

## **Appendix 4A**

### **GCR Options Report (BFA)**





# Ballinlee Green Energy Project

## Preferred Grid Route Option Assessment Report

A qualitative assessment of the civil engineering parameters associated with preferred  
grid route option.

## Document Name

24007-BFA-BE-XX-RP-C-6001

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## 1. EXECUTIVE SUMMARY

BFA Consulting were commissioned by Ballinlee Green Energy Project to complete a “Grid Route Options Assessment Report” whereby several potential grid connection route options were assessed a preferred route identified. This assessment is contained with the report 24007-BFA-BE-XX-RP-C-6001.

The results of this assessment identified “Option #1” as being the preferred grid connection route for the project. Subsequent to this assessment, BFA Consulting have completed an in-depth civil engineering assessment of Option #1, the results of which are contained within this report.

This report was completed using a technical qualitative assessment of the preferred grid route option for Ballinlee Green Energy Project, using industry standard route assessment parameters. Each parameter has been assessed as being “Advantageous”, “Neutral” or “Less Advantageous”.

The scoring system used in the assessment is outlined in Table 1.1 below while Table 1.2 represents the results of the assessment.

| Score             | Symbol |
|-------------------|--------|
| Advantageous      | ▲      |
| Neutral           | ●      |
| Less Advantageous | ▼      |

Table 1.1: Scoring system used in assessment

| Technical Parameter   | Option #1 |
|-----------------------|-----------|
| Distance              | ●         |
| Traffic Disruption    | ▼         |
| Watercourse Crossings | ▲         |
| Rail Crossings        | ▲         |
| Geotechnical          | ▲         |
| Flood Risk            | ▲         |
| Existing Utilities    | ▲         |

Table 1.2: Technical summary of the assessed grid connection route

Based on the findings of the qualitative evaluation, it was determined that Option#1 is a suitable option for the installation of the proposed grid connection route.

## 2. INTRODUCTION

### 2.1. Scope of Report

The purpose of this report is to assess the preferred grid connection route associated with Ballinlee Green Energy Project from a civil engineering perspective. Electrical engineering parameters such as grid connection capacity and cable de-rating, are also outside the scope of this report.

The route assessed as part of this report solely focuses on the civil engineering parameters within public roads and therefore, the grid connection route within the site boundary itself has not been assessed.

Option #1 grid connection route will connect the proposed substation at Ballinlee Green Energy Project to Killonan 220kV substation, via approx. 25km of underground cables.

Figure 2.1 below illustrates the Option #1 grid connection route.

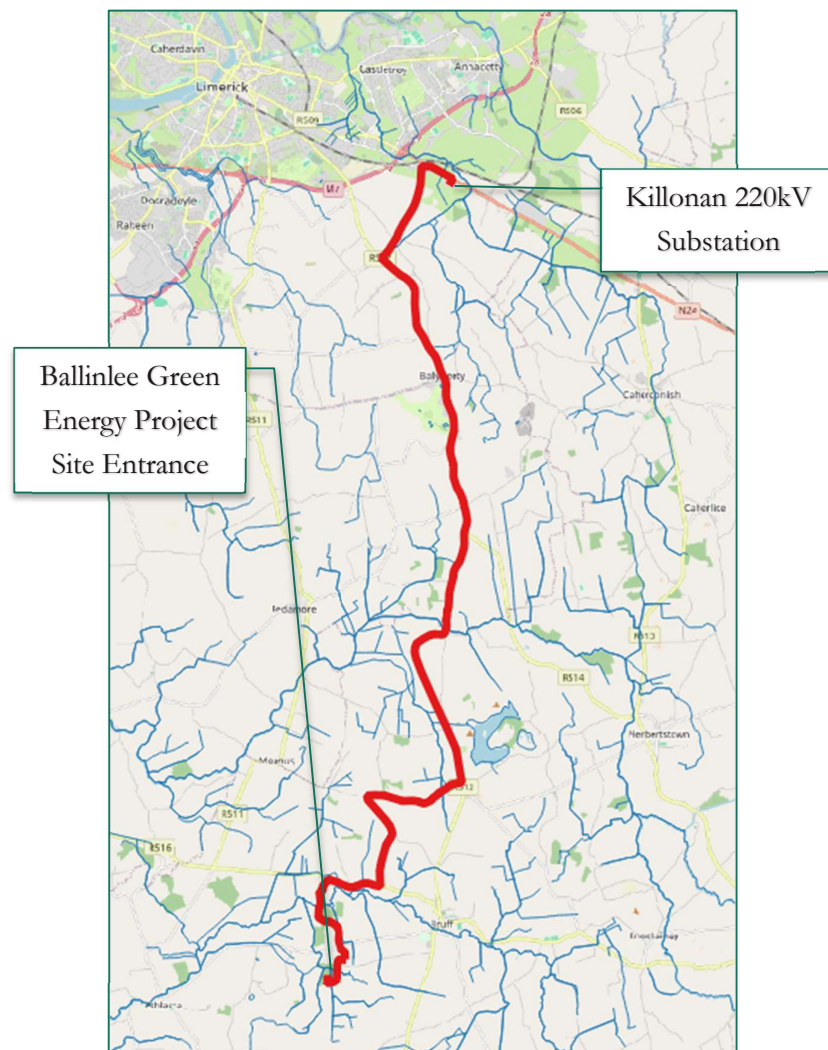


Figure 2.1: Grid route layouts

Where:  = Option #1



### 3. ASSESSMENT METHODOLOGY

Qualitative evaluation is a process of assessing risks based on nonnumerical categories and is used to inform decision making based on the information and knowledge obtained to date. The categories are assessed without implying whether one criterion is of greater or lesser importance than another.

The qualitative assessment of the grid route options contained within this report was conducted using the high-level scoring system as detailed in Table 3.1

| Score             | Symbol                                                                            |
|-------------------|-----------------------------------------------------------------------------------|
| Advantageous      |  |
| Neutral           |  |
| Less Advantageous |  |

Table 3.1: Scoring system used in assessment

Construction risks of underground grid routes are generally related to subsurface and geotechnical issues such as existing utilities, buried structures and varying ground conditions. Therefore, the following technical parameters were identified to be assessed as part of this report:

1. Distance
2. Traffic Disruption
3. Watercourse Crossings
4. Rail Crossings
5. Geotechnical
6. Flood Risk
7. Existing Utilities

The following sections of this report outline how each of the identified criteria will be used to assess the preferred grid connection route, while Section 4 “TECHNICAL ASSESSMENT” details the results of the findings.

#### 3.1. Distance

The length of a given route will impact on the environmental and economic cost of the construction works, as well as impacting the scale of the inconvenience caused to the local population.

Therefore, a shorter length of grid route will be deemed “Advantageous” as part of this report.

#### 3.2. Traffic Disruption

The level of traffic disruption associated with a given grid route will vary depending on the category of road with which the route interacts and for how long the interaction takes place.

Interactions with National and Regional Roads pose the greatest risk to traffic disruption. Therefore, the greater the length and quantity of the interactions with National and Regional Roads, the more likely a route will be scored as “Less Advantageous” as part of this report.

### 3.3. Watercourse Crossings

Watercourse crossings pose a potentially critical obstacle when constructing a grid connection route. Each watercourse crossing was individually surveyed and assessed from an *ease-of-constructability* perspective with the more challenging crossings being scored as “Less Advantageous”.

Environmental Protection Agency (EPA) River Network Route maps were used to determine the number and location of natural watercourse crossings along the proposed grid connection routes.

### 3.4. Rail Crossings

Rail crossings pose a potentially critical obstacle when constructing a grid route connection. Each rail crossing was individually surveyed and assessed from an *ease-of-constructability* perspective with the more challenging crossings being scored as “Less Advantageous” and no rail crossings being “Advantageous”.

### 3.5. Geotechnical

Geological Survey Ireland (GSI) mapping was used to assess the expected ground conditions along the proposed grid connection routes.

Grid routes constructed across areas of poor ground conditions, e.g. peat, are less favourable as they tend to endure longer construction timelines and larger economic costs. Furthermore, weak/soft subgrade beneath joint bays must be fully excavated until a suitable bearing level is reached, which has the potential to cause considerable constructability issues on poor ground.

Therefore, where the grid route traverses sections of poor subsoil conditions, it will be scored as “Less Advantageous” as part of this report.

### 3.6. Flood Risk

The proposed grid routes will be an entirely underground infrastructure and constructed to match existing ground levels. Therefore, the construction of these grid routes is highly unlikely to impact on an existing surface water runoff behaviour and also highly unlikely to directly cause any additional flooding.

Joint bays associated with grid connection routes can not be located within Flood Zone A rated areas. Given that the exact location and distance between joint bays will be determined at detailed design stage, a conservative approach was taken whereby a grid route traversing a Flood Zone A area greater than 500m, would be scored as “Less Advantageous” as part of this report.

Flood maps (floodinfo.ie) were reviewed to determine the flood risk associated with the grid route and are included in Section 4.6 of this document.

### 3.7. Existing Utilities

Existing utilities within the same corridor as a proposed grid connection route has the potential to lead to issues and complications at construction stage. Extreme congestion of existing utilities has the potential to rule out a potential underground route altogether.

Therefore, the grid route was assessed for interactions with existing utilities found as part of a desktop study and was scored appropriately depending on the severity of the interactions.

## 4. TECHNICAL ASSESSMENT

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Having assessed each of the proposed grid connection route options in the context of the outlined technical parameters, the below sections summarises the output of this assessment.

### 4.1. Distance

While Option #1 was the shortest of the three potential routes that were initially assessed in the Grid Route Options Assessment, at 25km in length it would not be deemed as “Advantageous” in terms of its length.

Instead, the “Distance” parameter for Option#1 has been scored as “Neutral”.

### 4.2. Traffic Disruption

**Regional Roads:** Construction of the grid route includes a 14.5km length within the R512 and 1.5km along the R516. The R512 has limited verge widths on either side and therefore it can be assumed that traffic management requirements will disrupt local traffic along this section during construction.

**National Roads:** Option#1 involves the construction of approx. 650m of the grid route along the N24. There are two potential options for constructing the cable route within the N24:

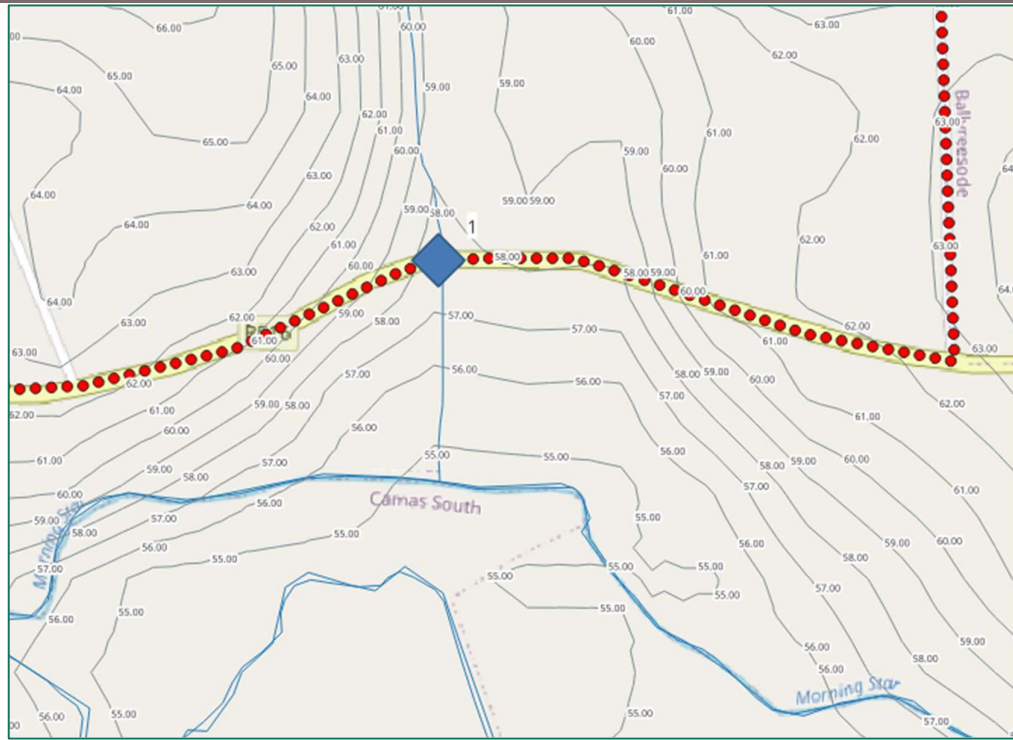
1. Standard trench method – The standard trench method will involve roadworks along the southside verge of the N24 to install the typical Eirgrid 110kV trench. It can be assumed that for this method, traffic management requirements will disrupt traffic along this section during construction.
2. Trenchless method – The trenchless option will involve using a horizontal directional drill to bore a hole beneath the carriageway of the N24, through which a pipeline can be pulled through and subsequently used to install the cable route ducts. This HDD option would be installed from the junction of the L1170 and the N24 to the entrance of Killonan Substation. This method will greatly reduce the potential traffic disruption caused by installing the cable route within the N24.

Given the length of Regional roads impacted, “Traffic Disruption” has been scored as “Less Advantageous” for Option#1.

### 4.3. Watercourse Crossings

Using the reviewing methodology as stated in Section 3.3 of this report, there are 7No. major watercourse crossings along the preferred grid route Option #1.

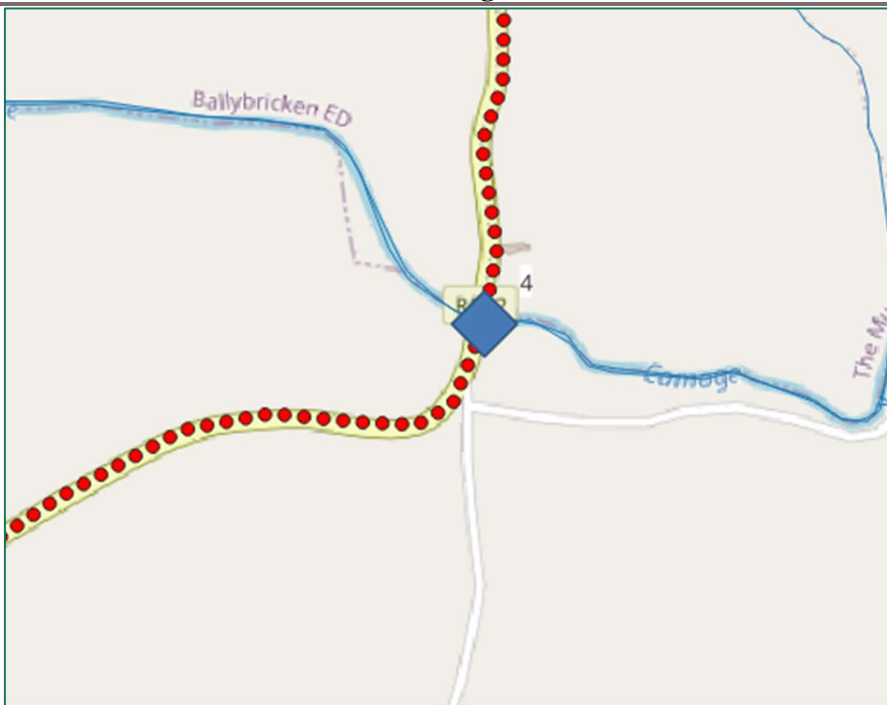
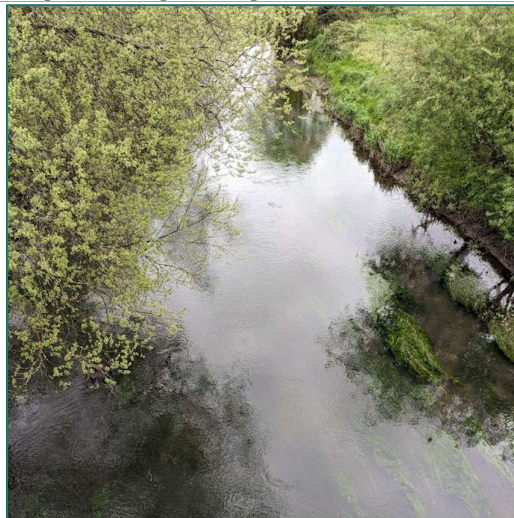
Each of these watercourse crossings have been assessed in the tables below. The findings of the assessment found that each watercourse crossing can be crossed above the existing structure and therefore has been scored as “Advantageous”.

| Location & Structure Type | <p style="text-align: center;"><b>Watercourse Crossing #1</b></p>  <p style="text-align: center;">Public Road: R516<br/>Townland: Camas<br/>Structure Type: Old Box Culvert</p> |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Photos                    |  <p>Photo of the R516 adjacent to WCC#1</p>                                                                                                                                   |
| Notes                     | <ol style="list-style-type: none"> <li>0.7m of cover was measured from the existing road surface level to the soffit of the culvert.</li> <li>Recommended crossing method is a flat formation above the culvert.</li> </ol>                                       |

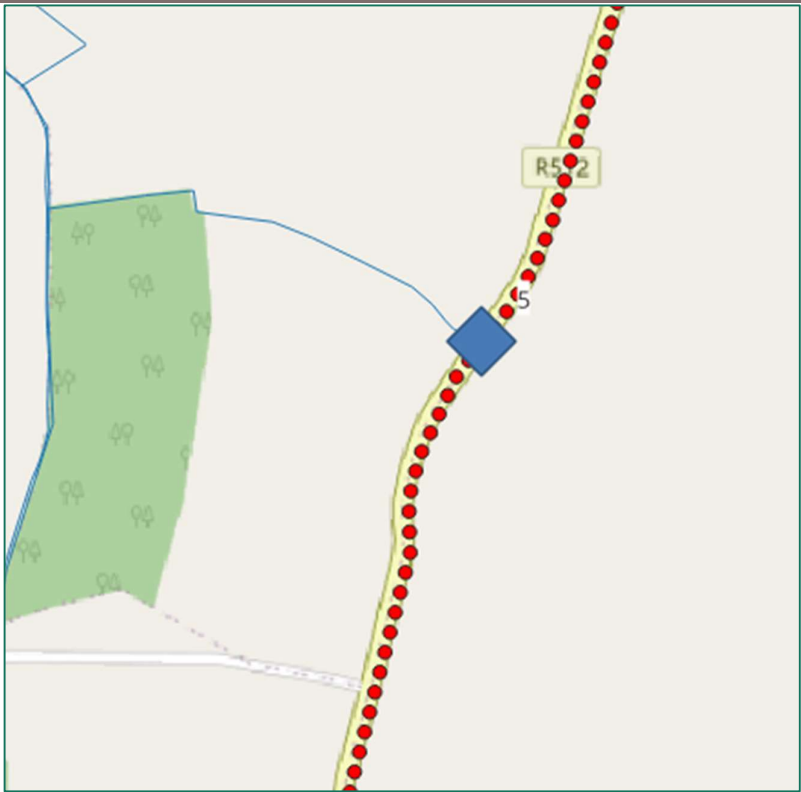
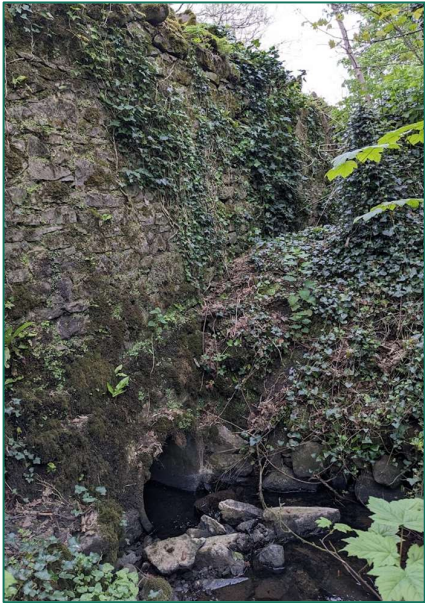


| Watercourse Crossing #2              |                                                                                                                                                                                                                                                                           |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Location &amp; Structure Type</b> | <div data-bbox="370 233 1393 951"> </div> <p>Public Road: L1412<br/>Townland: Rockbarton<br/>Structure Type: Culvert</p>                                                                                                                                                  |
| <b>Photos</b>                        | <div data-bbox="316 1058 857 1457"> <p>Photo of the L1412 adjacent to WCC#2</p> </div> <div data-bbox="914 1058 1437 1642"> <p>Photo looking along the culvert alignment</p> </div>                                                                                       |
| <b>Notes</b>                         | <ol style="list-style-type: none"> <li>1. Exact cover could not be measured from the existing road level to the soffit of the culvert.</li> <li>2. However, based on visual inspection, the recommended crossing method is a flat formation above the culvert.</li> </ol> |

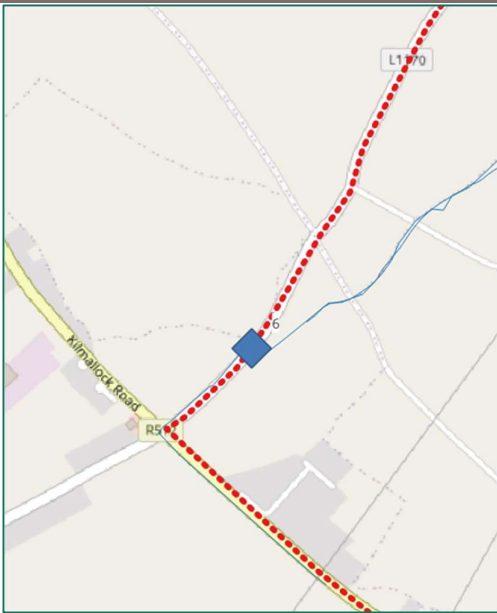
| Watercourse Crossing #3              |                                                                                                                                                                                                                                                                           |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Location &amp; Structure Type</b> | <div data-bbox="391 233 1377 957"> </div> <p>Public Road: R512<br/>Townland: Grange<br/>Structure Type: Old Box Culvert</p>                                                                                                                                               |
| <b>Photos</b>                        | <div data-bbox="568 1062 1195 1614"> </div> <p>Photo of the R512 adjacent to WCC#3</p>                                                                                                                                                                                    |
| <b>Notes</b>                         | <ol style="list-style-type: none"> <li>1. Exact cover could not be measured from the existing road level to the soffit of the culvert.</li> <li>2. However, based on visual inspection, the recommended crossing method is a flat formation above the culvert.</li> </ol> |

| Watercourse Crossing #4   |                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Location & Structure Type |  <p>Public Road: R512<br/>Townland: Grange<br/>Structure Type: Multi-Span Arch Bridge crossing Camoge River</p>                                                                                                                                                                              |
| Photos                    |  <p>Photo of the R512 adjacent to WCC#4</p>  <p>Photo looking down at the Camoge River from the R512</p>                                                                                                |
| Notes                     | <ol style="list-style-type: none"> <li>Cover from the existing road level to the soffit of the arches was measured to be 1.0m.</li> <li>There are two potential options recommended for crossing this bridge: <ol style="list-style-type: none"> <li>A flat formation above the bridge arches.</li> <li>HDD beneath the bridge abutments and river bed.</li> </ol> </li> </ol> |



| Watercourse Crossing #5   |                                                                                                                                                                                                                                |                                                                                                                               |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Location & Structure Type |  <p>Public Road: R512<br/>Townland: Friarstown<br/>Structure Type: 450mm DIA Culvert</p>                                                    |                                                                                                                               |
| Photos                    |  <p>Photo of the R512 adjacent to WCC#5</p>                                                                                                 |  <p>Photo looking at existing culvert</p> |
| Notes                     | <ol style="list-style-type: none"> <li>1. Culvert is a deep culvert with approx. 2.0m of cover from the existing road.</li> <li>2. The recommended crossing method is a standard trench formation above the culvert</li> </ol> |                                                                                                                               |



| Watercourse Crossing #6   |                                                                                                                                                                                                                             |  |                                                                                                                                |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------|
| Location & Structure Type |  <p>Public Road: L1170<br/>Townland: Ballybrennan</p>                                                                                      |  |  <p>Structure Type: Old box culvert</p>      |
|                           |  <p>Photo of the L1170 adjacent to WCC#6</p>                                                                                              |  |  <p>Photo looking across L1170 at WCC#6</p> |
| Notes                     | <ol style="list-style-type: none"> <li>0.9m of cover was measured from the existing road surface level to the soffit of the culvert.</li> <li>Recommended crossing method is a flat formation above the culvert.</li> </ol> |  |                                                                                                                                |

| Location & Structure Type | <p align="center"><b>Watercourse Crossing #7</b></p>  <p align="center">Public Road: N24<br/>Townland: Milltown (immediately adjacent to Killonan Substation)<br/>Structure Type: Culvert</p>                                                                                                                               |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Photos                    |  <p align="center">Photo of the N24 adjacent to WCC#7</p>                                                                                                                                                                                                                                                                  |
| Notes                     | <p>The recommended crossing method will depend on which installation method is implemented within the N24 carriageway (see section 4.2):</p> <ol style="list-style-type: none"> <li>1. A flat formation trench above the culvert would be recommend for the “typical trench” installation method.</li> <li>2. HDD beneath the culvert would be recommended for the trenchless installation method.</li> </ol> |



#### 4.4. Rail Crossings

There are no rail crossings along the assessed grid connection route.

Therefore, the parameter of “Rail Crossings” has been scored as “Advantageous”.

#### 4.5. Geotechnical

Option #1 traverses a section approx. 1.0km in length which runs parallel with lands classified as “cutover raised peat” in GSI quaternary mapping. The “cutover raised bog” does not overlap with the R512 where the proposed grid route is being installed.

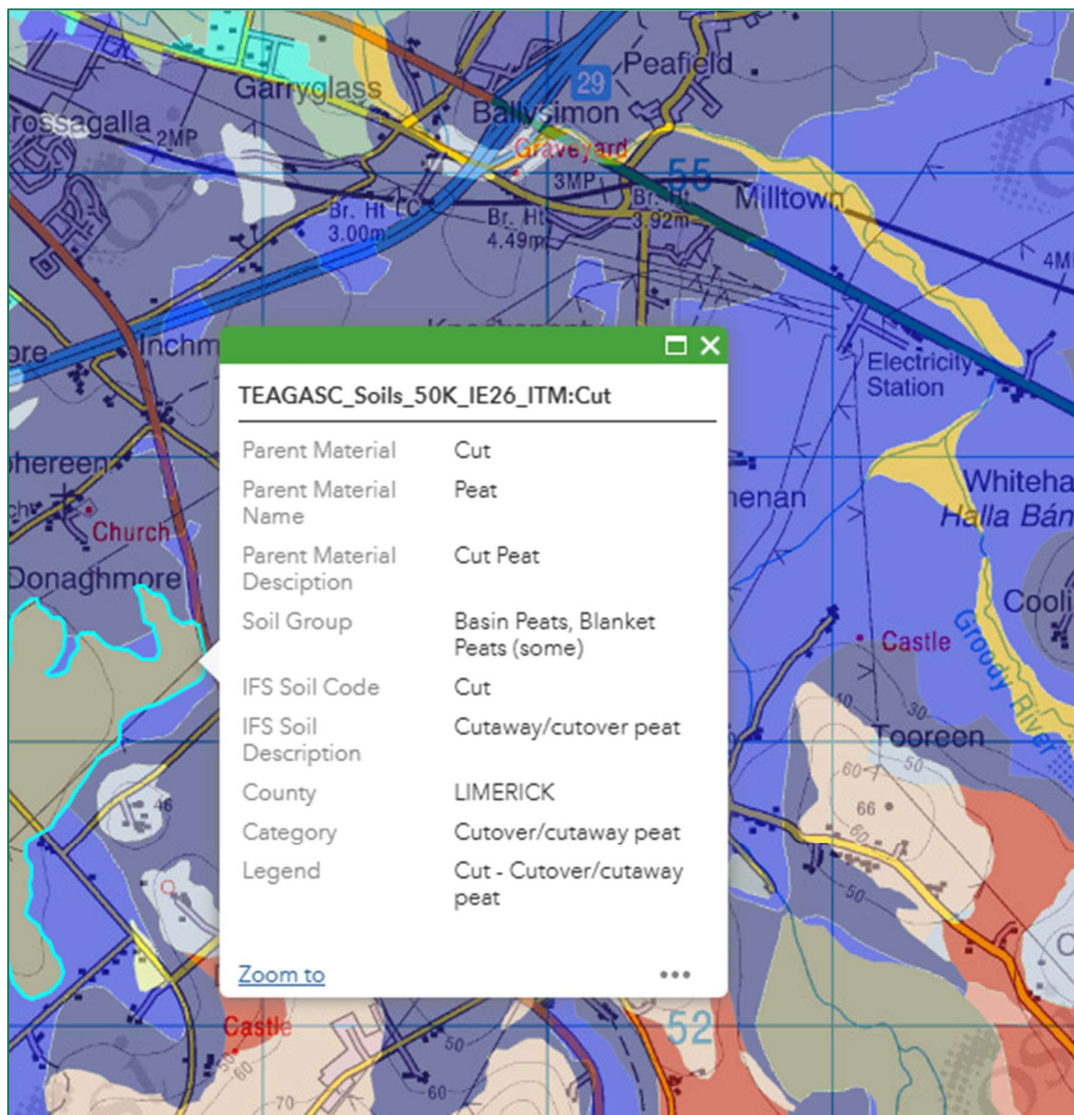


Figure 4.1: GSI Extract along the R512

The remaining grid route is within areas described as “Till derived from limestones”.

Therefore, the geotechnical parameters for Option#1 are “Advantageous”.

## 4.6. Flood Risk

A desktop study was carried out as detailed in Section 3.6 of this report.

It was observed that minor flooding was shown to indicatively occur only at WCC#4. The length of this flood zone was measured to be less than the 500m and therefore was assessed to have negligible impact on the proposed grid connection route.

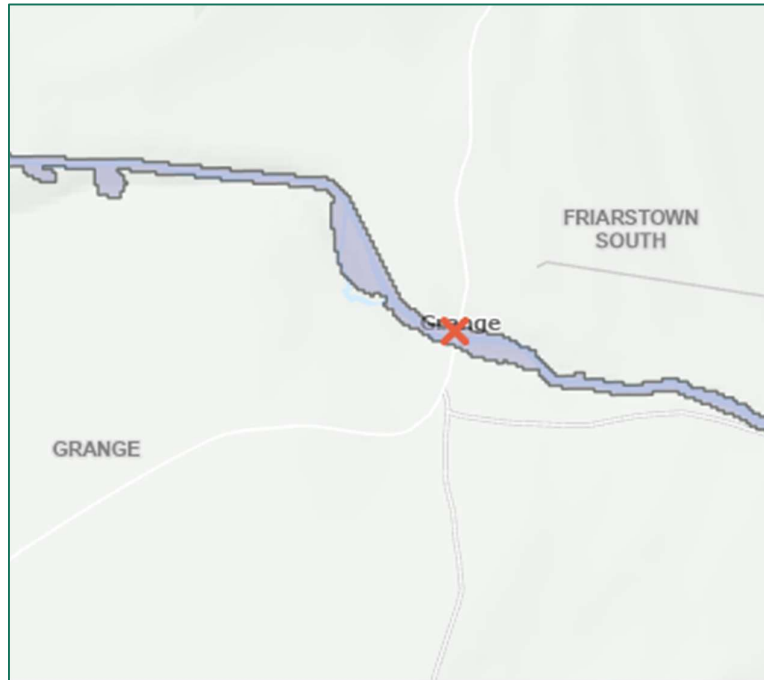


Figure 4.2: Minor flooding found to indicatively occur at WCC#4

Therefore, the “Flood Risk” parameter has been scored as “Advantageous” for Option#1.

## 4.7. Existing Utilities

A desktop study was completed to identify and assess existing utilities located adjacent to Option#1.

### 1.1.1 Gas

Gas Networks Ireland “Dial Before You Dig Online” mapping was reviewed along the proposed grid connection route.

There is a 125mm DIA gas main located within the R512 for approximately 4.1km between Ballyneety and the junction with the L1170. Gas Networks Ireland standards require a 600mm separation distance from a gas main to a high voltage cable.

The R512 is a 7.0m wide carriageway along this segment of the proposed grid connection route. Therefore, it is determined that the proposed grid connection route will be able to be installed in the R512 while still meeting the minimum GNI separation distances.

### 1.1.2 Electricity (MV & LV)

Overhead power lines were observed throughout the length of Option#1. For the most part these overhead lines are ESB distribution lines. Therefore, the detailed design and subsequent construction of the grid route adjacent

to these overhead lines shall be completed in line with ESB's Code of Practice for Avoiding Danger from Overhead Electricity Lines.

### 1.1.3 Electricity (HV)

Option#1 crosses HV overhead lines immediately adjacent to Killonan Substation. Interacting with existing HV lines when approaching the grid connection substation is to be expected.

### 1.1.4 Watermain

A high pressure watermain has the potential to require a separation distance of 600mm from any of the proposed grid route options. Digital mapping received from Uisce Eireann (formally Irish Water) indicate the presence of a watermain along the entirety of the proposed grid route.

However, due to the observed absence of other underground services along any of the proposed grid routes, it is not envisaged that maintaining 600mm separation distance from an encountered high pressure watermain would pose significant problems at detailed design stage.

Based on the desktop study of existing services, the parameter of "Existing Utilities" has been scored as "Advantageous" for Option#1.

## 4.8. Route Selection Summary

Based on the analysis described in the Route Selection Assessment, Table 4.1 below summarises the results of the qualitative assessment.

| Technical Parameter   | Option #1 |
|-----------------------|-----------|
| Distance              | ●         |
| Traffic Disruption    | ▼         |
| Watercourse Crossings | ▲         |
| Rail Crossings        | ▲         |
| Geotechnical          | ▲         |
| Flood Risk            | ▲         |
| Existing Utilities    | ▲         |

Table 4.1: Route Selection Summary Table

Based on the above, it is assessed that Option#1 grid route for Ballinlee Green Energy Project is an appropriate grid route from a civil engineering perspective.

## 5. Bibliography

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