Technical Note

Project	Moanmore Lower Wind Farm		
Subject	Grid Route Assessment		
To:	Harry Harbison	**Doc Ref.:**	22007-BFA-XX-XX-RP-C-6001-F5
Cc:		**Date**	13/09/2024

1 Executive Summary

A technical assessment of 2No. potential grid routes for Moanmore Lower Wind Farm has been carried out using industry standard route assessment criteria and scored via a high-level scoring system, namely:

- Advantageous
- Neutral
- Less Advantageous

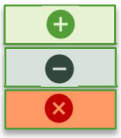


Table 1 below represents the scored assessment of the 2No. routes and determined that Option#1 is the preferred route.

ID	Option #1	Option #2
Distance	+	×
Crossings	×	×
Geotechnical	−	−
Flood Risk	−	−
Existing Utilities	+	−

Table 1: Technical assessment summary of the 2No. grid route options

2 Overview

The purpose of this report is to assess 2No. proposed grid connection routes associated with Moanmore Lower Wind Farm. The details of the 2No. grid routes are listed below.

Grid Route ID	Length	Description
Option #1	2.5km	38kV underground route
Option #2	10.2km	20kV underground routes

Table 2: Description of grid route options

A site location map is included in Appendix D of this report illustrating the alignment of each of the grid routes.

Construction risks of underground grid routes are generally related to subsurface and geotechnical issues such as existing utilities, buried structures and varying site conditions. This report has assessed the constructability of each of the routes using the following categories:

1. Crossings – Watercourse, Rail, Motorways etc.
2. Geotechnical – Assessment of expected ground conditions along each route.
3. Flood Risk – Assessment of areas where grid route infrastructure potentially cannot be accessed.
4. Existing Utilities – Gas, Electricity, Watermain etc.

3 Technical Assessment

3.1 Watercourse Crossings

Ordnance Survey Ireland (OSI) discovery maps were used to determine the number and location of natural watercourse crossings along the routes. Details of each watercourse crossing are provided in Appendix A.

3.1.1 Option #1

There was 1No. watercourse crossings identified along Option #1. The watercourse crossing is an arch bridge with an existing verge width of approx. 600mm.

As the grass verge is of insufficient width and depth to accommodate the standard 38kV flat formation crossing design, alternative crossing methodologies will be required. This assessment has identified 2No. alternative options for crossing this bridge, namely:

1. Install the 2No. comms ducts within the roadside grass verge on the opposite side of the road to that of the 3No. power ducts.
2. Horizontal Directional Drill beneath the existing structure and watercourse.

3.1.2 Option #2

A total of 7No. Watercourse Crossings along Option #2 were identified and each one checked to determine their suitability for a ducting crossing.

Based on the assessment and surveys carried out to date, it was determined that all watercourse crossings along Option #2 can be crossed using ESB standard crossings details i.e. above bridge deck and within carriageway.

3.2 Railway Crossings

None of the proposed grid route options cross any existing rail lines.

3.3 TII Carriageways

3.3.1 Option #1

There are no TII carriageway crossings along grid route Option #1.

3.3.2 Option #2

Option #2 will cross the N68 National Road transversely. At the proposed crossing location, the N68 is a single lane carriageway with no hard shoulders and grass verges on both sides.

There is an existing underground ESB cable running longitudinally with the N68 on the southern side of the carriageway. ESB records indicate that the existing cable at this location is part of the power distribution network and not a power supply line from an IPP source. The voltage of this existing line will need to be determined before the appropriate crossing design can be determined (standard safety practice is to install the lower voltage line on top at a given crossing).

TII Standard Construction Details such as CC-SCD-00560 or similar should be used for the detailed design of this crossing.

Option #2 will also run longitudinally along the N67 for approximately 500m. There is no hard shoulder along this section of the N67 and a grass verge only on the eastern side. There is a road safety barrier along the eastern edge of the carriage, between the edge of pavement and the grass verge, with the grass verge having a minimum width of approx. 7.5m at its narrowest point (see image below). The proposed grid route would be installed within this grass verge on the eastern side of the road.

Image 3.1.1 – N67 looking south towards Moneypoint. Note the crash barrier eastern side and steep drop western.

It is recommended that consultation between TII and ESB be carried out to determine the appropriate design along this section of road at detailed design stage.

It is envisaged that the design solution along the N67, given the dimensions of the grass verge (500m (L) x 7.5m (W)), will be that joint bays can be located at either end of the N67 and the ducts installed within the grass verge, however, this will be subject to approval from both TII and ESB.

It is noted that there are 2No. culvert crossings along this section of road. The southern most of these culverts is the diverted Mologha River and captured as WC#9 in Appendix A. Due to the depth these culverts are installed at (discharging below high tide level into the bay) it is envisaged that the proposed grid route will traverse above these culverts should they be present within the eastern verge of the N67. Image 3.1.2 below illustrates the location of these 2No. culverts.

Image 3.1.2 – 2No. culverts discharging to the bay adjacent to the N67

3.4 Geotechnical

Geological Survey Ireland (GSI) mapping were used to assess the expected ground conditions along the various routes.

The assessed quaternary mapping, groundwater vulnerability mapping, subsoil permeability mapping, Teagasc mapping and bedrock mapping have all been included in Appendix B.

3.4.1 Option #1

Option #1 traverses' lands of "cutover/cutaway peat" and "till derived from sandstone and shale". Ground investigation works will be required at detailed design stage to determine the most appropriate trench detail to be used along this route.

A hydrogeological assessment of this area has determined that bedrock is likely to be in the region of 3.0m – 10.0m below ground level.

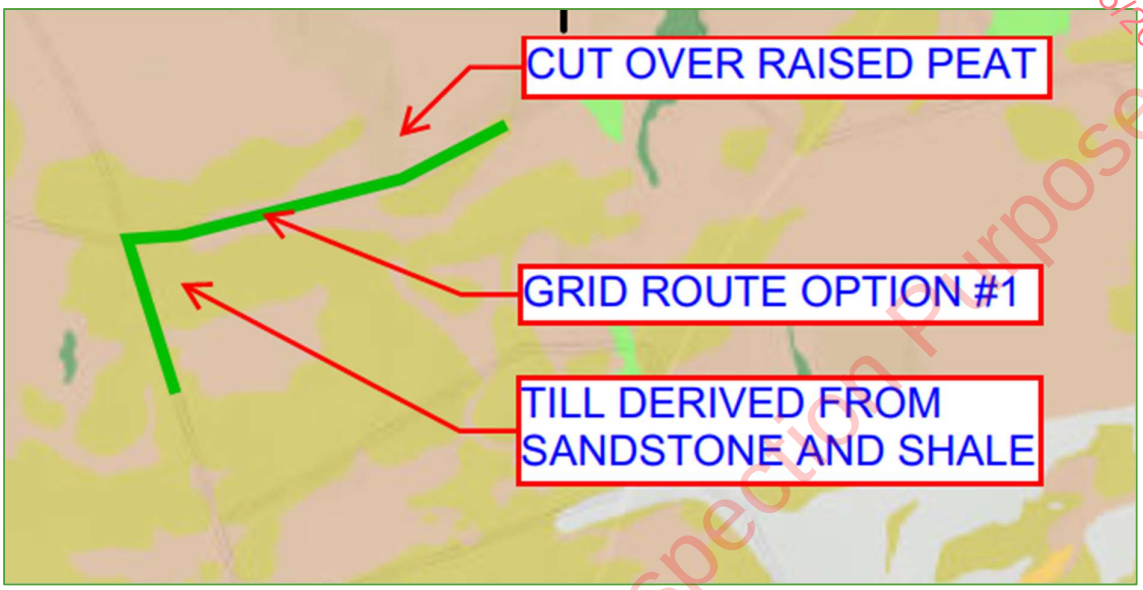


Image 3.2.2: Option#1 located entirely with lands of cut over raised peat.

A site inspection was carried out whereby the following elements were visually assessed only in an attempt to determine the formation type of the road i.e., solid or floating:

- Road conditions.
- Orientation of any surface cracks on the roads surface,
- Embankment strata (where possible).
- Finished floor level of any adjacent buildings; and
- Movement in road caused by passing traffic.

Based on the above assessment, it was assessed that the road is likely to be constructed to solid formation and therefore standard trench construction details could be used in these areas.

Should the existing road be floating and the depth of the bog in these areas be >2.0m, the trench design will likely involve the use of geotextiles to support the trench, with the geotextile anchored by the road build-up i.e., "top-hat" trench.

3.4.2 Option #2

For the most part, Option #2 traverses ground of till material. This is beneficial regarding construction methodologies and will offer flexibility at the detailed design stage when designing to avoid existing obstacles encountered along the route.

Option#2 also traverses lands with bedrock outcrop or high bedrock level (0.0m – 3.0m BGL). This could potentially lead to slower and more expensive than average construction in these sections.

Option #2 also sporadically traverses small sections of blanket peat (see Image 3.2.1 below) or cutover bog.

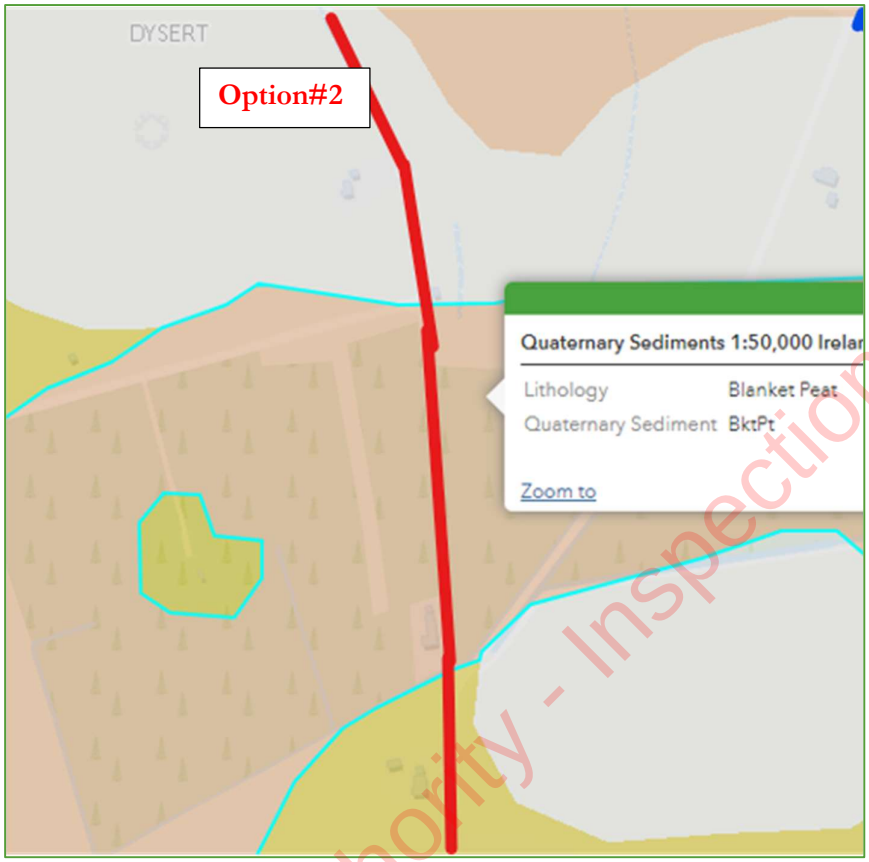


Image 3.2.1: Extract from GSI mapping where Option #2 traverses a small section of blanket peat

A hydrogeological desktop assessment of these bog areas has been carried out and it has determined that bedrock is likely to be shallow and in the region of 0.0m – 3.0m below ground level. The areas of sporadic bog are always immediately adjacent to areas where lithology mapping indicates bedrock outcrop or subcrop. This would reinforce the assumption that bog is likely to be shallow in these sections.

A site inspection was carried out whereby the following elements were visually assessed only in an attempt to determine the formation type of the road i.e., solid or floating:

- Road conditions.
- Orientation of any surface cracks on the roads surface,
- Embankment strata (where possible).
- Finished floor level of any adjacent buildings; and
- Movement in road caused by passing traffic.

Based on the above assessment, it was assessed that the road is likely to be constructed to solid formation and therefore standard trench construction details could be used in these areas.

Should the existing road be floating and the depth of the bog in these areas be >2.0m, the trench design will likely involve the use of geotextiles to support the trench, with the geotextile anchored by the road build-up i.e., "top-hat" trench.

When specifying the use of a "top-hat" trench, it is imperative to note that constructing multiple "top hat" tranches in a single, narrow roadway will be difficult from a constructability point of view and potentially extremely costly.

3.5 Flood Risk

Flood maps (floodinfo.ie) were reviewed to determine the flood risk associated with each of the grid route options.

The proposed grid routes will be an entirely underground infrastructure and constructed to tie-into 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.

Flood maps are included in Appendix C of this document.

3.5.1 Option #1

Although not covered by CFRAM mapping, Grid Route Option #1 is shown to run adjacent to an area of medium probability flooding (1:100 year) in the National Indicative Fluvial Mapping. However, the flood maps do not show the flood extents crossing the proposed route of the grid route.

There is also a previous recorded flood event at this location (ID-12978) with the flood source being recorded as "Coastal/Estuarine Waters". Image 3.3.1 below illustrates a the flooding location as per floodinfo.ie.

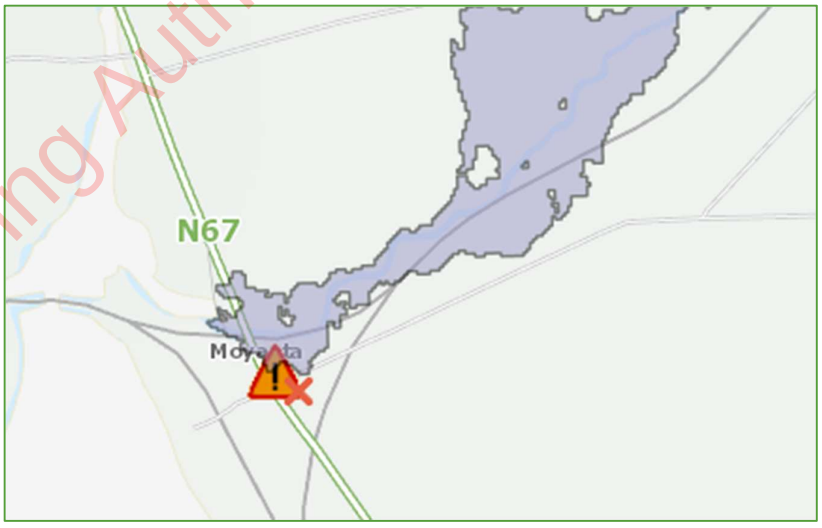


Image 3.3.1 – Moderate probability flooding shown at WC#1

As the purpose of the National Indicative Fluvial Mapping is to inform indicative flooding extents only, a detailed flood risk assessment may need to be carried out at detailed design stage to more accurately assess the flood extents at this location.

ESB specifications require that infrastructure shall not be located within Flood Zone A areas i.e. a 1:100 year event as is illustrated above. Therefore, the location of joint bays along Option #1 shall be determined at detailed design stage to avoid such flood extents.

3.5.2 Option #2

Where Option #2 transverses watercourse crossing #5 (WC#5), the grid route is within a zone of high probability flooding (1 in 10 year) for approximately 300m. Joint bays should not be located within this section of road.

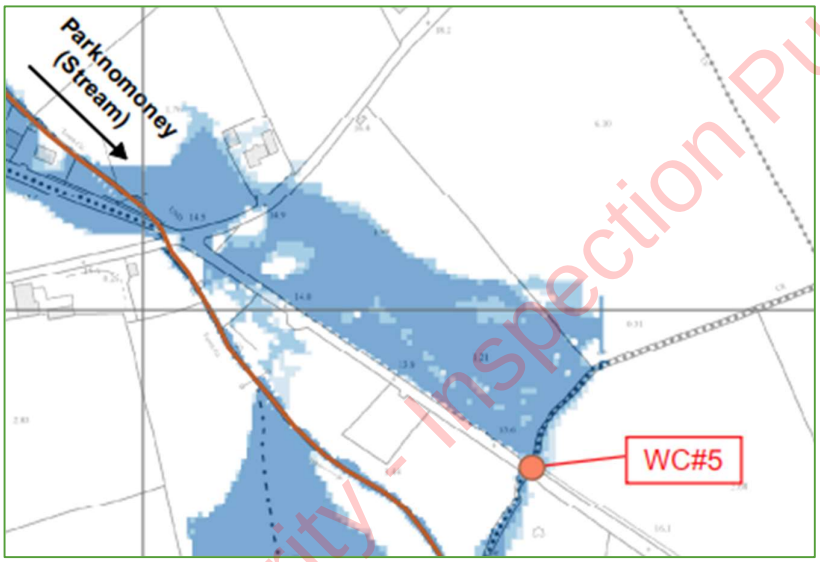


Image 3.3.1 – High probability flooding shown at WC#4.

3.6 Exiting Utilities

The below commentary is based on a preliminary desktop assessment of existing services along each of the proposed grid route options and shall be confirmed as part of the detailed design stage of the grid routes.

3.6.1 Gas

Gas Networks Ireland mapping was reviewed as part of this assessment and there were no gas mains indicated to be installed along any of the proposed routes.

3.6.2 Electricity

Overhead power lines were observed to be installed in front of all properties located along Option#1 and Option#2.

There is an existing underground ESB cable running longitudinally with the N68 on the southern side of the carriageway. ESB records indicate that the existing cable at this location is part of the power distribution network and not a power supply line from an IPP source.

The voltage of this existing line will need to be determined before the appropriate crossing design can be determined (standard safety practice is to install the lower voltage line on top at a given crossing).

Extreme caution shall be taken at detailed design stage when designing the final grid route alignment. It was noted that there are a number of wind farms in the vicinity of Tullabrack Substation and Moneypoint Substation. The underground grid routes of these wind farms may not be recorded within the ESB's existing services drawing checked as part of this desktop study.

3.6.3 Watermain

Images 3.4.1 and 3.4.2 below illustrate the minimum separation distances for MV (20kV) and 38kV underground ducts.

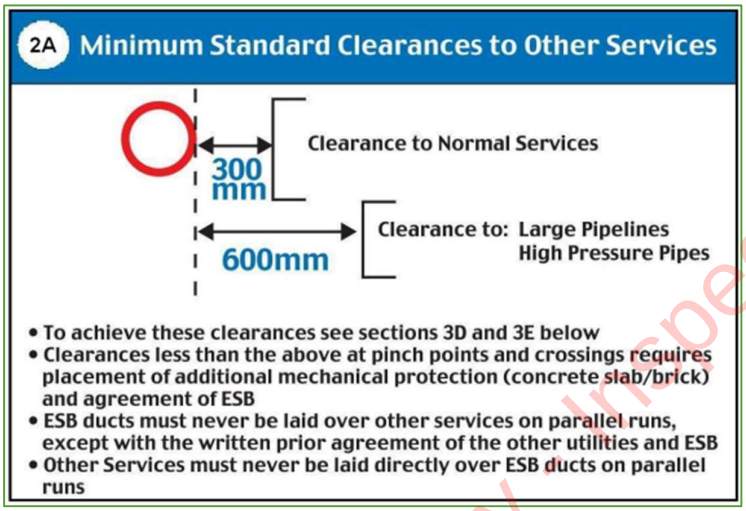


Image 3.4.1: Minimum MV separation distances.

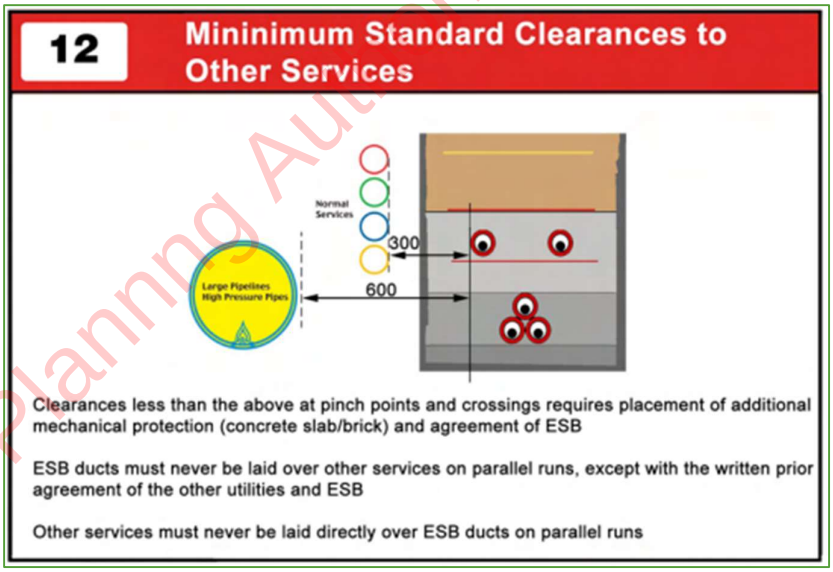
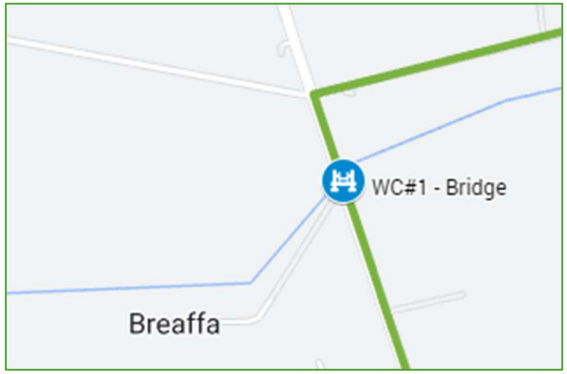
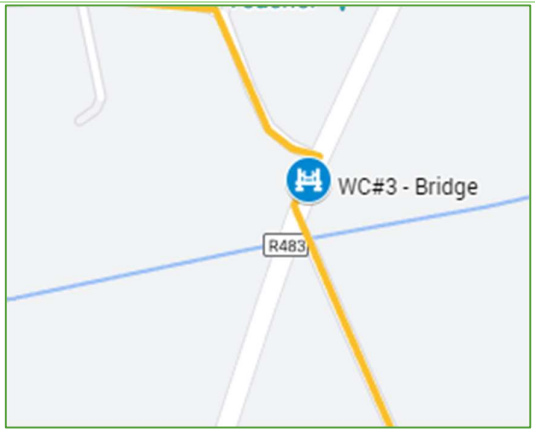
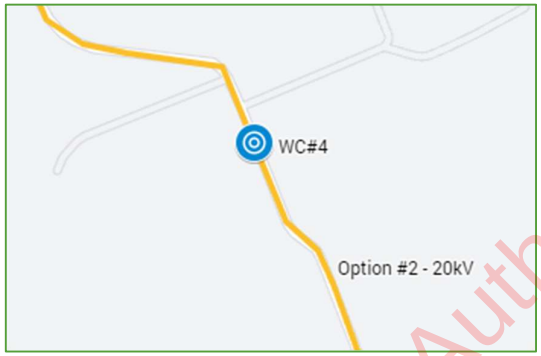


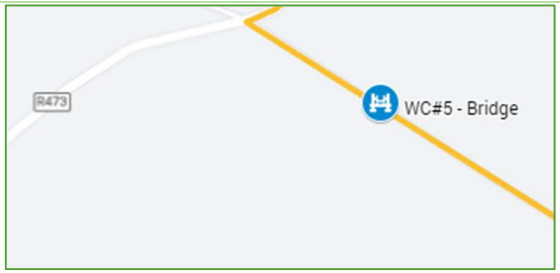
Image 3.4.2: Minimum 38kV separation distances.

Based on the above, a watermain has the potential to require a separation distance of 600mm from any of the proposed grid route options. 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.

Appendix A – Watercourse Crossing Details

ID	Location	Streetview	Notes
WC#1	 52.66737, -9.50403		**Route:** Option #1 **Type:** Bridge **Cover:** 200mm **Ducts:** 5No. 110mm HDPE **Method:** There are 2 potential methods for crossing this structure, namely 1. Within roadside verge 2. Horizontal Directional Drill
WC#2	 52.66439, -9.48269		**Route:** Option #2 **Type:** Bridge **Cover:** 370mm **Ducts:** 1No. 125mm uPVC **Method:** Trench in roadway. 525mm (W) x 225mm (H); or open crossing
			Route: Option #2

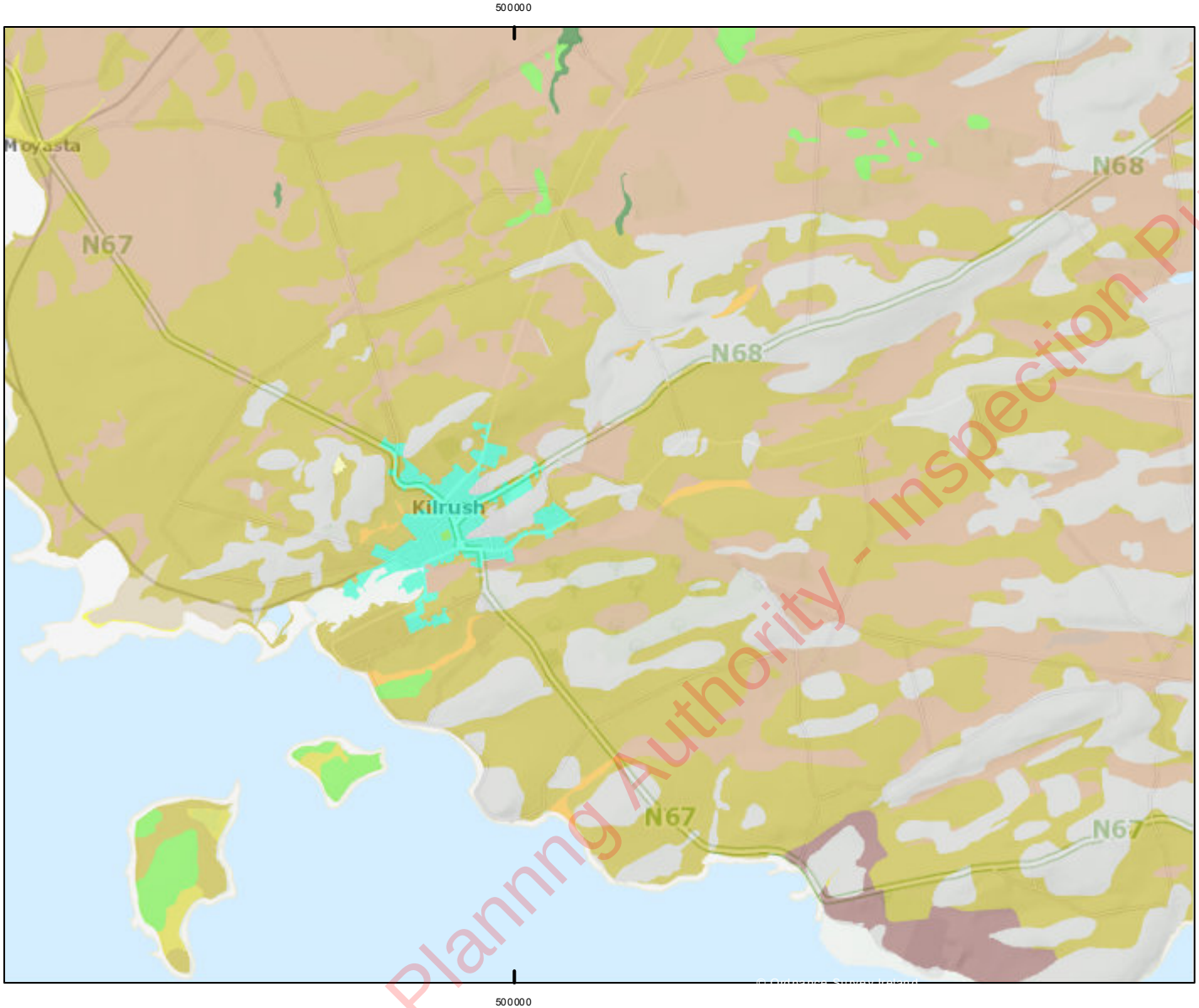
WC#3	 52.66399, -9.47231		**Type:** Bridge **Cover:** 370mm **Ducts:** 1No. 125mm uPVC **Method:** Trench in roadway. 525mm (W) x 225mm (H); or open crossing
WC#4	 52.65403, -9.461		**Route:** Option #2 **Type:** Culvert **Ducts:** 1No. 125mm uPVC **Method:** Trench in verge. 525mm (W) x 225mm (H)

WC#5	 52.64107, -9.45902		**Route:** Option #2 **Type:** Bridge **Cover:** 100mm **Ducts:** 1No. 125mm uPVC **Method:** Trench in roadway. 525mm (W) x 225mm (H); or open crossing
WC#6	 52.63647, -9.4481		**Route:** Option #2 **Type:** Culvert **Cover:** 800mm **Ducts:** 1No. 125mm uPVC **Method:** Trench in verge. 525mm (W) x 225mm (H)

WC#7	 52.62785, -9.44122		**Route:** Option #2 **Type:** Culvert **Cover:** 1200mm **Ducts:** 1No. 125mm uPVC **Method:** Trench in verge. 525mm (W) x 225mm (H)
WC#8	 52.62205, -9.4398		**Route:** Option #2 **Type:** Culvert **Cover:** 1900mm **Ducts:** 1No. 125mm uPVC **Method:** Trench in verge. 525mm (W) x 225mm (H)
WC#9			**Route:** Option #2

	 52.6117, -9.43802		**Type:** Culvert **Cover:** Unknown (discharge is beneath high tide level in bay) **Ducts:** 1No. 125mm uPVC **Method:** Trench in verge. 525mm (W) x 225mm (H)

Geological Survey Ireland Public Data



Scale: 1:54,308

Geological Survey Ireland

0 0.375 0.75 1.5 mi

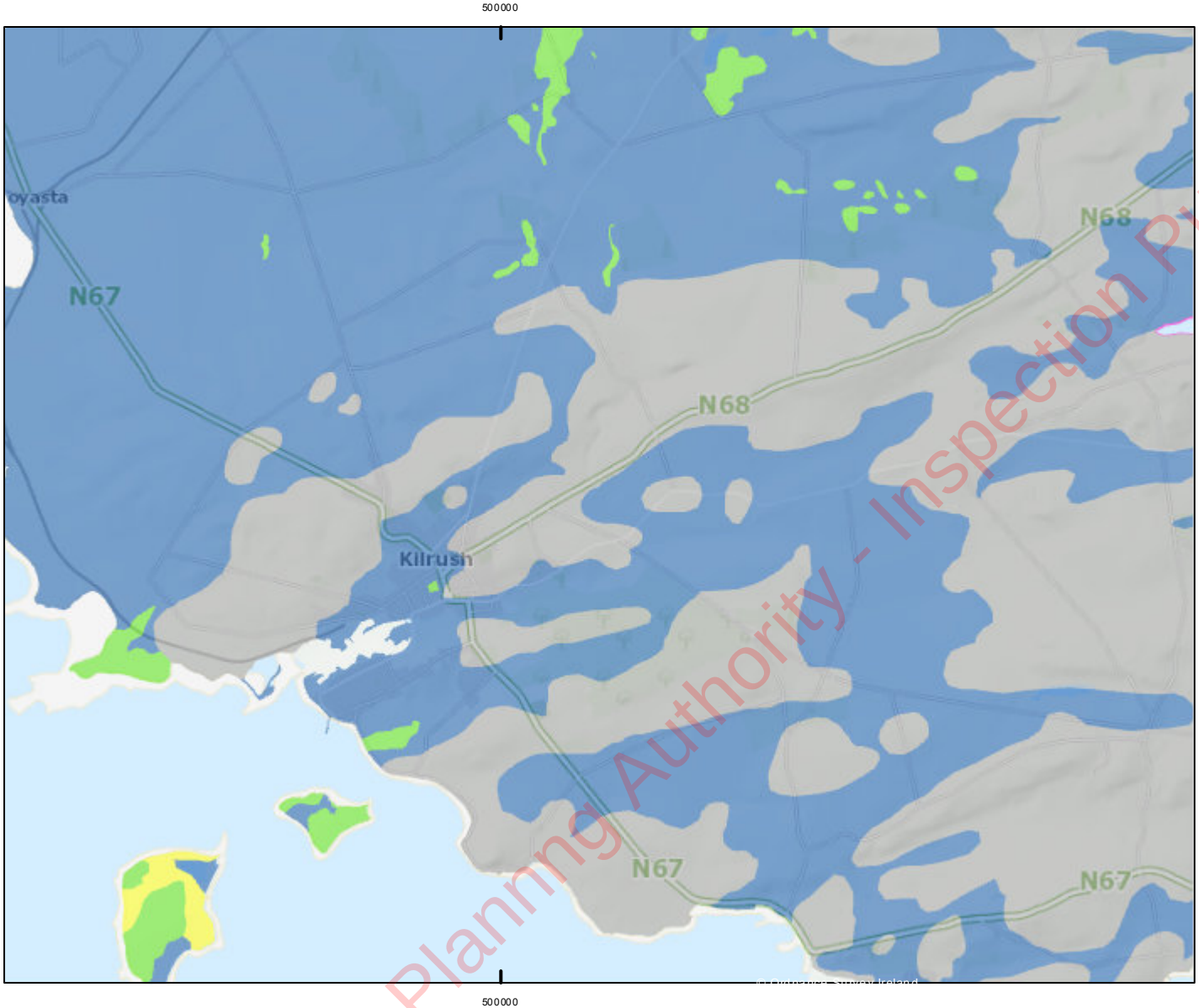
0 0.5 1 2 km

Map Centre Coordinates (ITM) 500,726 655,453

21/10/2022, 16:51:36

Legend

Geological Survey Ireland Public Data



Legend

Subsoil_Permeab...

- High
- Moderate
- Low
- Water
- Not mapped

Scale: 1:54,308

Geological Survey Ireland

0 0.375 0.75 1.5 mi

0 0.5 1 2 km

Map Centre Coordinates (ITM) 500,833 655,893

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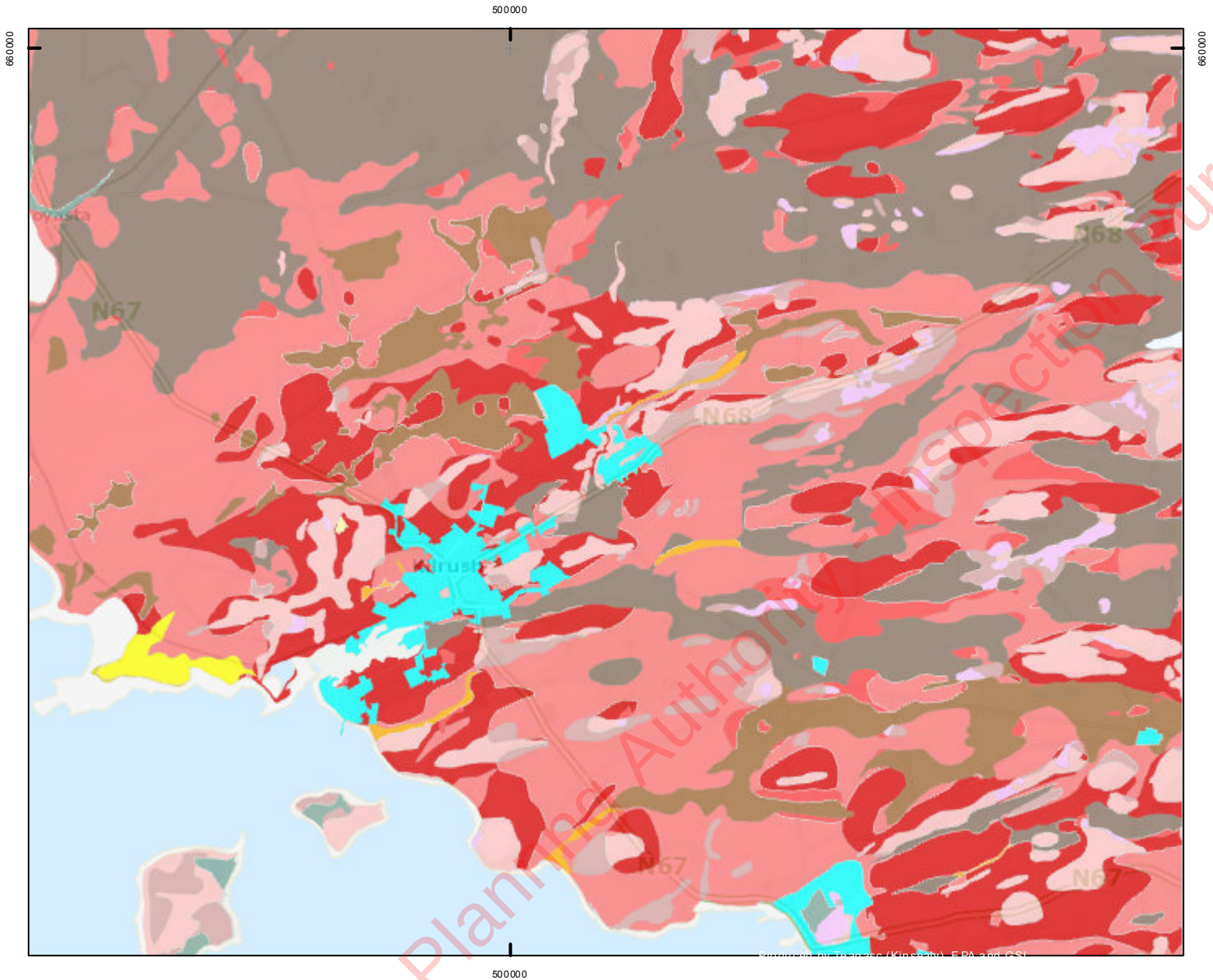
Geological Survey Ireland Public Data



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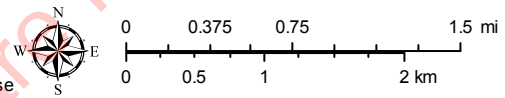
Geological Survey Ireland



Map Centre Coordinates (ITM) 500,833 656,081

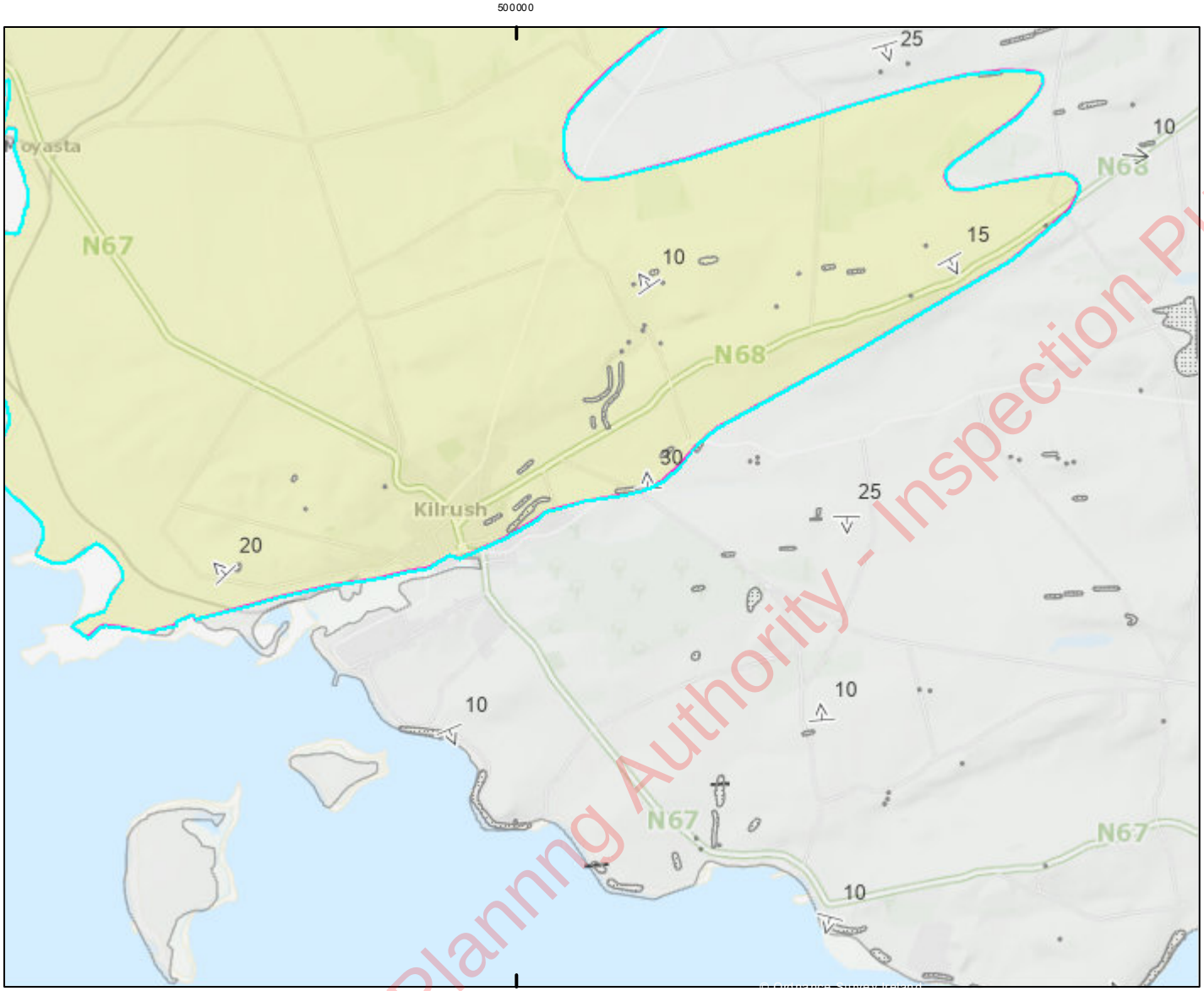
22/10/2022, 12:44:48

Legend

TEAGASC_Soils_50K...

- AminDW - Deep well drained mineral (Mainly acidic)
- AminPD - Mineral poorly drained (Mainly acidic)
- AminPDPT - Peaty poorly drained mineral (Mainly acidic)
- AminSW - Shallow well drained mineral (Mainly acidic)
- AminSP - Shallow poorly drained mineral (Mainly acidic)
- AminSPPT - Shallow peaty poorly drained mineral (Mainly acidic)
- AminSRPT - Shallow, rocky, peaty/non-peatymi... complexes (Mainly acidic)
- BminDW - Deep well drained mineral (Mainly basic)
- BminPD - Mineral poorly drained (Mainly basic)
- BminPDPT - Peaty poorly drained mineral (Mainly basic)
- BminSW - Shallow well drained mineral (Mainly basic)
- BminSP - Shallow poorly drained mineral (Mainly basic)
- BminSPPT - Shallow peaty poorly drained mineral (Mainly basic)
- BminSRPT - Shallow, rocky, peaty/non-peatymi... complexes (Mainly basic)
- BktPt - Blanket peat
- FenPt - Fen peat
- RsPt - Raised Peat
- Cut - Cutover/cutaway peat
- AlluvMIN - Alluvial (mineral)
- AlluvMRL - Alluvial (marl)
- Lac - Lacustrine type soils
- Scree - Scree
- AeoUND - Aeolian undifferentiated
- MarSands - Marine sand and gravel
- MarSed - Marine/estuarine sediments
- Made - Made ground
- Water - Water
- Unclass

Geological Survey Ireland Public Data



Scale: 1:54,308

Geological Survey Ireland

0 0.375 0.75 1.5 mi

0 0.5 1 2 km

Map Centre Coordinates (ITM) 500,726 655,453

21/10/2022, 16:49:24

Legend

Structural Symbols 100K ITM 2018

- Dip of bedding or main foliation, old GSI data
- First foliation parallel to bedding
- Foliation trend, Thorr and Rosses Granites
- Horizontal Bedding
- Strike and dip of bedding, right way up
- Strike and dip of bedding, way up unknown
- Strike and dip of first foliation
- Strike and dip of overturned bedding
- Strike and dip of second foliation
- Strike and dip of third foliation
- Strike and plunge of first generation fold axis
- Strike and plunge of second generation fold axis
- Strike and plunge of third generation fold axis
- Strike of vertical bedding/foliation
- Strike of vertical first foliation
- <all other values>

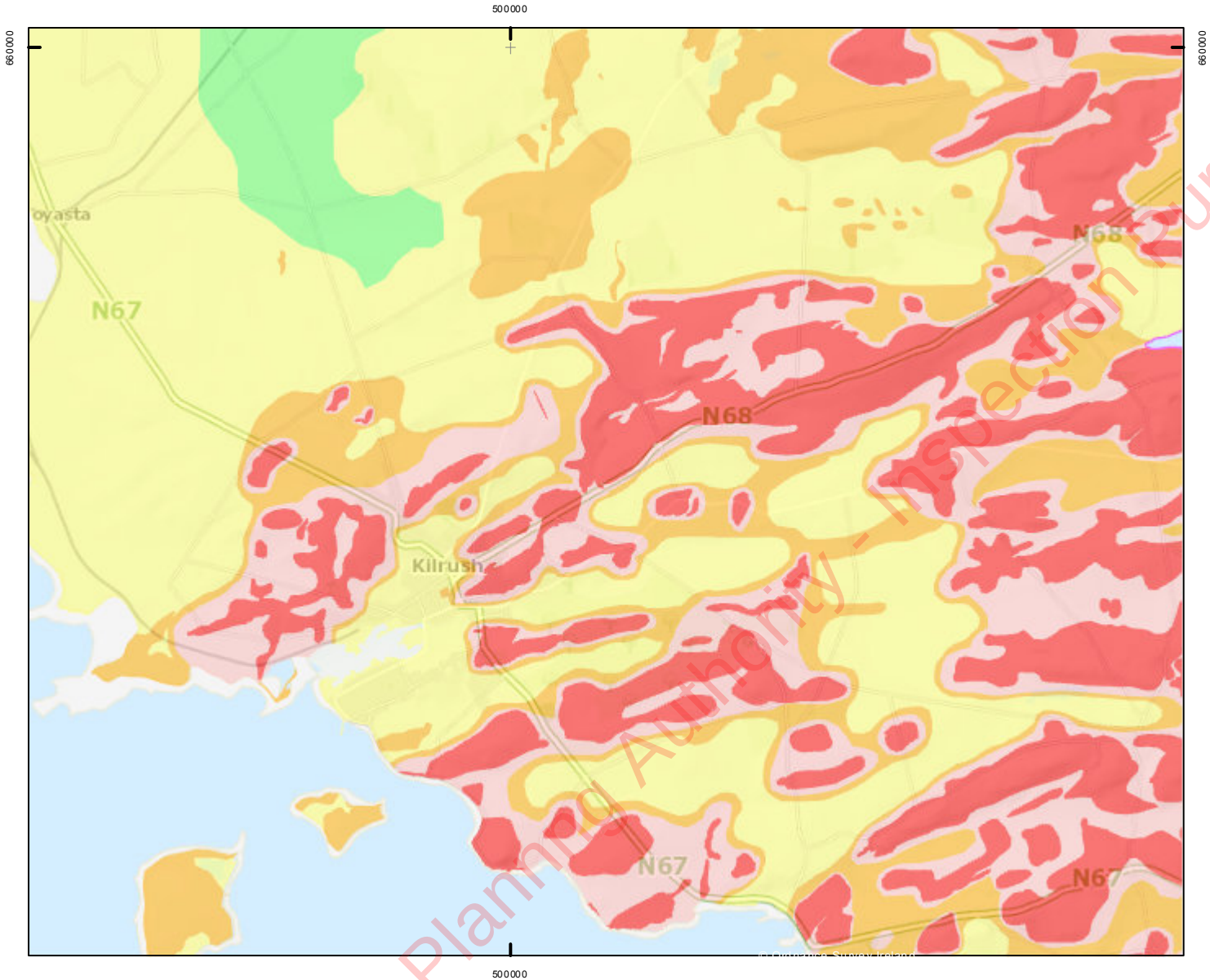
- Bedrock Outcrops 100 ITM 2018

Bedrock Linework 100k ITM 2018

- Anticlinal Axis
- Antiformal axis
- Aquifer Boundary
- Area
- Coal seam
- Dyke
- Fault
- Ghost Line
- Goniatite marine band (R1-R4)
- Lithological boundary offshore
- Metadolerite sheet, mainly sills
- Paleogene/ Tertiary Dyke
- Synclinal Axis
- Synformal axis
- Tectonic Slide, barbs on hanging-wall
- Thin stratigraphical unit, diagrammatic
- Thrust, barbs on hanging-wall side
- Tuff band
- Unconformity, dots on younger side
- X-Section

Appendix B – GSI Mapping

Geological Survey Ireland Public Data



Legend

Groundwater Vulnerability

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low
- Water

Scale: 1:54,308

Geological Survey Ireland

N W E S

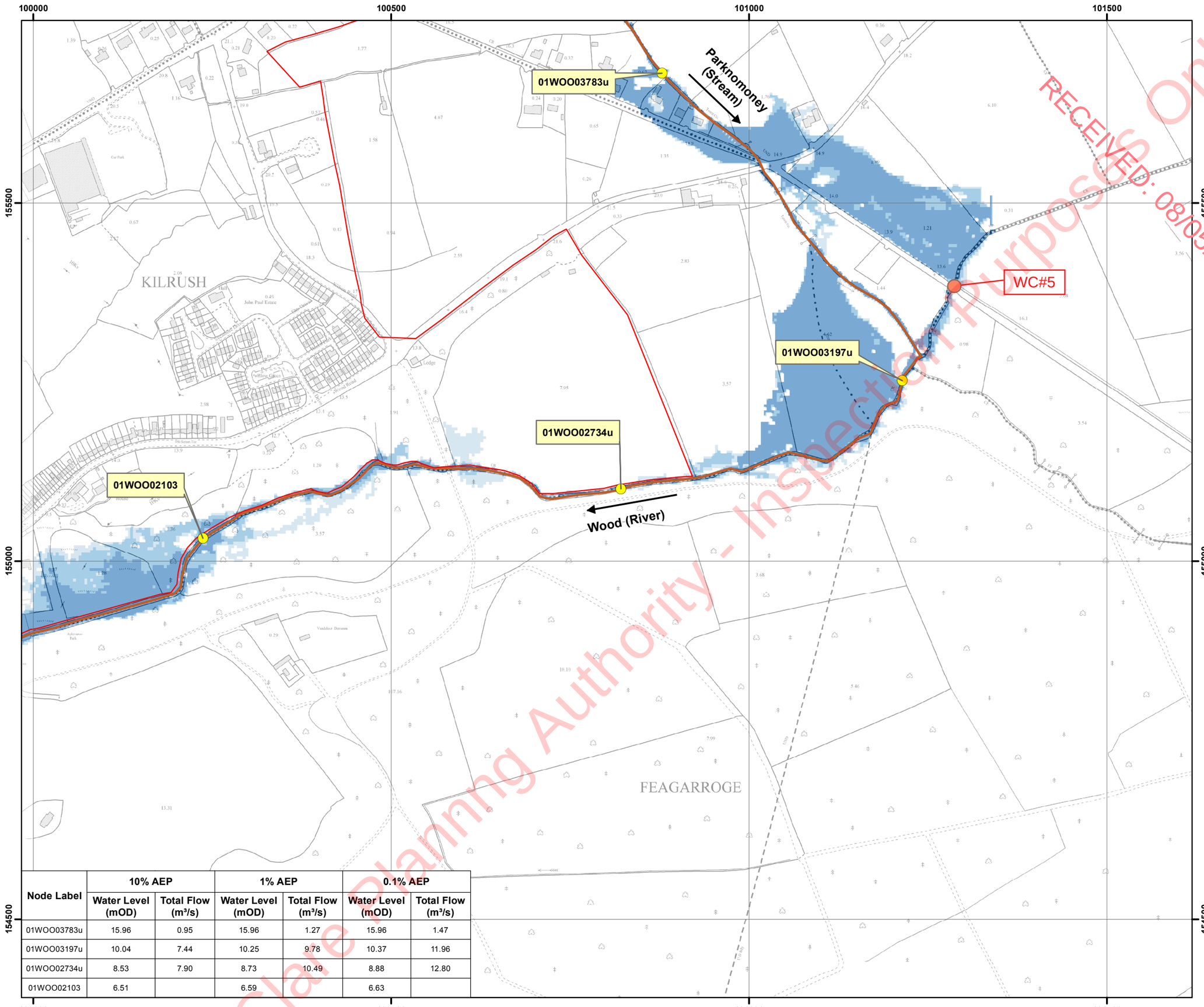
0 0.375 0.75 1.5 mi

0 0.5 1 2 km

Map Centre Coordinates (ITM) 500,833 656,081

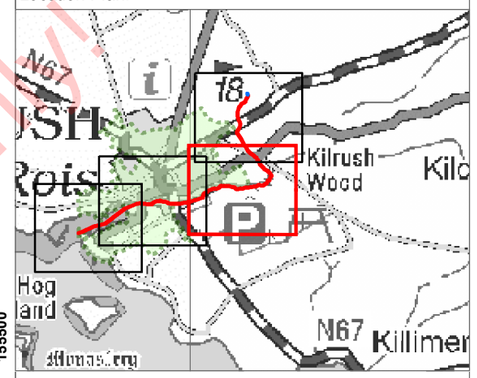
22/10/2022, 12:14:55

Appendix C – Flood Maps



Node Label	10% AEP		1% AEP		0.1% AEP	
	Water Level (mOD)	Total Flow (m^3/s)	Water Level (mOD)	Total Flow (m^3/s)	Water Level (mOD)	Total Flow (m^3/s)
01WOO03783u	15.96	0.95	15.96	1.27	15.96	1.47
01WOO03197u	10.04	7.44	10.25	9.78	10.37	11.96
01WOO02734u	8.53	7.90	8.73	10.49	8.88	12.80
01WOO02103	6.51		6.59		6.63	

Location Plan:



Legend:

- Nodes
- Model Reach
- AFA Boundary
- Defence: Wall
- Defence: Embankment
- Defended Area

10% AEP Fluvial Flood Extent
(1 in 10 chance in any given year)

1% AEP Fluvial Flood Extent
(1 in 100 chance in any given year)

0.1% AEP Fluvial Flood Extent
(1 in 1000 chance in any given year)

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath
C15 NX36

Merrion House
Merrion Road
Dublin 4
D04 R2C5

Project:	SHANNON CFRAM STUDY
Map Type:	EXTENT
Source:	FLUVIAL
Area:	KILRUSH
Scenario:	EXISTING
Drawn by: GH	Date: JUNE 2016
Checked by: AC	Date: JUNE 2016
Reviewed by: MC	Date: JUNE 2016
Approved by: PS	Date: JUNE 2016
Map Number:	S27KIH_EXFCD_F1_02
Sheet: 2 of 4	Revision: 0
Map Scale: 1: 5,000	Plot Scale: 1:1 @ A3

Appendix D – Site Location Map

GENERAL NOTES

1. DRAWINGS ISSUED ARE FOR PLANNING APPLICATION PURPOSES ONLY. DRAWINGS NOT TO BE USED FOR CONSTRUCTION OR OTHER PURPOSES.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND DOCUMENTATION.
3. DO NOT SCALE DRAWING. FIGURED DIMENSIONS ONLY TO BE USED.
4. ALL LEVELS AND DIMENSIONS SHOWN ARE TO BE VERIFIED BY PRE-WORKS SURVEYS.
5. TRENCH LEVELS ARE SHOWN TO CROWN OF DUCT/PIPE.
6. FINAL REINSTATEMENT WORKS ARE SUBJECT TO AGREEMENT WITH THE LOCAL AUTHORITY. PRIOR TO CONSTRUCTION, CONSULTATION WILL BE HELD WITH THE LOCAL AUTHORITY TO AGREE THE REINSTATEMENT SPECIFICATIONS.
7. FINAL TRENCH DETAILS ARE SUBJECT TO APPROVAL FROM THE ESB. PRIOR TO CONSTRUCTION, CONSULTATION WILL BE HELD WITH THE ESB TO AGREE THE TRENCH DETAIL SPECIFICATIONS.
8. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL CARRY OUT DETAILED SITE INVESTIGATION WORKS TO DETERMINE THE LOCATION OF ALL EXISTING UTILITIES IN THE VICINITY OF THE PROPOSED WORKS.
9. ALL LANDSCAPE AND ENVIRONMENTAL WORKS TO CONFORM WITH EIAR.
10. ALL TRAFFIC MANAGEMENT WORKS TO CONFORM TO AN APPROVED TRAFFIC MANAGEMENT PLAN.
11. SITE BOUNDARY LINES FOR THE GRID CONNECTION ROUTE ARE INTENDED TO CORRELATE TO THE EDGE OF THE PUBLIC ROAD BOUNDARY LINES. IN NO CIRCUMSTANCES IS IT INTENDED THAT THE SITE BOUNDARY LINES FOR THE GRID CONNECTION ROUTE CROSS THIRD-PARTY LANDS.

KEYED NOTES

1. WATERCROSSING #1
2. WATERCROSSING #2
3. WATERCROSSING #3
4. WATERCROSSING #4
5. WATERCROSSING #5
6. WATERCROSSING #6
7. WATERCROSSING #7
8. WATERCROSSING #8
9. WATERCROSSING #9

10. TULLABRACK SUBSTATION
11. MONEYPOINT SUBSTATION

12. SITE ENTRANCE

LEGEND

GRID ROUTE OPTION 1 - 38kV

GRID ROUTE OPTION 2 - 20Kv

Rev	Description	Drawn	Checked	Date
P4	UPDATE TO PROJECT NAME	E.B.	B.F.	10/07/2024
P3	ADDED WC#9	B.F.	B.F.	12/05/2023
P2	GENERAL REVISION	S.O'S.	B.F.	28/04/2023
P1	FIRST ISSUE	M.B.	B.F.	03/02/2023

Suitability Status:
PLANNING

Client:
GREENSOURCE SUSTAINABLE DEVELOPMENTS

Job Title:
MOANMORE LOWER WIND FARM

Drawing Title:
GRID CONNECTION ROUTE
SITE LOCATION

Scale:	Date:	Sheet:
1:25000	02/02/2023	A1

bfa consulting

Dwg No:	Rev:
22007-BFA-XX-XX-DR-C-6001	P4