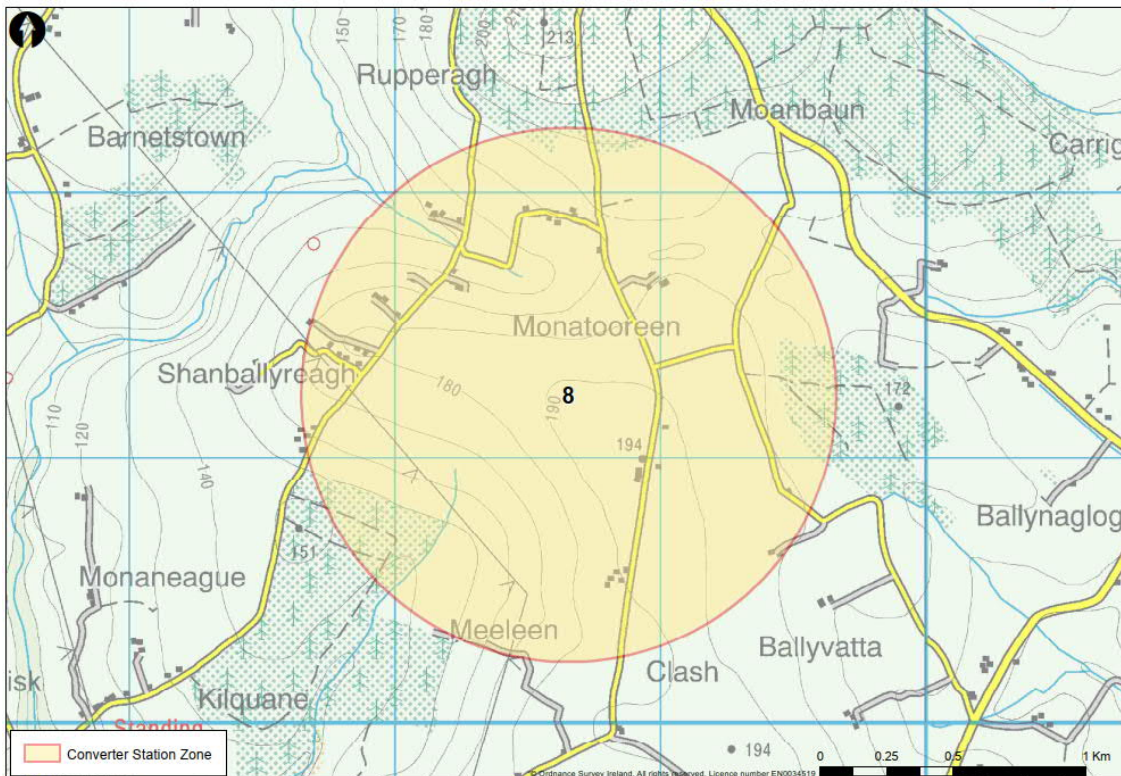
- CSLZ boundary is approximately 3 kilometres straight line distance from Knockraha 220kV station. In terms of cable route length, it is very likely that an AC underground cable could be installed without the requirement for reactive compensation.
- The road network in the area appears to offer opportunities for independent routes for both AC and DC cable routes.
- Majority of zone elevated and exposed.
- Includes an area of forestry which may offer screening potential (considered under CSLZ 14).
- Potential for ecological and cultural heritage impacts associated with tree felling.

## 5.9 Converter Station Location Zone 8 - Monatooreen

### 5.9.1 Location

CSLZ 8, presented in Figure 27 below, is located within the townlands of Clash, Meeleen, Shanballyreagh and Monatooreen within Knockraha ED and the townland of Ballynavatta within Lisgould ED. The boundary of CSLZ 8 is located a straight-line distance of approximately 2 kilometres from Knockraha 220kV station.

**Figure 27: Converter Station Location Zone 8 (Monatooreen)**



Source: Mott MacDonald

### 5.9.2 Land Use

CSLZ 8 can be characterised as improved agricultural grassland/pastures with an area of forestry (conifer plantation) in the south western section. A 110kV transmission line traverses the zone to the south west.

CSLZ 14, refer to Section 5.15, wholly encompasses the area of forestry referred to above.

### 5.9.3 County Development Plan / Local Area Plans

CSLZ 8 is located within the County Metropolitan Cork Strategic Planning Area and the Municipal Districts of Cobh – Glanmire and East Cork.

No area specific policies were identified further to a review of Municipal District LAP mapping for the zone.

#### 5.9.4 Soils and Geology

According to GSI mapping, the zone is located within sandstone with rock outcrops to the north and east. The zone is underlain by a Locally Important Aquifer with bedrock which is Moderately Productive only in Local Zones of high vulnerability. There are areas of extreme vulnerability corresponding to the rock outcrops.

#### 5.9.5 Topography

CSLZ 8 is exposed with steep slopes across this elevated zone.

According to DTM data, the zone rises steeply in elevation in an easterly direction before dropping gently in elevation in a south easterly direction to approximately 180 metres. The hill in the centre of the zone is approximately 190 metres. The zone to the southeast appears to be relatively flat at approximately 180 metres.

#### 5.9.6 Landscape and Visual

Zone 8 is located within the Fissured Fertile Middleground Landscape Character Area. Due to the topography of this area it is considered that significant visual impacts could arise from development within this zone.

#### 5.9.7 Biodiversity

The zone is located approximately 7 kilometres straight line distance from Cork Harbour SPA and Great Island Chanel SAC.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation. The area of forestry is wholly encompassed under CSLZ 14 and is discussed in further detail in, Section 5.15.

#### 5.9.8 Watercourses

Two tributaries of the Butlerstown River (IE\_SW\_19B060500), classified as being of High status, flow from the north west and south west of the zone.

#### 5.9.9 Flood Risk

There is no evidence of flood risk within the zone, further to a review of CFRAMs mapping. Cork County Council has identified the area outside of the zone to the north west as being at risk of fluvial flooding.

#### 5.9.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are no recorded cultural heritage features within the boundary of this zone.

#### 5.9.11 Settlements

CSLZ 8 is sparsely populated with ribbon type development along local roads.

According to CSO data, the total population in Knockraha ED in 2016 was 1,462. The total housing stock was 488, of which vacant households (excluding holiday homes) numbered 23.

The total population in Lisgoold ED in 2016 was 996. The total housing stock was 331, of which vacant households (excluding holiday homes) numbered 26.

#### 5.9.12 Communities, Recreation and Tourism

Community Groups and / or recreational and / or tourist facilities have not been identified within the zone itself, however, it can be expected that facilities and organisations in the wider area, including those in the area of Knockraha, are utilised, for example:-

- Knockraha Community Association Ltd.
- St. Mary's Church
- St. Cuain's Well, Holly Well
- Knockraha National School
- The Old School House Childcare Facility
- A1-K9 Dog Training Centre and Boarding Kennel
- Ballyspillane West and Surrounding Area Action Group

#### 5.9.13 Nuisance (Traffic and Noise and Air Quality)

Background noise levels are expected to be low in this area. This zone potentially includes a limited number of sensitive receptors in terms of nuisance impacts.

#### 5.9.14 Potential AC/DC Circuit Route Options

There are a number of local roads traversing the zone, although the ESBI Feasibility Study did not identify a potential route within this zone. Consultation with Cork County Council and TII and service providers would be required to determine the feasibility of routes through this zone.

#### 5.9.15 Technical Constraints

The road network at this zone encompasses local roads. There appears to be potential routes for both the AC and DC cable circuits. However, these roads appear to be narrow and therefore further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase.

There is a water main on the western edge of the zone with no evidence of foul sewerage from available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. There doesn't appear to be any gas infrastructure within the zone.

A 110kV single circuit overhead line runs through the south western side of the zone.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 29km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.5 cable faults over 40 year life.

#### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will not require the installation of reactive compensation equipment.

### 5.9.16 Deliverability

#### Project Plan Flexibility

The land slopes in the western area of the zone which may impact the volume of civil/enabling works required for construction and which may limit the micro-siting of the converter station.

There are narrow tree lined roads to the east of the zone however this route could be used for the narrower DC circuit but may require additional roadway on approach to the zone.

With a wider trench required for the AC cable circuit, the proximity of the converter station to Knockraha 220kV station is advantageous in terms of a short AC cable route with the emerging preferred route heading south into the connection point, however, this route is very narrow in places with some sharp bends and some large trees on both sides of the road. An alternative AC route could be brought further west and then south through Knockraha village, however, this will increase the length of the AC route and any obstacles encountered will be considerably more challenging for an AC route versus a DC given that there are tree lined roads on approach from the west to the connection point.

Accessibility of construction traffic to the zone may be limited and challenging due to the local road network, which will need further examination.

#### Permits and Wayleaves

The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to reinstate or re-construct roads and the potential impact on trees along the roads also pose a risk to achieving consents.

Dependent on the micro-siting of the converter station some additional road construction may be required for the cable routes in order to pick up the existing road network which may require additional wayleaves.

#### Traffic and Noise Impact during Development

The wider trench required for the AC cable circuit, the long DC cable route will require increased traffic management and road closures to the converter station site and the connection point.

### 5.9.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- Boundary is approximately 2 kilometres straight line distance from Knockraha 220kV station. In terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.
- The road network in the zone is narrow however appears to offer opportunities for establishing AC and DC cable routes.
- Majority of zone is elevated and exposed with potentially limited flexibility in terms of micro-siting.
- Includes an area of forest which may offer screening potential (considered under CSLZ 14).
- Potential for ecological and cultural heritage impacts associated with tree felling.

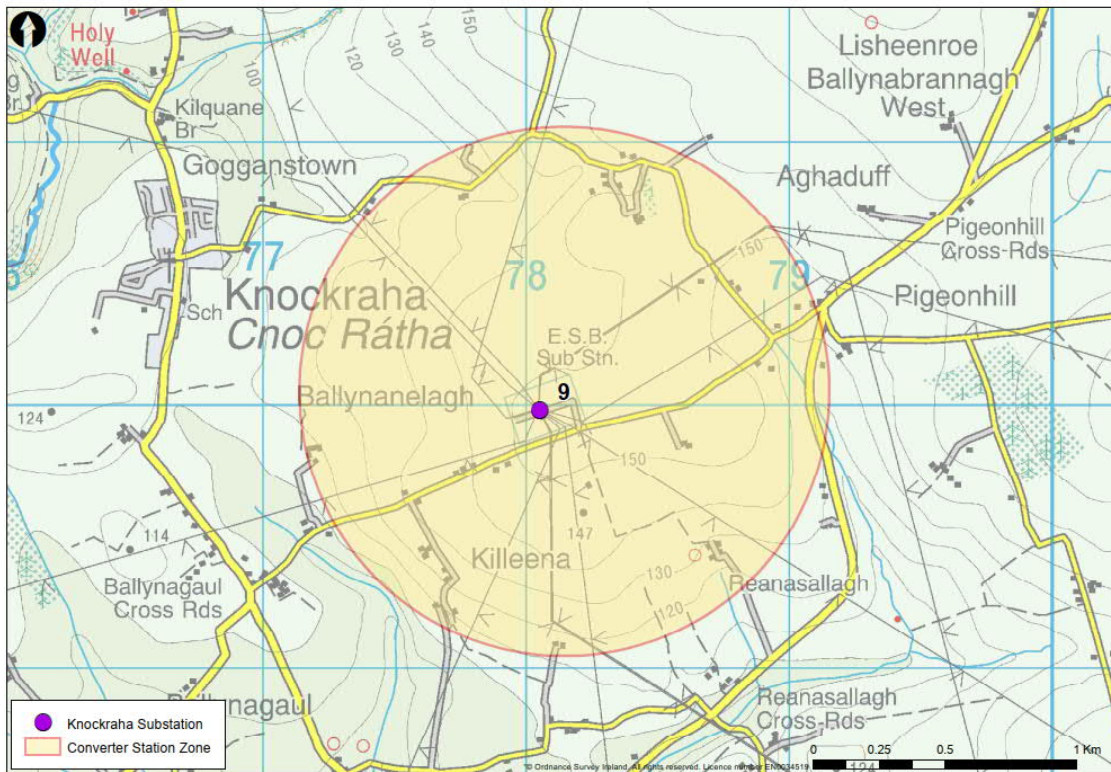


## 5.10 Converter Station Location Zone 9 - Knockraha

### 5.10.1 Location

CSLZ 9, presented in Figure 28 below, is centred around Knockraha 220kV station and includes the townlands of Ballynanelagh, Ballyloohane, Killeena and Knockraha East, all of which are located within Knockraha ED.

**Figure 28: Converter Station Location Zone 9 (Knockraha)**



Source: Mott MacDonald

### 5.10.2 Land Use

The zone includes Knockraha 220kV station. Numerous overhead transmission lines radiate from the north, south, east and west of the substation. The surrounding area can be characterised as pasture. The population centre of Knockraha is located outside of the zone, to the north-west.

### 5.10.3 County Development Plan / Local Area Plans

CSLZ 9 is located within the Municipal Districts of Cobh – Glanmire.

The area immediately to the north west of CSLZ 9 is zoned for community and open spaces, including a road/walkway, potentially associated with a school.

No area specific policies were identified further to a review of Municipal District LAP mapping for the zone.



#### 5.10.4 Soils and Geology

According to GSI mapping, the zone is located within an area of sandstone. Made ground is shown in the area of the substation. The zone is underlain by a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones. Bedrock is indicated along the road that traverses the zone.

#### 5.10.5 Topography

CSLZ 9 is elevated and exposed. Knockraha 220kV station itself is located on top of an elevated area.

There are steep elevations to the east, west and south, sloping in a north easterly direction. The substation is approximately 150 metres in elevation with steep slopes in a south westerly direction to approximately 110 metres.

#### 5.10.6 Landscape and Visual

CSLZ 9 is located within the Fissured Fertile Middleground Landscape Character Area, approximately 900 metres from an area designated by Cork County Council as being a High Value Landscape. Views of developments in this zone would be taken in the context of the established transmission infrastructure. The elevated and exposed nature of the zone would limit visual screening opportunities.

#### 5.10.7 Biodiversity

The zone is located approximately 3.8 kilometres straight line distance from Cork Harbour SPA and Great Island Chanel SAC.

#### 5.10.8 Watercourses

Two tributaries of the Butlerstown River (IE\_SW\_19B060800), at Good status, traverse the zone to the south and east.

#### 5.10.9 Flood Risk

There is a small area at risk of pluvial flooding identified in the northern section of the zone, according to a review of CFRAMs mapping.

#### 5.10.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are a significant number of archaeological sites within the area of CSLZ 9 including

- Ringfort – rath (record number CO064-028----
- Ringfort – rath (record number CO064-074----
- Enclosure (record number CO064-075----
- Ringfort – rath (record number CO064-078----

The potential for encountering previously unrecorded archaeological finds in previously undeveloped lands could be considered to be high.

#### 5.10.11 Settlements

According to CSO data, the total population in Knockraha ED in 2016 1,462. The total housing stock was 488, of which vacant households (excluding holiday homes) numbered 23.

#### 5.10.12 Communities, Recreation and Tourism

Community associations, recreational activities and amenities, facilities and organisations in the area include:-

- Knockraha Community Association Ltd.
- St. Mary's Church
- St. Cuain's Well, Holly Well
- Knockraha National School
- The Old School House Childcare Facility

#### 5.10.13 Nuisance (Traffic and Noise and Air Quality)

It is understood that the area immediately surrounding Knockraha 220kV station is particularly sensitive to potential nuisance impacts with concerns having been raised previously by local community groups in relation to socio-economic impacts, in particular, associated with transmission infrastructure projects.

#### 5.10.14 Potential AC/DC Circuit Route Options

The ESBI Feasibility Study identified a potential access route from the east. It is however considered that access from the north and north east may also be feasible, subject to consultation with Cork County Council and TII and service providers.

#### 5.10.15 Technical Constraints

The road network at this zone encompasses local roads. There appears to be potential routes for both the AC and DC cable circuits. However, these roads appear to be narrow and therefore further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase. Within this zone, the AC circuit will be short and the risk associated with establishing the wider trench width will be low.

There does not appear to be any water mains within the zone from available services mapping. There should be adequate electrical distribution infrastructure in the area for supply of the converter station. There doesn't appear to be any gas infrastructure within the zone.

Knockraha 220kV station is centred within the zone with multiple overhead line circuits converging at the substation.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 21km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.1 cable faults over 40 year life.

#### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will not require the installation of reactive compensation equipment.

### 5.10.16 Deliverability

#### Project Plan Flexibility

With a wider trench required for the AC cable circuit, the proximity of the converter station to Knockraha 220kV station is advantageous in terms of a shorter AC cable route. However, there are numerous overhead lines (OHLs) originating from Knockraha 220kV station that traverse the zone. Due to their footprint and clearance requirements, these OHLs will reduce the number of possible converter sites within the zone and will reduce the flexibility associated with some particular sites.

#### Permits and Wayleaves

It's possible that construction of new roads may be required requiring additional wayleaves. However, the scale of any new road construction may be greatly reduced given the close proximity to the connection point and that the zone is bisected by a local road.

Although the siting of the converter station may be constrained by the presence of overhead lines, there may also be a risk to consents where the converter station is in proximity to an HV overhead line.

#### Traffic and Noise Impact during Development

The length of DC circuit is greater than the AC which makes overcoming obstacles along the route more manageable coupled with the proximity of the zone to the connection point, should help reduce the scale of traffic management required. This option has been assessed as Low-Moderate.

### 5.10.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

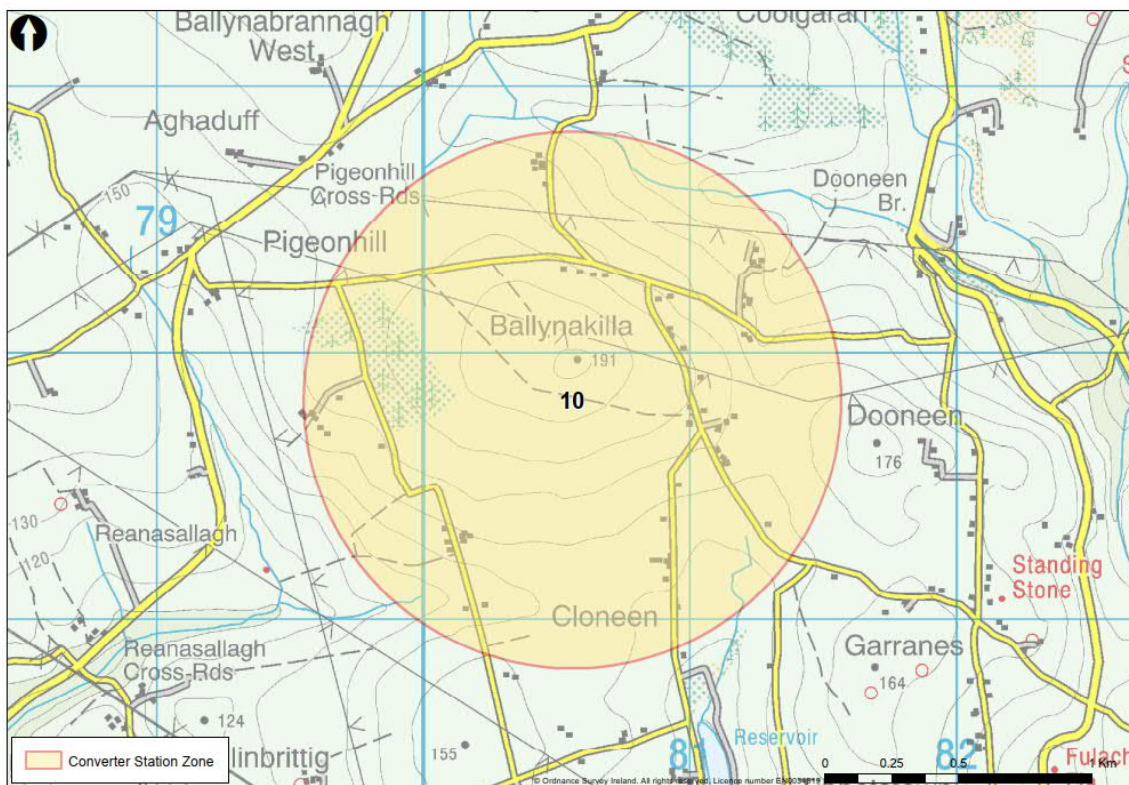
- Incorporates Knockraha 220kV station. An underground AC circuit will not require reactive compensation.
- The length of the wider cable trench (AC) is short and the associated risk of establishing a route is low.
- Existing infrastructure may limit flexibility in terms of micro-siting opportunities.
- Elevated and exposed zone with potentially limited screening opportunities.

## 5.11 Converter Station Location Zone 10 - Pigeon Hill

### 5.11.1 Location

CSLZ 10, presented in Figure 29 below, is located east of Knockraha 220kV station at a straight line distance of approximately 1 kilometre distance from Knockraha (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone) substation within the townlands of Ballynakilla (Lisgoold ED) and Cloneen (Carrigtwohill ED) Killeena (Knockraha ED), Pigeonhill (Knockraha ED), Tibbotstown (Carrigtwohill ED), and Garranes (Carrigtwohill ED).

**Figure 29: Converter Station Location Zone 10 (Pigeon Hill)**



Source: Mott MacDonald

### 5.11.2 Land Use

In general, the area within the zone can be categorised as improved agriculture. The zone includes forestry (conifer plantation), in the townland of Cloneen and two overhead transmission lines that traverse the zone to the north.

Change of use planning consent would be required to facilitate development within the commercial forested area.

### 5.11.3 County Development Plan / Local Area Plans

CSLZ 10 is located within the County Metropolitan Cork Strategic Planning Area and the Municipal Districts of Cobh – Glanmire and East Cork.

No area specific policies were identified further to a review of Municipal District LAP mapping for the zone.

#### 5.11.4 Soils and Geology

CSLZ 10 is located within an area of sandstone, mudstone and siltstone with rock outcrops to the east corresponding to the highest elevations in the zone.

The aquifer is underlain by a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones Aquifer and of high vulnerability. Areas of Extreme vulnerability correspond to rock outcrops.

#### 5.11.5 Topography

CSLZ 10 is located within an elevated area rising in all directions in elevation from approximately 130 metres to approximately 180 metres in the centre of the zone. The slopes generally decrease in a southerly-directions.

#### 5.11.6 Landscape and Visual

CSLZ 10 is located within the Fissured Fertile Middleground Landscape Character Area, approximately 150 metres north of the area of High Value Landscape.

The forested area to the north west is located at elevations between approximately 160 and 170 metres. The forest itself and the surrounding topography potentially offer good screening potential although this will require more detailed investigation, in particular in terms of the south sloping elevations and the available screening.

#### 5.11.7 Biodiversity

The zone is located approximately 4 kilometres straight line distance from Cork Harbour SPA and Great Island Chanel SAC.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation.

#### 5.11.8 Watercourses

The Owenacurra River traverses the zone to the north. The Buttlerstown River (IE\_SW\_19B060800) flows to the west of the zone. Both are classified as being of Good status.

#### 5.11.9 Flood Risk

Cork County Council has identified the Owenacurra River immediately outside of the zone to the north east as being at risk of fluvial flooding.

#### 5.11.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are no recorded cultural heritage features within the boundary of this zone. There is one archaeological site bordering the eastern perimeter of this zone; CO064-090---- Fulacht fia. There is potential however to encounter previously unrecorded archaeological finds in undeveloped lands. In addition to construction works, tree felling operations have potential for direct or indirect disturbance or impact to archaeological sites and monuments.

#### 5.11.11 Settlements

According to CSO data, the total population in Knockraha ED in 2016 1,462. The total housing stock was 488, of which vacant households (excluding holiday homes) numbered 23.

The total population in Lisgoold ED in 2016 was 996. The total housing stock was 331, of which vacant households (excluding holiday homes) numbered 26. The total population in Carrigtwohill (ED) in 2016 was 7,334. The total housing stock was 2,657, of which vacant households (excluding holiday homes) numbered 147.

#### 5.11.12 Communities, Recreation and Tourism

Community associations, recreational activities and amenities, facilities and organisations in the area include:-

- Knockraha Community Association Ltd.
- Lisgoold Community Centre Committee
- Brookfield Care Centre
- Lisgoold/Leamlara Community Council

#### 5.11.13 Nuisance (Traffic and Noise and Air Quality)

Background noise levels are expected to be low in this area. The western section of this zone potentially includes a limited number of sensitive receptors in terms of nuisance impacts.

#### 5.11.14 Potential AC/DC Circuit Route Options

There is a potentially feasible circuit route to the north of the forested area in the western section of this zone.

#### 5.11.15 Technical Constraints

The road network in this zone encompasses local roads with a mix of single and double lanes leading up from the N25 at Carrigtwohill. There appears to be potential routes for both the AC and DC cable circuits. However, further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase. It is likely that due to the proximity to Knockraha 220kV station, the AC cable route will be less than 5km and reactive compensation will not be required.

The area within the zone does not appear to be serviced by a water main, however, a water main is installed outside the zone to the south fed from a local reservoir. There appears to be some electrical distribution infrastructure in the area for supply of the converter station. According to the gas networks mapping, there is no gas infrastructure within the zone.

Both a 220kV and a 110kV single circuit overhead line runs through the north half of the zone.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 24km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.3 cable faults over 40 year life.



### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will not require the installation of reactive compensation equipment.

### 5.11.16 Deliverability

#### Project Plan Flexibility

Sloped land to the north, north west and south of the zone and bedrock outcrop to the east of the zone which could impact the volume of civil/enabling works required for construction and which may limit the micro-siting of the converter station.

With a wider trench required for the AC cable circuit, the proximity of the converter station to Knockraha 220kV station is advantageous in terms of a shorter AC cable route. However, there are two overhead lines (OHLs) originating from Knockraha 220kV station that traverse the zone. Due to their footprint and clearance requirements, these OHLs will reduce the number of possible converter sites within the zone and will reduce the flexibility associated with some particular sites. This zone is advantageous in that the length of DC circuit is greater than the AC which makes overcoming obstacles along the route more manageable. This route will likely follow the N25 and travel north at Carrigtwohill and west at Upper Garranes.

#### Permits and Wayleaves

It's possible that construction of new roads may be required requiring additional wayleaves. However, the scale of any new road construction may be greatly reduced given the close proximity to the connection point and that the zone is bisected by a local road.

Although the siting of the converter station may be constrained by the presence of two overhead lines traversing the zone, there may also be a risk to consents where the converter station is in proximity to an HV overhead line.

#### Traffic and Noise Impact during Development

The length of DC circuit is greater than the AC which makes overcoming obstacles along the route more manageable coupled with the proximity of the zone to the connection point, should help reduce the scale of traffic management required.

### 5.11.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- CSLZ boundary is approximately 1 kilometre straight line distance from Knockraha 220kV station. In terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.
- Independent routes for the AC and DC circuits appear to be available within the local road network.
- Elevated and exposed zone but potential opportunities for screening within the forested area.
- Potential ecological and cultural heritage impacts associated with tree felling.



## 5.12 Converter Station Location Zone 11 - Moanbaun

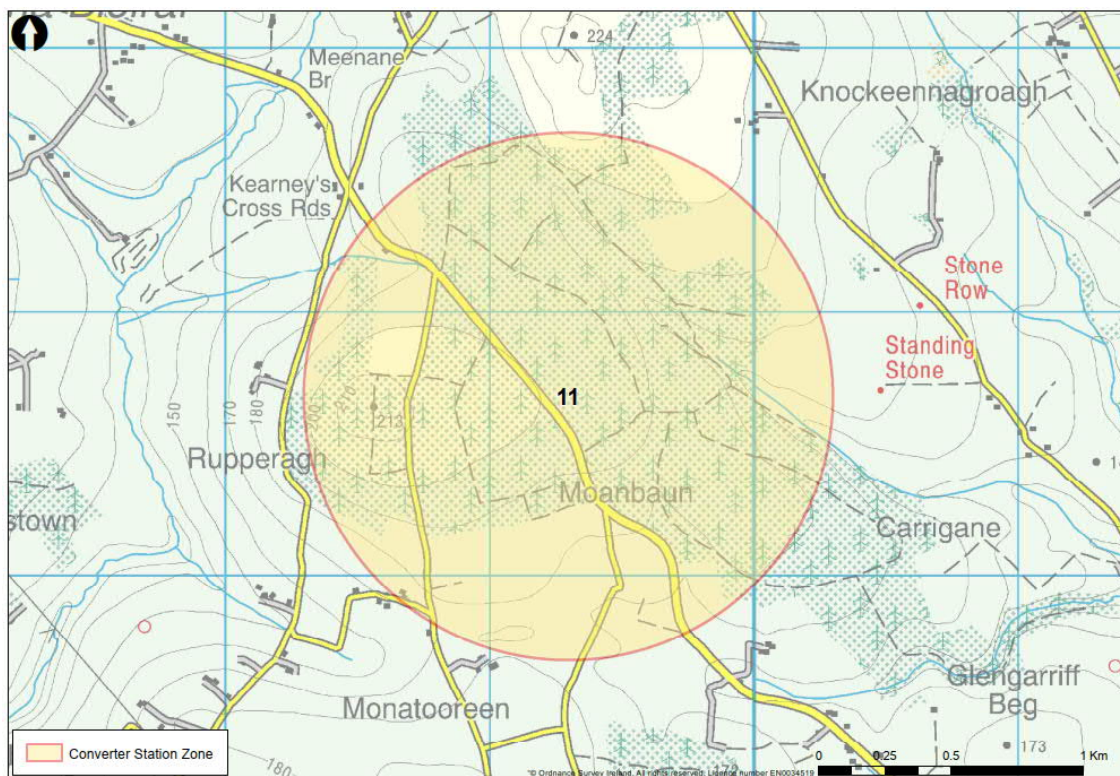
### 5.12.1 Location

CSLZ 11, presented in Figure 30 below, is directly north of CSLZ 8.

This zone encompasses a forest located in the townlands of Glengarriff Beg, Carrigane, Moanbaun, Rupperagh, Skahanagh South, Knockeenagroagh, Monatooreen and Knockanenafinoga. The forest is traversed by a local road.

CSLZ 11 is located approximately 4 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone), approximately 3 kilometres east of the M8 and Watergrasshill. The zone includes both the Electoral Division of Lisgould and the Electoral Division of Knockraha.

**Figure 30: Converter Station Location Zone 11 (Moanbaun)**



Source: Mott MacDonald

### 5.12.2 Land Use

The forest is, in general surrounded by improved agricultural land. Change of use planning consent would be required to facilitate development within the commercial forested area.

The forested area to the north of the local road includes the Moanbaun walking trail.

An inactive gravel pit, owned by Roadstone, borders the forest to the north, approximately 800 metres to the north of the zone. It is understood that there is potential for this gravel pit to re-open.

Watergrasshill Business Park is located approximately 1.5 kilometres to the north west of the zone.

### 5.12.3 County Development Plan / Local Area Plans

CSLZ 11 is located within the County Metropolitan Cork Strategic Planning Area and the Municipal Districts of Cobh – Glanmire and East Cork.

No area specific policies were identified further to a review of Municipal District LAP mapping for the zone.

### 5.12.4 Soils and Geology

According to GSI mapping, the zone is underlain by sandstone, silts and mudstone and a poorly productive bedrock. The area to the west is classified as being of Extreme vulnerability and Rock at or near Surface or Karst, these areas correspond to rock outcrops.

According to GSI data, a drinking water protection zone is located approximately 400 metres to the north of the road that traverses the forested area.

### 5.12.5 Topography

The western section of the forested area is constrained with rock outcrops and elevated lands.

The area south of the local road is at an elevation of approximately 190 metres rising to the west to approximately 205 metres. The surrounding area slopes gently in a south easterly direction.

The area to the north of the local road slopes down steeply to the east, where it forms a narrow valley through which the Ownacurra river flows.

### 5.12.6 Landscape and Visual

CSLZ 11 is located within the Fissured Fertile Middleground Landscape Character Area. The R626 Leamlara to Middleton scenic route is approximately 5.5 kilometres to the south east. The Ardglass to Monaleen Bridge scenic route is approximately 7.5 kilometres to the east.

A roughly hexagonal shaped section of forest directly south of the local road (with elevations to the west and forestry to the east, west and the surrounding area) may offer screening potential. This area may however be limited in terms of micro-siting flexibility.

### 5.12.7 Biodiversity

The closest designated ecological site to the zone is the Blackwater River SAC, located approximately 4.5 kilometres upstream, to the north east of the zone.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation.

### 5.12.8 Watercourses

The Owneacurra river (IE\_SW\_19O030050), which is classified as being of High status, flows in an easterly direction to the east and a westerly direction to the west before discharging into the Great Island Channel SAC, Cork Harbour SPA and Great Island Channel pNHA, a straight line distance of approximately 13 kilometres from the zone.

### 5.12.9 Flood Risk

Pluvial flood risk has been identified to the north and south east of the zone. Fluvial flood risk has not been identified in proximity to the zone, further to a review of CFRAM and Cork County Council data.

### 5.12.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are no recorded cultural heritage sites within the zone. There is however a risk of encountering previously unrecorded archaeological finds in the area. In addition to construction works, tree felling operations have potential for direct or indirect disturbance or impact to archaeological sites and monuments.

### 5.12.11 Settlements

The surrounding area is sparsely populated. According to CSO data, the total population in Knockraha ED in 2016 was 1,462. The total housing stock was 488, of which vacant households (excluding holiday homes) numbered 23. The total population in Lisgoold ED in 2016 was 996. The total housing stock was 331, of which vacant households (excluding holiday homes) numbered 26.

### 5.12.12 Communities, Recreation and Tourism

Moanbaun Woods, a popular local recreational amenity, and the associated trails are located directly north of the local road within the forested area.

### 5.12.13 Nuisance (Traffic and Noise and Air Quality)

It is understood the local road is used by freight haulage vehicles, potentially avoiding motorway tolls, background noise levels could therefore be expected to be higher than what would normally be expected in a rural area.

### 5.12.14 Potential AC/DC Circuit Route Options

There are a number of roads within this area that may offer feasible route connections to Knockraha 220kV station.

### 5.12.15 Technical Constraints

The road network at this zone encompasses local roads. There appear to be potential routes for both the AC and DC cable circuits. However, these roads appear to be narrow and therefore further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase.

There is a water main on the western edge of the zone with no evidence of foul sewerage from available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. There doesn't appear to be any gas infrastructure within the zone.

### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 32km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.7 cable faults over 40 year life.

## Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.

### 5.12.16 Deliverability

#### Project Plan Flexibility

Sloped land in the western side of the zone which could impact the volume of civil/enabling works required for construction and which may limit the micro-siting of the converter station. With a wider trench required for the AC cable circuit, the proximity of the converter station to Knockraha 220kV station is advantageous in terms of a shorter AC cable route with the emerging preferred route heading south into the connection point, however, this route is very narrow in places with some sharp bends and some large trees on both sides of the road. An alternative AC route could be brought further west and then south through Knockraha village, however, this will increase the length of the AC route and any obstacles encountered will be considerably more challenging for an AC route versus a DC route given that there are tree lined roads on approach from the west to the connection point. This zone is advantageous in that the length of DC circuit is greater than the AC which makes overcoming obstacles along the route more manageable, however, the zone is located north beyond the connection point. Accessibility of construction traffic to the zone may be limited and challenging due to the local road network, which will need further examination.

#### Permits and Wayleaves

The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to reinstate or re-construct roads and the potential impact on trees along the roads also pose a risk to achieving consents.

#### Traffic and Noise Impact during Development

The length of DC circuit is greater than the AC which makes overcoming obstacles along the route more manageable, however, the route will go north beyond the connection point. This coupled with the proximity of the zone to the connection point, should help reduce the scale of traffic management required.

### 5.12.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- CSLZ boundary is approximately 4 kilometres straight line distance from Knockraha 220kV station, longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.
- Independent routes for the AC and DC circuits appear to be available within the local road network.
- Elevated areas within the zone with rock outcrops.
- Potential opportunities for screening within the forested area but micro-siting options may be limited.
- Adjacent to Maonbaun Woods amenity area.
- Potential ecological and cultural heritage impacts associated with tree felling.

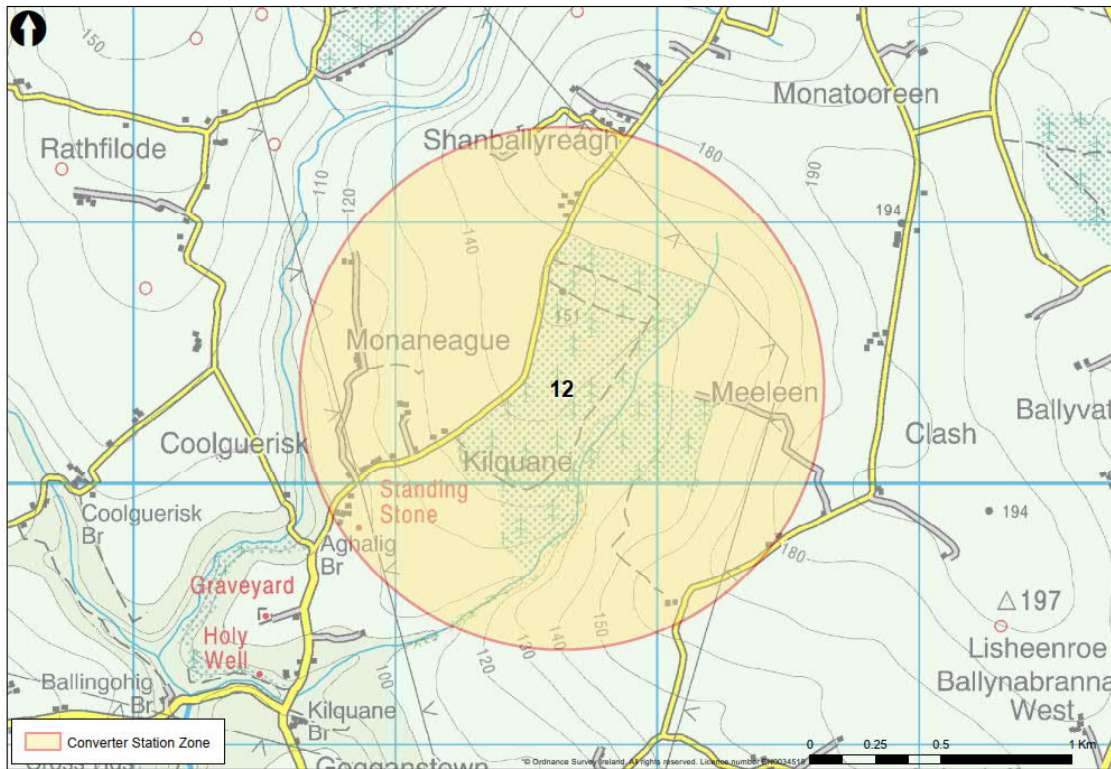


## 5.13 Converter Station Location Zone 12 - Kilquane

### 5.13.1 Location

CSLZ 12, presented in Figure 31 below, is located within the townlands of Kilquane and Meeleen and Shanballyreagh within Knockraha ED, approximately 2 kilometres straight line distance north west of Knockraha 220kV station.

**Figure 31: Converter Station Location Zone 12 (Kilquane)**



Source: Mott MacDonald

### 5.13.2 Land Use

The zone is centred on an area of forestry (conifer plantation). In general, the surrounding area could be categorised as improved agriculture. Change of use planning consent would be required to facilitate development within the commercial forested area. Two overhead transmission lines cross north and south of the forested area.

### 5.13.3 County Development Plan / Local Area Plans

CSLZ 12 is located within the Municipal Districts of Cobh – Glanmire. No area specific policies were identified within the zone further to a review of Municipal District LAP mapping. There is an area zoned for community and open spaces including a road/walkway, potentially associated with a school, approximately 1 kilometre to the south of the zone.

#### 5.13.4 Soils and Geology

The zone is underlain by sandstones and mudstones with rock outcrops to the south. The aquifer is Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones of high groundwater vulnerability, with extreme vulnerability to the south.

#### 5.13.5 Topography

This zone is elevated at a height of approximately 140 metres in the centre rising gently in a north easterly direction to approximately 150 metres at the perimeter.

The surrounding area to the north west rises to approximately 190 metres. The area to the south west is undulating dropping in elevation to approximately 100 metres before rising and falling again.

#### 5.13.6 Landscape and Visual

CSLZ 12 is located within the Fissured Fertile Middleground Landscape Character Area, approximately 1.8 kilometres north of an area of High Value Landscape. The area of forestry and surrounding topography may offer sufficient screening.

#### 5.13.7 Biodiversity

The zone is located approximately 6.5 kilometres straight line distance from Cork Harbour SPA and Great Island Chanel SAC.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation.

#### 5.13.8 Watercourses

A tributary of the Butlerstown River (IE\_SW\_19O030050), which is classified as being of High status, flows along the eastern boundary of the area of forestry (conifer plantation).

#### 5.13.9 Flood Risk

No areas of flood risk have been identified within this location, further to a review of CFRAM and Cork County Council mapping.

#### 5.13.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are no recorded cultural heritage sites in the immediate area of this forest. There is potential however to encounter previously unrecorded archaeological finds in undeveloped lands. In addition to construction works, tree felling operations have potential for direct or indirect disturbance or impact to archaeological sites and monuments.

#### 5.13.11 Settlements

There is ribbon type development along the local roads to the northeast and southwest of the forest.

According to CSO data, the total population in Knockraha ED in 2016 was 1,462. The total housing stock was 488, of which vacant households (excluding holiday homes) numbered 23.

#### 5.13.12 Nuisance (Traffic and Noise and Air Quality)

Background noise levels are expected to be low in this area. There are a number of receptors in proximity to the forest which may be sensitive to nuisance impacts.

#### 5.13.13 Communities, Recreation and Tourism

It could be expected that community associations, recreational activities and amenities, facilities and organisations relevant to this area are similar to CSLZ 9, such as -

- Knockraha Community Association Ltd.
- St. Mary's Church
- St. Cuain's Well, Holly Well
- Knockraha National School
- The Old School House Childcare Facility

#### 5.13.14 Potential AC/DC Circuit Route Options

The forest is directly north of Knockraha 220kV station with a local road west of the forest.

#### 5.13.15 Technical Constraints

The road network at this zone encompasses local roads. Although narrow, these roads can be expected to offer opportunity to establish routes for both the AC and DC cable circuits. However as CSLZ 12 is north of the Connection point, routes for both AC and DC will be required between the Connection Point and the CSLZ. Further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase.

There is a water main on the western edge of the zone with no evidence of foul sewerage from available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. There doesn't appear to be any gas infrastructure within the zone.

A 110kV single circuit overhead line runs through the east and north east side of the zone. A 220kV overhead line runs through the western side of the zone.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 32km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.7 cable faults over 40 year life.

#### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.



### 5.13.16 Deliverability

#### Project Plan Flexibility

The land slopes to the south and there is a small amount of bedrock outcrop in the east and west of the zone which may impact the volume of civil/enabling works required for construction and which may limit the micro-siting of the converter station.

There are narrow tree-lined roads to the east of the zone; however, this route could be used for the narrower DC circuit. However, the road on approach to the zone to the north is very narrow with steep sections.

With a wider trench required for the AC cable circuit, the proximity of the converter station to Knockraha 220kV station is advantageous in terms of a shorter AC cable route with the emerging preferred route south through Knockraha village. An alternative route that picks up the road going south into the connection point would require construction of a new road, is limited by the forest and the steep section to the east of the zone. This route is also very narrow in places with some sharp bends and some large trees on both sides of the road.

#### Permits and Wayleaves

The zone is located close to roads that may offer opportunities to establish a cable route. However, it may be difficult to establish a cable route for both AC and DC circuits given the lack of roads within the zone which may require construction of new roads and additional wayleaves as a result.

The wide trench associated with the AC cable route to the connection point, the resulting civil works potentially required to reinstate or re-construct roads and the potential impact on trees along the roads, especially on approach from the west to the connection point, also pose a risk to achieving consents.

#### Traffic and Noise Impact during Development

With the wider trench required for the AC cable circuit, the potential additional civil works for any new roads will require increased construction traffic, traffic management and road closures between the converter station site and the connection point.

### 5.13.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

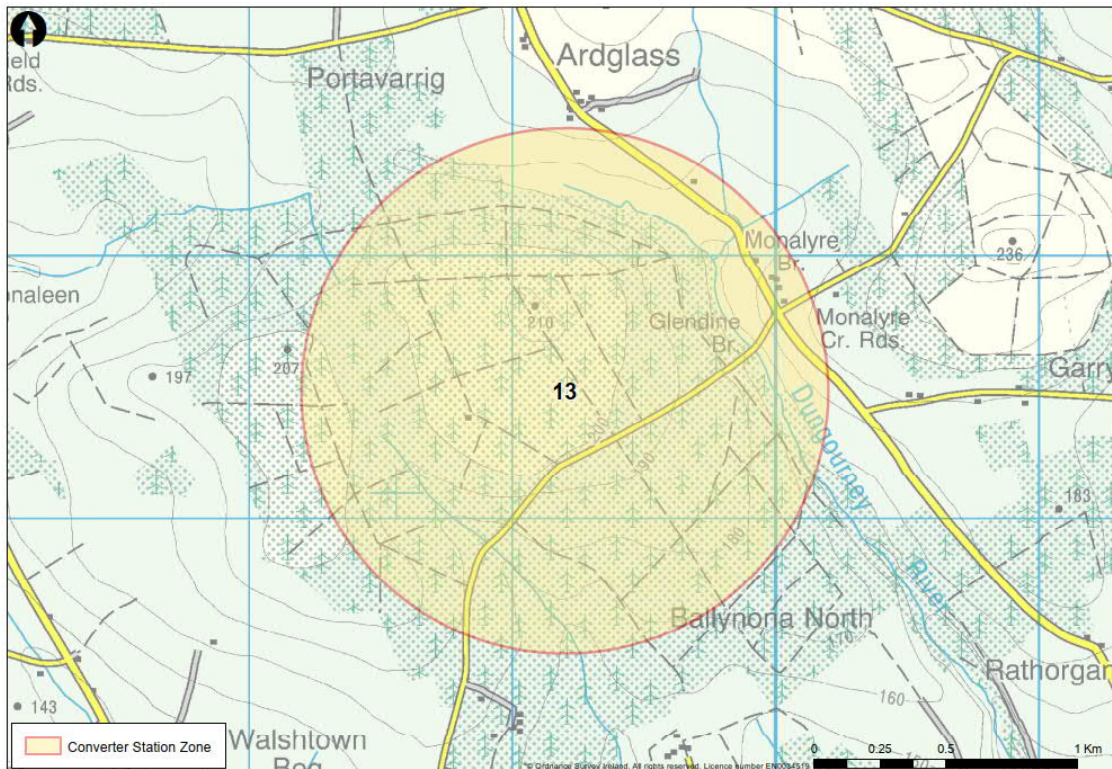
- CSLZ boundary is approximately 2 kilometres straight line distance from Knockraha 220kV station, however longer by road. In terms of cable route length, it is unlikely that an AC underground cable could be installed without the requirement for reactive compensation.
- Establishing independent routes for the AC and DC circuits will be challenging within the local road network.
- Potential opportunities for screening within the forested area.
- Potential ecological and cultural heritage impacts associated with tree felling.

## 5.14 Converter Station Location Zone 13 - Ballynona

### 5.14.1 Location

CSLZ 13, presented in Figure 32 below, is within the townland of Walshtown More West and Ballynona North within the Electoral Division of Templenacarriga, approximately 8.5 kilometres north of Midleton and approximately 12 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone).

**Figure 32: Converter Station Location Zone 13 (Ballynona)**



Source: Mott MacDonald

### 5.14.2 Land Use

The zone is centred around an area of forestry (conifer plantation) and includes the Irish Distillers site at Dungourney. In general, the surrounding area could be categorised as agricultural lands. Change of use planning consent would be required to facilitate development within the commercial forested area.

### 5.14.3 County Development Plan / Local Area Plans

This zone is within the Municipal District of East Cork. There are however no specific policy objectives associated with the zone further to a review of LAP mapping.

### 5.14.4 Soils and Geology

This zone is within an area of mudstone and sandstone with poorly productive bedrock.

The aquifer is Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones of high groundwater vulnerability, with extreme vulnerability to the east and west of the forest.

#### 5.14.5 Topography

The area adjacent to the Irish Distillers site rises gently in a north westerly direction from approximately 170 metres to approximately 190 metres. Further northwest the land rises to a peak of approximately 205 metres before falling in elevation to the west.

#### 5.14.6 Landscape and Visual

The area around the forest is undulating, which, in combination with the forested area, may offer screening opportunities.

The Ardglass to Monaleen Bridge scenic route follows the northern boundary of the forested area before travelling southwards approximately 800 metres to the west of the forest.

The Leamlara to Midleton scenic route is approximately 4.25 kilometres to the south west of the forest.

CSLZ 13 is located within the Fissured Fertile Middleground Landscape Character Area. The forest is located approximately 4 kilometres north of the area designated High Value Landscape by Cork County Council.

#### 5.14.7 Biodiversity

There are no designated SPA, SAC or (p)NHA sites within 15 kilometres of CSLZ 13.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation.

#### 5.14.8 Watercourses

The Dungourney river (IE\_SW\_19D070500) flows to the east and the Walstown More Stream (IE\_SW\_19D070500) flows to the west of the zone. Both are classified as being of Good status.

#### 5.14.9 Flood Risk

This zone has not been identified as being at risk of flooding.

#### 5.14.10 Cultural Heritage (Archaeological and Architectural Heritage)

A protected house (20905406) is located to the east of the forest. There are two Children's burial grounds identified within the forested area (CO054-146002- and CO054-146001- a burial ground). Tree felling operations have potential for direct or indirect disturbance or impact to archaeological sites and monuments.

#### 5.14.11 Settlements

According to census data, the total population in Templenacarriga ED in 2016 was 596. The total housing stock was 211, of which vacant households (excluding holiday homes numbered 9).

#### 5.14.12 Nuisance (Traffic and Noise and Air Quality)

In-combination nuisance impacts associated with the distillery would need to be considered for this zone.

#### 5.14.13 Communities, Recreation and Tourism

Local community groups and activities in the area include:-

- Dungourney Church
- Dungourney Church of Ireland
- St. Peter's National School
- Post office
- Rigney Bros.
- Dungourney Clonmult Community Group

The village supports two sports clubs, Dungourney GAA club and Dungourney Camogie Club, and benefits from Knockakeo Wood which provides the area with a recreational (hillwalking) and natural heritage amenity.

- Leahy's Open Farm is located approximately 4 kilometres to the east of the zone.

#### 5.14.14 Potential AC/DC Circuit Route Options

There are a number of local roads in this area that could potentially offer feasible access to Knockraha 220kV station.

#### 5.14.15 Technical Constraints

The road network in this zone is comprised of local roads. The potential routes for the AC and DC cable circuits are constrained by the lack of roads within the zone. There is a risk that both the AC and DC circuits would have to share the same road and adequate space may not be available.

In particular, the local roads between the zone and Knockraha are narrow, tree lined lanes which are considered challenging to establish a route due to the width of the required trench, the presence of tree root systems which would be threatened by and could potentially damage the cable system and also, steep inclines which pose a difficulty to the cable installation, requiring additional bracing of the cabling to ensure it is supported.

The area within the zone does not appear to be serviced by water mains or foul sewerage, according to the available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. There doesn't appear to be any gas infrastructure within the zone.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 51km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 2.7 cable faults over 40 year life.

#### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area

in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.

#### 5.14.16 Deliverability

##### Project Plan Flexibility

Potential route options for the AC cable include a number of river and bridge crossings which require further examination. The zone is located away from the main road routes between Midleton and Knockraha and given the lack of road infrastructure within the zone it may therefore be difficult to establish a cable route for both AC and DC circuits with potential construction of new roads required. Routes to the south on approach to the zone are also narrow tree lined roads which will present difficulty establishing independent AC and DC cable routes. Routes to the west of this zone present narrow winding tree lined lanes with steep sections and bridge crossings with shallow deck space and sharp crossing angles. Obstacles encountered will be considerably more challenging for an AC route versus a DC. However, there is also limited routes available both through and around Midleton for the DC cable.

##### Permits and Wayleaves

The lack of route options for the AC cable circuit from the converter zone to the connection point and the potential requirement to construct new roadways particularly to pick up the road to the west of the zone as there appears to be only one road approaching the zone will require additional wayleaves. The width of the AC cable route to the connection point, the potential re-construction of roads and bridges and possible HDD sections where that is not feasible for crossing of rivers all pose a risk to achieving consents.

Further, the road network is narrow with steep sections and sharp angles which cannot be accommodated by the minimum bend radius of the cable route will require that the road deviates from the road network in many places. This will require additional wayleaves.

##### Traffic and Noise Impact during Development

With the wider trench required for the AC cable circuit, and the potential additional civil works for any new roads will require increased construction traffic, traffic management and road closures between the converter station site and the connection point.

#### 5.14.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- CSLZ boundary is approximately 12 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.
- AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha. Steep sections pose additional challenge.
- Potential opportunities for screening within the forested area.
- Existing Irish Distillers site adjacent to forested area.
- Children's burial grounds recorded within the zone.
- Potential ecological and cultural heritage impacts associated with tree felling.

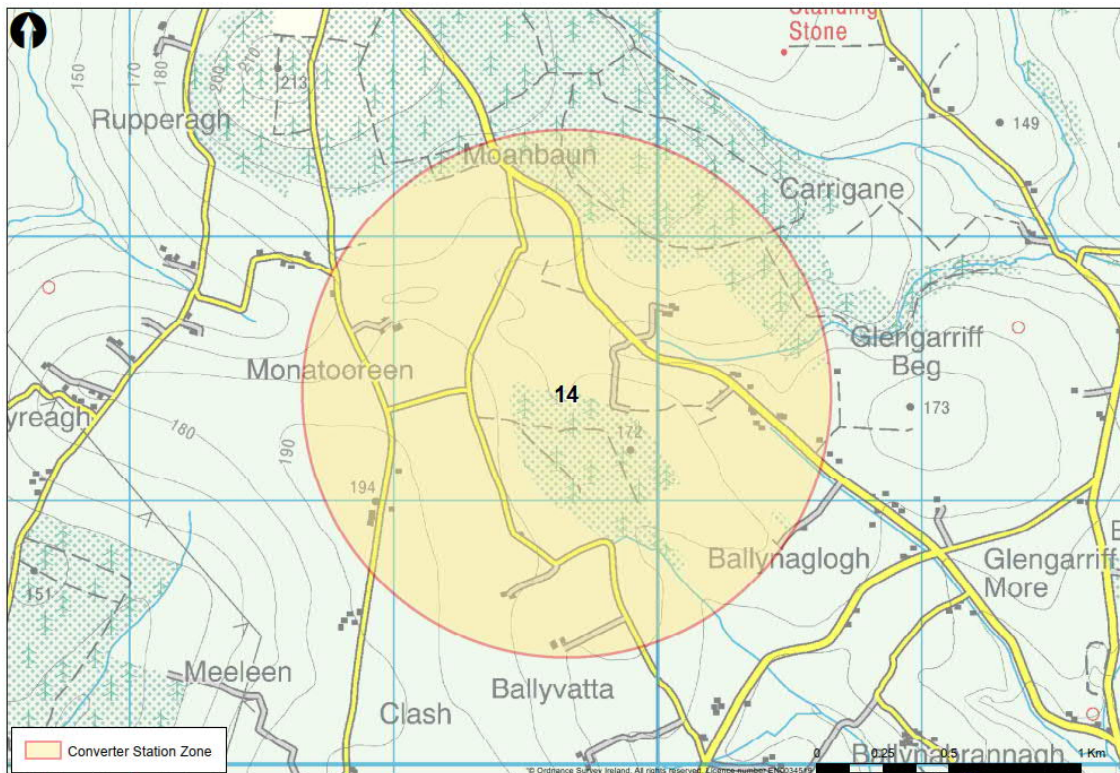


## 5.15 Converter Station Location Zone 14 - Ballyvatta

### 5.15.1 Location

CSLZ 14, presented in Figure 33 below, is centred on an area of forestry (conifer plantation) between CSLZ 7 and CSLZ 8 in the townland of Ballyvatta within Lisgoold ED, approximately 3 kilometres from Knockraha 220kV station (straight-line distance between Knockraha 220kV station and the outer perimeter of the zone).

**Figure 33: Converter Station Location Zone 14 (Ballyvatta)**



Source: Mott MacDonald

### 5.15.2 Land Use

In general, the area surrounding the commercial forest could be categorised as improved agriculture. Change of use planning consent would be required to facilitate development within the commercial forested area.

### 5.15.3 County Development Plan / Local Area Plans

CSLZ 14 is within the Municipal District of East Cork.

No specific land use policies were identified for this zone further to a review of Municipal District LAP mapping for the zone.

### 5.15.4 Soils and Geology

This zone is underlain with sandstone with rock outcrops outside of the forested area to the north and south. The aquifer is Locally Important which is Moderately Productive only in Local



Zones and is of high vulnerability. Areas of extreme vulnerability correspond to rock outcrops to the north and south.

#### 5.15.5 Topography

According to DTM data, the zone gently rises in elevation in a westerly direction from approximately 170 metres in the east to approximately 180 metres in the west. The immediate surrounding area falls quickly in elevation in a south easterly direction to approximately 120 metres. The area directly south however quickly rises again with elevations up to approximately 180 metres.

#### 5.15.6 Landscape and Visual

This location is within Landscape Character Type Fissured Fertile Middleground.

The forested area and surrounding undulating topography may offer sufficient screening for a converter station.

#### 5.15.7 Biodiversity

The closest designated ecological site to the zone is the Blackwater River SAC, located approximately 7 kilometres upstream, to the north east of the zone.

Tree felling that may be associated with development within an area of forestry could impact on ecological receptors, the value of those receptors, and the significance of the overall impact cannot however be determined without targeted investigations and assessment and evaluation.

#### 5.15.8 Watercourses

A tributary of the Owenacurra River (IE\_SW\_19O030400), classified as being of Good status, flows in a south easterly direction to the south of the forested area, two other tributaries of the same river flow in an easterly direction to the north of the forest.

#### 5.15.9 Flood Risk

There is no evidence of flood risk within the zone, further to a review of CFRAMs and Cork County Council mapping.

#### 5.15.10 Cultural Heritage (Archaeological and Architectural Heritage)

There are no recorded cultural heritage sites within the zone. In addition to construction works, tree felling operations have potential for direct or indirect disturbance or impact to archaeological sites and monuments.

#### 5.15.11 Settlements

According to census data, the total population in Lisgoold ED in 2016 was 996. The total housing stock was 331, of which vacant households (excluding holiday homes) numbered 26.

#### 5.15.12 Nuisance (Traffic and Noise and Air Quality)

Background noise levels are expected to be low in this area. This zone potentially includes a limited number of sensitive receptors in terms of nuisance impacts.

### 5.15.13 Communities, Recreation and Tourism

Moanbaun Woods, a popular local recreational amenity, and the associated trail are located directly north of the local road. Other community groups and / or recreational and / or tourist facilities have not been identified within the zone itself, however, it can be expected that facilities and organisations in the wider area, including those in the area of Knockraha, are utilised, for example:-

- Knockraha Community Association Ltd.
- St. Mary's Church
- St. Cuain's Well, Holly Well
- Knockraha National School
- The Old School House Childcare Facility

### 5.15.14 Potential Cable Route Options

This zone is surrounded by local roads. The relatively straight local road in the south western section may provide access to Knockraha 220kV station.

### 5.15.15 Technical Constraints

The road network at this zone encompasses local roads. There appears to be potential routes for both the AC and DC cable circuits. However, these roads appear to be narrow and therefore further assessment will be required to ascertain if there is adequate space available within these roads when the exact requirements of the cable circuit configuration are determined during the design phase.

There is a water main on the western edge of the zone with no evidence of foul sewerage from available services mapping. There is limited electrical distribution infrastructure in the area for supply of the converter station. There doesn't appear to be any gas infrastructure within the zone.

### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 31km (AC route length x 2 due to two cables per phase plus the DC route length). Cigre 379 XLPE cable circuit failure rate indicates 1.6 cable faults over 40 year life.

### Repeatability

While our assessment does not consider the repeatability of the Interconnector as a whole, it takes account that use of a longer section of AC cable will limit the use of AC cable in the area in the future. Further, the length of the AC route will require the installation of reactive compensation equipment.

### 5.15.16 Deliverability

#### Project Plan Flexibility

The land slopes in the western area of the zone which may impact the volume of civil/enabling works required for construction and which may limit the micro-siting of the converter station.

There are narrow tree lined roads to the east of the zone. This route could be used for the narrower DC circuit but may require additional roadway on approach to the zone.

With a wider trench required for the AC cable circuit, the proximity of the converter station to Knockraha 220kV station is advantageous in terms of a shorter AC cable route with the likely best route heading south east towards Leamlara and turning south west after Ballinaglogh and into the connection point, however, this route is narrow in places and will require further examination.

An alternative AC route could be brought further west and then south into the connection point, however, this route is very narrow in places with some sharp bends and some large trees on both sides of the road.

#### Permits and Wayleaves

This zone is bisected by a local road which may reduce the amount of additional road needed within the zone to accommodate the cable routes, thereby potentially reducing the number of wayleaves required. However, there may be some additional road widening required to pick up the road to the south of the zone heading south west towards the connection point.

#### Traffic and Noise Impact during Development

The wider trench required for the AC cable circuit, the longer DC cable route will require increased traffic management and road closures to the converter station site and the connection point.

#### 5.15.17 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- CSLZ boundary is approximately 3 kilometres straight line distance from Knockraha 220kV station, in terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.
- The road network in the zone is narrow however appears to offer opportunities for establishing AC and DC cable routes.
- Potential opportunities for screening within the forested area.
- Potential ecological and cultural heritage impacts associated with tree felling.



- The landfall locations and the distances presented in this report should be considered as indicative only. Determination of the landing point will be subject to targeted investigations and micro-siting considerations.
- The Western European Waters, which includes the coast of Cork and all five landfall locations, has been categorised by the International Maritime Organisation (IMO) as a Particularly Sensitive Sea Area (PSSA). A PSSA is an area that needs special protection through action by the International Maritime Organisation because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities.
- The exact timing of works will be dependent on a number of variables associated with the installation of a cable, including the availability of equipment and weather conditions. Installation of the cable in winter months will however be avoided, if possible.
- All of the landfall locations and surrounding areas can be expected to be used as roosting and foraging habitat for wintering birds. The I-WeBS species recorded in the area of the landfalls is listed in Appendix B of this report.

The following sections outline the identified constraints associated with the landfall locations. The themes considered are in line with those detailed previously, it should be noted however that due to the nature of the activities associated with the installation of an underground DC circuit, including the re-instatement of the landfall, it is anticipated that impacts associated with the installation of the cable will, in general, be temporary in nature.

## 6.2 Landfall Location Option 1 – Inch Beach

### 6.2.1 General

Inch beach, presented in Figure 35 below, is located within Inch ED, in the townlands of Lahard and Inch. The beach is located between Roches Point and Power Head.

According to Intertek's Land Report (P1812\_R3400, November 2014), the beach faces 210° T (True north) and is exposed to the prevailing south westerly wind and waves. It is sheltered from west-north-west to south-east directions by substantial rock cliffs.

Access is gained via two winding single-track roads. According to DTM data, the surrounding area rises gently in elevation from 0 to 50 metres over a distance of approximately 1 kilometre.

**Figure 35: Landfall Location Option 1 (Inch Beach)**



Source: Mott MacDonald

### 6.2.2 Land Use

Inch Beach is a relatively narrow, approximately 160 metres wide, and shallow inlet with a deep and sandy beach that is extensively used as a local amenity area. A gas transmission pipeline comes ashore at Inch beach, the 24" gas pipeline has been installed within the beach.

A surf school is located in proximity to the beach. There is a slipway at Glyeen to the north of Inch beach and a slipway and a pier at Power Head to the south.

The Glanagow – Rafeen submarine cable crosses Cork Harbour to the area of Whitegate Refinery. There are also numerous overhead transmission infrastructure in proximity to Aghada, approximately 5.5 kilometres to the north west.



There are a number of holiday homes along the local road networks including Inch Hideaway Eco Sustainable Campsite to the north of Inch Beach. Mutlins Boarding Kennels are located to the south of Inch Beach. Trabolgan Holiday Village is located to the east of Roche's Point. Whitegate village and Whitegate Refinery and Aghada Power Plant are located to the north of Trabolgan.

In general, surrounding land uses could be categorised as improved agriculture.

### 6.2.3 County Development Plan / Local Area Plans

Inch Beach is within the Municipal District of East Cork. No specific policies were identified further to a review of Municipal District LAP mapping for Inch beach. It is worth noting however that the Municipal District LAP for Cobh states that Roche's Point is located within an area comprising significant heritage and scenic amenities. Its coastguard station is included in the Record of Protected Structures.

### 6.2.4 Soils and Geology and Water

Inch beach is located within an area of sandstone with bedrock outcrops to the east and alluvium and bedrock outcrops to the west. Two tributaries of the Ardra More\_010 (status unassigned) flow to the east and west of the beach.

The aquifer in the area of Inch Beach is a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones. The aquifer is classified as being of Extreme vulnerability.

Coastal susceptibility is a dataset created to ascertain the level of vulnerability to erosion processes along seven coastal local authorities. The dataset classifies the coast line into areas at High, Medium or Low risk based on the subsoil type along the coast at that point. The data was extracted from the EPA/Teagasc subsoils dataset, with each subsoil type within this dataset classified with either a 'High', 'Moderate' or 'Low' ranking, depending on their susceptibility to erosion. Inch beach is classified as having Medium coastal susceptibility.

The potential cable route from the landfall location passes through Ballycroneen Bay Geological Heritage Area.

### 6.2.5 Landscape and Visual

Inch beach is located within an area designated by Cork County Council as High Value Landscape within Broad Bay Coast Landscape Character Type. The landscape Character Area is Undulating Fertile Patchwork Coastline. The area directly south of Inch Beach has been designated a Scenic Area by Cork County Council.

Inch beach is overlooked by the following scenic routes:

- S50 - Road between Inch and Aghada
- S49 - Road between Inch and Ballycotton via Ballybranagan

The potential cable route from the landfall location is via the S49.

### 6.2.6 Biodiversity

Inch Beach is located approximately 8 kilometres south east of Cork Harbour SPA (site code: 004030). All of the landfall locations and surrounding areas can be expected to be used as roosting and foraging habitat for wintering birds. Ecological surveys will be required to determine the potential for significant ecological impacts. In addition to the I-WeBS data included in

Appendix B, a review of NPWS data (up to 10 kilometre accuracy) indicates the following recorded rare and threatened species and habitats in the area of Inch Beach:-

- Common porpoise (*Phocoena phocoena*)
- Otter (*Lutra lutra*)
- Leatherback Turtle (*Dermochelys coriacea*)
- Large carder bee or moss carder bee (*Bombus muscorum*)
- Green-tufted Stubble moss (*Weissia controversa*)

#### 6.2.7 Flood Risk

The potential cable route from the landfall location has been identified as being at risk of fluvial flooding.

#### 6.2.8 Cultural Heritage (Archaeological and Architectural Heritage)

There are a number of recorded cultural heritage sites and finds in proximity to Inch Beach including:-

- Coastguard Station (RPS ID – 00666), approximately 280 metres to the north west of Inch beach
- Prehistoric site - lithic scatter (CO100-043---- Small scatter of flint including some Later Mesolithic"), near the car park at Inch Beach

The potential land circuit route also passes a number of NIAH sites associated with a freestanding gable-fronted Church of Ireland church and the associated graveyard (CO100-013001-).

The potential land circuit route from Inch Beach/Ballycroneen Beach may pass through Cloyne Conservation Area.

#### 6.2.9 Settlements

There are a small number of buildings in the immediate vicinity of Inch Beach, although in general the area is undeveloped. According to the 2016 census, the total population of Inch (ED) in 2016 was 525. The total housing stock was 225, of which vacant households (excluding holiday homes) numbered 16. The total population in the Small Area (SA) of Inch, was recorded as 243. The total housing stock was 117, of which vacant households (excluding holiday homes) numbered 4.

#### 6.2.10 Communities, Recreation and Tourism

Inch Beach is part of An Taisce's Clean Coasts Programme. Clean Coasts engages communities in the protection of Ireland's beaches, seas and marine life. There are two main elements; Clean Coasts Volunteering and the Green Coast Award. Inch Beach is extensively used as a local amenity area. Community organisations and amenities in the area include:-

- Swell Surf School
- Inch Hideaway Eco Sustainable Campsite
- Mutlins Boarding Kennels
- Trabolgan Holiday Village

The route between Inch Beach and Ballycroneen passes by a national school.

### 6.2.11 Nuisance (Traffic and Noise and Air Quality)

There are a number of receptors in the area that would be sensitive to nuisance and disturbance impacts associated with traffic, noise and dust impacts.

### 6.2.12 Technical Constraints

At the proposed landfall area there is limited space for a construction laydown area. The proposed transition joint bay would be situated at the end of the road leading to the beach. A gas main would need to be crossed on the route to Inch Beach.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 12.5km. Cable failures on a statistical basis will be lowest for this option due to it having the shortest cable length. Cigre 379 XLPE cable circuit failure rate indicates 0.665 cable faults over 40 year life.

### 6.2.13 Deliverability

#### Project Plan Flexibility

The cable route between Inch Beach and Midleton is narrow and winding and is likely to encounter issues during design and construction. A gas transmission line comes ashore at Inch beach and potential crossings will have to be considered. The narrow lane to landfall would likely require closure for cable route installation. There is no obvious location for laydown/working compounds affecting contractors works and programme

#### Permits and Wayleaves

Winding and narrow approach to landfall. The narrow lane to landfall would likely require additional wayleaves off the road network. The number of potential permissions for third party crossings and possible closure of roads may be substantial.

#### Traffic and Noise Impact during Development

Narrow lane to landfall would likely require closure for cable route installation with no alternative route identified requiring increased traffic management.

### 6.2.14 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- Limited space available for a construction laydown area.
- The route will need to cross an existing gas main and Ballycroneen Bay Geological Heritage Area.
- Potential to cause damage and disturbance to habitats and species (including protected birds).
- A number of sensitive receptors to temporary nuisance and disturbance impacts associated with the installation of a cable.

## 6.3 Landfall Location Option 2- Ballycroneen Beach

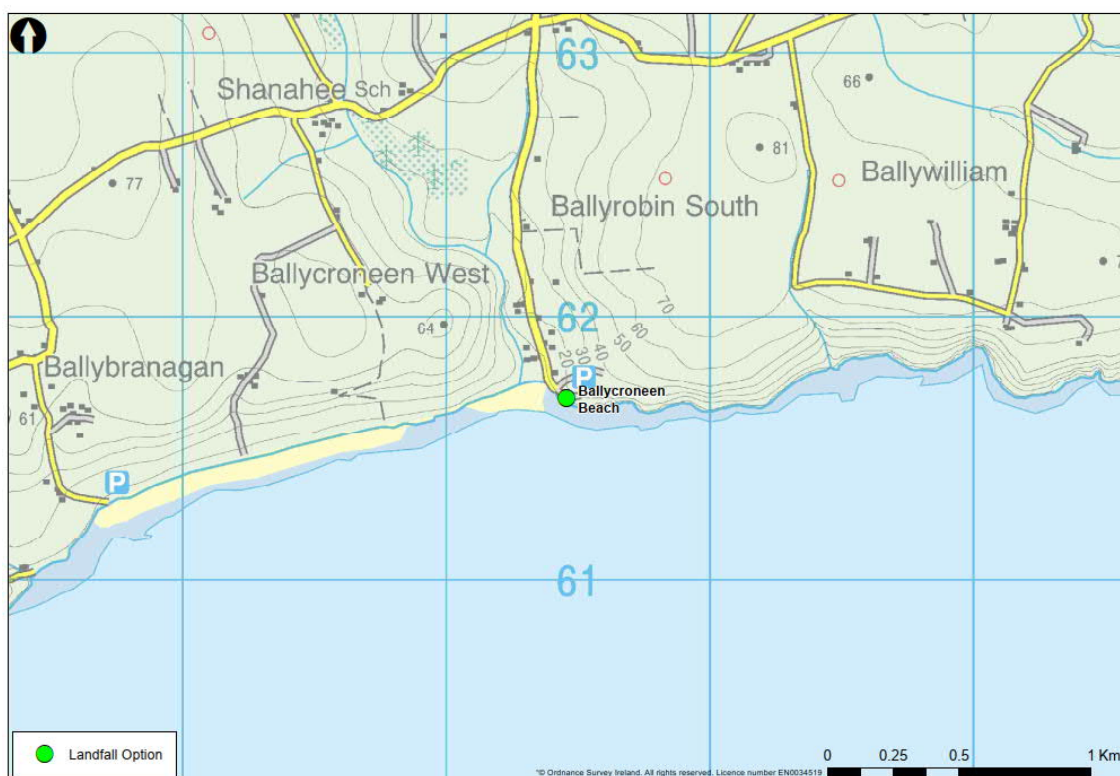
### 6.3.1 General

Ballycroneen Beach, presented in Figure 36 below, is located within the townlands of Ballybranagan, Ballycroneen West and Ballycroneen South within Ballintemple ED.

Access to the beach is via a single track. According to Intertek's Land Report (P1812\_R3400, November 2014), the beach is highly exposed to prevailing south westerly weather and waves.

According to DTM data, the surrounding area rises steeply in elevation from 0 to 50 metres over a distance of approximately 300 metres.

**Figure 36: Landfall Location Option 2 (Ballycroneen Beach)**



Source: Mott MacDonald

### 6.3.2 Land Use

Ballycroneen is a sandy beach with amenity value for shore fishing, swimming and angling. The beach can be accessed via Ballycotton Cliff Walk. It is understood that the beach is also used for periwinkle harvesting.

### 6.3.3 County Development Plan / Local Area Plans

Ballycroneen Beach is within the Municipal District of East Cork. No specific policies were identified further to a review of Municipal District LAP mapping for the area. A development boundary is assigned to the area of Churchtown however, approximately 2.5 kilometres to the north east of the beach.

#### 6.3.4 Soils and Geology and Water

The area around the beach is within sandstone with rock outcrops directly north of the beach and to the east. The beach has been identified as being Medium to Low coastal soil susceptibility.

The landfall point is located approximately 960 metres from Ballycroneen Bay Geological Heritage Area.

The Arda More River flows to the west of the beach. The aquifer is a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones of Extreme vulnerability.

#### 6.3.5 Landscape and Visual

Ballycroneen Beach is located within an area designated by Cork County Council as High Value Landscape within Broad Bay Coast Landscape Character Type.

The potential cable route from the landfall traverses scenic route S49 (road between Inch and Ballycotton via Ballybranagan).

#### 6.3.6 Biodiversity

The closest designated ecological site to the landfall is Carrigacrump Caves pNHA (site code 001408), approximately 4 kilometres north west of the landfall. All of the landfall locations and surrounding areas can however be expected to be used as roosting and foraging habitat for wintering birds. Ecological surveys would be required to determine the potential for significant ecological impacts. In addition to the I-WeBS data included in Appendix B, it is noted that otter are likely to utilise this area of coastline. A review of NPWS data (up to 10 kilometre accuracy) indicates that Green tufted stubble moss (*Weissia controversa*) was recorded in 2006 approximately 300 metres to the east of the landfall location.

#### 6.3.7 Flood Risk

The area directly west of the proposed route is identified in CFRAMs mapping as being at risk of fluvial flooding.

#### 6.3.8 Cultural Heritage (Archaeological and Architectural Heritage)

There is a record of flint and scraper finds within the beach in close proximity to the landfall location point (CO100A001----).

The proposed route from Inch Beach/Ballycroneen Beach passes through Cloyne Conservation Area.

#### 6.3.9 Settlements

There are a small number of buildings in the immediate vicinity of Ballycroneen Beach, although in general the area is undeveloped. According to census 2016, the total population of Ballintemple (ED) in 2016 was 550. The total housing stock was 226, of which vacant households (excluding holiday homes) numbered 21.

#### 6.3.10 Communities Recreation and Tourism

The site offers bathing, fishing and surfing amenity value to locals and tourists.

### 6.3.11 Nuisance (Traffic and Noise and Air Quality)

There are a limited number of receptors in the area that would be sensitive to nuisance and disturbance impacts associated with traffic, noise and dust impacts.

### 6.3.12 Technical Constraints

At the proposed landfall area there is suitable space for a construction laydown area. The proposed transition joint bay would be situated at the end of the road leading to the beach. The route to the Ballycroneen beach the cable route will need to pass a section of tree lined roadway. Tree roots along the cable route could be damaged during the construction of the trench and further, have the potential to cause damage to the cable system if allowed to grow around the duct installation.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 13km. Cigre 379 XLPE cable circuit failure rate indicates 0.69 cable faults over 40 year life.

### 6.3.13 Deliverability

#### Project Plan Flexibility

The route is complicated by access to the landfall and the need to cross a gas transmission main between landfall and Midleton. The primary route is relatively free of obstructions as far as Midleton. However, the approach to the beach is a tree lined and narrow lane which would likely require closure for cable route installation with no alternative route identified requiring increased traffic management. There is a relatively small area at beach that could be used for local laydown.

#### Permits and Wayleaves

Winding and narrow approach to landfall. The narrow lane to landfall would likely require additional wayleaves off the road network. The number of potential permissions for third party crossings and possible closure of roads may be substantial.

#### Traffic and Noise Impact during Development

Narrow lane to landfall would likely require closure for cable route installation with no alternative route identified requiring increased traffic management.

### 6.3.14 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- Small suitable space for a construction laydown area at the landfall.
- Proposed route to Ballycroneen beach passes a section of tree lined roadway.
- Proposed route from Inch Beach/Ballycroneen beach passes through Cloyne Conservation Area.
- Potential to cause damage and disturbance to habitats and species (including protected birds).
- Approximately 960 metres from Ballycroneen Bay Geological Heritage Area.



## 6.4 Landfall Location Option 3 - Ballinwilling Strand

### 6.4.1 General

Ballinwilling Strand, presented in Figure 37 below, is a sandy/shingle beach located within the townland of Ballycrenane (within Garryvoe ED) north of Shanagarry and approximately 26 kilometres to the south east of Knockraha 220kV station.

According to DTM data, the surrounding area rises gently in elevation from 0 to 50 metres over a distance of approximately 1.3 kilometres.

According to Intertek's Land Report (P1812\_R3400, November 2014), primary access to the beach is available direct from the road via a concrete slipway. The slipway is robust and wide enough for heavy plant to easily access the beach, however the end of the slipway is currently obstructed by numerous boulders. Secondary access is available via a minor road approximately 700 metres to the north east.

**Figure 37: Landfall Location Option 3 (Ballinwilling Strand)**



Source: Mott MacDonald

### 6.4.2 Land Use

The beach is relatively isolated. There is a small car park located at the top of a ramp leading to the beach.

The area is used for angling and for shrimp and dredge fishing.

### 6.4.3 County Development Plan / Local Area Plans

The development boundary of Shanagarry/Garryvoe is located approximately 200 metres from the identified landfall location.

### 6.4.4 Soils and Geology

Ballinwilling Strand is within an area of sandstone, mudstone, limestone, although no karst features have been identified in proximity to the strand. The landfall is west of rock outcrops recorded on the [www.gsi.ie](http://www.gsi.ie) datasets.

The strand is of Medium Coastal Soil Susceptibility. The aquifer is a Regionally Important Aquifer - Karstified (diffuse) of Moderate vulnerability.

The landfall is located approximately 3 kilometres from Ballycotton Bay Geological Heritage Area.

### 6.4.5 Landscape and Visual

Ballinwilling Strand is located within an area designated by Cork County Council as High Value Landscape within Broad Bay Coast Landscape Character Type.

The proposed route from the landfall traverses scenic route S47: Road between Garryvoe and Knockadoon.

### 6.4.6 Biodiversity

The landfall is located approximately 400 metres to the north of Ballycotton, Ballymona and Shanagarry pNHA (site code 000076) and approximately 2 kilometres from Ballycotton Bay SPA (site code 004022). Ballycotton Bay is also a designated Ramsar Site. Ballycotton Islands pNHA is located approximately 6.5 kilometres to the south west of the landfall location.

Ballycotton Bay SPA is designated for wintering birds, wetlands and waterbirds. All of the landfall locations and surrounding areas can be expected to be used as roosting and foraging habitat for birds, refer to I-WeBS data in Appendix B. Ecological surveys will be required to determine the potential for significant ecological impacts.

According to NPWS, Ballycotton Bay is an east-facing coastal complex, which stretches northwards from Ballycotton towards Garryvoe, a distance of approximately 3 kilometres. The site is characterised by two sheltered inlets which receive the flows of several small rivers. The southern inlet had been lagoonal in character (Ballycotton Lake) but breaching of the shingle barrier in recent times has seen the area revert back to estuarine conditions. The principal habitat is intertidal sandflats, which are mostly well exposed. Sandy beaches are well represented. Salt marshes fringe the flats in the sheltered inlets and these provide high tides roosts. Fringes of *Phragmites australis* occur where there are freshwater influences. The site includes some marginal grassland fields which are used by a range of waterfowl species. A small area of shallow marine water is also included.

According to the Irish Ramsar Wetland Committee (IRWC), Ballycotton Bay includes a mobile shingle beach and a series of three wetlands dominated by reed and marsh vegetation. It supports nationally, regionally or locally important numbers of numerous species of waterbirds. The site is also notable for its large numbers of rare migrant birds that breed in the phragmites beds. Human activities include livestock grazing.

#### 6.4.7 Flood Risk

Cork County Council identifies the strand as being at risk of flooding. It is noted that the ESBI Feasibility Study refers to the installation of flood defences in this area.

#### 6.4.8 Cultural Heritage (Archaeological and Architectural Heritage)

A Fulacht fia (CO089-076----) was recorded in the marshy area close to 'Garryvoe beach', the record records the site as having been levelled in the late 1960s.

A House - vernacular house (CO077-041----), which is also recorded as a Thatch House, is located approximately 450 metres from the proposed landfall point.

Flint Bann Flake is also recorded within the beach area.

A walkover survey of Ballinwilling Strand was carried out by Cotswold Archaeology Marine (ca. 2018) as part of the off-shore archaeological investigations. The associated report stated that the walkover survey found no evidence to challenge the conclusion of a previous archaeological assessment (Headland Archaeology, 2015) that no significant heritage assets have been identified at Ballinwilling Strand.

#### 6.4.9 Settlements

Ballinwilling Strand is sparsely populated and undeveloped, although a dwelling is evident directly north west of the landfall point.

According to Census data, the total population in Garryvoe ED in 2016 was 619. The total housing stock was 267, of which vacant households (excluding holiday homes) numbered 22.

#### 6.4.10 Communities, Recreation and Tourism

Recreational activities in the area appear to centre around angling with the following organisations in operation in the area.

- South Coast Charter Angling; and
- Ballycotton Angling.

#### 6.4.11 Nuisance (Traffic and Noise and Air Quality)

There are a number of receptors in the area that would be sensitive to nuisance and disturbance impacts associated with traffic, noise and dust impacts.

#### 6.4.12 Technical Constraints

At the proposed landfall area there is limited space for a construction laydown area but some space is available in the carpark. The proposed joint bay would be situated in the car park adjacent to the beach. The route to the Ballinwilling strand the cable route will need to pass over a number of bridges with limited deck space along the route.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 15km. Cigre 379 XLPE cable circuit failure rate indicates 0.825 cable faults over 40 year life.

### 6.4.13 Deliverability

#### Project Plan Flexibility

The route is approximately 15km and complicated by access to the beach. Narrow winding road leading from main road to beach will pose design challenges and may require an off road route. Alternative route through soft ground to the west of landing point to meet up with main road and avoid narrow winding lanes. Access issues could be mitigated by crossing over soft ground which may also provide good laydown.

Potential route options include a number of bridge crossings which may pose design challenges. Should crossing over land be achievable the access constraints to the landfall could be mitigated.

#### Permits and Wayleaves

The route is complicated by access to the beach area. Access issues could be mitigated by crossing over soft ground which may also provide good laydown. Additional wayleaves would be required where the route leaves the road network. Although the approach to the landfall is narrow and winding, the primary route is likely to pose fewer design challenges over its length than shorter route options. The bridge at Castlemartyr will require further examination and may require crossing 3rd party land.

#### Traffic and Noise Impact during Development

Narrow lane to landfall would likely require closure for cable route installation.

### 6.4.14 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- There is limited space at the proposed landfall area for a construction laydown area but some space may be available in the carpark
- The route to Ballinwilling will need to pass over a number of bridges with limited deck space along the route.
- Potential to cause damage and disturbance to habitats and species (including protected birds).
- Approximately 3 kilometres from Ballycotton Bay Geological Heritage Area.
- Proximate to Ballycotton, Ballymona and Shanagarry pNHA (site code 000076).
- Approximately 2 kilometres from Ballycotton Bay SPA / Ramsar Site.
- Approximately 6.5 kilometres from Ballycotton Islands pNHA.
- Sparsely populated and undeveloped.

## 6.5 Landfall Location Option 4 - Redbarn Beach

### 6.5.1 General

Redbarn Beach, presented in Figure 38 below, is a sandy beach within the townlands of Redbarn / Conard East, approximately 3 kilometres south of Youghal.

Intertek's Land Report (P1812\_R3400, November 2014), records the beach as being offered some protection from prevailing winds by Knockadoon Head and Ardmore Head. Two single track roads provide access to the site.

**Figure 38: Landfall Location Option 4 (Redbarn Beach)**



Source: Mott MacDonald

### 6.5.2 Land Use

Redbarn Beach is used by anglers, walkers, surfers and windsurfers. The beach was awarded the Blue Flag Beach Award in 2018.

The beach is located north east of Ballymacoda Bay, a Shellfish Designated Area, licensed for clams, oysters and mussels.

Planning consent was granted in August 2014 for the construction of a new mobile home park, in the vicinity of Redbarn Beach (planning reference 136335).

Cork County Council has also applied for Part 8 planning for the development of a greenway and related ancillary works along the route of the Middleton - Youghal railway. Part of this route traverses Ballyvergan Marsh pNHA to the north of Redbarn Beach.

### 6.5.3 County Development Plan / Local Area Plans

The landfall is located in proximity to Redbarn LAP with an objective to facilitate a mix of uses, holiday homes and mobile homes.

### 6.5.4 Soils and Geology

Redbarn Beach is within an area of limestone with sandstone till with estuarine sands and tills to the north. A karst feature, a cave, is located to north of the landfall point.

The strand is of Medium Coastal Soil Susceptibility. The aquifer is a Regionally Important Aquifer - Karstified (diffuse) of Low vulnerability. The landfall is located approximately 3 kilometres from Ballycotton Bay Geological Heritage Area.

Along the proposed route, traced connections between karst springs have been recorded across the N25 near Castlemartyr.

### 6.5.5 Landscape and Visual

The landfall is located within an area designated by Cork County Council as High Value Landscape within Broad Bay Coast Landscape Character Type. The proposed route from the landfall traverses the N25 scenic route (Youghal Bypass, S46).

### 6.5.6 Biodiversity

Redbarn Beach is bounded to the rear (north west) by sand dunes leading to agricultural lands. Ballyvergan Marsh pNHA (site code 000078) is located approximately 400 metres northeast of the landfall. Approximately 180 metres to the south is Ballymacoda Bay SPA (site code 004023) / Ramsar site.

Ballymacoda Bay SAC (site code 000077) / Ballymacoda (Clonpriest and Pillmore) pNHA (site code 000077) are located approximately 2.5 kilometres from the landfall location.

Ballymacoda SPA is designated for wintering birds, wetlands and waterbirds. Ballymacoda Bay is also a Shellfish Designated Area, licensed for clams, oysters and mussels.

According to NPWS datasets, Wild Clary (*Salvia verbenaca*) was recorded immediately west of the dunes in 1999.

All of the landfall locations and surrounding areas can be expected to be used as roosting and foraging habitat for birds, refer to Appendix B regarding I-WeBS data.

According to NPWS, Ballymacoda Bay SPA comprises the estuary of the Womanagh River, a substantial river which drains a large agricultural catchment. The inner part of the site is well sheltered by a stabilised sandy peninsula (Ring peninsula) and includes the tidal section of the river as far as Crompaun Bridge. Sediments here are mostly muds or muddy sands, and salt marshes are well developed. The outer part of the site is well exposed and sediments here are mostly fine, rippled sands. An area of shallow marine water is included. Usage of the site is low, with low-level recreation on the sandy beaches.

According to IRWC, Ballymacoda Bay is an estuary of intertidal sand and mudflats flanked by reclaimed marshy fields and saltmarsh, sheltered by a stabilized shingle bar and extensive sandy beach. Internationally important numbers of waterbirds winter at the site and up to 106 wetland species use it. The marshy fields are important feeding areas for various species of waterbirds. Human activities include intensive agricultural use, cattle grazing, and silage.



According to the NPWS, Ballyvergan Marsh pNHA, located approximately 280 metres from the landfall location, is of interest because it contains the largest freshwater coastal marsh in County Cork, exhibiting well developed plant communities and holding a sizeable breeding population of Reed Warblers. Adding to the importance of the site is Wild Clary (*Salvia verbenaca*), a Rare Red Data Book species. The area includes an extensive reed bed with some marshy land around the edges. The main interest of the marsh is ornithological, with the reed bed supporting a sizeable proportion of the Irish breeding population of Reed Warblers. This species has only recently become an established breeding bird in Ireland. Other breeding birds using the site include Reed Buntings, Moorhen, Coot, Water Rail and Mallard. This site is also a traditional Hen Harrier wintering roost area and is known to be used by wintering Curlew. Hen Harrier and Reed Warblers are both Amber listed on the Birds of Conservation Concern in Ireland 2014-2019, Curlew is Red listed.

The proposed Midleton – Youghal Greenway traverses Ballyvergan Marsh pNHA to the north of Redbarn Beach. The section through the pNHA will run along a 4.5 metre high raised boardwalk. The screening report for Appropriate Assessment (<https://www.corkcoco.ie/planning/municipal-districts-part-8-planning>) concluded that construction and operation of the proposed Greenway between Midleton and Youghal, County Cork, poses no risk of likely significant effects on Natura 2000 sites (e.g. Great Island Channels SAC, Cork Harbour SPA, Ballymacoda (Clonpriest and Pillmore) SAC or Ballymacoda Bay SPA).

The proposed route from Redbarn beach also passes adjacent to Ancient Long-Established Woodland in the area of Ladysbridge and Castlemartyr.

#### 6.5.7 Flood Risk

The proposed landfall is located directly south of an area identified as having Extreme Coastal Flood risk.

#### 6.5.8 Cultural Heritage (Archaeological and Architectural Heritage)

An archaeological assessment was carried out by Cotswold Archaeology Marine (ca. 2018) as part of the off-shore archaeological investigations. The assessment comprised a foreshore walkover, and a review of foreshore and offshore geophysical survey data. A possible sub-surface depression was identified in the geophysical survey at Redbarn Beach, covering an area of approximately 275 metres by 60 metres that suggests a possible site of archaeological potential.

There do not appear to be any recorded cultural heritage sites in proximity to the landfall site.

#### 6.5.9 Settlements

The Quality Hotel and tourist accommodation is located in proximity to the beach. The total population of Youghal Rural ED in 2016 was 1,264. The total housing stock was 540, of which vacant households (excluding holiday homes) numbered 36.

#### 6.5.10 Communities, Recreation and Tourism

Redbarn Beach and the surrounding area is popular with locals and tourists for bathing, sea and shore angling and rowing. Redbarn Beach is part of Ireland's Ancient East.

The proposed route from Redbarn Beach crosses walking routes in the area of Ladysbridge and Castlemartyr, associated with Mitchel's Wood and Pigeon Wood.

There are also numerous recreational and tourism attractions in proximity to the potential landfall point, including those detailed below:-

- South Coast Charter Angling
- Youghal Dive Charters
- Deep Sea Angling
- Quality Hotel and Leisure Centre Youghal
- Redbarn Holiday Homes

Youghal also hosts a number of festivals in the summer months including:-

- Youghal Food and Mackerel Festival in August
- Youghal's Queen of the Sea (July, August)
- Youghal Moby Dick Festival (June)

The first ever international Ironman competition in Ireland will be held in Youghal in June 2019 and is expected to run for the next three years.

#### 6.5.11 Nuisance (Traffic and Noise and Air Quality)

There are a number of receptors in the area that would be sensitive to nuisance and disturbance impacts associated with traffic, noise and dust impacts.

#### 6.5.12 Technical Constraints

At the proposed landfall area there is limited space for a construction laydown area. The proposed transition joint bay would be situated at the end of the road leading to the beach. This road provides access to the beach and is used by the Coast Guard. The cable route to Redbarn beach will need to pass along narrow and winding roads with a number of bridges with limited deck space along the route.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 23.5km. Cigre 379 XLPE cable circuit failure rate indicates 1.25 cable faults over 40 year life.

#### 6.5.13 Deliverability

##### Project Plan Flexibility

This approximately 23.5km route is complicated by multiple bridge crossings and approach to the beach. Design challenges are likely at two narrow bridges at Castlemartyr and Killeagh with limited or no deckspace. Beach approach issues could be mitigated by crossing over soft ground however this is subject to ecological assessment.

##### Permits and Wayleaves

Long route complicated by multiple bridge crossings and approach to the beach. Two narrow bridges at Castlemartyr and Killeagh with limited or no deckspace coupled with the additional joint bays required in a longer route will result in additional wayleaves being required.

##### Traffic and Noise Impact during Development

Narrow lane to landfall would likely require closure for cable route installation.

#### 6.5.14 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- Limited space for a construction laydown area at the proposed landfall area.
- The cable route to Redbarn beach will need to pass along narrow and winding roads with a number of bridges with limited deck space along the route.
- Potential to cause damage and disturbance to protected habitats and species (including birds).
- Bounded to the rear (north west) by sand dunes. Ballyvergan Marsh pNHA to the northeast.
- Proximate to Ballymacoda Bay SPA.
- Approximately 2.5 kilometres from Ballymacoda (Clonpriest and Pillmore) SAC/(p)NHA.
- Ballymacoda Bay is a Shellfish Designated Area, licensed for clams, oysters and mussels.
- Approximately 3 kilometres from Ballycroneen Bay Geological Heritage Area.
- Potential site of archaeological potential, associated with a possible sub-surface depression identified in the geophysical survey at Redbarn Beach.
- Developed and popular resort with a number of sensitive receptors.

## 6.6 Landfall Location Option 5 – Claycastle Beach

### 6.6.1 General

Claycastle Beach, presented in Figure 39 below, is a sandy beach with a narrow area of marsh/dunes (part of Ballyvergan Marsh pNHA (Site Code 000078) is located to the west and east of the landfall point.

The beach is located approximately 1 kilometre to the south west of Youghal. The surrounding area is low lying and relatively flat. Access to the beach can be gained via an approach road from the car park.

**Figure 39: Landfall Location Option 5 (Claycastle Beach)**



Source: Mott MacDonald

### 6.6.2 Land Use

Claycastle Beach is a seaside tourist destination, activities include walking, surfing, windsurfing and canoeing. Claycastle beach includes a promenade extending to Front Strand. The area is popular for both shore and sea angling.

The RNLI lifeboat station is located directly north of Claycastle Beach. A fishing port and a number of piers are also located directly north of Claycastle Beach.

Youghal is a medium size town with mixed commercial and residential land uses. There are a number of caravan parks, B&B's and holiday homes in proximity to the potential landfall site.

Further to a review of Cork County Council's website it is noted that planning permission (planning reference 146281) for the addition of 10 mobile homes to Seafield caravan park was granted in January 2015.

Planning reference 134137 relates to the construction of a motorhome park to include site entrance via the existing leisure centre entrance, 84 no. motorhomes, parking and a playground approximately 350 metres north of the landfall. The site is located between the existing Seafield Caravan Park and Summerfield Holiday Park. Planning consent was granted in January 2015.

Youghal Landfill (W0068-03) and waste transfer station (W0211-01) are located to the north of Youghal town and not considered to be constraining land uses due to their locations.

### 6.6.3 County Development Plan / Local Area Plans

The landfall at Claycastle Beach is within Youghal Development Boundary and directly north of the Green Belt area designated by Cork County Council.

### 6.6.4 Soils and Geology

Claycastle Beach is considered to be of high coastal soil susceptibility. The bedrock has been classified by the GSI as limestone with estuarine silts and clays. A known karst feature (a spring) is located to the north of the beach.

An area of peat deposits has been recorded along Claycastle Beach (refer to Section 6.6.8 Cultural Heritage), extending landwards under the beach sands, and seawards into the nearshore zone.

The aquifer is categorised as a Regionally Important Aquifer - Karstified (diffuse) Low vulnerability.

Claycastle Beach is located approximately 1 kilometre from a Geological Heritage Site in Youghal (under the light-house).

### 6.6.5 Landscape and Visual

The area around Claycastle beach is categorised as a High Value Landscape within the landscape area of Broad Bay Coast. The proposed route from the landfall traverses the N25 scenic route (Youghal Bypass, S46).

### 6.6.6 Biodiversity

All of the landfall locations and surrounding areas can be expected to be used as roosting and foraging habitat for birds, refer to the I-WeBS data included in Appendix B. Ecological surveys will be required to determine the potential for significant ecological impacts.

The landfall location at Claycastle Beach is bounded to the east and west by Ballyvergan Marsh pNHA (site code 000078).

Ballyvergan Marsh pNHA is a traditional Hen Harrier wintering roost area with a breeding population of Reed Warblers. Both of these species are Amber listed on the Birds of Conservation Concern in Ireland 2014-2019. Wintering Curlew, a Red listed species, are also understood to use the area. According to the NPWS, this site is of interest because it contains the largest freshwater coastal marsh in County Cork, exhibiting well developed plant communities and holding a sizeable breeding population of Reed Warblers. Adding to the importance of the site is Wild Clary (*Salvia verbenaca*), a Rare Red Data Book species. The main interest of the marsh is ornithological, with the reed bed supporting a sizeable proportion

of the Irish breeding population of Reed Warblers. This species has only recently become an established breeding bird in Ireland. Other breeding birds using the site include Reed Buntings, Moorhen, Coot, Water Rail and Mallard. The area includes an extensive reed bed with some marshy land around the edges. It is noted that the proposed Midleton – Youghal Greenway traverses Ballyvergan Marsh pNHA to the north of Redbarn Beach. The section through the pNHA will run along a 4.5 metre high raised boardwalk. The screening report for Appropriate Assessment (<https://www.corkcoco.ie/planning/municipal-districts-part-8-planning>) concluded that construction and operation of the proposed Greenway between Midleton and Youghal, County Cork, poses no risk of likely significant effects on Natura 2000 sites (e.g. Great Island Channels SAC, Cork Harbour SPA, Ballymacoda (Clonpriest and Pillmore) SAC or Ballymacoda Bay SPA).

Blackwater Estuary SPA / Ramsar Site is located approximately 3 kilometres to the northeast of the landfall point. Blackwater River SAC / Blackwater River and Estuary pNHA is located approximately 2 kilometres to the northeast of the landfall point.

Ballymacoda Bay SPA (site code 004023) / Ramsar site is located approximately 2 kilometres to the south of the landfall point. Ballymacoda Bay SAC (site code 000077) and Ballymacoda (Clonpriest and Pillmore) pNHA (site code 000077) are located approximately 4.5 kilometres to the south of the landfall point.

Ballymacoda SPA is designated for wintering birds, wetland and waterbirds. According to NPWS, Ballymacoda Bay SPA comprises the estuary of the Womanagh River, a substantial river which drains a large agricultural catchment. The inner part of the site is well sheltered by a stabilised sandy peninsula (Ring peninsula) and includes the tidal section of the river as far as Crompaun Bridge. Sediments here are mostly muds or muddy sands, and salt marshes are well developed. The outer part of the site is well exposed and sediments here are mostly fine, rippled sands. An area of shallow marine water is included. Usage of the site is low, with low-level recreation on the sandy beaches.

#### **6.6.7 Flood Risk**

Claycastle Beach, and an extensive part of the surrounding area, have been identified as being within an area of Extreme Coastal Flood risk.

#### **6.6.8 Cultural Heritage (Archaeological and Architectural Heritage)**

An archaeological assessment was carried out by Cotswold Archaeology Marine (ca. 2018) as part of the off-shore archaeological investigations. The assessment comprised a foreshore walkover, and a review of foreshore and offshore geophysical survey data. Peat deposits were recorded along Claycastle Beach, including evidence of a submerged forest (tree roots), and evidence of excavation in the form of recti-linear cuts, possibly for use as fulachtaí fiadh. These peat deposits are considered to have archaeological potential.

A small scatter of flint including some Later Mesolithic (CO100-044----) has been recorded near the car park at Claycastle Beach.

There are in the order of 25 architectural heritage (NIAH) sites along the strand (to the north of the beach) at Claycastle.

#### **6.6.9 Settlements**

Due to its proximity to Youghal, the area directly north of Claycastle is densely populated.



The total population of Youghal ED in 2016 was 7,075. The total housing stock was 3,704, of which vacant households (excluding holiday homes numbered 438).

#### 6.6.10 Communities, Recreation and Tourism

Claycastle is a popular seaside resort. Claycastle Beach / Youghal Bay is also popular for sea and shore angling and rowing. There are also numerous recreational and tourism attractions in proximity to the potential landfall point, including the adjacent Claycastle Pitch and Putt Club and Greyhound track and Youghal Golf Club. Youghal and Claycastle Beach are part of Ireland's Ancient East.

Other facilities and attractions include:-

- South Coast Charter Angling
- Youghal Dive Charters / Deep Sea Angling
- Perks Entertainment Centre
- Ireland's Ancient East (Youghal)
- Aura Leisure Centre, Claycastle, Youghal

Youghal also hosts a number of festivals in the summer months including:-

- Youghal Food and Mackerel Festival in August
- Youghal's Queen of the Sea (July, August)
- Youghal Moby Dick Festival (June)

The first ever international Ironman competition in Ireland will be held in Youghal in June 2019 and is expected to run for the next three years.

Community organisations in the area include those listed below:-

- Cumann na Daoine (Youghal)
- Muintir Mhuire Teoranta
- The Youghal Socio-Economic Development Group
- Youghal Community Response Network
- Youghal Family Support Centre c/o Youghal Community Health Project
- Youghal Maritime Development Group
- Youghal Residents Network
- Youghal Senior Citizens Co. Ltd
- Youghal4All
- Youghal Town Council
- Coastal Rowing Association
- Irish Coastal Rowing Fed
- Our Lady of Lourdes Church
- Fire station
- RNLI lifeboat station

#### 6.6.11 Nuisance (Traffic and Noise and Air Quality)

There are a number of receptors in the area that would be particularly sensitive to traffic, noise and dust impacts.

### 6.6.12 Technical Constraints

At the proposed landfall area there may be suitable space for a construction laydown area in the car park (subject to agreements) and a narrow road leading to the beach. This area can be avoided by re-routing through the adjacent Ballyvergan Marsh pNHA. The cable route to Claycastle Beach is relatively straight forward with one difficult bridge crossing.

#### Average Failure Rates

Based on the likely routes available, the combined circuit length associated with this option can be expected to be 22.5km. Cigre 379 XLPE cable circuit failure rate indicates 1.2 cable faults over 40 year life.

### 6.6.13 Deliverability

#### Project Plan Flexibility

This approximately 22.5km route is complicated by multiple bridge crossings. Good laydown could be available at car park. Design challenges are likely at two narrow bridges at Castlemartyr and Killeagh with limited or no deckspace. Further, the approach to the beach is complicated by a railway bridge which may require the route to come off the road.

#### Permits and Wayleaves

A long route complicated by multiple bridge crossings. Good laydown could be available at the car park which may require permissions. Two narrow bridges at Castlemartyr and Killeagh with limited or no deckspace coupled with the additional joint bays required in a longer route will result in additional wayleaves wherever the route leaves the road network. Further, railway bridge close to Claycastle which may require the route to come off the road adjacent to or into a Ballyvergan Marsh pNHA. This requires further examination and has the potential to add risk to consent.

#### Traffic and Noise Impact during Development

Narrow lane to landfall would likely require closure for cable route installation.

### 6.6.14 Key Constraints and Considerations

Key constraints and considerations associated with this zone can be summarised as follows:-

- Space for a construction laydown area may be available at the car park, but this may require permissions
- A narrow road leading to the beach complicated by railway crossing which may require works in pNHA area.
- Potential to cause damage and disturbance to protected habitats and species (including birds).
- Bounded to the east and west by Ballyvergan Marsh pNHA.
- Ballymacoda Bay SPA (site code 004023) / Ramsar site located approximately 2 kilometres to the south.
- Ballymacoda Bay SAC (site code 000077) and Ballymacoda (Clonpriest and Pillmore) pNHA (site code 000077) located approximately 4.5 kilometres to the south.
- Blackwater Estuary SPA / Ramsar Site located approximately 3 kilometres to the northeast.
- Blackwater River SAC and Blackwater River and Estuary pNHA are located approximately 2 kilometres to the northeast.

- Area of peat deposits (including a submerged forest), of archaeological potential, have been recorded at Claycastle Beach.
- Densely populated and popular resort with a number of particularly sensitive receptors.

## 7 Summary and Next Steps

### 7.1 Summary of Constraints

The following table presents a summary of the key technical and environmental constraints identified for each of the CSLZs considered in this report.

**Table 8: Converter Station Location Zone Constraints/Considerations Summary**

Reference	Location	Key Constraints / Considerations
1	Ballyadam	<ul style="list-style-type: none"> <li>Approximately 7 kilometres straight line distance from Knockraha 220kV station, longer by road route. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha 220kV station will be challenging due to railway and bridge crossings.</li> <li>Partially zoned for industry but surrounded by Prominent and Strategic Metropolitan Greenbelt Areas. Potentially limited flexibility in terms of micro-siting.</li> <li>Encompasses the N25 Route Protection Corridor.</li> <li>Includes karst features within areas of extreme aquifer vulnerability.</li> <li>Potential drainage issues.</li> <li>Low lying site within High Value Landscape.</li> <li>Significant number of cultural heritage features on site.</li> </ul>
2	Water Rock	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 9 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha 220kV station will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha 220kV station.</li> <li>Encompasses built-up area of mixed commercial, retail and residential use.</li> <li>Potentially limited flexibility in terms of micro-siting. Encompasses the N25 Route Protection Corridor. Partially zoned for residential and enterprise uses. Also, partially located within Prominent and Strategic Metropolitan Greenbelt Areas.</li> <li>Includes a Geological Heritage Site and karst features.</li> <li>Low lying within High Value Landscape.</li> <li>Potential connectivity to proximate Natura 2000 sites.</li> <li>Close proximity to a significant number of sensitive receptors.</li> </ul>
3	Curragh	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 7 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha 220kV station will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha 220kV station.</li> <li>Potentially limited flexibility in terms of micro-siting. The majority of the zone forms part of Prominent and Strategic Metropolitan Greenbelt Areas. The section to the south east is classed as a Built-Up area, zoned for residential development. The zone also incorporates part of a golf course.</li> <li>Within a High Value Landscape.</li> <li>Low lying and potentially overlooked by the R626 Leamlara to Midleton scenic route.</li> </ul>
4	Elfordstown	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 9 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha. Steep sections pose additional challenge.</li> </ul>

Reference	Location	Key Constraints / Considerations
		<ul style="list-style-type: none"> <li>Potentially limited flexibility in terms of micro-siting. The majority of the zone forms part of Prominent and Strategic Metropolitan Greenbelt Areas and is located within High Value Landscape.</li> <li>Prominent and elevated zone. Includes National Space Centre which may limit screening potential.</li> <li>Steep elevations to the east and west sloping down towards a ridge and a valley (with rock outcrops and a river flowing through it).</li> </ul>
5	Lisgould East	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 5 kilometres straight line distance from Knockraha 220kV station, longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.</li> <li>AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha.</li> <li>An elevated zone in proximity to a scenic route and partially located within a High Value Landscape.</li> <li>Located in proximity to the Lisgould Development Boundary.</li> </ul>
6	Leamlara	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 4 kilometres straight line distance from Knockraha 220kV station, however longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.</li> <li>Limited road network in the zone could result in both AC and DC circuits routes in the same road - adequate space may not be available.</li> <li>Incorporates part of the Leamlara Development Local Area Plan Boundary</li> <li>An elevated zone. The forested area may offer screening but change of land use consent would be required.</li> <li>Potential for ecological and cultural heritage impacts associated with tree felling.</li> </ul>
7	Ballynaglough	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 3 kilometres straight line distance from Knockraha 220kV station. In terms of cable route length, it is very likely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>The road network in the area appears to offer opportunities for independent routes for both AC and DC cable routes.</li> <li>Majority of zone elevated and exposed.</li> <li>Includes an area of forestry which may offer screening potential (considered under CSLZ 14).</li> <li>Potential for ecological and cultural heritage impacts associated with tree felling.</li> </ul>
8	Monatooreen	<ul style="list-style-type: none"> <li>Boundary is approximately 2 kilometres straight line distance from Knockraha 220kV station. In terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>The road network in the zone is narrow however appears to offer opportunities for establishing AC and DC cable routes.</li> <li>Majority of zone is elevated and exposed with potentially limited flexibility in terms of micro-siting.</li> <li>Includes an area of forest which may offer screening potential (considered under CSLZ 14).</li> <li>Potential for ecological and cultural heritage impacts associated with tree felling.</li> </ul>
9	Knockraha	<ul style="list-style-type: none"> <li>Incorporates Knockraha 220kV station. An underground AC circuit will not require reactive compensation.</li> <li>The length of the wider cable trench (AC) is short and the associated risk of establishing a route is low.</li> <li>Existing infrastructure may limit flexibility in terms of micro-siting opportunities.</li> <li>Elevated and exposed zone with potentially limited screening opportunities.</li> </ul>
10	Pigeon Hill	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 1 kilometre straight line distance from Knockraha 220kV station. In terms of cable route length, it is likely that an AC</li> </ul>

Reference	Location	Key Constraints / Considerations
		<p>underground cable could be installed without the requirement for reactive compensation.</p> <ul style="list-style-type: none"> <li>Independent routes for the AC and DC circuits appear to be available within the local road network.</li> <li>Elevated and exposed zone but potential opportunities for screening within the forested area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
11	Moanbaun	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 4 kilometres straight line distance from Knockraha 220kV station, longer by road. In terms of cable route length, it is likely that an AC underground cable would require the installation of reactive compensation.</li> <li>Independent routes for the AC and DC circuits appear to be available within the local road network.</li> <li>Elevated areas within the zone with rock outcrops.</li> <li>Potential opportunities for screening within the forested area but micro-siting options may be limited.</li> <li>Adjacent to Maonbaun Woods amenity area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
12	Kilquane	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 2 kilometres straight line distance from Knockraha 220kV station, however longer by road. In terms of cable route length, it is unlikely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>Establishing independent routes for the AC and DC circuits will be challenging within the local road network.</li> <li>Potential opportunities for screening within the forested area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
13	Ballynona	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 12 kilometres straight line distance from Knockraha 220kV station, longer by road. This exceeds the indicated maximum length of AC cable without reactive compensation.</li> <li>AC cable route to Knockraha will be challenging due to the width of the trench required for the AC circuit and the narrow, tree lined roads between the zone and Knockraha. Steep sections pose additional challenge.</li> <li>Potential opportunities for screening within the forested area.</li> <li>Existing Irish Distillers site adjacent to forested area.</li> <li>Children's burial grounds recorded within the zone.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>
14	Ballyvatta	<ul style="list-style-type: none"> <li>CSLZ boundary is approximately 3 kilometres straight line distance from Knockraha 220kV station, in terms of cable route length, it is likely that an AC underground cable could be installed without the requirement for reactive compensation.</li> <li>The road network in the zone is narrow however appears to offer opportunities for establishing AC and DC cable routes.</li> <li>Potential opportunities for screening within the forested area.</li> <li>Potential ecological and cultural heritage impacts associated with tree felling.</li> </ul>

Source: Mott MacDonald

The following table presents a summary of the key technical and environmental constraints identified for each of the landfall locations considered in this report.

As detailed in Section 1.3 *What is the Celtic Interconnector Project*, overhead line is not being considered for the DC circuit between the landfall location and the converter station. The landfalls will be fully re-instated following the installation of the land circuit. In general, impacts associated with the installation of the cable are expected to be temporary in nature.



**Table 9: Landfall Location Options Summary**

Landfall Options	Location	Key Constraints
1	Inch Beach	<ul style="list-style-type: none"> <li>Limited space available for a construction laydown area .</li> <li>The route will need to cross an existing gas main and Ballycroneen Bay Geological Heritage Area.</li> <li>Potential to cause damage and disturbance to habitats and species (including protected birds).</li> <li>A number of sensitive receptors to temporary nuisance and disturbance impacts associated with the installation of a cable.</li> </ul>
2	Ballycroneen Beach	<ul style="list-style-type: none"> <li>Small suitable space for a construction laydown area at the landfall.</li> <li>Proposed route to Ballycroneen beach passes a section of tree lined roadway.</li> <li>Proposed route from Inch Beach/Ballycroneen beach passes through Cloyne Conservation Area.</li> <li>Potential to cause damage and disturbance to habitats and species (including protected birds)</li> <li>Approximately 960 metres from Ballycroneen Bay Geological Heritage Area.</li> </ul>
3	Ballinwilling Strand	<ul style="list-style-type: none"> <li>There is limited space at the proposed landfall area for a construction laydown area but some space may be available in the carpark</li> <li>The route to Ballinwilling will need to pass over a number of bridges with limited deck space along the route.</li> <li>Potential to cause damage and disturbance to habitats and species (including protected birds).</li> <li>Approximately 3 kilometres from Ballycotton Bay Geological Heritage Area.</li> <li>Proximate to Ballycotton, Ballymona and Shanagarry pNHA (site code 000076).</li> <li>Approximately 2 kilometres from Ballycotton Bay SPA / Ramsar Site.</li> <li>Approximately 6.5 kilometres from Ballycotton Islands pNHA.</li> <li>Sparsely populated and undeveloped.</li> </ul>
4	Redbarn Beach	<ul style="list-style-type: none"> <li>Limited space for a construction laydown area at the proposed landfall area.</li> <li>The cable route to Redbarn beach will need to pass along narrow and winding roads with a number of bridges with limited deck space along the route.</li> <li>Potential to cause damage and disturbance to protected habitats and species (including birds).</li> <li>Bounded to the rear (north west) by sand dunes. Ballyvergan Marsh pNHA to the northeast.</li> <li>Proximate to Ballymacoda Bay SPA.</li> <li>Approximately 2.5 kilometres from Ballymacoda (Clonpriest and Pillmore) SAC/(p)NHA.</li> <li>Ballymacoda Bay is a Shellfish Designated Area, licensed for clams, oysters and mussels.</li> <li>Approximately 3 kilometres from Ballycroneen Bay Geological Heritage Area.</li> <li>Potential site of medium archaeological potential, associated with a possible sub-surface depression identified in the geophysical survey at Redbarn Beach.</li> </ul>
5	Claycastle Beach	<ul style="list-style-type: none"> <li>Space for a construction laydown area may be available at the car park, but this may require permissions.</li> <li>A narrow road leading to the beach complicated by railway crossing which may require works in a pNHA.</li> <li>Potential to cause damage and disturbance to protected habitats and species (including birds).</li> <li>Bounded to the east and west by Ballyvergan Marsh pNHA.</li> <li>Ballymacoda Bay SPA (site code 004023) / Ramsar site located approximately 2 kilometres to the south.</li> </ul>

Landfall Options	Location	Key Constraints
		<ul style="list-style-type: none"> <li>• Ballymacoda Bay SAC (site code 000077) and Ballymacoda (Clonpriest and Pillmore) pNHA (site code 000077) located approximately 4.5 kilometres to the south.</li> <li>• Blackwater Estuary SPA / Ramsar Site located approximately 3 kilometres to the northeast.</li> <li>• Blackwater River SAC and Blackwater River and Estuary pNHA are located approximately 2 kilometres to the northeast.</li> <li>• An area of peat deposits (including a submerged forest), of archaeological potential, have been recorded at Claycastle Beach.</li> <li>• Densely populated and popular resort with a number of particularly sensitive receptors.</li> </ul>

Source: Mott MacDonald

## 7.2 Evaluation of Options

The findings of this constraints report and ongoing studies, including those being undertaken by Wood Group PLC (the marine consultant on the project), will be collated into a set of enhanced performance matrices, which will be made available separately to this report. The matrices will evaluate each of the options detailed in this report and compare them relative to each of the other options with the aim of identifying general areas / zones where the proposals could be best located, taking account of criteria defined under the following headings:-

- Economic Performance;
- Technical Performance;
- Deliverability Performance;
- Environmental Performance; and
- Socio-economic Performance.

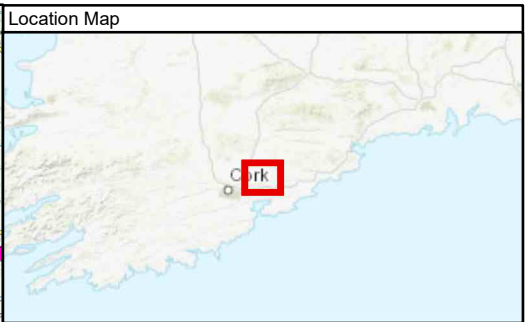
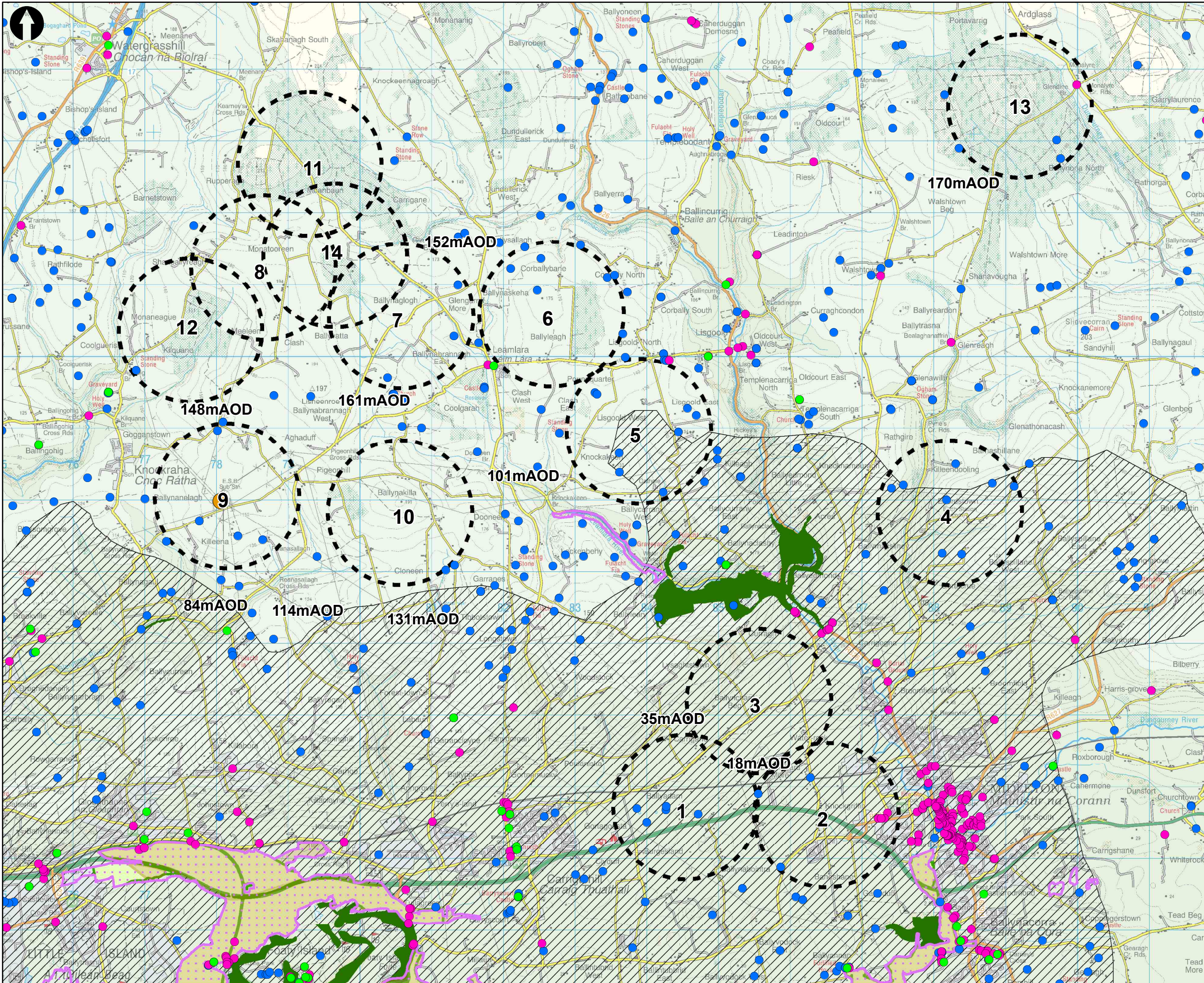
# Appendices

A.	Constraints Mapping	148
B.	I-WeBS Data and Associated Conservation Status	149

## A. Constraints Mapping







Key to Symbols	
	Connection Point
	NIAH Sites
	RPS
	SMR Sites
	Cork CoCo Ancient and Long Established Woodland
	High Value Landscape
	SAC
	SPA
	Designated NHA
	Proposed NHA
	Converter Station Location Zone

Notes	
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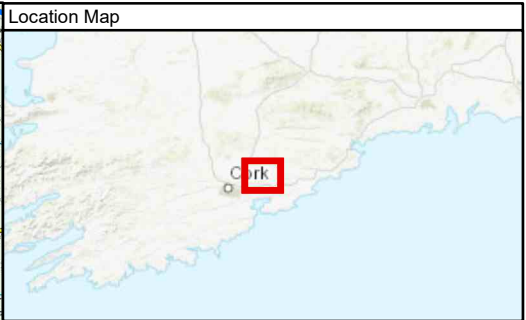
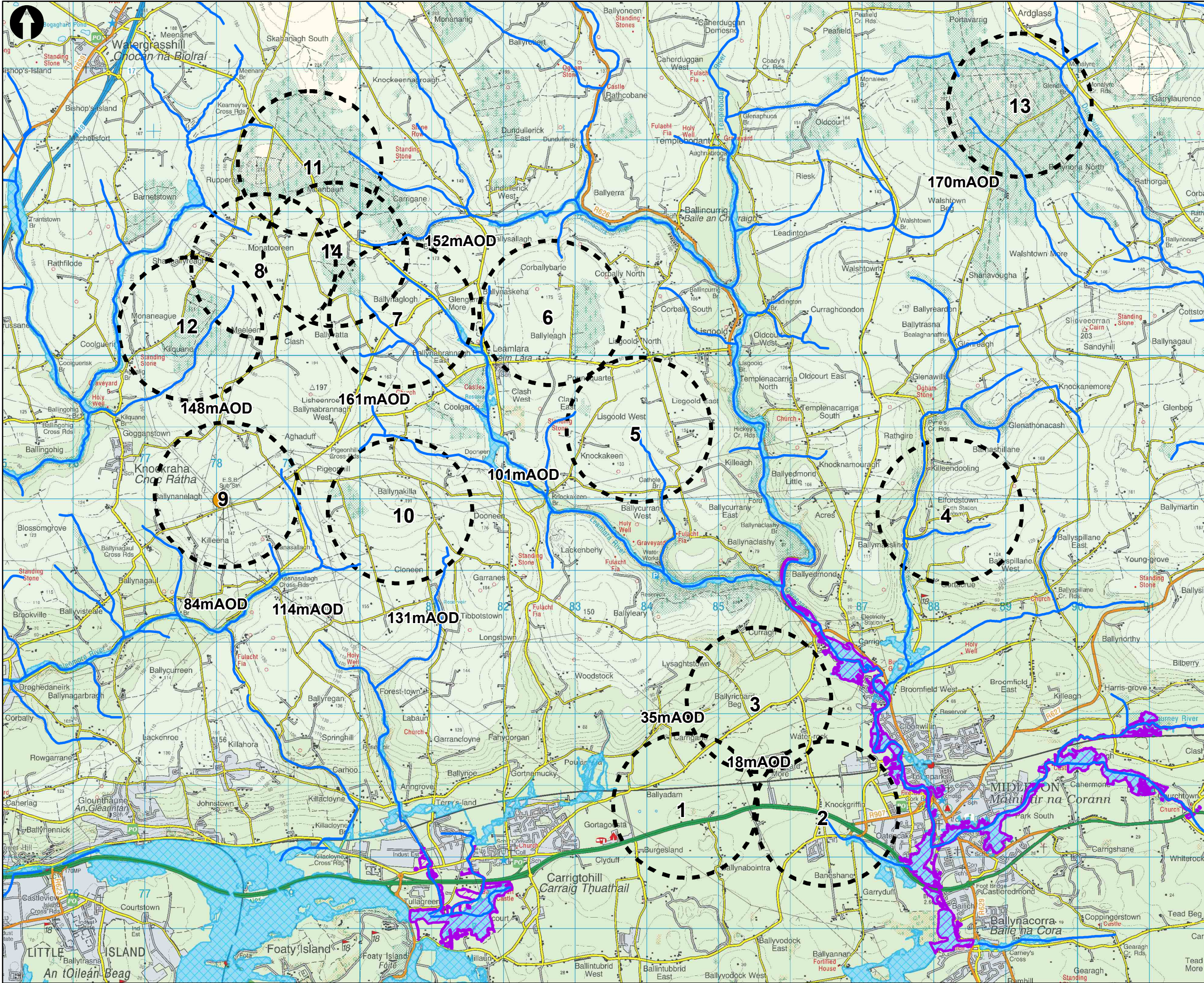
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Celtic Interconnector Project Step 3 Converter Station Location Zones Environmental Constraints Map					

Designed	J.Irons		Eng Check	D.Hassett	
Drawn	J.Irons		Coordination	D.Hassett	
GIS Check	D.Hassett		Approved	G. McCarthy	
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Key to Symbols	
	Connection Point
	EPA Rivers and Streams and Lakes
	CFRAMS Flood Risk
	Cork CoCo Flood Zone A
	Converter Station Location Zone

Notes	
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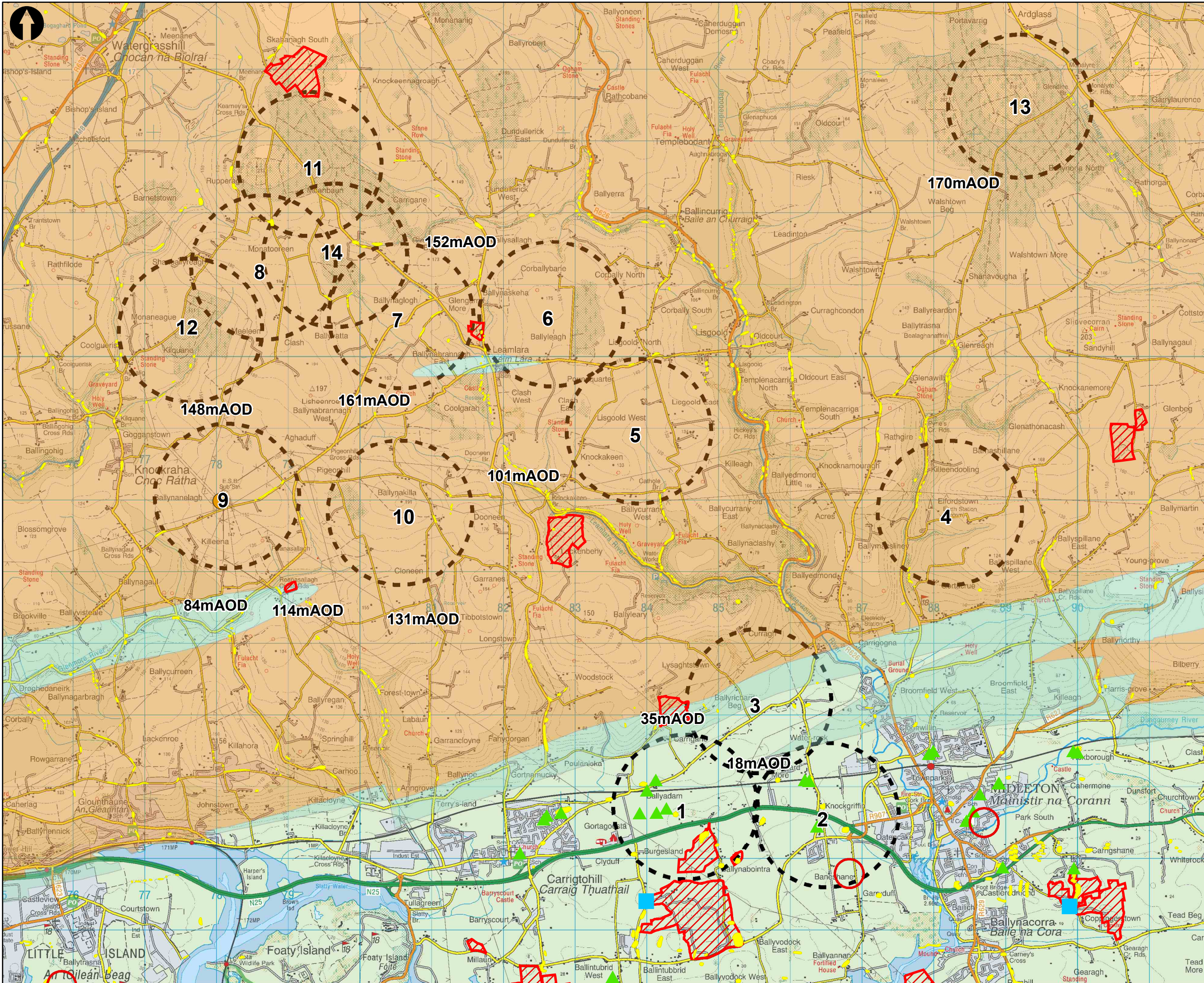
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Title Celtic Interconnector Project Step 3 Converter Station Location Zones Watercourses and Flood Risk Constraints Map					
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Location Map

Key to Symbols

- Connection Point
- Karst Features
- Landslide Events
- GSI Active Quarries
- GSI Bedrock Outcrops
- GSI Heritage Site Boundary
- GSI Heritage Site - Unaudited
- Cork CoCo Quarry Register

GSI Rock Unit

- Devonian Kiltorcan-type Sandstones
- Devonian Old Red Sandstones
- Dinantian (early) Sandstones, Shales and Limestones
- Dinantian Mixed Sandstones, Shales and Limestones
- Dinantian Mudstones and Sandstones (Cork Group)
- Dinantian Sandstones
- Granites & other Igneous Intrusive rocks
- Namurian Sandstones
- Permo-Triassic Sandstones
- Westphalian Sandstones
- Converter Station Location Zone

Notes

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Title

**Celtic Interconnector Project  
Stage 3 Converter Station Location Zones  
Geological Constraints Map**

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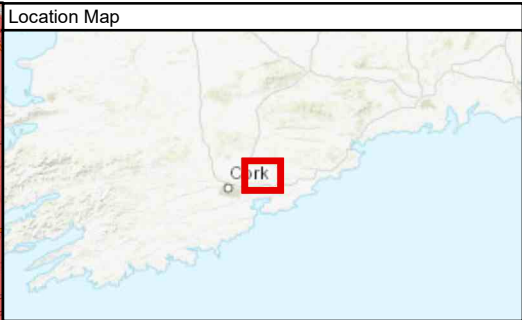
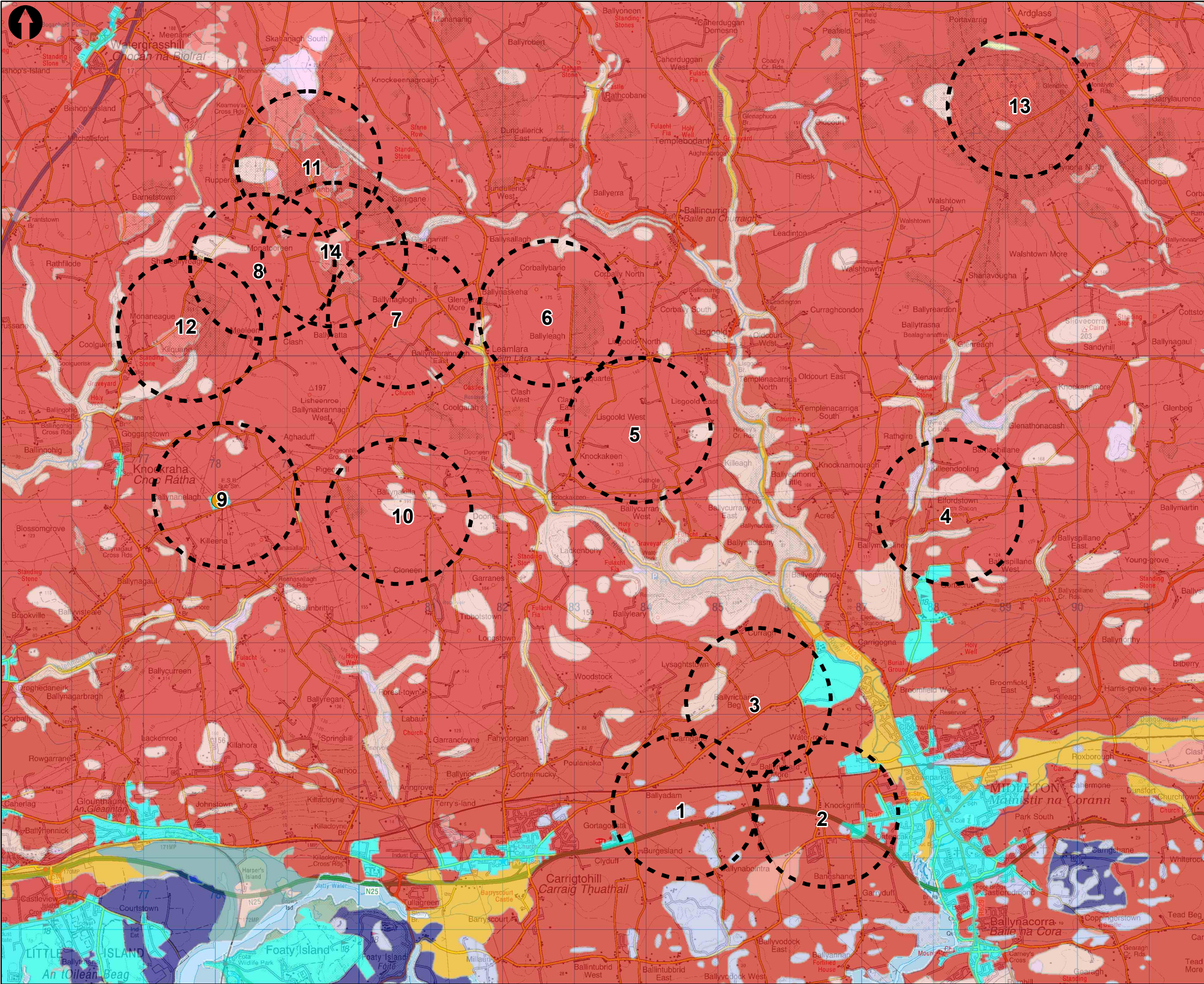
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0 2.5 5 Km









**Key to Symbols**

- Connection Point
- ⬢ Converter Station Location Zone

**GSI Teagasc Soils**

- AminDW - Deep well drained mineral (Mainly acidic)
- AminDW - Deep well drained mineral (Mainly acidic)
- MarSed - Marine/estuarine sediments
- AlluvMIN - Alluvial (mineral)
- MarSands - Marine sand and gravel
- Made - Made ground
- BminDW - Deep well drained mineral (Mainly basic)

**Notes**

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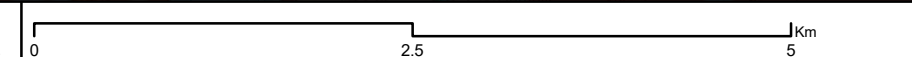
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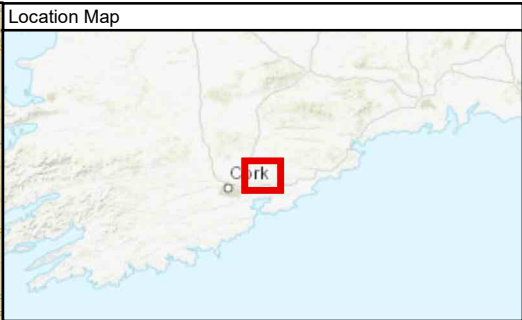
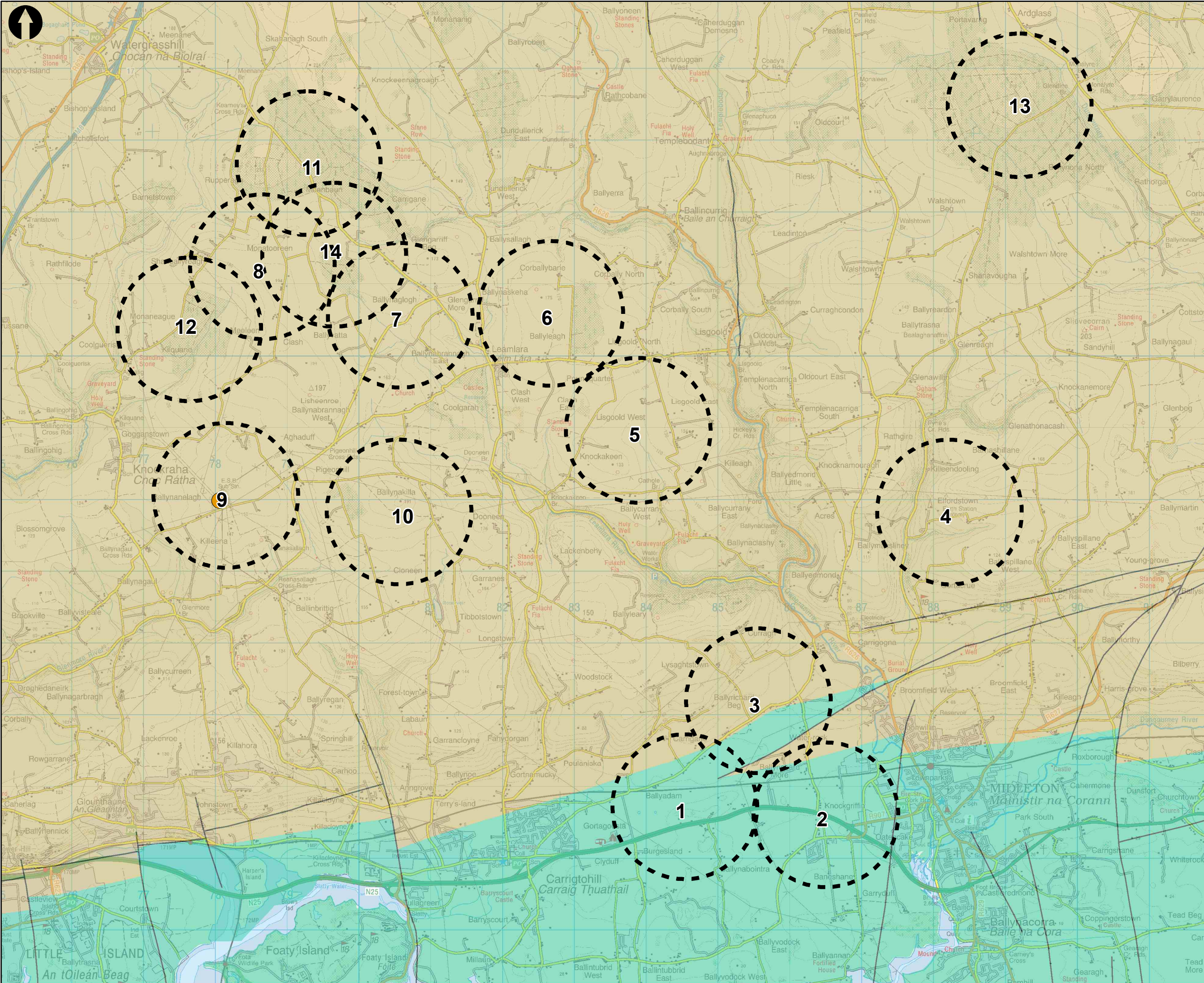
Celtic Interconnector Project  
Step 3 Converter Station Location Zones  
Teagasc Soils Constraints Map

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**Key to Symbols**

- Connection Point
- Bedrock Aquifer
- Lake
- Locally Important Aquifer -
- Locally Important Aquifer - Bedrock which is Generally Moderately Productive only in Local Zones
- Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Poor Aquifer - Bedrock which is Generally Unproductive
- Regionally Important Aquifer - Karstified (Fissured Bedrock)
- Regionally Important Aquifer -
- Regionally Important Aquifer - Karstified
- Regionally Important Aquifer - Karstified
- Converter Station Location Zone

**Notes**

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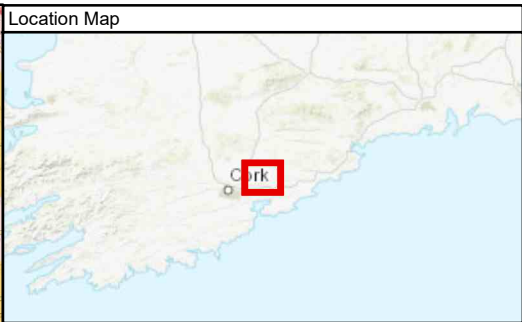
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Step 3 Converter Station Location Zones  
Groundwater Aquifers Constraints Map

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**Key to Symbols**

- Connection Point
- Converter Station Location Zone
- GSI Groundwater Vulnerability**
  - X - Rock at or near surface or Karst
  - E - Extreme
  - H - High
  - M - Moderate
  - L - Low
  - W - Water

**Notes**

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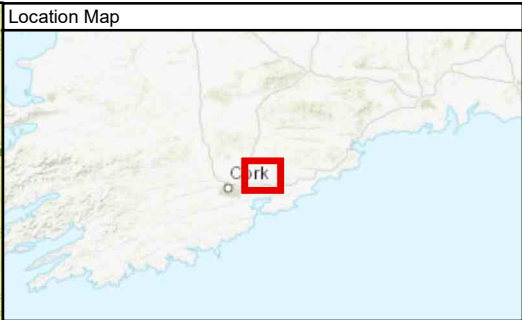
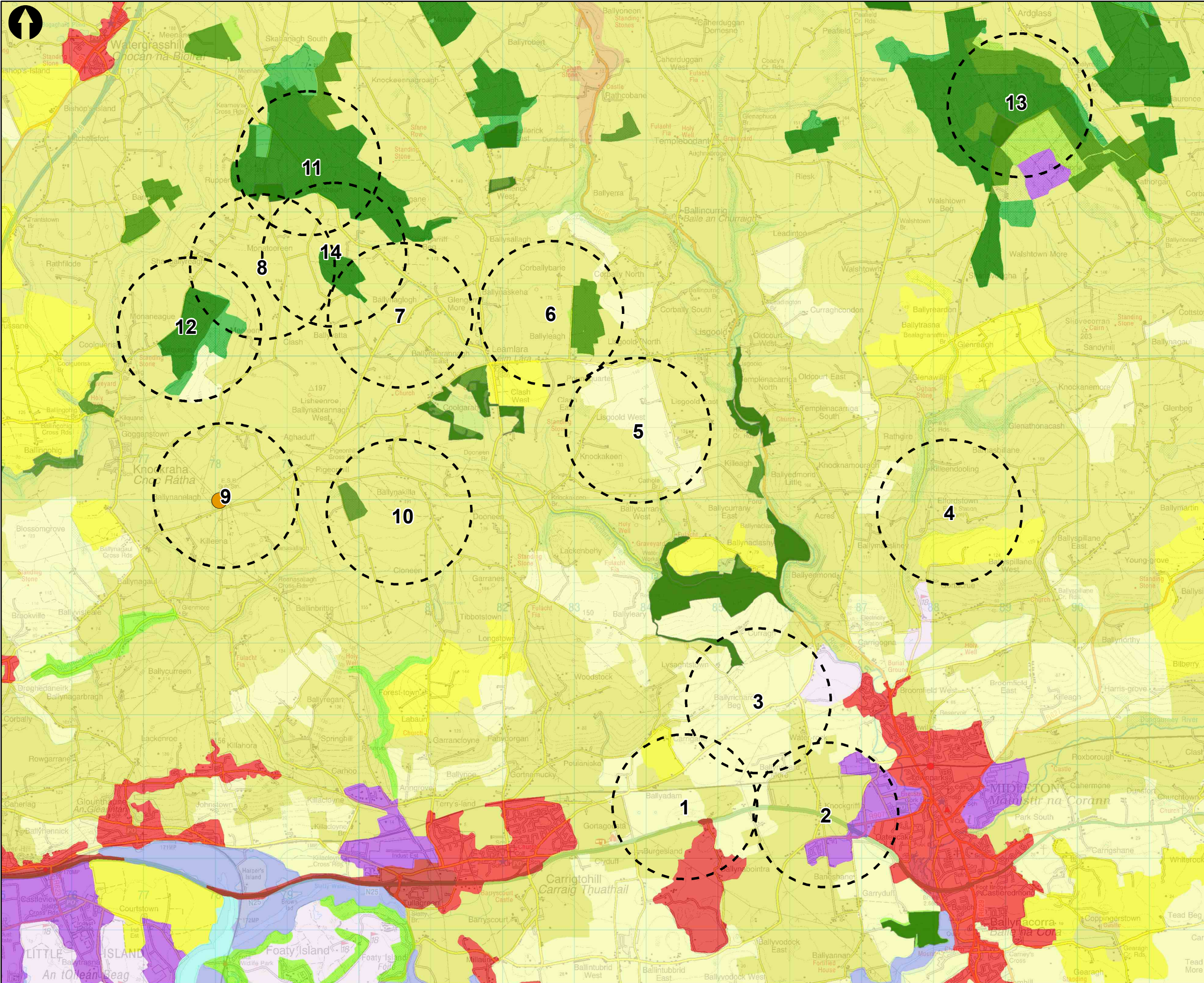
**Celtic Interconnector Project  
Step 3 Converter Station Location Zones  
Groundwater Vulnerability  
Constraints Map**

Designed	J.Irons	Eng Check	D.Hassett
Drawn	J.Irons	Coordination	D.Hassett
GIS Check	D.Hassett	Approved	G. McCarthy
Scale at A3	Status	Rev	Security
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Drawing Number  
**229100428-MMD-00-XX-DR-N304-0008**







Key to Symbols	
	Connection Point
	Converter Station Location Zone
	Coillte Forests
CORINE Landuse 2018	
	111 Continuous urban fabric
	112 Discontinuous urban fabric
	121 Industrial or commercial units
	122 Road and rail networks
	123 Sea ports
	124 Airports
	131 Mineral extraction sites
	132 Dump
	133 Construction sites
	141 Green urban sites
	142 Sport and leisure facilities
	211 Non-irrigated land
	231 Pastures
	242 Complex cultivation patterns
	243 Land principally occupied by agriculture with areas of natural vegetation
	311 Broad-leaved forest
	312 Coniferous forest
	313 Mixed forest
	321 Natural grassland
	322 Moors and heaths
	324 Transitional woodland scrub
	331 Beaches dunes sand
	332 Bare rocks
	333 Sparsely vegetated areas
	334 Buried areas
	411 Inland marshes
	412 Peat bogs
	421 Salt Marshes
	423 Intertidal flats
	511 Stream courses
	512 Water bodies
	521 Coastal lagoons
	522 Estuaries

Notes

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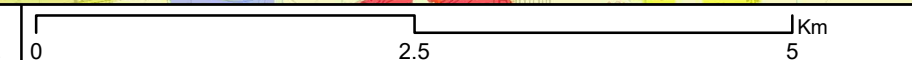
Celtic Interconnector Project  
Step 3 Converter Station Location Zones  
Land Use: Corine 2018 Constraints Map

Designed	J.Irons	Eng Check	D.Hassett
Drawn	J.Irons	Coordination	D.Hassett
GIS Check	D.Hassett	Approved	G. McCarthy
Scale at A3	Status	Rev	Security
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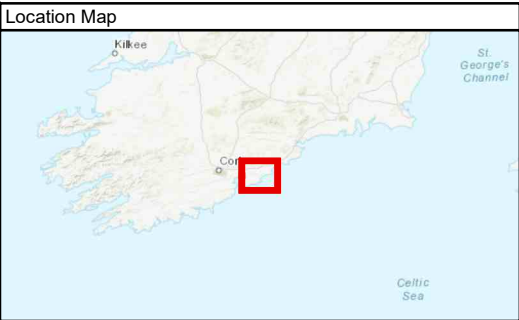
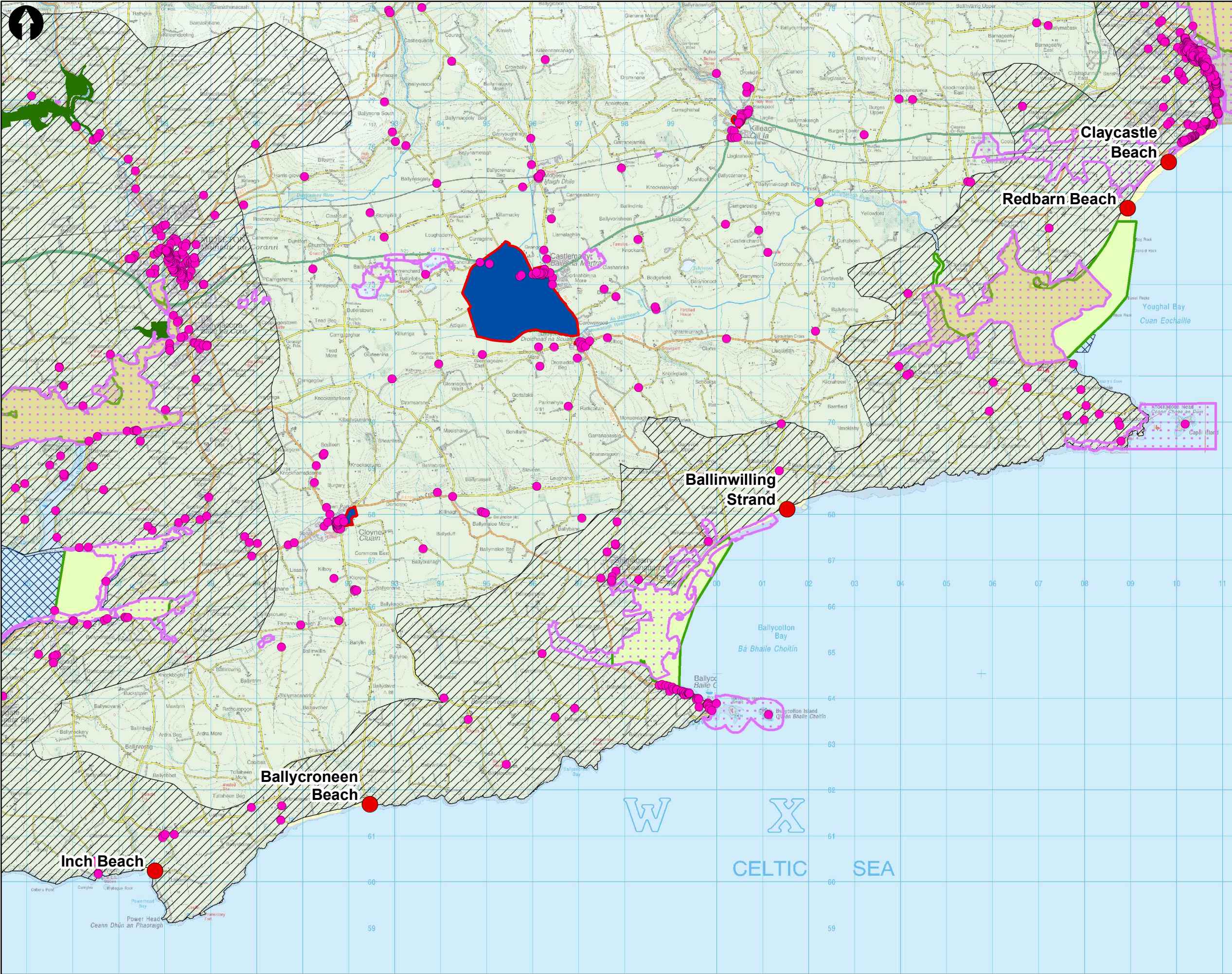
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Key to Symbols	
	Landfall Location
	NIAH Sites
	RPS
	SMR Sites
	Architectural Conservation Areas
	Cork CoCo Ancient and Long Established Woodland
	High Value Landscape
	SAC
	SPA
	Designated NHA
	Proposed NHA
	Shellfish Designations

Notes	
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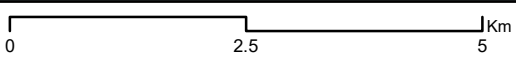
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Title	
Celtic Interconnector Project Step 3 Landfall Locations Environmental Constraints Map	

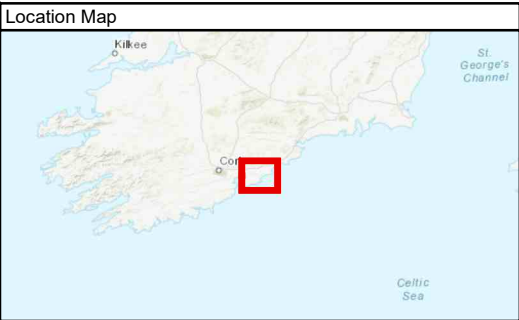
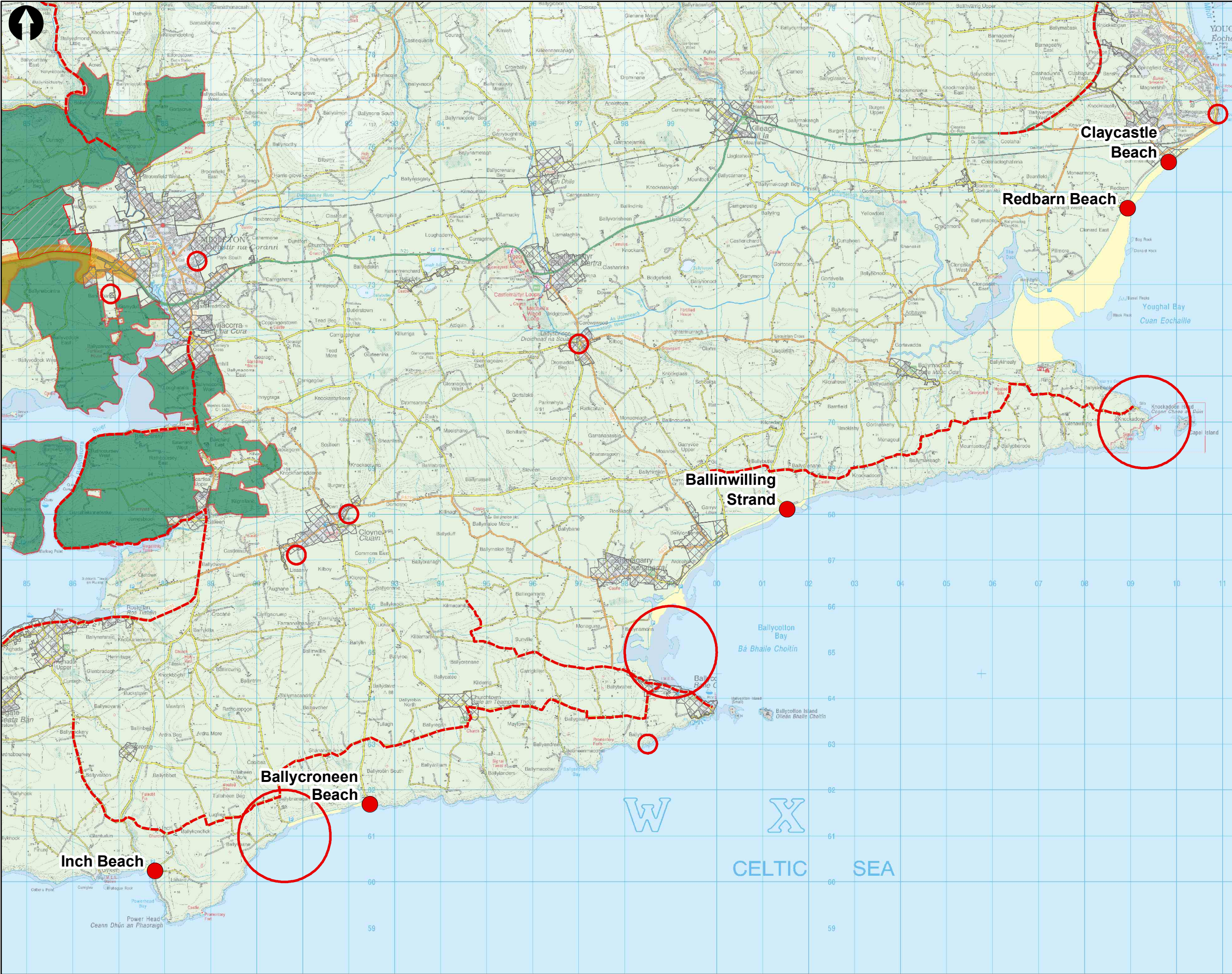
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Drawing Number
229100428-MMD-00-XX-DR-N304-0010







- Key to Symbols**
- Landfall Location
  - Scenic Routes
  - GSI Heritage Site
  - GSI Heritage Site - Unaudited
  - ▨ Existing Built Up Areas
  - Prominent and Strategic Metropolitan Greenbelt Areas
- Route Protection Corridors**
- Cork County Preferred Route Protection Corridor
  - ▨ Strategic Land Reserve

**Notes**

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS

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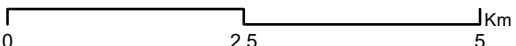
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Celtic Interconnector Project  
Step 3 Landfall Locations  
Landuse Planning Constraints Map

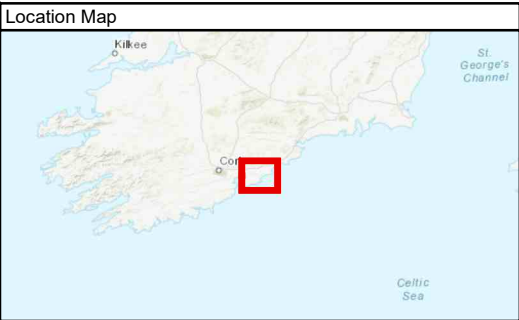
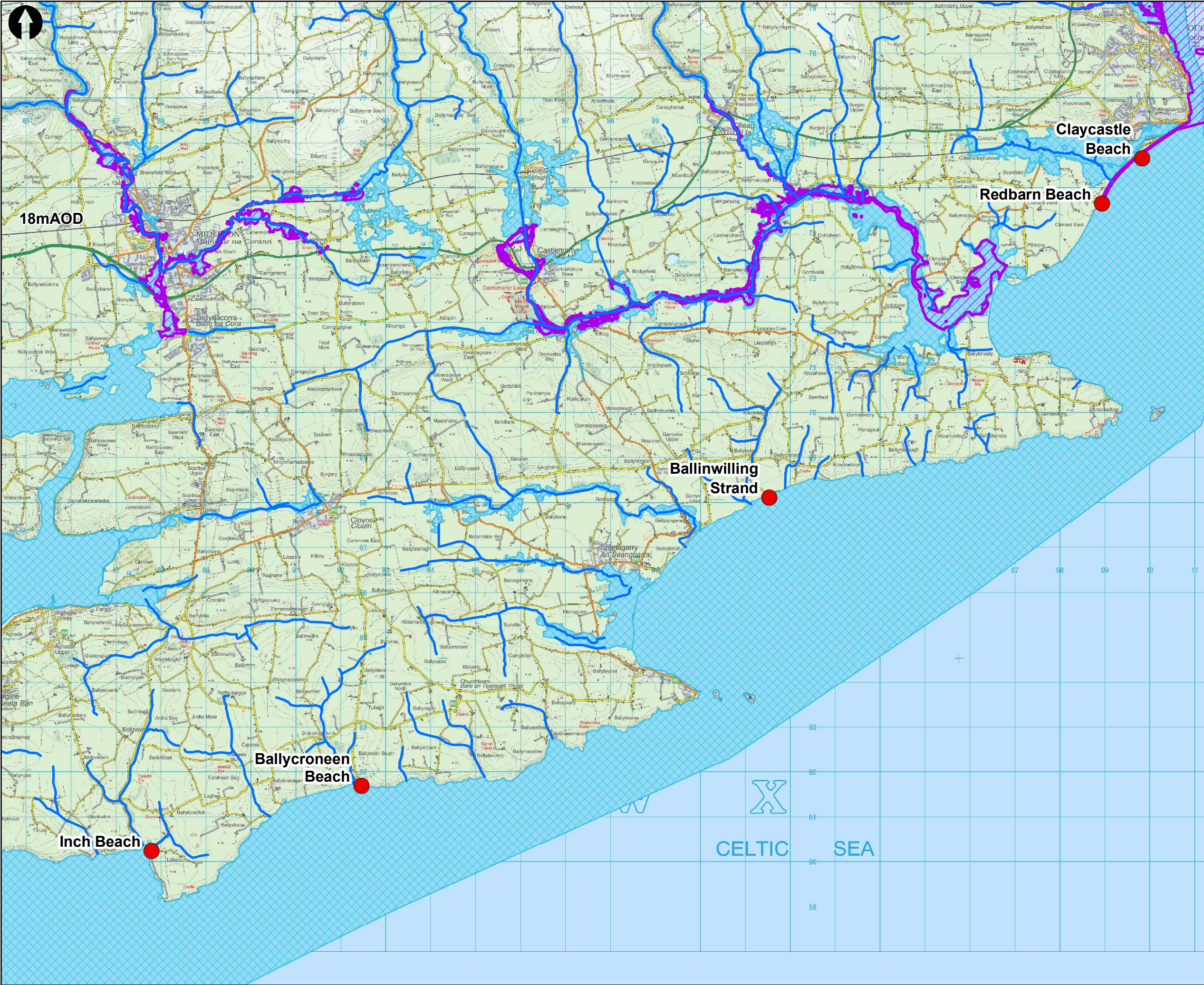
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Key to Symbols	
	Landfall Location
	EPA Rivers and Streams and Lakes
	CFRAMS Flood Risk
	Cork CoCo Flood Zone A

Notes	
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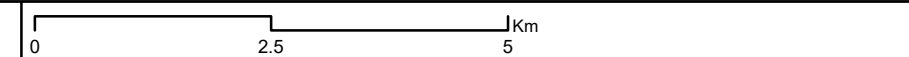
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Celtic Interconnector Project  
Step 3 Landfall Locations  
Watercourses and Flood Risk  
Constraints Map

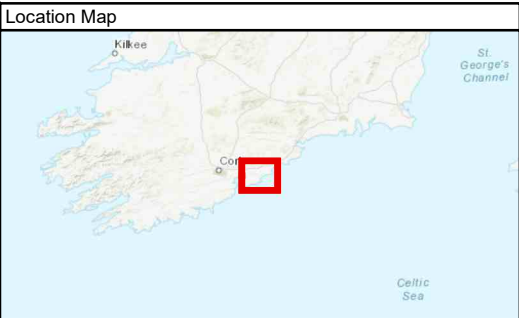
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**Key to Symbols**

- Landfall Location
- ▲ Karst Features
- Landslide Events
- GSI Active Quarries
- GSI Bedrock Outcrops
- GSI Heritage Site Boundary
- GSI Heritage Site - Unaudited
- Cork CoCo Quarry Register

**GSI Rock Unit**

- Devonian Kiltoran-type Sandstones
- Devonian Old Red Sandstones
- Dinantian (early) Sandstones, Shales and Limestones
- Dinantian Mixed Sandstones, Shales and Limestones
- Dinantian Mudstones and Sandstones (Cork Group)
- Dinantian Sandstones
- Granites & other Igneous Intrusive rocks
- Namurian Sandstones
- Permo-Triassic Sandstones
- Westphalian Sandstones


**Notes**

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS

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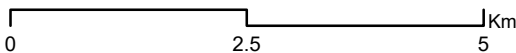
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Celtic Interconnector Project  
Step 3 Landfall Locations  
Geological Constraints Map

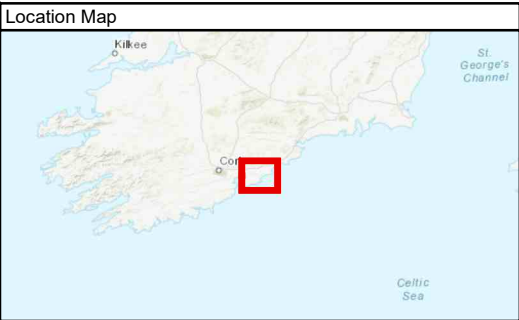
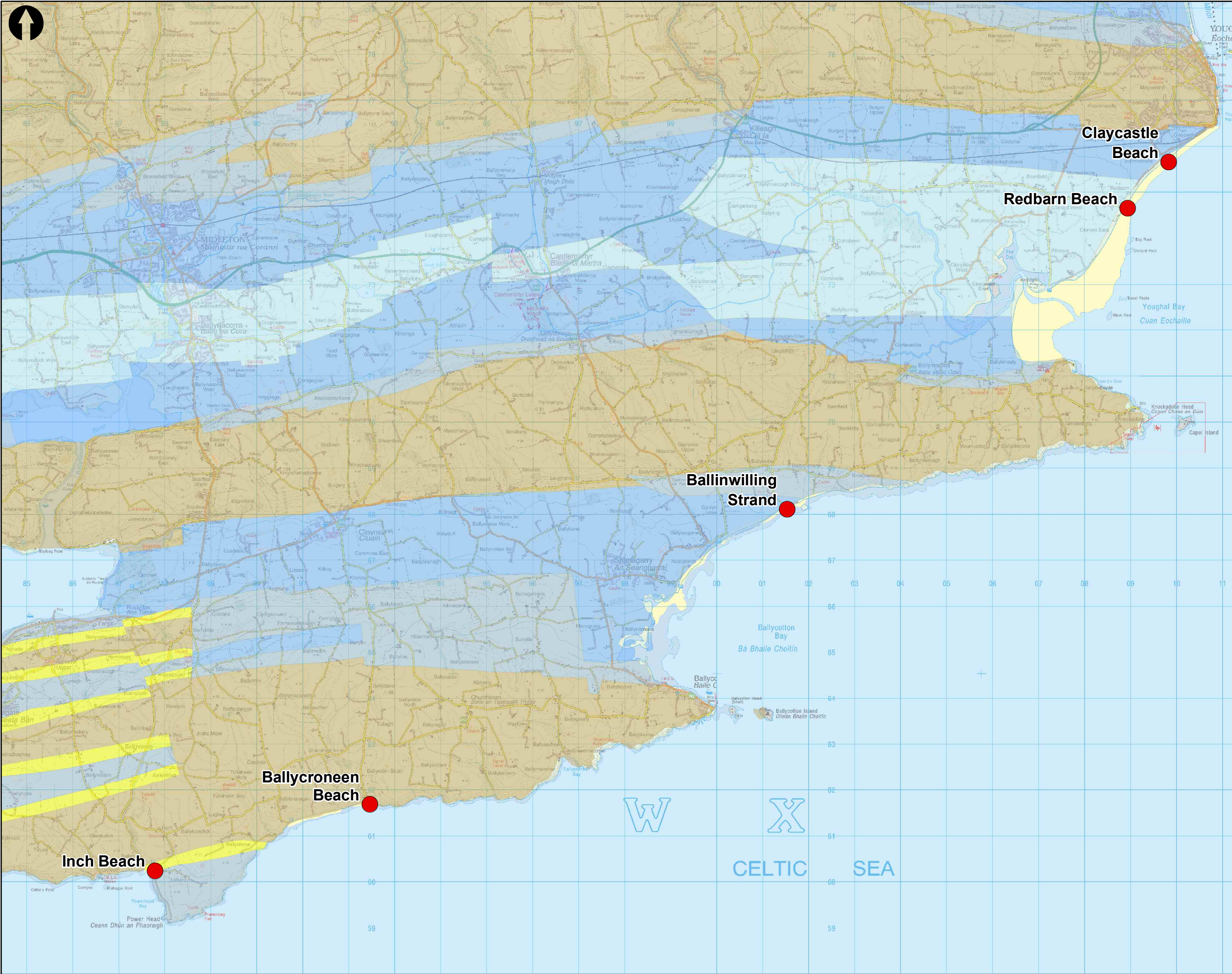
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**Key to Symbols**

● Landfall Location

**GSI Bedrock Geology**

- Up. Devonian sandstone & mudstone (Old Head Sandstone Fm)
- Namurian shale, sandstone, siltstone & coal
- Tournaisian limestone
- Tournaisian sandstone, mudstone, limestone
- Visean limestone & calcareous shale
- ORS, sandstone, conglomerate & mudstone

**Notes**

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS

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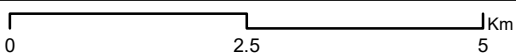
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Celtic Interconnector Project  
Step 3 Landfall Locations  
Bedrock Geology Constraints Map

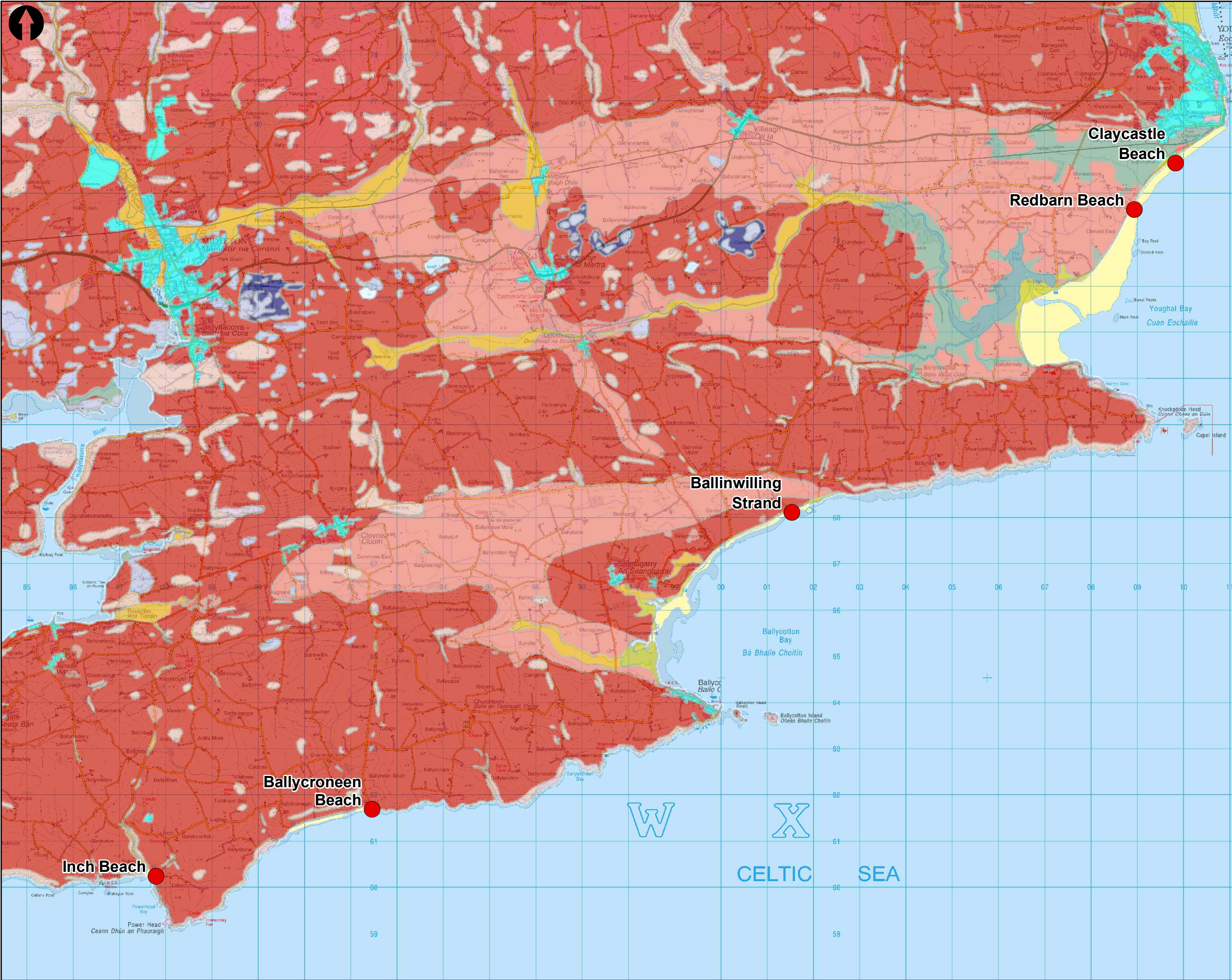
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GIS Check	D.Hassett	Approved	G. McCarthy

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229100428-MMD-00-XX-DR-N304-0014







**Key to Symbols**

- Landfall Location

**GSI Teagasc Soils**

- AminDW - Deep well drained mineral (Mainly acidic)
- AminDW - Deep well drained mineral (Mainly acidic)
- MarSed - Marine/estuarine sediments
- AlluvMIN - Alluvial (mineral)
- MarSands - Marine sand and gravel
- Made - Made ground
- BminDW - Deep well drained mineral (Mainly basic)

**Notes**

Service Layer Credits: EPA, GSI  
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, ©

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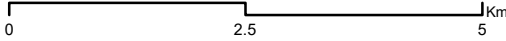
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Celtic Interconnector Project  
Step 3 Landfall Locations  
Teagasc Soils Constraints Map

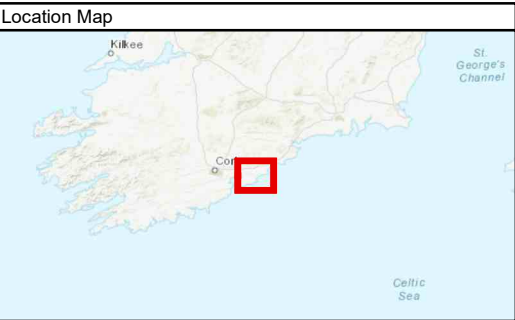
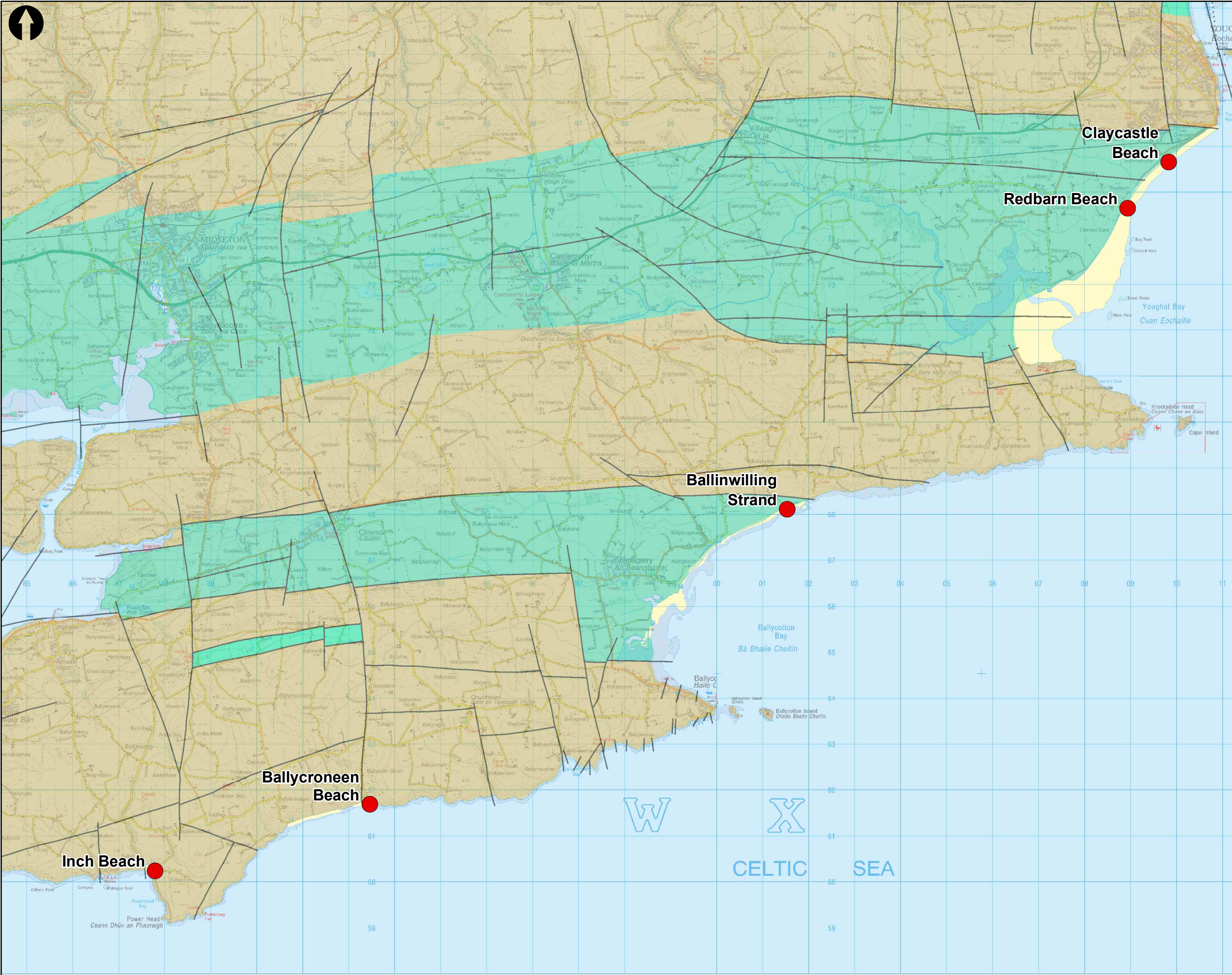
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Drawing Number  
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Key to Symbols	
	Landfall Location
	Bedrock Aquifer Faults
	Lake
	Locally Important Aquifer - Karstified
	Locally Important Aquifer - Bedrock which is Generally Moderately Productive only in Local Zones
	Locally Important Aquifer - Bedrock which is Generally Moderately Productive
	Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
	Poor Aquifer - Bedrock which is Generally Unproductive
	Regionally Important Aquifer - Karstified (Fissured Bedrock)
	Regionally Important Aquifer - Karstified
	Regionally Important Aquifer - Karstified (Conduit)
	Regionally Important Aquifer - Karstified (Diffuse)

Notes	
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Title		Celtic Interconnector Project Step 3 Landfall Locations Groundwater Aquifers Constraints Map	
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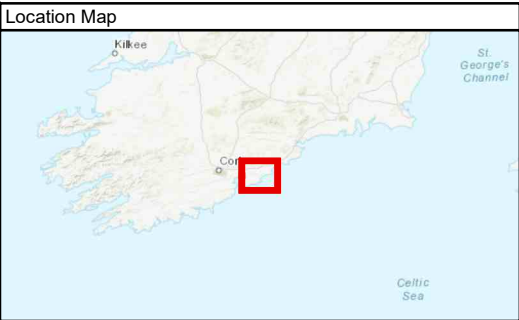
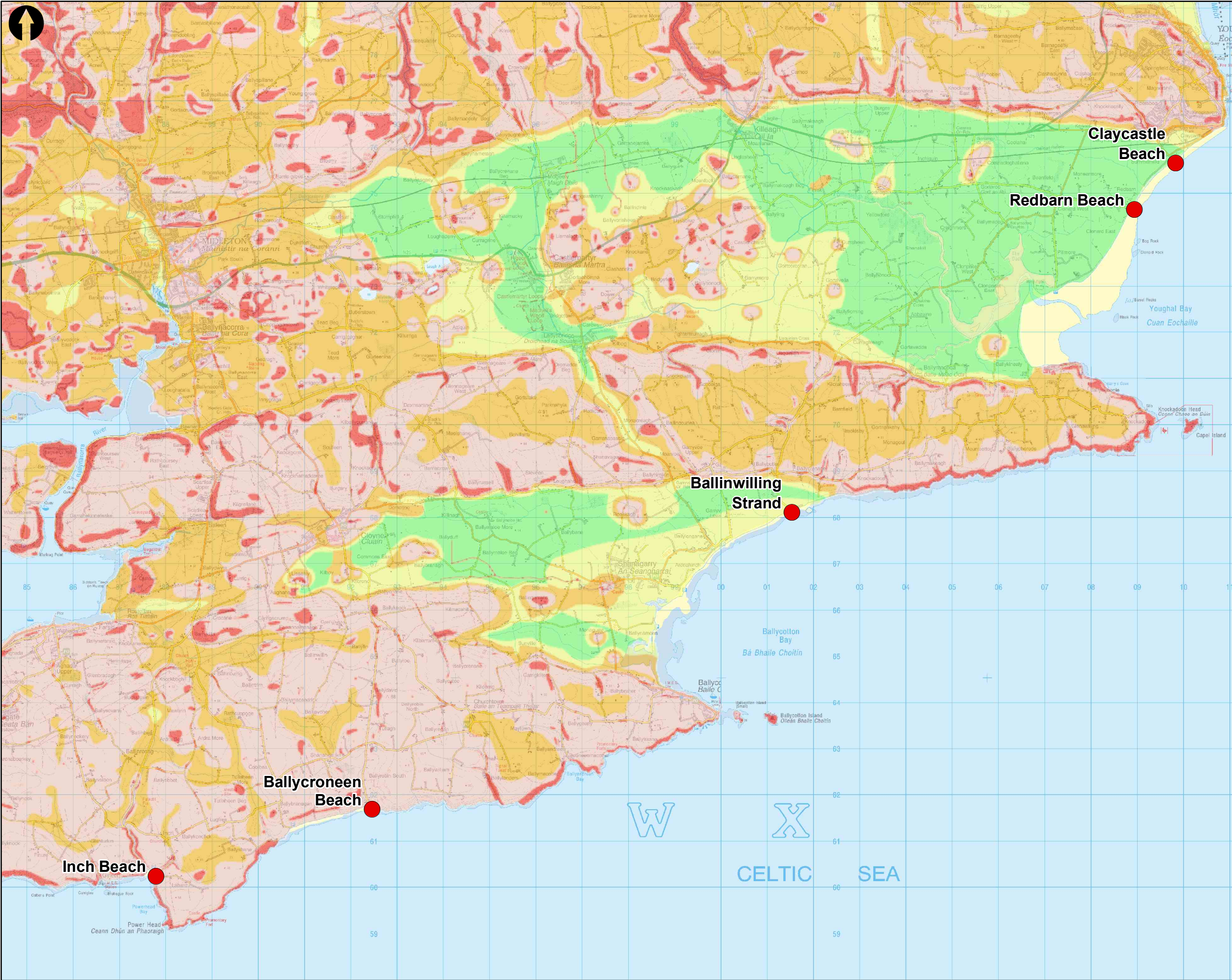
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Drawing Number
229100428-MMD-00-XX-DR-N304-0016







**Key to Symbols**

- Landfall Location
- GSI Groundwater Vulnerability
  - X - Rock at or near surface or Karst
  - E - Extreme
  - H - High
  - M - Moderate
  - L - Low
  - W - Water

**Notes**

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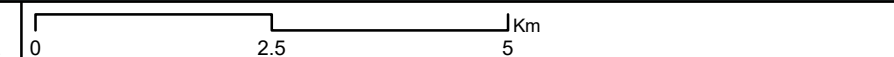
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Step 3 Landfall Locations  
Groundwater Vulnerability  
Constraints Map

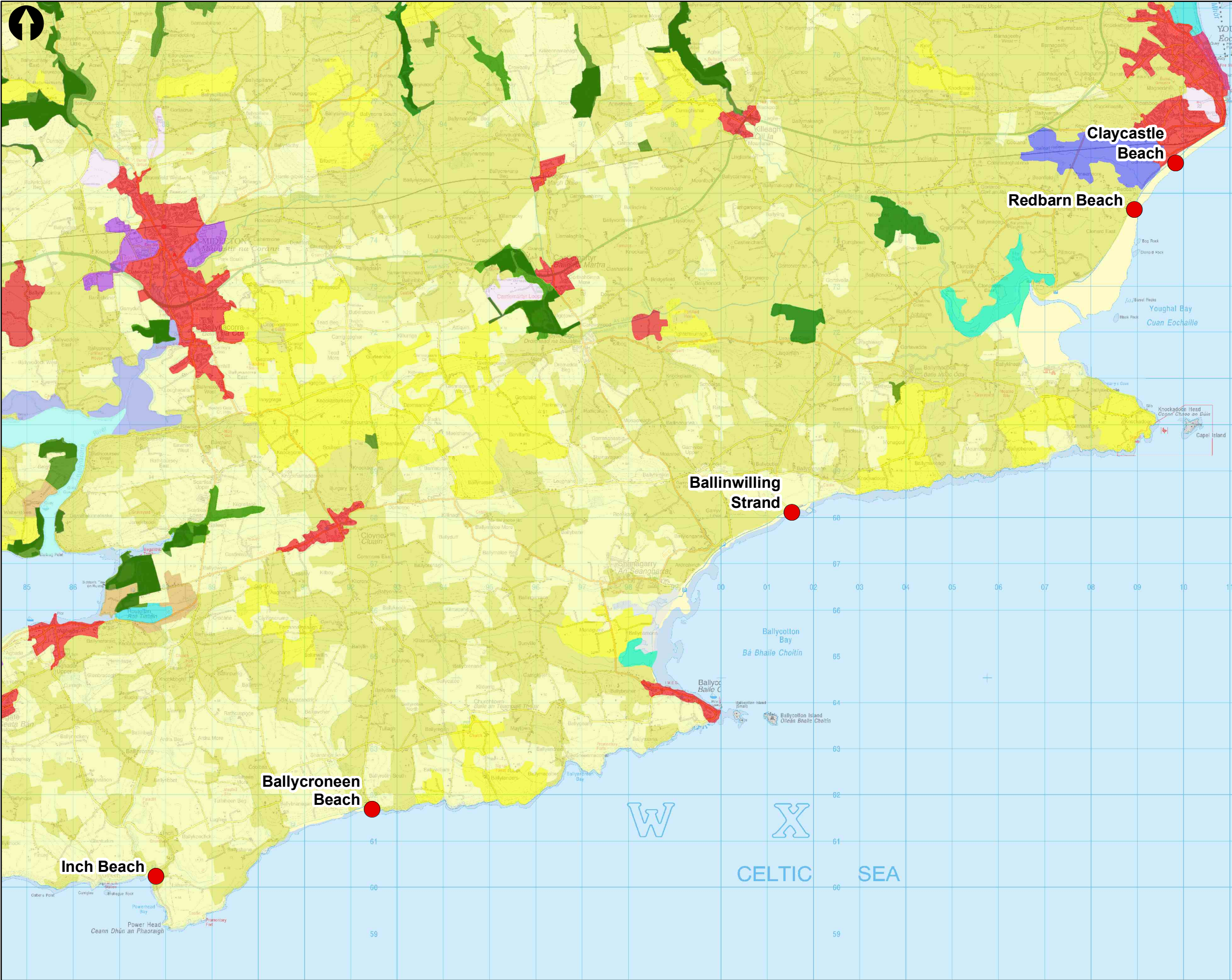
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Key to Symbols	
	Landfall Location
	Coilte Forests
CORINE Landuse 2018	
	111 Continuous urban fabric
	112 Discontinuous urban fabric
	121 Industrial or commercial units
	122 Road and rail networks
	123 Sea ports
	124 Airports
	131 Mineral extraction sites
	132 Dump
	133 Construction sites
	141 Green urban sites
	142 Sport and leisure facilities
	211 Non-irrigated land
	231 Pastures
	242 Complex cultivation patterns
	243 Land principally occupied by agriculture with areas of natural vegetation
	311 Broad-leaved forest
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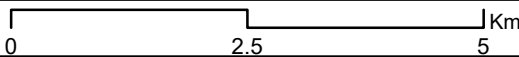
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Step 3 Landfall Locations  
Land Use: Corine 2018 Constraints Map

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GIS Check	D.Hassett	Approved	G. McCarthy	

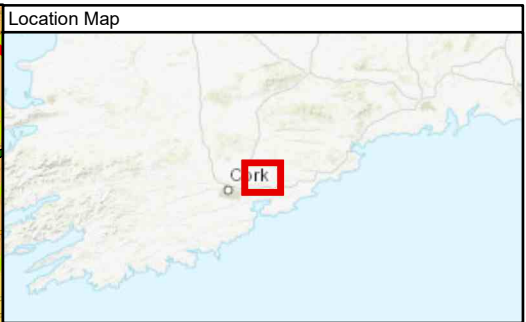
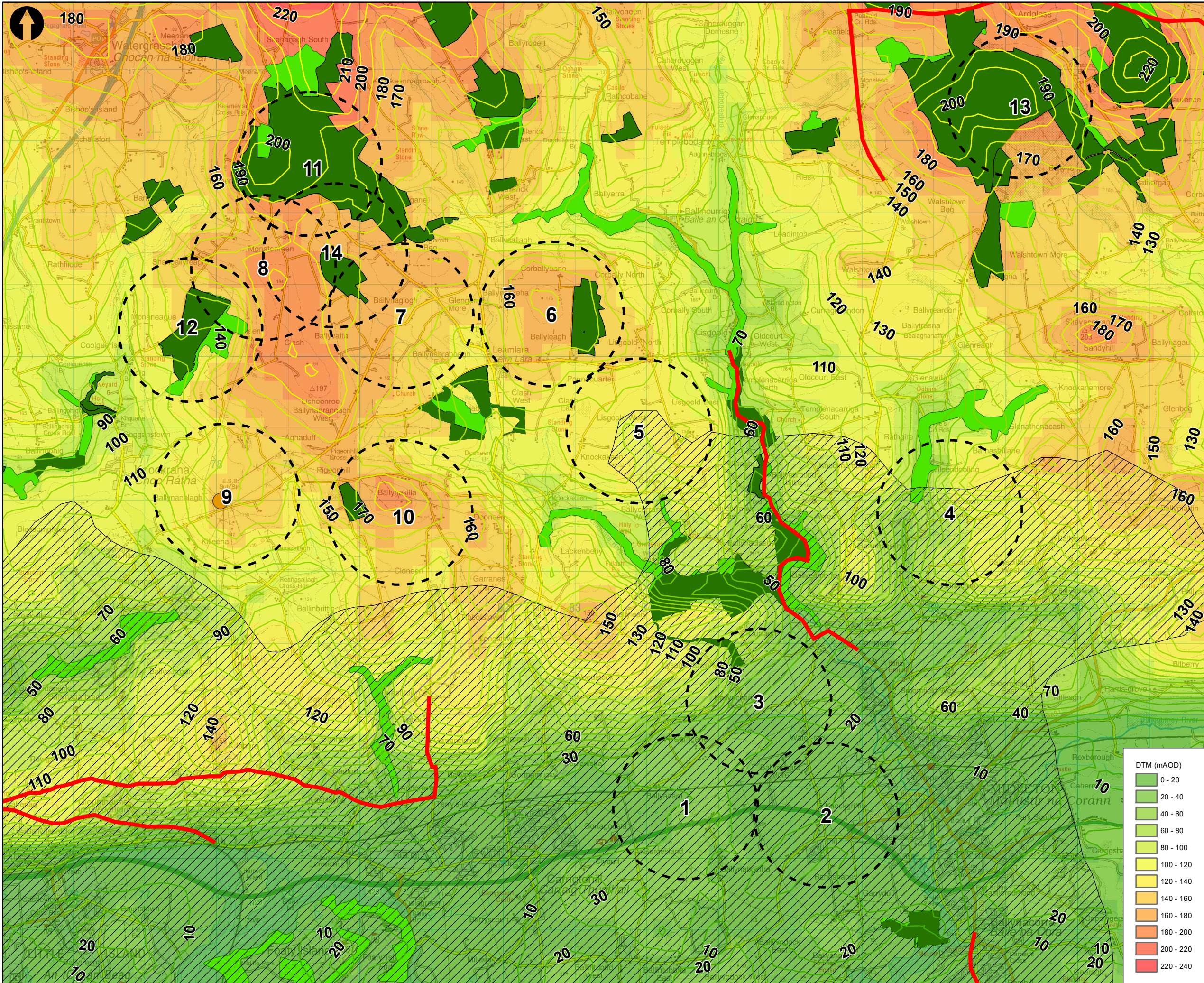
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Drawing Number

229100428-MMD-00-XX-DR-N304-0018







**Key to Symbols**

- Connection Point
- Scenic Routes
- ▨ High Value Landscape Cork
- Coillte Landbank
- CORINE 2018 Forested Areas
- - - Converter Station Location Zone

**Notes**

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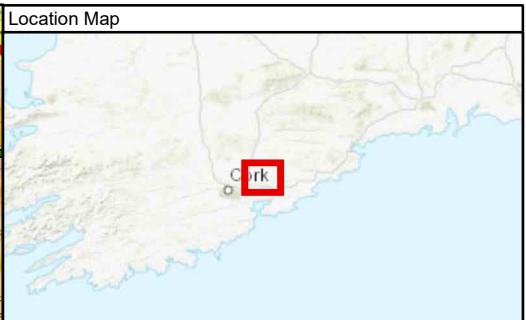
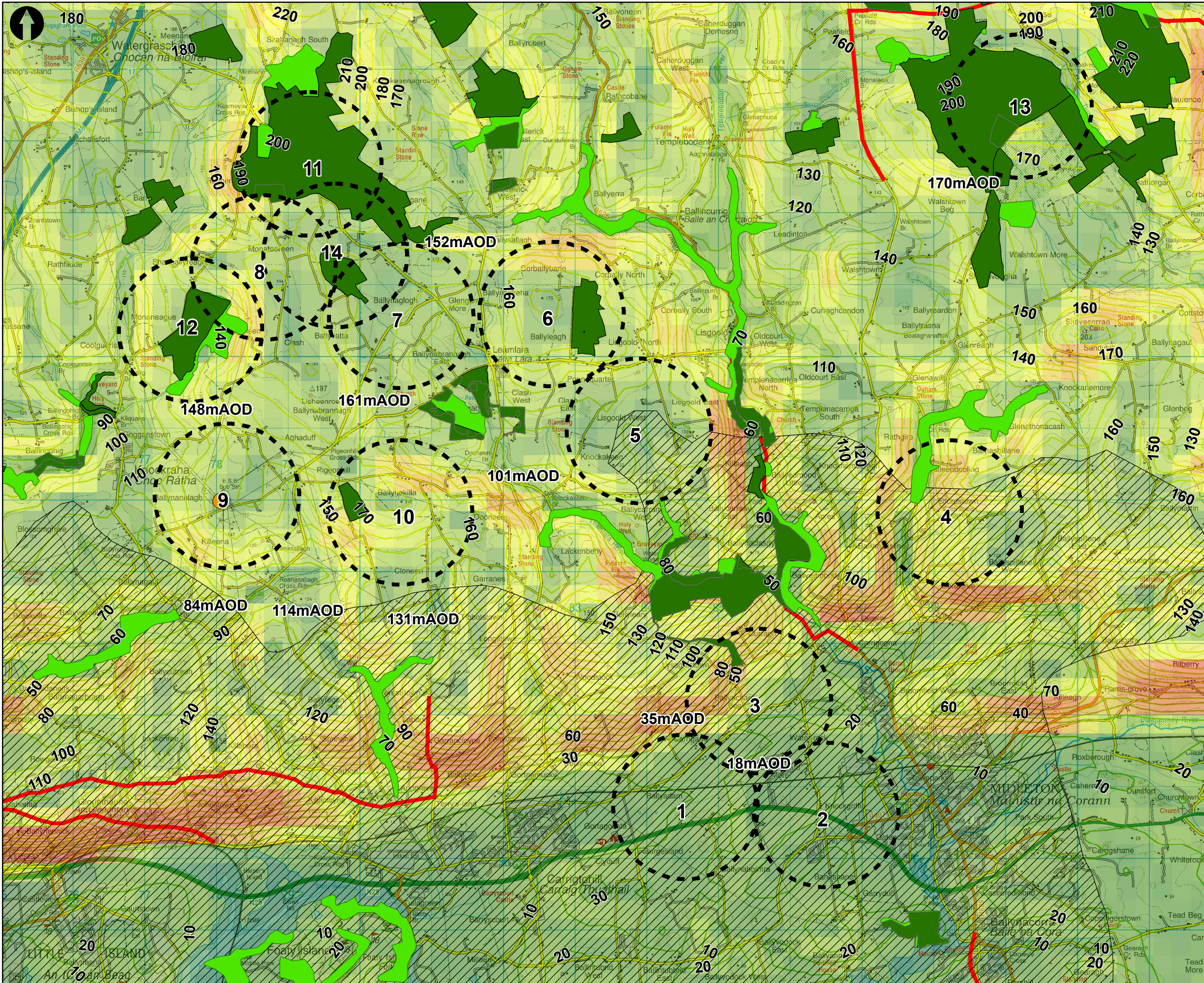
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Step 3 Converter Station Location Zones  
DTM Map

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**Key to Symbols**

- Connection Point
- Scenic Routes
- High Value Landscape Cork
- Coillte Landbank
- CORINE 2018 Forested Areas
- Converter Station Location Zone

**Slope Angle (°)**

- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- >10

**Notes**

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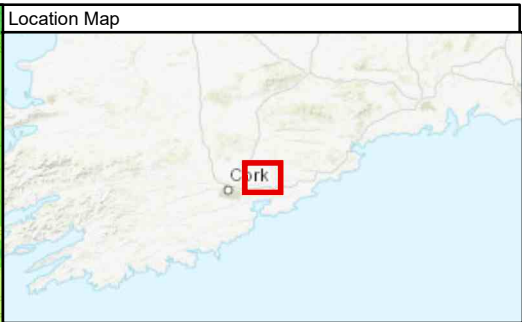
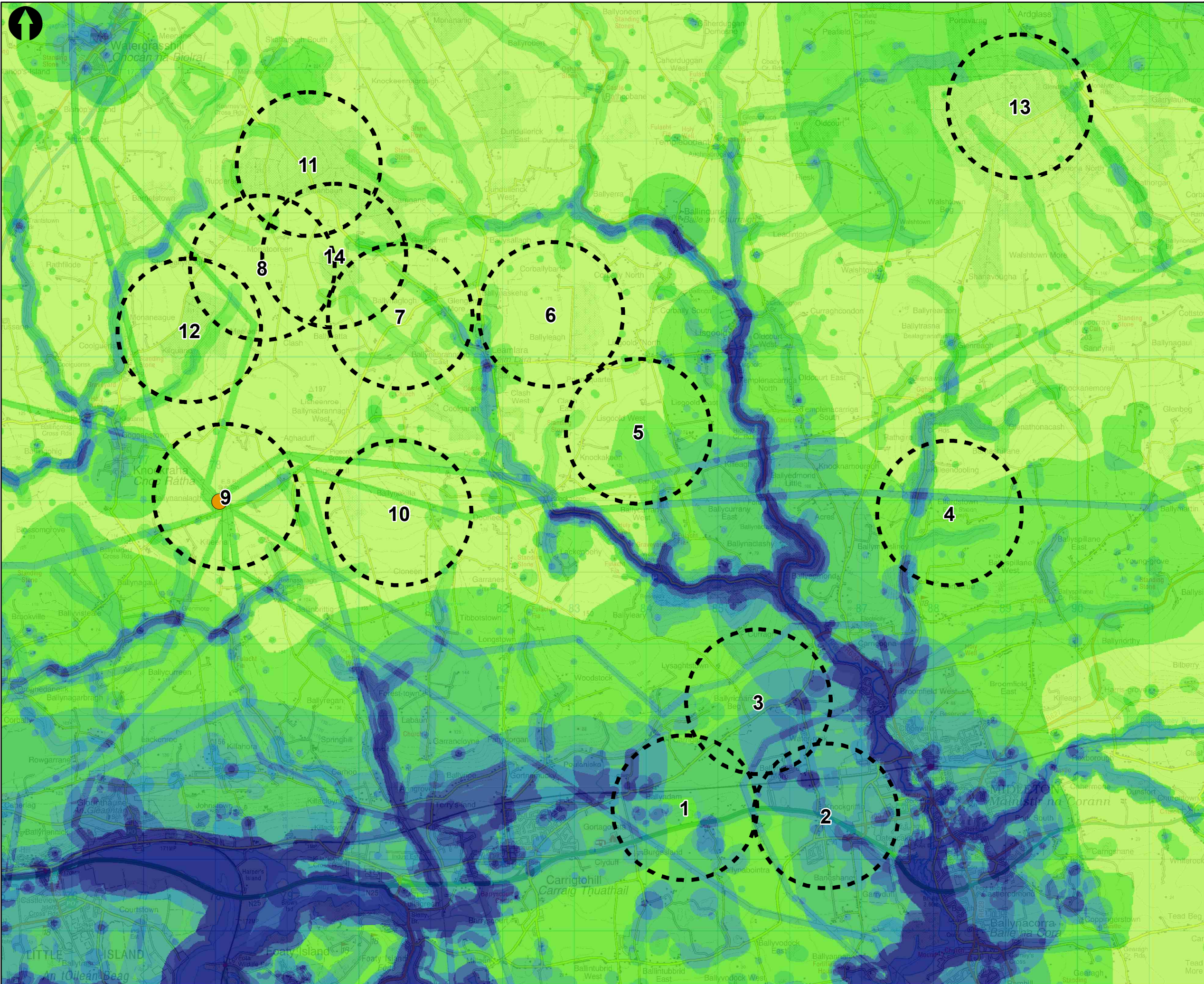
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Slope Angle Map

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**Key to Symbols**

- Orange dot: Connection Point
- Black dashed line: Converter Station Location Zone

**Cumulative Constraints Weighting**

More Significant/Difficult/Risk

Less Significant/Difficult/Risk

**Notes**

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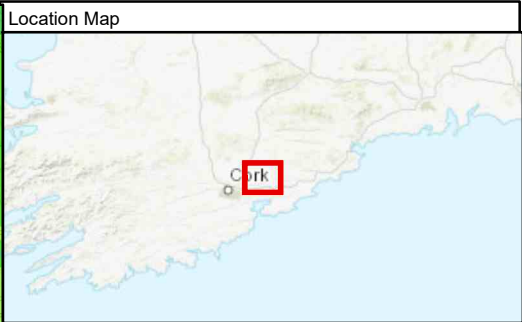
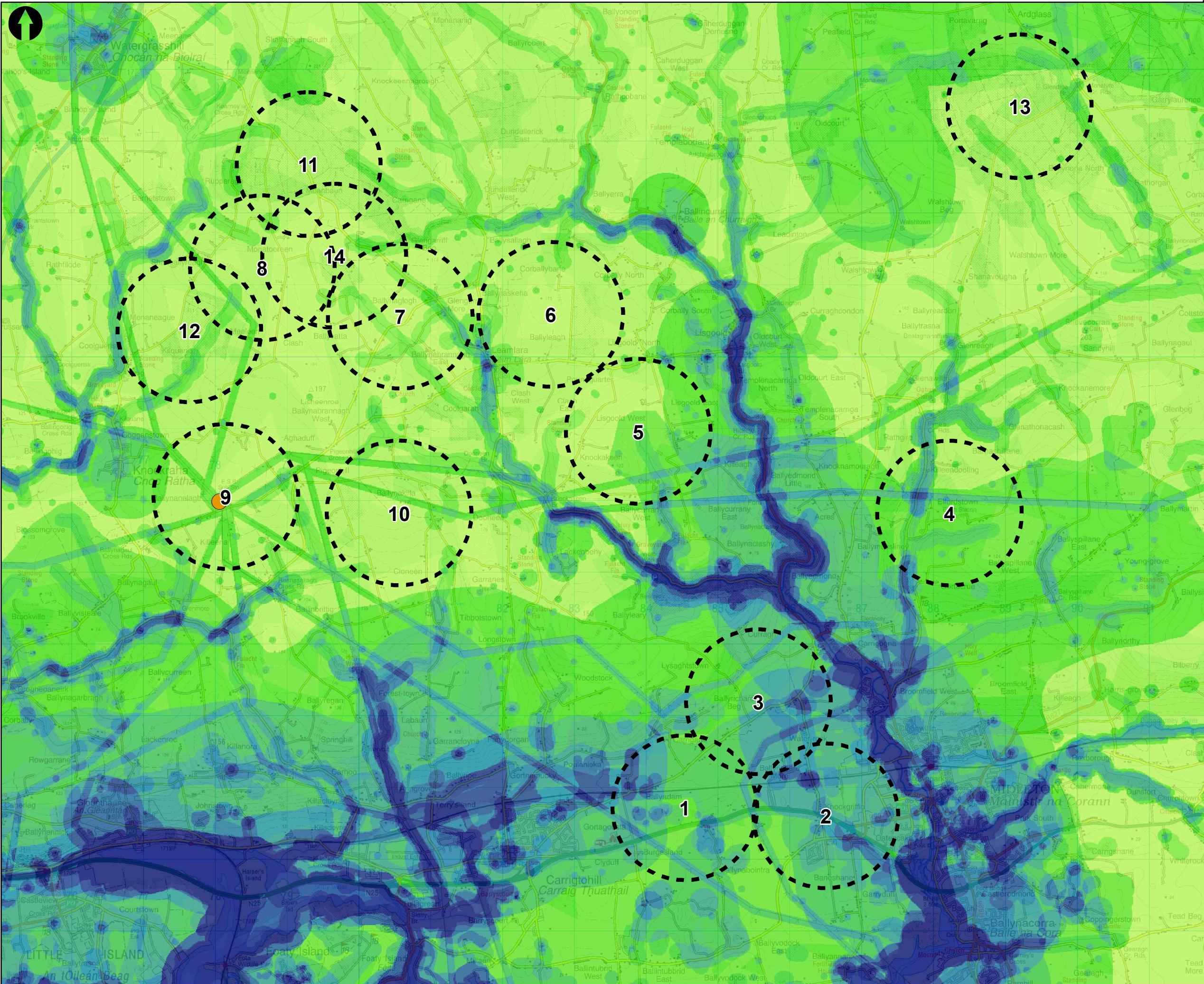
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		Security	STD





Key to Symbols

- Orange circle: Connection Point
- Black dashed line: Converter Station Location Zone

Cumulative Constraints Weighting

- Dark blue: More Significant/Difficult/Risk
- Light green: Less Significant/Difficult/Risk

Notes

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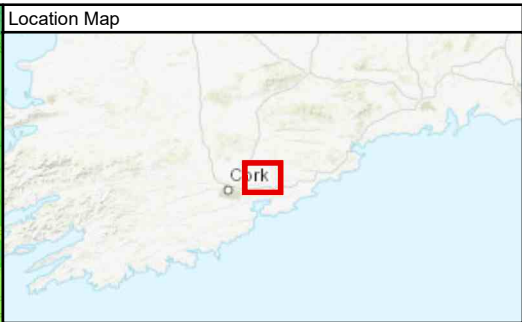
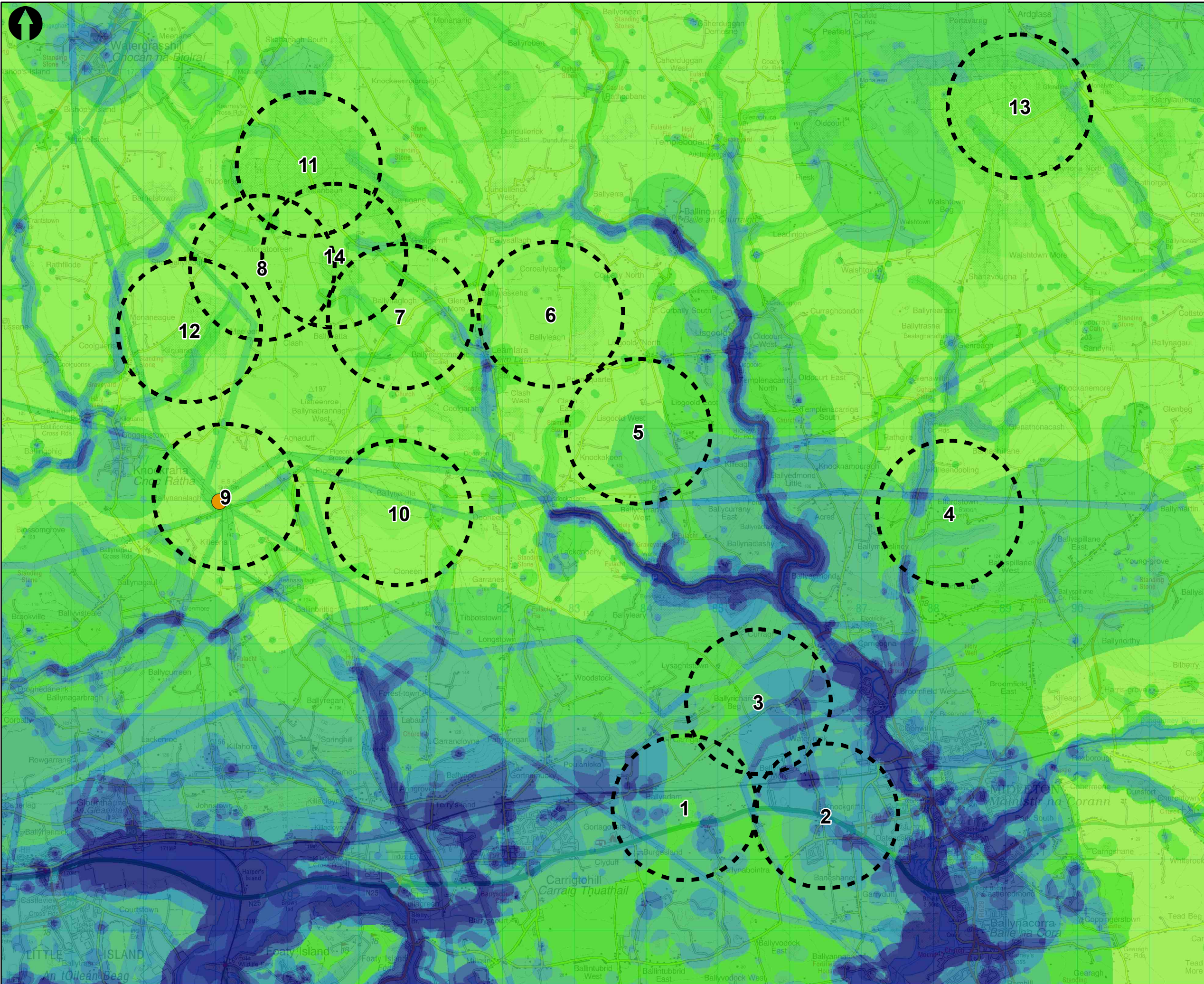
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**Key to Symbols**

- Connection Point
- Converter Station Location Zone

**Cumulative Constraints Weighting**

More Significant/Difficult/Risk

Less Significant/Difficult/Risk

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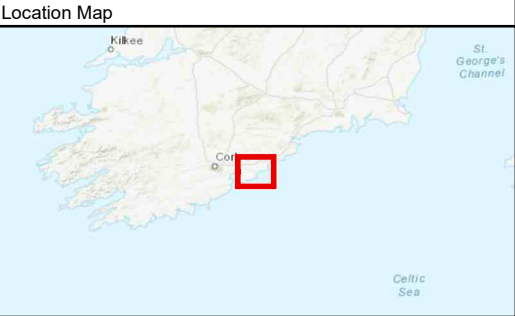
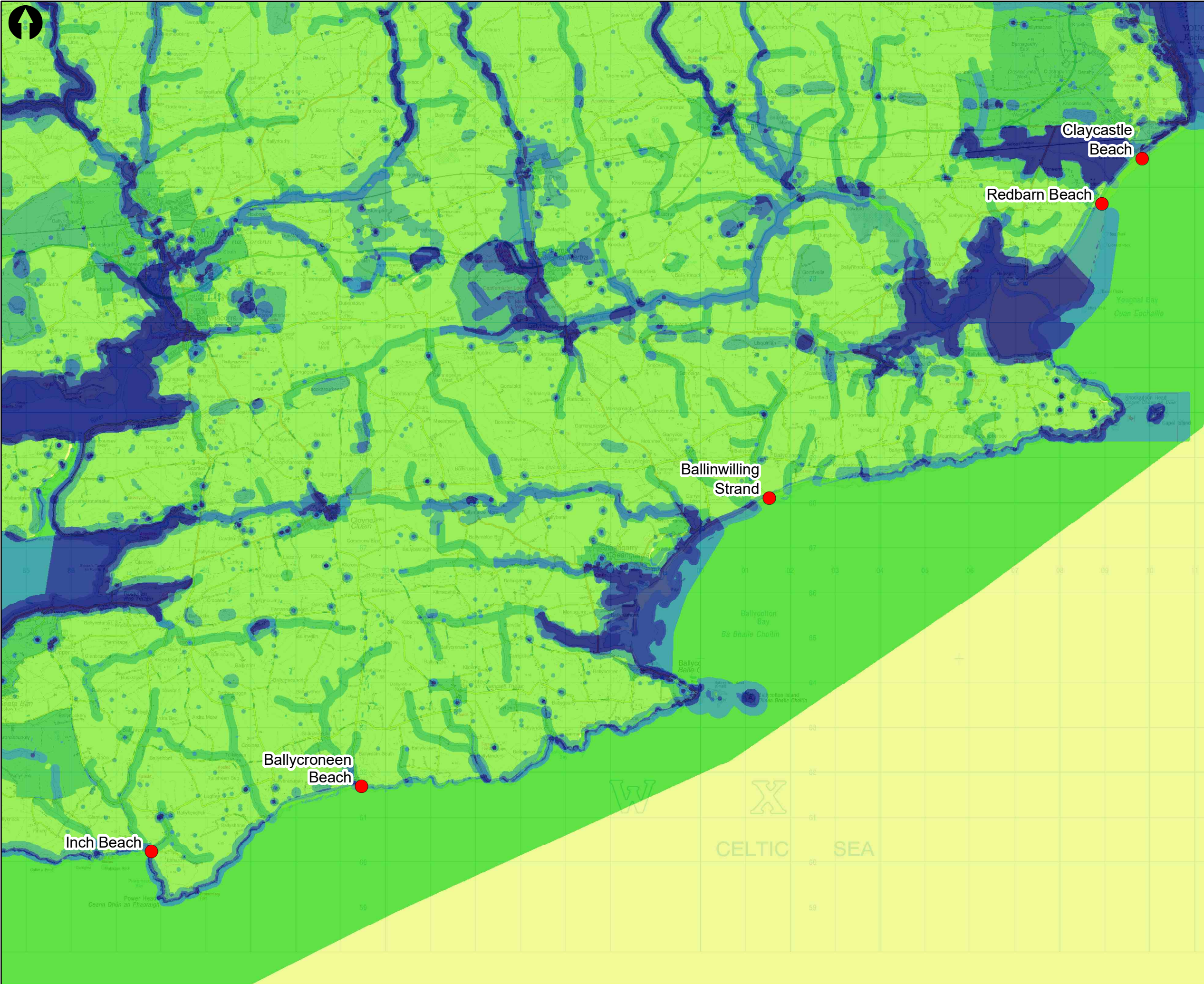
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Cumulative Constraints Weighting  
(Including DEM)

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Key to Symbols

- Landfall Location

Cumulative Constraints Weighting

- More Significant/Difficult/Risk
- Less Significant/Difficult/Risk

Notes

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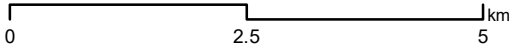
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Step 3 Landfall Locations  
Cumulative Constraints Weighting

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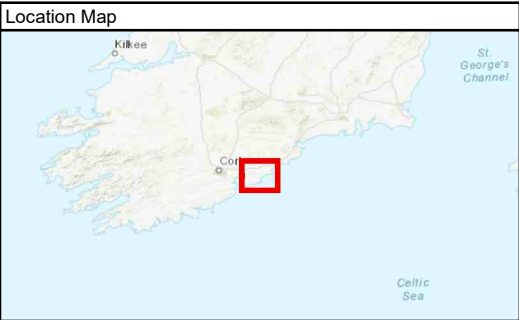
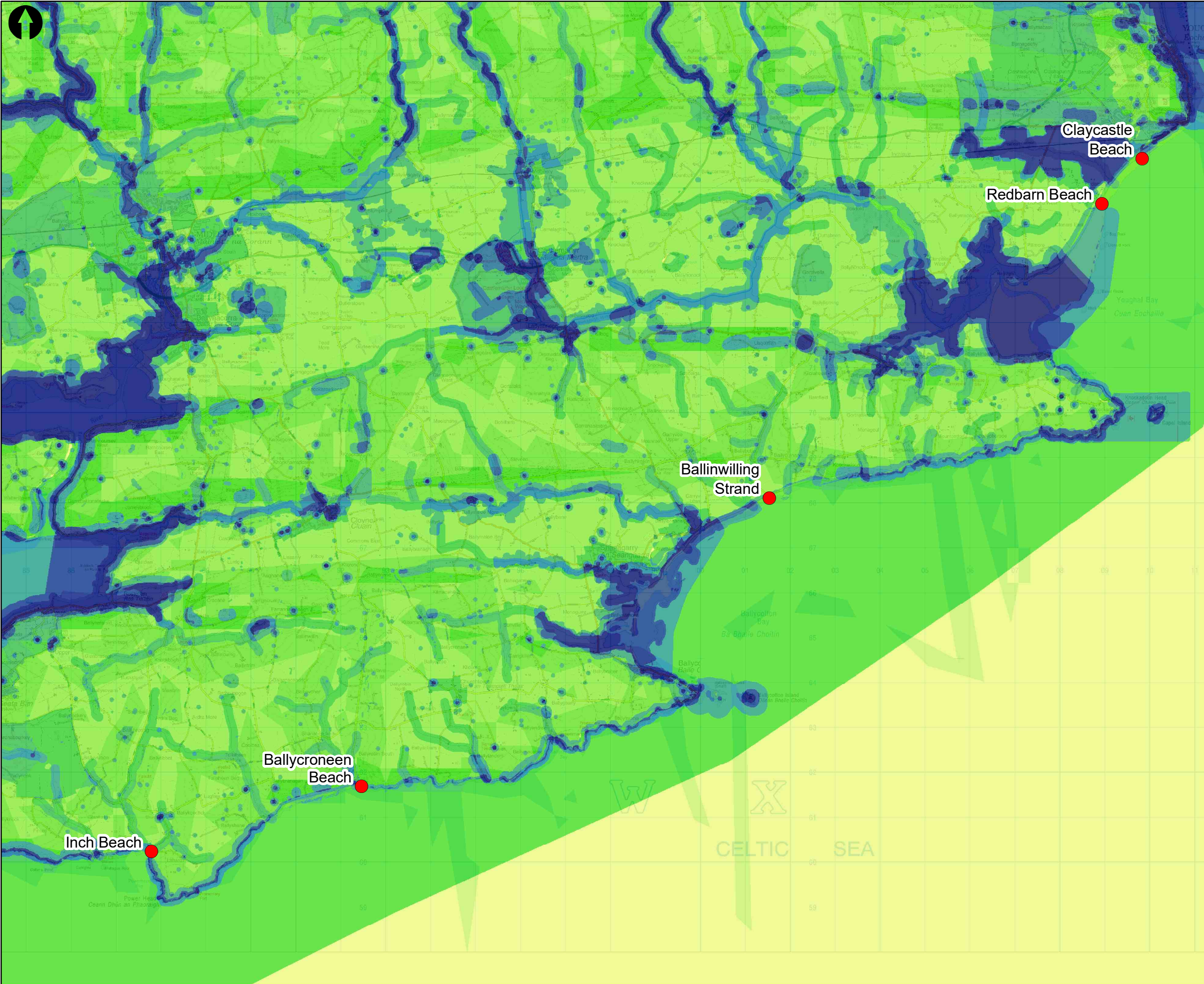
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**Key to Symbols**

● Landfall Location

**Cumulative Constraints Weighting**

More Significant/Difficult/Risk

Less Significant/Difficult/Risk

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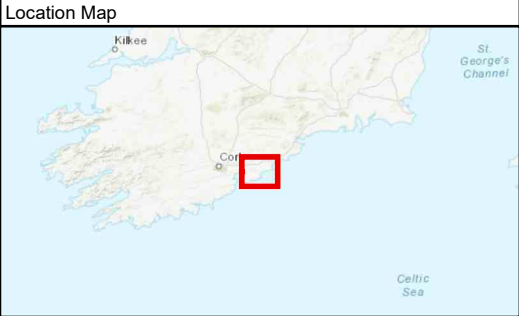
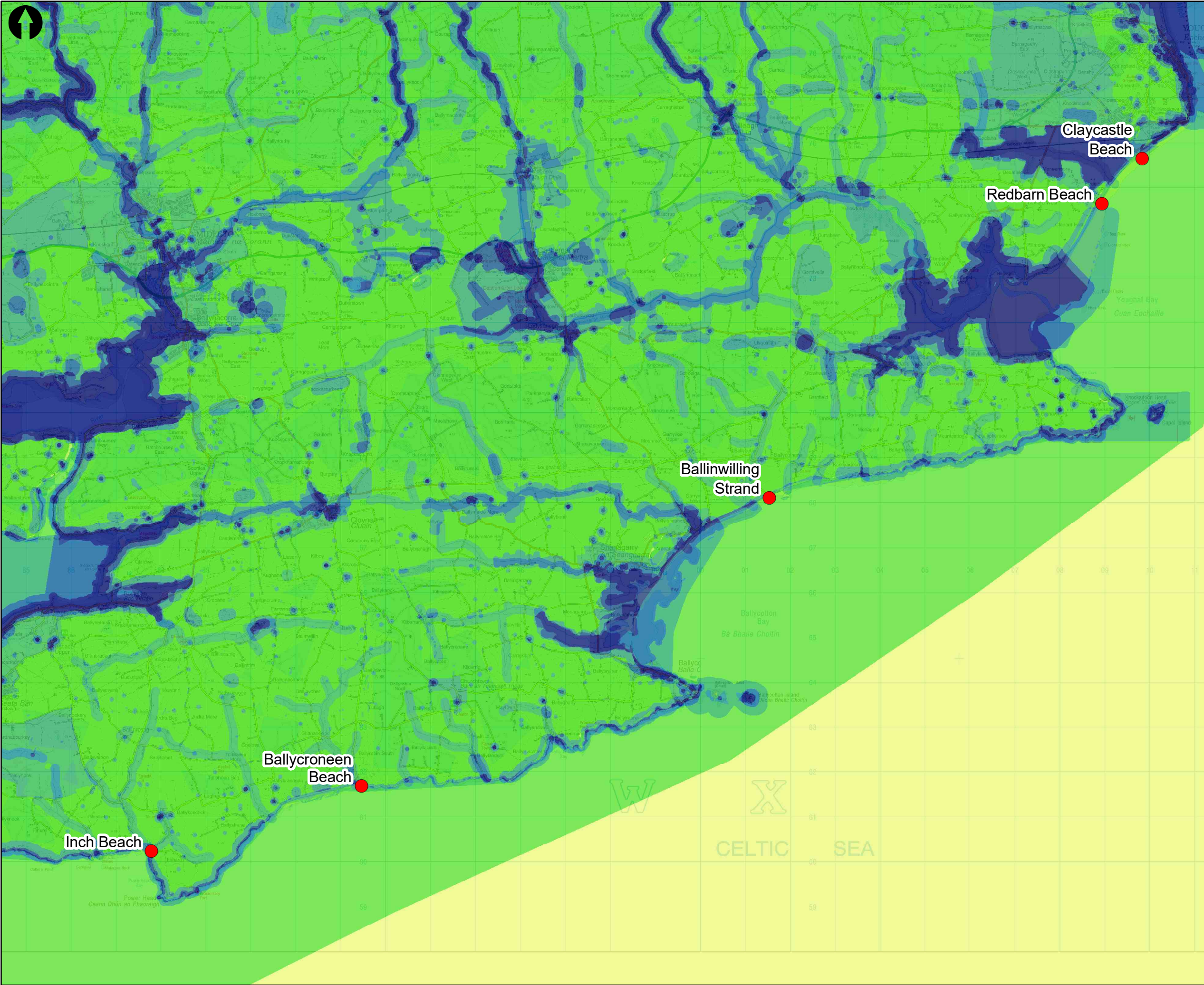
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Step 3 Landfall Locations  
Cumulative Constraints Weighting  
(Including Slope Angle)

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**Key to Symbols**

● Landfall Location

**Cumulative Constraints Weighting**

More Significant/Difficult/Risk

Less Significant/Difficult/Risk

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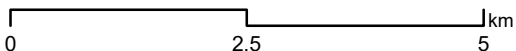
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Step 3 Landfall Locations  
Cumulative Constraints Weighting  
(Including DEM)

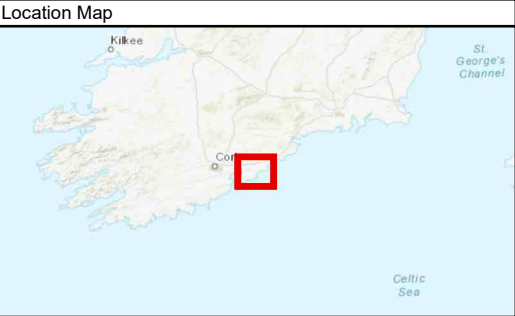
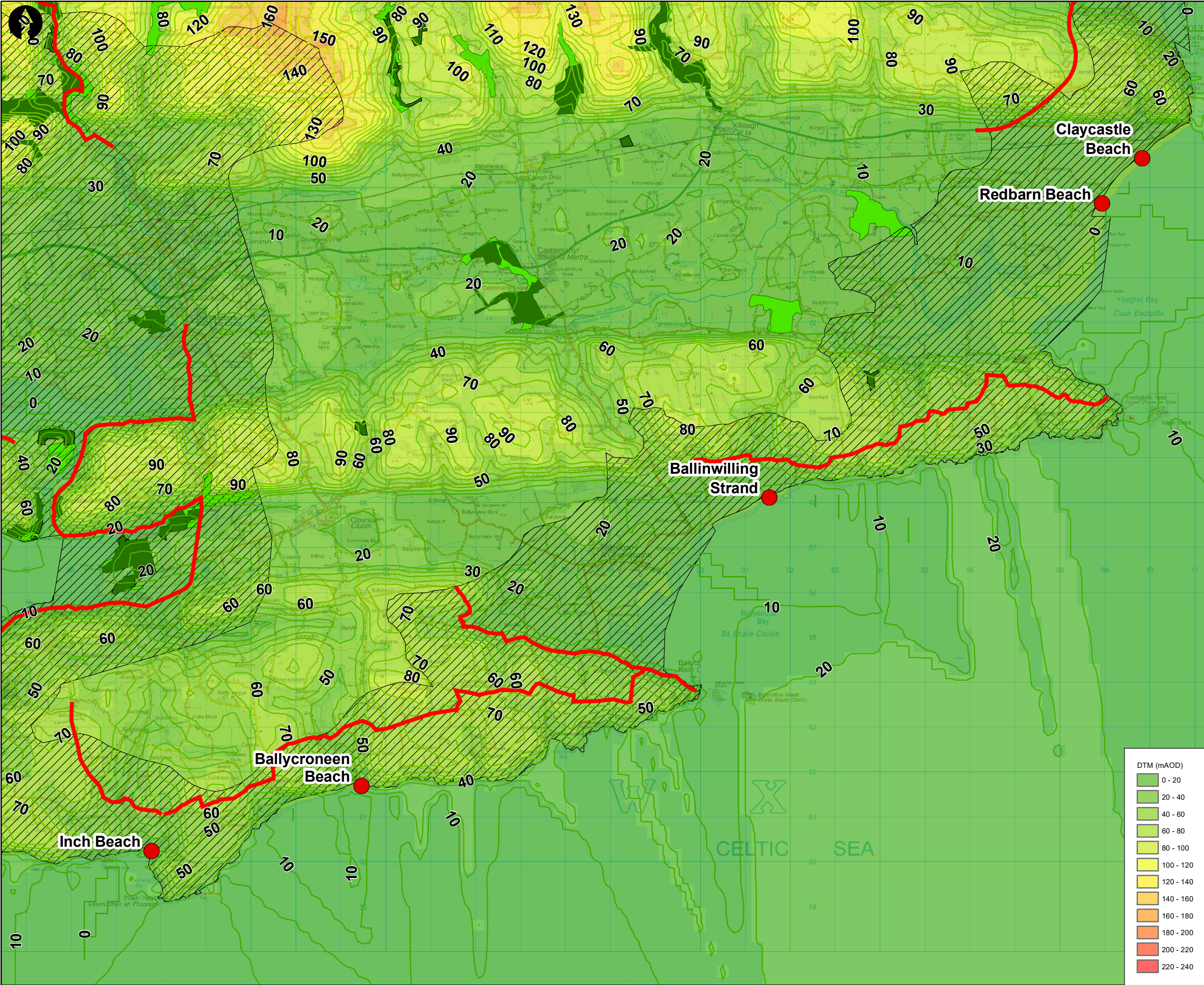
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**Key to Symbols**

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- Scenic Routes
- ▨ High Value Landscape Cork
- Coillte Landbank
- CORINE 2018 Forested Areas

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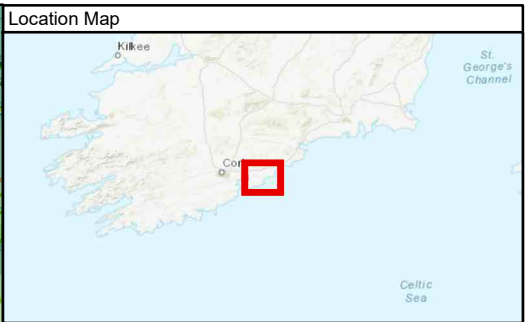
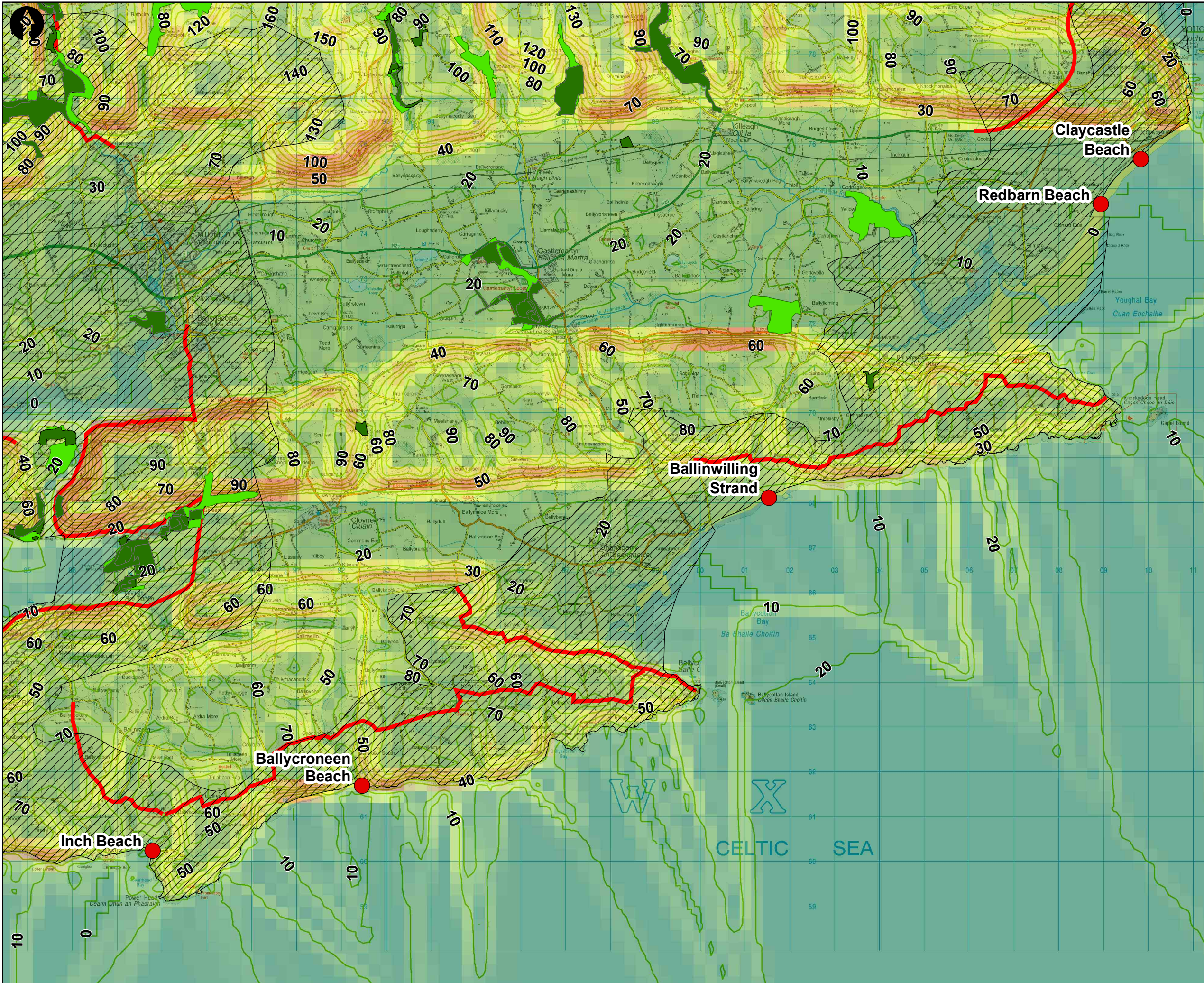
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**Key to Symbols**

- Landfall Location
- Scenic Routes
- High Value Landscape Cork
- Coillte Landbank
- CORINE 2018 Forested Areas

**Slope Angle (°)**

- 0 - 1
- 1 - 3
- 3 - 5
- 5 - 10
- >10

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## B. I-WeBS Data and Associated Conservation Status

The Irish Wetland Bird Survey (I-WeBS) monitors wintering water birds in Ireland. A review of the I-WeBS website was carried out on 14th January 2019 to identify the number of wintering birds which occur within the SPA's in the vicinity of the five landfall locations. The survey runs from September to March each winter. In addition, the conservation status of the species, according to the Birds of Conservation Concern in Ireland (2014 – 2019), is also listed for all sites.

Birds on the **Red List** birds are those of highest conservation concern, **Amber List** birds are of medium conservation concern and the **Green List** birds are not considered threatened ([www.birdwatchireland.ie](http://www.birdwatchireland.ie)). Blank mean counts show previously recorded species and blank concern = no data available. Tables listing the mean peak counts of bird species carried out between 2011/12 and 2015/16 at the Blackwater Estuary SPA (OM493) north of Claycastle Beach are included below.

**Table 10: Blackwater Estuary SPA I-WeBS Data and Associated Conservation Status**

Species	Mean Count	Conservation Concern	Designated in SPA
American Golden Plover		-	
Arctic Tern	2	Amber	
Bar-tailed Godwit	31	Amber	Yes
Black-headed Gull	730	Red	
Black-tailed Godwit	1500	Amber	Yes
Brent Goose (Black Brant)	1	Green	
Cattle Egret		-	
Common Gull	361	Amber	
Common Sandpiper	2	Amber	
Cormorant	71	Amber	
Curlew	688	Red	Yes
Curlew Sandpiper	1	Green	
Dunlin	287	Amber	Yes
Feral/hybrid Mallard type	-	-	
Gadwall	2	-	
Glaucous Gull	2	Green	
Golden Plover	74	Red	Yes
Goldeneye	-	Red	
Great Black-backed Gull	167	Amber	
Great Crested Grebe	9	Amber	
Great Northern Diver	2	Amber	
Green Sandpiper	1	-	
Greenshank	34	Amber	
Grey Heron	25	Green	
Grey Plover	4	Amber	
Greylag Goose	-	Amber	



Species	Mean Count	Conservation Concern	Designated in SPA
Herring Gull	143	Red	
Iceland Gull	1	-	
Jack Snipe	1	Green	
Kingfisher	-	Amber	
Knot	23	Red	
Lapwing	727	Red	Yes
Lesser Black-backed Gull	777	Amber	
Light-bellied Brent Goose	277	Amber	
Little Egret	33	Green	
Little Grebe	2	Amber	
Little Stint	-	Green	
Mallard	103	Green	
Mediterranean Gull	1	Amber	
Moorhen	2	Green	
Mute Swan	5	Amber	
Oystercatcher	455	Amber	
Pintail	2	Red	
Red-breasted Merganser	3	Green	
Redshank	331	Red	Yes
Red-throated Diver	-	Amber	
Ringed Plover	22	Amber	
Sanderling	27	Green	
Sandwich Tern	62	-	
Shag	17	Amber	
Shelduck	140	Amber	
Shoveler	2	Red	
Slavonian Grebe	1	Green	
Snipe	8	Amber	
Spotted Redshank	1	Green	
Teal	344	Amber	
Tufted Duck	1	Amber	
Turnstone	33	Green	
Whimbrel	1	Green	
White-rumped Sandpiper	-	-	
Wigeon	426	Red	Yes
Yellow-legged Gull	-	-	

Source: I-WeBS/NPWS

The following table lists the mean peak counts of bird species carried out between 2011/12 and 2015/16 (excluding 12013/2014 when no counts were carried out) at the Ballymacoda Bay SPA (0L401), located to the south of Redbarn Beach.

**Table 11: Ballymacoda Bay SPA I-WeBS Data and Associated Conservation Status**

Species	Mean Count	Conservation Concern	Designated in SPA
American Golden Plover	-	-	
Barnacle Goose	-	Amber	
Bar-tailed Godwit	591	Amber	Yes
Black-headed Gull	1302	Red	Yes
Black-tailed Godwit	1034	Amber	Yes
Brent Goose (Black Brant)	-	Green	
Buff-breasted Sandpiper		Green	
Common Gull	633	Amber	Yes
Common Sandpiper	2	Amber	
Common Tern	12	Amber	
Cormorant	26	Amber	
Curlew	453	Red	Yes
Curlew Sandpiper	9	Green	
Dunlin	805	Red	Yes
Eider	2	Amber	
Gadwall	-	-	
Glaucous Gull	1	Green	
Golden Plover	6720	Red	Yes
Goldeneye	-	Amber	
Great Black-backed Gull	322	Amber	
Great Crested Grebe	6	Amber	
Great Northern Diver	2	Amber	
Green Sandpiper	-	-	
Greenland White-fronted Goose	-	Amber	
Greenshank	12	Amber	
Grey Heron	12	Green	
Grey Plover	231	Amber	
Greylag Goose	2	Amber	
Herring Gull	149	Red	
Iceland Gull	2	-	
Kingfisher	1	Amber	
Knot	164	Amber	
Lapwing	1150	Red	Yes
Lesser Black-backed Gull	3543	Amber	Yes
Light-bellied Brent Goose	426	Amber	
Little Egret	32	Green	
Little Grebe	4	Amber	
Little Stint	-	Green	
Mallard	112	Green	
Mediterranean Gull	5	Amber	
Moorhen	5	Green	
Mute Swan	19	Amber	
Oystercatcher	459	Amber	
Pectoral Sandpiper	-	Green	
Pink-footed Goose	-	Green	



Species	Mean Count	Conservation Concern	Designated in SPA
Pintail	2	Red	
Red-breasted Merganser	4	Green	
Redshank	272	Red	Yes
Red-throated Diver	-	Amber	
Ringed Plover	219	Amber	Yes
Ruff	2	Green	
Sanderling	191	Green	Yes
Sandwich Tern	202	Amber	
Scaup	1	Amber	
Shag	30	Amber	
Shelduck	57	Amber	
Shoveler	5	Red	
Snipe	48	Amber	
Spotted Redshank	1	Green	
Teal	495	Amber	Yes
Turnstone	168	Green	Yes
Water Rail	-	-	
Whimbrel	2	Green	
Whooper Swan	3	Amber	
Wigeon	499	Red	Yes

Source: I-WeBS/NPWS

The following table lists the mean peak counts of bird species carried out between 2011/12 and 2015/16 at the Ballycotton Bay SPA (0L615) south of Ballinwillling Beach.

**Table 12: Ballycotton Bay SPA I-WeBS Data and Associated Conservation Status**

Species	Mean Count	Conservation Concern	Designated in SPA
American Golden Plover		-	
Barnacle Goose	1	Amber	
Bar-tailed Godwit	47	Amber	Yes
Black-headed Gull	643	Red	
Black-tailed Godwit	189	Amber	Yes
Buff-breasted Sandpiper	-	Green	
Canada Goose	11	Green	
Common Gull	308	Amber	Yes
Cormorant	13	Amber	
Curlew	410	Red	Yes
Curlew Sandpiper	1	Green	
Dunlin	228	Amber	
Eider	-	Amber	
Feral/hybrid Goose	-	-	
Gadwall	-	Amber	
Glaucous Gull	2	Green	
Golden Plover	2132	Red	Yes
Great Black-backed Gull	229	Amber	

Species	Mean Count	Conservation Concern	Designated in SPA
Great Crested Grebe	5	Amber	
Great Northern Diver	2	Amber	
Green Sandpiper	1	-	
Greenshank	12	Amber	
Grey Heron	11	Green	
Grey Plover	43	Amber	Yes
Herring Gull	229	Red	
Iceland Gull	-	-	
Jack Snipe	2	Green	
Kingfisher	1	Amber	
Knot	34	Red	
Lapwing	686	Red	Yes
Lesser Black-backed Gull	1666	Amber	Yes
Light-bellied Brent Goose	141	Amber	
Little Egret	14	Green	
Little Grebe	-	Amber	
Little Stint	3	Green	
Mallard	72	Green	
Mediterranean Gull	6	Amber	
Moorhen	4	Green	
Mute Swan	1	Amber	
Oystercatcher	255	Amber	
Pectoral Sandpiper	-	Green	
Pintail	-	Red	
Red-breasted Merganser	-	Green	
Redshank	99	Red	
Red-throated Diver	8	Amber	
Ringed Plover	78	Amber	Yes
Ruddy Shelduck	-	Green	
Ruff	1	Green	
Sanderling	78	Green	
Sandwich Tern	58	Amber	
Shelduck	30	Amber	
Shoveler		Red	
Snipe	29	Amber	
Spotted Redshank	-	Green	
Teal	501	Amber	Yes
Turnstone	71	Green	Yes
Unidentified wader sp.	1	-	
Water Rail	2	-	
Whimbrel	1	Green	
Wigeon	264	Red	

Source: I-WeBS/NPWS

The following table lists the mean peak counts of bird species carried out between 2011/12 and 2015/16 at the Cork Harbour SPA (OL491) north-west of Inch Beach.



**Table 13: Cork Harbour SPA I-WeBS Data and Associated Conservation Status**

Species	Mean Count	Conservation Concern	Designated in SPA
American Wigeon	1	-	
Arctic Tern	5	Amber	
Barnacle Goose	1	Amber	
Bar-tailed Godwit	300	Amber	Yes
Black Swan	-	-	
Black-headed Gull	3460	Red	Yes
Black-necked Grebe	1	Red	
Black-tailed Godwit	2951	Amber	Yes
Black-throated Diver	-	Green	
Bonaparte's Gull	-	-	
Brent Goose (Black Brant)	-	Green	
Canada Goose	10	Green	
Cattle Egret	-	-	
Common Gull	306	Amber	Yes
Common Sandpiper	1	Amber	
Common Scoter	2	Red	
Common Tern	9	Amber	Yes
Coot	5	Amber	
Cormorant	335	Amber	Yes
Curlew	1520	Red	Yes
Curlew Sandpiper	-	Green	
Dunlin	4316	Amber	Yes
Eider	1	Amber	
Feral/hybrid Goose	-	-	
Gadwall	22	Amber	
Garganey	-	Amber	
Glaucous Gull	-	Green	
Glossy Ibis	2	-	
Golden Plover	4067	Red	Yes
Goldeneye	12	Amber	
Goosander	-	Amber	
Great Black-backed Gull	162	Amber	
Great Crested Grebe	107	Amber	Yes
Great Northern Diver	5	Amber	
Great White Egret	-	-	
Green Sandpiper	1	-	
Greenshank	98	Amber	
Green-winged Teal	1	Green	
Grey Heron	81	Green	Yes
Grey Plover	29	Amber	Yes
Greylag Goose	-	Amber	
Herring Gull	105	Red	
Iceland Gull	-	-	
Kingfisher	2	Amber	
Knot	135	Red	

Species	Mean Count	Conservation Concern	Designated in SPA
Lapwing	1917	Red	Yes
Lesser Black-backed Gull	133	Amber	Yes
Light-bellied Brent Goose	53	Amber	
Little Egret	103	Green	
Little Grebe	74	Amber	Yes
Little Gull	1	Green	
Long-tailed Duck	1	Green	
Mallard	374	Green	
Mediterranean Gull	68	Amber	
Moorhen	25	Green	
Mute Swan	45	Amber	
Oystercatcher	1659	Amber	Yes
Pink-footed Goose	1	Green	
Pintail	18	Red	Yes
Pochard	1	Amber	
Red-breasted Merganser	66	Green	Yes
Redshank	1595	Red	Yes
Red-throated Diver	-	Amber	
Ring-billed Gull	1	-	
Ringed Plover	29	Amber	
Ruddy Shelduck	2	Green	
Ruff	1	Green	
Sandwich Tern	170	Amber	
Scaup	1	Amber	
Shag	7	Amber	
Shelduck	1114	Amber	Yes
Shoveler	22	Red	Yes
Slavonian Grebe	1	Green	
Snipe	44	Amber	
Spoonbill	-	-	
Spotted Redshank	4	Green	
Surf Scoter	1	-	
Teal	1225	Amber	Yes
Tufted Duck	26	Amber	
Turnstone	137	Green	
Unidentified Tern	31	-	
Velvet Scoter	-	Red	
Water Rail	2	-	
Whimbrel	17	Green	
Whooper Swan	-	Amber	
Wigeon	1378	Red	Yes
Wilson's Phalarope	1	-	
Yellow-legged Gull	1	-	

Source: I-WeBS/NPWS



