APPENDIX 8-2

KARST RISK ASSESSMENT

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Geotechnical Karst Risk Assessment

Client	**MKO**
Document Ref.	22098-R-03-02
Project Title	Cooloo Wind Farm
Date	19/09/2025

Project Title:	Cooloo Wind Farm
Report Title:	Geotechnical Karst Risk Assessment
Document Reference:	22098-R-03-02

Client:	MKO
Ultimate Client:	Neoen
Confidentiality	Client Confidential

REVISION HISTORY

Rev	Date	Reason for Issue	Originator	Checker	Reviewer	Approver
00	20/06/2025	First issue	CE	AP	PQ	PQ
01	16/09/2025	Revision to address client comments	CE	AP	PQ	PQ
02	19/09/2025	Revision to address client comments	CE	CE	TOS	TOS

DISCLAIMER

REVISION SUMMARY

Rev	Date	Section(s)	Detail of Change
00	20/06/2025	All	First Issue
01	16/09/2025	3, 4.4, 5.6	Revision to address client comments
02	19/09/2025	Executive Summary, 5.6, 6	Revision to address client comments

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Gavin and Doherty Geosolutions (GDG) was commissioned in October 2024 by MKO to undertake a Geotechnical Karst Risk Assessment (KRA) for the Proposed Wind Farm, located at Cooloo, County Galway. Refer to Appendix A for the Proposed Wind Farm location. Karst features have been identified within the boundaries of the Proposed Wind Farm site, indicating a potential karst risk at the Proposed Wind Farm.

The purpose of this report is to outline the potential for karst risk at the Proposed Wind Farm site, to develop a quantitative karst risk assessment, and to outline mitigation measures and recommendations for consideration at the detailed design and construction stages of the project.

A desk study, site walkovers, ground investigation campaigns, and a risk assessment were conducted to assess the potential karst risk at the Proposed Wind Farm site. The walkover inspections and GI campaign were conducted over a larger search area to assess karst risk across the local area immediately adjacent to the Proposed Wind Farm site. Consultation with the published geological maps indicates that the Proposed Wind Farm site is located in an area susceptible to the development of karst landforms. This is supported by the findings of both the desk study review of aerial and topographic imagery as well as the site walkovers. A total of 41 potential karst features have been identified within 1km of the Proposed Wind Farm site boundary, with 13 potential features identified within the EIAR boundary.

The assessment findings showed that the majority of the proposed infrastructure locations are located in areas of low to medium karst hazard, with additional localised areas of high and very high hazard identified. One turbine (T4) was identified as being located in an area of high karst hazard, with a section of the access track immediately north of T4 also being classified as having a high karst hazard. Areas identified as being of very high karst hazard within the Proposed Wind Farm site do not interact with any of the proposed infrastructure footprint.

The karst risk assessment shows that the risk at each infrastructure location ranges from medium to very high (at T4) before the application of mitigation measures. Following the implementation of mitigation measures, the residual risk at each infrastructure location ranges from low to medium, indicating that development can proceed as long as mitigation measures are implemented and that the risk assessment is further refined following a more detailed confirmatory ground investigation.

1 INTRODUCTION

1.1 BACKGROUND

Gavin and Doherty Geosolutions (GDG) was commissioned by MKO to undertake a Geotechnical Karst Risk Assessment (KRA) for the Proposed Wind Farm, located in Cooloo, County Galway. Figure A-1 in Appendix A shows the Proposed Wind Farm location. Karst features have been identified within the boundaries of the Proposed Wind Farm site, indicating a potential karst risk at the Proposed Wind Farm.

This assessment is limited to consideration of the geotechnical risks posed by karstic features to the Proposed Wind Farm. Consideration of the impact of the Proposed Wind Farm on the hydrology and hydrogeology of the Proposed Wind Farm site is outside the scope of this report.

1.2 STATEMENT OF AUTHORITY

GDG has been involved in numerous renewable energy projects in both Ireland and the UK at various stages of development, including preliminary feasibility, planning, design, and construction. In addition to this, the GDG team, comprising engineering geologists, geomorphologists, geotechnical engineers, and environmental scientists, has developed expertise in ground modelling, geotechnical design, and geotechnical risk assessment, including onshore wind and linear infrastructure projects.

GDG combines state-of-the-art research with direct industry experience, offering a bespoke engineering service that delivers the most progressive, reliable, and efficient designs across a wide range of projects and technical areas. This includes providing forensic engineering and expert witness services to the Insurance and Legal sectors. Our clients include large civil engineering contractors, renewable energy developers, semi-state bodies and engineering and environmental consulting firms.

The members of the GDG team involved in this assessment include:

- **Paul Quigley – Project Director**. Paul is a Chartered Engineer with over 28 years of experience in geotechnical engineering and a UK Registered Engineering (RoGEP) Advisor. He has worked on a wide variety of projects for employers, contractors and third parties, gaining a range of experience, including earthworks for major infrastructure schemes in Ireland and overseas, roads, tunnelling projects, flood protection schemes, retaining wall and basement projects, ground investigations and forensic reviews of failures. Paul is adept at designing creative solutions for complex problems and has published numerous peer-reviewed technical papers. He has gained extensive experience working in developments on peatlands, including the Corrib Gas Terminal, wind farm development and linear infrastructure such as roads, rail, gas pipeline, etc. He has also acted as an independent expert for several legal disputes centred on ground-related issues. He is a reviewer for the ICE Geotechnical Engineering Journal, a member of the Eurocode 7 review panel at NSAI and a former Chairman of the Geotechnical Society of Ireland.
- **Chris Engleman – Project Manager**. Chris is a Professional Geologist with a Master's degree in Geological Sciences from the University of Leeds. He is chartered with the Institute of Geologists

Ireland (IGI) and the European Federation of Geologists. He has six years of industry experience within the onshore renewables sector and the field of geological mapping with a particular focus on Quaternary geology, peat stability, ground investigation, ground modelling, GIS mapping and geotechnical design. Chris has worked on several renewable energy projects, particularly wind and solar, for over three years. Chris is the primary author of this report. Chris carried out peat probing, site walkovers and investigation of suspected karst features, and supervised site investigation works at the Proposed Wind Farm in 2024.

- **Alasdair Pilmer – Senior Hydrogeologist.** Alasdair is a Senior Hydrogeologist at GDG and a Chartered Hydrogeologist (BSc, MSc, PGeo, EurGeol) with the Institute of Geologists of Ireland and European Federation of Geologists. He has seven years of postgraduate experience working in the environmental, civil engineering, and renewables sectors in the UK, Ireland, and Africa. Alasdair has worked on multiple onshore and offshore wind farm projects, including Yellow River Wind Farm, Cushaling Wind Farm, Setanta Wind Park and Codling Wind Park.
- **Patrick Kelly.** Patrick is an experienced geologist with an Exploration Geology MSc from the Camborne School of Mines. He has five years of experience in engineering geology, exploration and mining, working across Ireland, the UK and Australia. He has worked in underground, brownfield and greenfield sites in both mining and engineering settings, supervising engineering projects such as wind farm ground investigation, foundation design, flood relief ground investigation, ground stabilisation, and various ground monitoring works, and supervising surface and underground drilling programs. Patrick carried out trial pit logging at the Proposed Wind Farm site in 2025.
- **Sowmya Reddy Gudipati.** Sowmya is a graduate engineer at GDG. She has two years of post-graduate experience working in the environmental, civil engineering, and renewables sectors. Sowmya has worked on multiple onshore wind and solar farm projects in the UK and Ireland. Sowmya carried out peat probing and site walkovers at the Proposed Wind Farm site in 2024.

1.3 PROPOSED WIND FARM

For the purpose of this application, the proposed development, hereafter the 'Proposed Wind Farm', will consist of the following:

i. *9 no. wind turbines with the following parameters:*
   - *Total turbine tip height of 180 metres;*
   - *A rotor blade diameter of 150 to 162 metres;*
   - *A hub height of 99 to 105 metres;*
ii. *Permanent turbine foundations, hard-standing and assembly areas;*
iii. *Underground electrical (33kV) and communications cabling;*
iv. *1 no. temporary construction compound (including site offices and welfare facilities);*
v. *A meteorological mast with a height of 100 metres, security fencing and associated foundation and hard-standing area;*
vi. *1 no. new site entrance on the R332 in the townland Lisavally;*
vii. *1 no. new access and egress point off the L6056 Local Road in the townland of Dangan Eighter;*

viii. *1 no. new access and egress point on to an existing access track in the townland of Dangan Eighter;*
ix. *2 no. new access and egress points off the L6301 Local Road in the townland of Cooloo and Lecarrow;*
x. *Upgrade of existing site tracks/roads and provision of new site access roads, clear span crossings, junctions and hard-standing areas;*
xi. *A new temporary access road from N63 national road and to R332 Regional Road in the townland of Slievegorm to facilitate the delivery of turbine components and other abnormal sized loads;*
xii. *Demolition of an existing derelict house and adjacent outbuilding in the townland of Cooloo;*
xiii. *Peat and Spoil Management Areas;*
xiv. *Tree felling and hedgerow removal;*
xv. *Biodiversity Management and Enhancement measures;*
xvi. *Site Drainage;*
xvii. *Operational Stage site signage; and*
xviii. *All ancillary apparatus and site development works above and below ground, including soft and hard landscaping.*

Sections of the Proposed Grid Connection as defined in Section 1.1.1 of Chapter 1 Introduction are also included within this KRA. These include the onsite 110kV substation and battery energy storage system (BESS) compound.

1.4 OVERVIEW OF GEOTECHNICAL KARST RISK

1.4.1 KARST DEFINITION

Karst is defined by Drew (2018) as 'a terrain with distinctive hydrology and landforms due to the high solubility of the rock and the high degree of development of secondary permeability in the aquifer'. The development of karstic landscapes occurs most frequently in very pure, well-fractured limestone, such as the Carboniferous limestone in Ireland, but can form in any carbonate rock susceptible to dissolution. Solution of the limestone by acidified runoff is the dominant process by which karstic weathering occurs. The degree of solutional erosion varies both across the surface and below the ground. These variations in intensity, combined with the areal variability of the solution processes on different limestone lithologies and structures, produce a variety of karstic landforms on both large and small scales.

1.4.2 KARST LANDFORMS

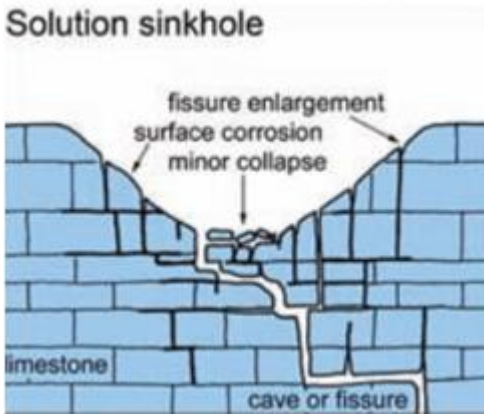
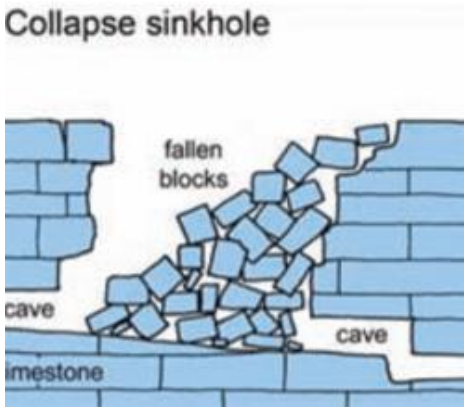
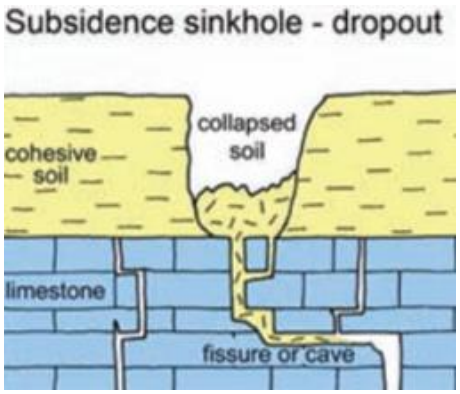
Karstic landscapes consist of a highly variable and complex set of features, including fissures, voids and cavities, spread across often quite large areas. These features may range from microscale dissolution (<1m in depth), e.g., grykes in exposed limestone, to kilometre-scale enclosed depressions. A number of the most commonly encountered karst features are as follows.

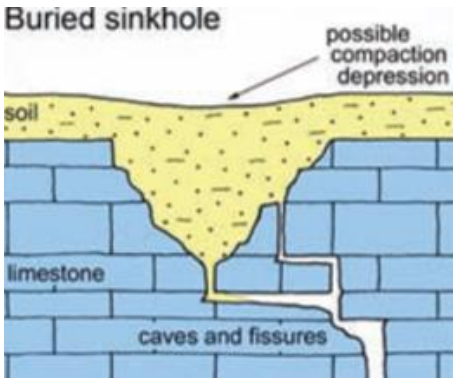
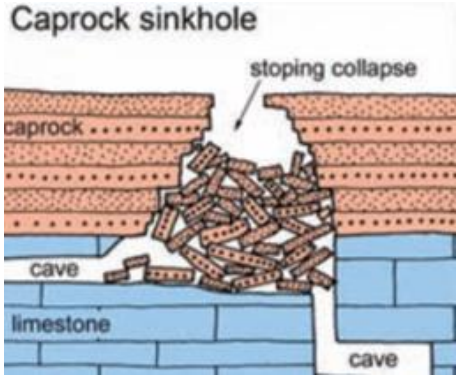
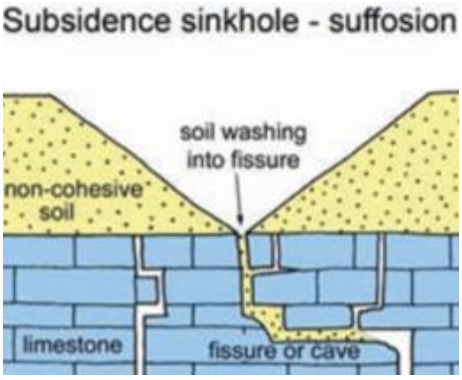
Enclosed Depressions

Enclosed depressions, in which runoff is funnelled vertically down to become groundwater recharge, are regarded as the most common karst landforms (Drew, 2018). They range in diameter from a few metres to tens of kilometres and range in depth from a few centimetres to hundreds of metres. They

all represent local zones of concentrated solutional erosion of limestone. The smallest of these features are termed dolines or sinkholes, and these take several forms. A summary of the main types of doline/sinkhole is provided in Table 1-1.

Table 1-1: Doline classification, after Waltham et al. (2005).

Feature Type	Description
	**Solution dolines** develop from the surface, where erosion becomes focused at particular locations, particularly where vertical lines of weakness (e.g. faults, joints, and bedding) allow significant quantities of water to enter the deeper aquifer. In contrast to collapse dolines, solution dolines commonly deepen as they evolve, becoming conical in form with progressively steepening slopes. The main geotechnical hazards are typically groundwater and drainage issues.
	**Collapse dolines** are typically observed as vertical-sided cylindrical features, usually formed by rapid, catastrophic collapse of the overlying rock into an underlying cavity – essentially rock roof failure into an underlying cave. The main geotechnical hazard is sudden, catastrophic collapse.
	**Dropout dolines** are typically observed as vertical-sided cylindrical features, usually formed by rapid, catastrophic collapse of the overlying subsoil into an underlying cavity. Over time, weathering of the steep walls degrades the slope angle and the doline becomes bowl-shaped and, finally, saucer-shaped. Dropout dolines form most commonly in cohesive soils. The main geotechnical hazard is sudden, catastrophic collapse.

Feature Type	Description
	**Buried dolines** consist of existing dolines of any type that have been infilled with soil overburden following their formation. The main geotechnical hazard is local subsidence of the potentially soft fill material relative to the surrounding stable rock mass.
	**Caprock dolines** form in a similar manner to collapse dolines, but in this case, the failure is caused by the sudden collapse of an insoluble caprock forming the roof of a karstic cavity developing below. The main geotechnical hazard is sudden, catastrophic collapse.
	**Suffosion dolines** are formed by down-washing of soil into fissures developing in the bedrock beneath the soil cover. These features are typically conical in form with progressively steepening slopes. Suffosion dolines form most commonly in granular soils. The main geotechnical risk is gradual subsidence as soil is continuously eroded.

Dry Valleys

In humid climates, valleys or fragments of valleys are often found in karst areas. They develop when not all runoff can become sub-surface recharge. Such valleys may be devoid of streams and relate to different environmental conditions in the past, such as a higher water table, frozen ground, superimposition of the drainage pattern from a cover rock or wetter conditions in the past.

Caves

Caves are defined by Ford and Williams (2007) as cavities typically metres or tens of metres across, formed within the rock by its dissolution, and left empty or filled with sediment. In hydrogeological terms, however, every water-transmitting opening greater than 5–10 mm in diameter within the limestone aquifer has turbulent flow and should be considered a conduit (Drew, 2018).

Swallow Holes

A swallow hole is a surface depression or opening where a stream or surface water disappears underground, recharging the karst aquifer system. These are common in limestone areas where surface water is redirected into subterranean channels (Drew, 2018).

Springs

A spring is a natural point where groundwater (GW) discharges from aquifers at the surface, often at the base of a slope or cliff (Drew, 2018).

Turloughs

A turlough is a seasonal lake found in karst lowlands, especially in western Ireland (Coxon, 1987). It fills with water during wet seasons when the water table rises and drains away through underground channels in dry periods (Drew, 2018).

1.4.3 GEOTECHNICAL KARST HAZARDS

The main hazards posed by karst to engineering projects, including wind farm developments, are enclosed depressions, particularly dolines/sinkholes. The main geotechnical hazards associated with dolines and karstic landscapes are:

- Rapid failure of rock or cohesive soil to form collapse or dropout dolines. Instantaneous failures of this type can be catastrophic, leading to serious injury or severe structural damage;
- Karst collapse due to loss of buoyant support and effective stress changes in the soil arch following GW lowering (e.g. by road cutting);
- Karst collapse brought on by erosion of soils by downward-moving surface water drainage to rock (seepage erosion/ migration of fines)
- Differential settlement caused by subsidence of soils overlying suffusion of buried dolines;
- Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design.

1.5 KARST RISK ASSESSMENT WORKFLOW

The karst risk assessment methodology adopted for this project is based on assessments undertaken on previous road schemes in Ireland (Rutty and Jennings, 2012; Madden and O'Hara, 2016), discussion in published literature (Waltham et al., 2005; Waltham and Fookes, 2003) and previous project expertise of the project team on large linear infrastructure projects in karstic environments. Figure 1-1 shows a workflow diagram for the KRA.

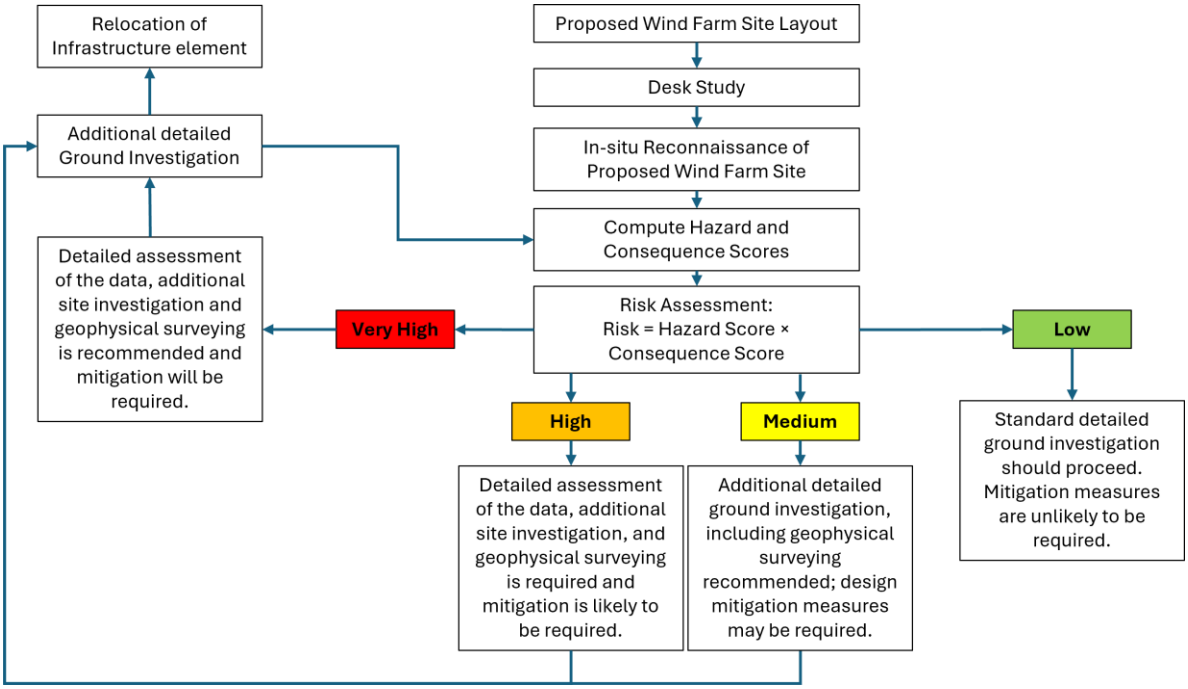


Figure 1-1: Workflow of the KRA methodology for the acceptability of the Proposed Wind Farm.

2 DESK STUDY

2.1 QUATERNARY SEDIMENTS

The map of Quaternary sediments at 1:50,000 scale shown in Figure B- 1 in Appendix B (GSI, 2025) shows that the Proposed Wind Farm site is located in a mixed area consisting primarily of cut-over raised peat and glacial till. Cut-over raised peat consists of discrete, raised, dome-shaped masses of peat that have had part of their peat volume removed by anthropogenic peat harvesting methods. Parts of the Proposed Wind Farm site area consist of uncut raised peat bog, surrounded by cut-over peat. These raised bog areas are located north of T5, between T7 and T9, and north of T2.

Alluvium deposits are not mapped within the site boundary; however, some form of alluvium is expected to be present adjacent to most of the minor watercourses that cross the Proposed Wind Farm site.

Pockets of till derived from limestones are mapped throughout the Proposed Wind Farm, largely corresponding with small ridge features mapped by the Geological Survey Ireland (GSI) as drumlins. Glacial till consists of typically over-consolidated sediments directly deposited by glacial action and can vary between cohesive clays and sands, as well as gravels. T1, T3, T4, T6, T8, the temporary construction compound, and parts of the substation are located in areas mapped by the GSI as till derived from limestone. A small area of gravels derived from limestone and associated with an esker is mapped approximately 300m north of T7, outside of the EIAR boundary.

2.2 BEDROCK GEOLOGY

According to the GSI bedrock geological map of Ireland at 1:100,000 scale (GSI, 2025) (Figure B-2 in Appendix B), the bedrock underlying the Proposed Wind Farm site consists of limestone of the Burren Formation, undifferentiated Viséan limestones and the Croghan Limestone formation. The northern part of the Proposed Wind Farm site, approximately 100m northeast of T7, is mapped as consisting of the Croghan Formation, while the remainder of the Proposed Wind Farm site is mapped as Undifferentiated Viséan Limestones, aside from a small band of Burren Formation rocks, mapped at T7, and running south-east from this location to approximately 150m north of T9. All of the turbine locations, except T7, are mapped as being underlain by Undifferentiated Viséan Limestones.

Pale grey argillaceous and bioclastic packstones and wackestones typify the Burren and Croghan formations. These formations also contain intervals of dark cherty limestones and shales, often associated with oolitic grainstones. Little information is available regarding the Undifferentiated Viséan Limestones; however, they are anticipated to consist of pure, bedded limestone. A summary of the expected lithologies is shown in Table 2-1.

One rotary core borehole (GSI-17-003) from the GSI borehole database was drilled within the Proposed Wind Farm site, approximately 390m east of T7 (Figure B-2 in Appendix B). The available borehole log indicated that bedrock was encountered at 5 meters below ground level (mbgl) and was drilled to a final depth of 122 meters below ground level (mbgl). A dark grey argillaceous

limestone and calcareous mudstone from the Croghan Formation was encountered from 5.0 to 105 m below ground level (mbgl). A very fine-grained argillaceous limestone of the Ballymore Formation was encountered from 105 to 122m below ground level (bgl).

Table 2-1: Summary of bedrock lithologies (descriptions as per Pracht et al., 2015 and GSI).

Bedrock Formation	System	Series	Stage	Brief Description
Burren Formation	Carboniferous	Dinantian	Viséan	Medium- and coarse-grained light and dark grey well-bedded and massive limestone, rare clay bands; frequent coral colonies and brachiopod bands; rare massive fine-grained limestone intervals with cavities; some partial dolomitization.
Croghan Formation	Carboniferous	Dinantian	Viséan	Mostly fine- to medium-grained, dark grey well-bedded argillaceous limestone.
Undifferentiated Viséan Limestone	Carboniferous	Dinantian	Viséan	Undifferentiated Limestones of Viséan age.

2.3 HYDROGEOLOGY

2.3.1 HYDROSTRATIGRAPHIC ROCK UNIT

According to the GSI Hydrostatigraphic Rock Unit dataset (Figure C-1 in Appendix C), the entirety of the Proposed Wind Farm site is underlain by Dinantian Pure Bedded Limestones (DUIL). The limestones in the Dinantian Pure Bedded Limestone Rock Unit Group are described by Drew (2018) as generally pure, pale grey, well-bedded and fine to coarse-grained. The absence of clay minerals within the limestone beds makes these rocks more brittle than the impure limestones, resulting in a high degree of fracturing and, consequently, increased permeability. The degree of bedding, jointing and deformation of these limestones has allowed a high degree of karstification to develop. These limestones are associated with low-density surface drainage networks, a high degree of interconnectivity between surface and groundwater, and the presence of numerous high-yielding springs (>25 l/s).

2.3.2 KARST FEATURES

The GSI Karst database (shown in Figure C-1 in Appendix C) records a total of eight karst features within a 1km buffer of the Proposed Wind Farm boundary, with each of these recorded as enclosed depressions. This dataset has been compiled by GSI using historical mapping, aerial imagery, and site inspections for a number of years since its original issue (Burke, 1998). GSI karst feature mapping is ongoing, and the presence of mapped features often reflects areas with greater field mapping coverage. It does not constitute a definite representation of all features present in the receiving environment. This dataset is not exhaustive, and additional karst features have been identified. Please see Section 3 for additional details.

2.3.3 BEDROCK AQUIFERS

According to the GSI Bedrock Aquifer map (2018), shown in Figure C- 2 in Appendix C, the entirety of the Proposed Wind Farm site is underlain by a Regionally Important Aquifer – Karstified (conduit).

This corresponds to the GSI aquifer category 'Rkc'. This aquifer is classed by the GSI as capable of supporting large public water supplies sufficient to support a large town.

2.3.4 GROUNDWATER BODIES

The entire proposed Wind Farm site is underlain by the Clare-Corrib Groundwater Body (GWB) (GSI, 2025). The extent of the GWB relative to the Proposed Wind Farm site can be seen in Figure C-3 in Appendix C. This GWB covers much of Counties Galway, Mayo, and Roscommon, encompassing a total area of approximately 1,400 km² (GSI, 2004). The north, south and west groundwater divides of the GWB are topographic highs that coincide with surface water catchment boundaries. It is bounded to the west by Lough Corrib.

The River Clare and its tributaries principally drain the area; however, the present-day drainage network has been significantly altered by arterial drainage that took place early in the nineteenth century. Much of the current stream network serves as a storm runoff system and remains inactive during the summer months. Before artificial drainage, streams sank underground via turlough sinks in the GWB. Within the GWB, surface water catchments are often bypassed by groundwater flowing beneath surface water channels and across surface water catchment divides.

The GWB is composed primarily of high transmissivity karstified limestone (Rkc). Transmissivity and well yields are variable, with rapid groundwater flow velocities recorded through groundwater tracing (GSI, 2004). The tracing indicates an anisotropy in the transmissivity, with faster groundwater flow velocities and higher transmissivity in an E-W direction, which may be linked to shallow E-W trending synclinal axes and steeper E-W hydraulic gradients.

The groundwater in this body is generally unconfined but may become locally confined beneath thick, low-permeability subsoil. Most of the groundwater flow occurs in the upper epikarstic layer and in a zone of interconnected solutionally enlarged bedding planes and fissures, generally extending to a depth of 30 m (GSI, 2004).

2.3.5 GROUNDWATER VULNERABILITY

The GSI Groundwater Vulnerability map indicates land where groundwater is susceptible to pollution. The vulnerability category assigned to a site or area is based on how easily water, which may contain pollutants, can reach the groundwater. GSI mapping (2025) indicates that the groundwater vulnerability across the Proposed Wind Farm site is highly variable, ranging from low in central portions of the Proposed Wind Farm site, to extreme/Rock at or near surface or karst in localised areas along watercourses in the centre of the Proposed Wind Farm site, and along the southern access track as far as the temporary construction compound. The GSI groundwater vulnerability map for the Proposed Wind Farm site is shown in Figure C-4 in Appendix C. Areas of low vulnerability generally correspond to areas mapped by the GSI as peat (such as at T2, T5, T7 and T9), with areas of moderate vulnerability mapped by the GSI in areas of glacial till (such as T3, T4, T6 and T8). T1 is mapped in an area of high vulnerability adjacent to an area classified as having extreme vulnerability, suggesting that the bedrock is relatively close to the surface in this location.

2.3.6 SUBSOIL PERMEABILITY

The GSI Subsoil Permeability map, shown in Figure C-5 in Appendix C, indicates that the Proposed Wind Farm site varies between areas of low and moderate permeability. T2, T5, T7, and T9 are mapped in areas of moderate permeability (corresponding to areas mapped as peat), while the remaining turbines are mapped in areas of low permeability (corresponding to areas mapped as till). A small area marked by the GSI as 'not mapped' is located close to T1 and along the southern access, extending as far as the temporary construction compound. This indicates that insufficient data is available for the GSI to assign a subsoil permeability rating, or that bedrock is close to or at the surface.

2.4 AERIAL IMAGERY

Aerial imagery from the following sources has been used to identify potential karst features:

- Bing Aerial Imagery (2025);
- Google Earth Multitemporal Aerial Imagery (2009-2025);
- Ordnance Survey Ireland Orthophoto (OSi, 1995-2013); and
- OSI 6-inch and 25-inch historic base mapping.

Due to the nature of changes in vegetation and land use, as well as seasonal variations in water tables and hydrological conditions, the identification of features must take into account multi-temporal imagery. An example of this is visible for the area surrounding T4, as seen in Google Earth aerial imagery from 2009 (Figure 2-1), 2018 (Figure 2-2) and 2025 (Figure 2-3). A number of features which may be identified as possible enclosed depressions/dolines are visible in the imagery from 2009 and 2018, but many are obscured by vegetation and water table changes in 2025.

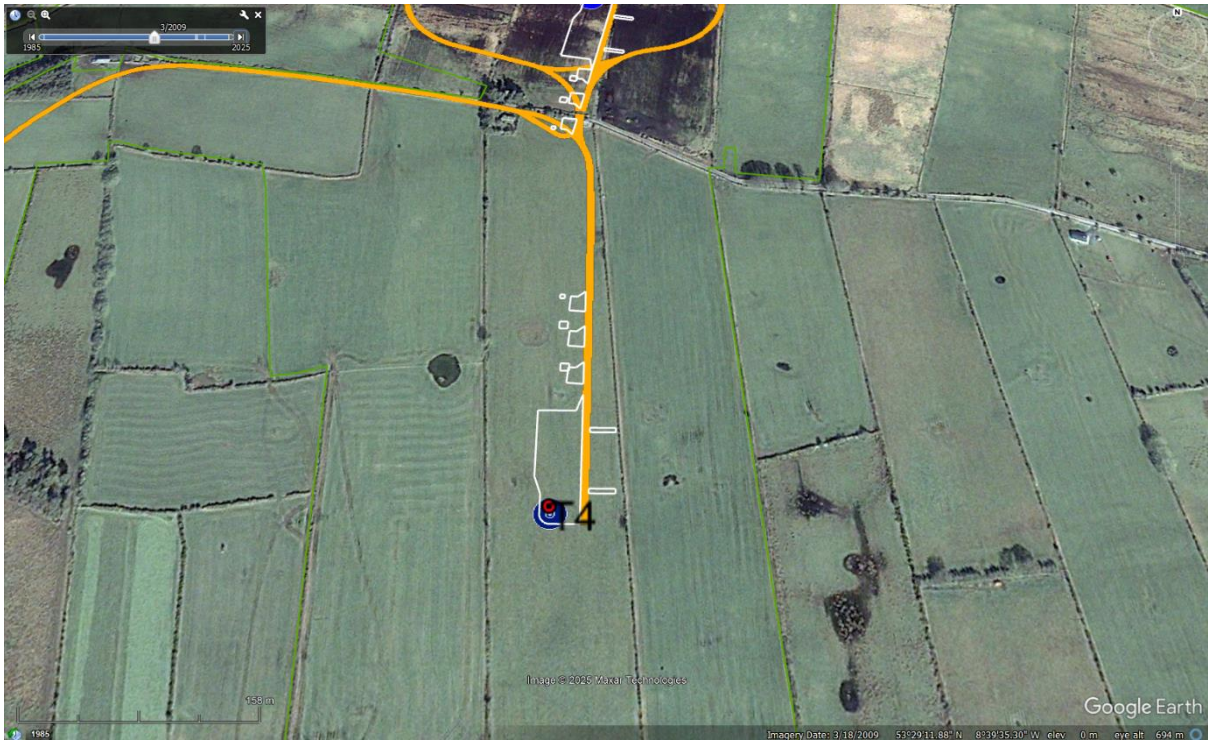


Figure 2-1: Google Earth aerial imagery for the area around T4 (2009).

Figure 2-2: Google Earth aerial imagery for the area around T4 (2018).

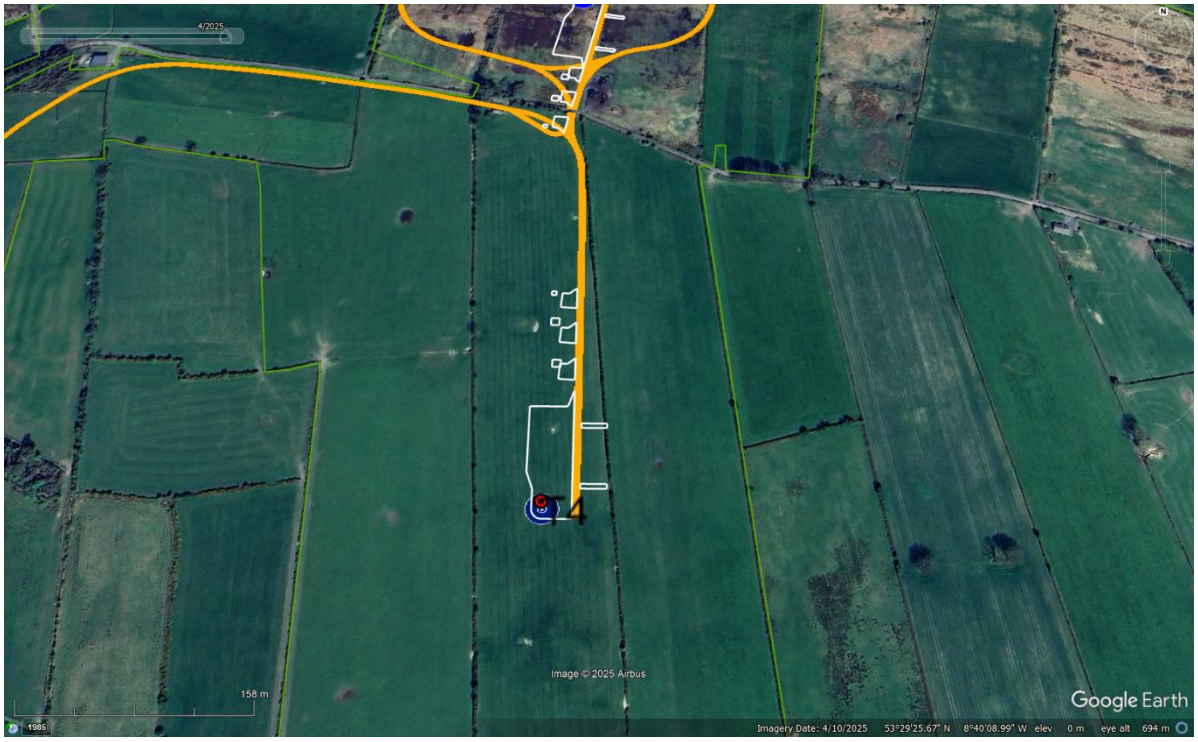


Figure 2-3: Google Earth aerial imagery for the area around T4 (2025).

2.5 TOPOGRAPHY

A Digital Terrain Model derived from Bluesky's (2022) LiDAR data was used for topographical analysis and is shown in Figure D-1 of the Appendix.

The topography of the Proposed Wind Farm site varies between low, undulating ridges and flat areas of raised bog, and the geomorphology is dominated by low, ribbed moraines and low, NW-SE-oriented ridges mapped by the GSI as drumlins running across the Proposed Wind Farm site. The peat bogs on site occupy generally flat depressions between the drumlins, with raised peat bog areas forming topographic highs relative to areas of cutover peat. The topography of the Proposed Wind Farm site can be described as flat to undulating raised bog plain. The elevation varies between 63 mAOD to 86 mAOD (meters Above Ordnance Datum).

A hillshade raster generated from the LiDAR DTM has been used to aid in identifying potential karst features, and is illustrated in Figure D-2 of Appendix D.

2.6 HYDROLOGY

According to the Ordnance Survey Ireland (OSi) shapefiles of rivers, lakes, and catchments/basins (Figure E- 1 in Appendix E), the Proposed Wind Farm site is located within the watershed of two catchments: Grange (Galway - 010) and Abbert (030). T9 is located 80m from minor watercourse labelled as *Dangan Eighter,* which flows northeast through the northern part of the Proposed Wind Farm site. This watercourse forms part of the Grange catchment, which flows eventually to the Clare River, and eventually the Corrib. Two watercourse crossings are proposed across the *Dangan Eighter,* between T5 and T6, and between T7 and T9. An additional watercourse crossing is proposed across an unnamed minor tributary of the Dangan Eighter between T5 and T9. Two additional minor

watercourses (*Lecarrow* and *Forty Acre)* are identified in the southern portion of the Proposed Wind Farm site. Both of these watercourses flow southwards, forming part of the Abbert catchment and eventually joining the Clare and Corrib river catchments. T1 is located 85m from the *Lecarrow,* and one watercourse crossing is proposed between T1 and T2. An additional watercourse crossing of the *Forty Acre* is proposed close to the southern site entrance. The rest of the projected elements (e.g., turbines, substation) are located more than 50m from any watercourse. Two small lakes, mapped as the Derrynacrick Loughs by the OSI, or located between T6 and T9, with one lake located outside of the EIAR boundary, and one lake just within the EIAR boundary.

The GSI karst database notes the presence of turloughs in the area surrounding the Proposed Wind Farm site. As a result, a review of GSI Groundwater flooding has been conducted, and is shown in Figure E-2 in Appendix E. Historic groundwater flooding is not recorded within the EIAR boundary; however, historic groundwater flooding is noted approximately 100m southwest of the EIAR boundary, approximately 350m southwest of T4, at locations identified in Section 3 as karst features (K16 and K21). Additionally, an area of medium probability for groundwater flooding is recognised by the GSI approximately 170m from the EIAR boundary, approximately 350m east of T6, at the feature recorded at Derrynacrick Lough by the OSI mapping. Flood risk, including groundwater flooding, is discussed in detail in Chapter 9 of the EIAR (Water).

2.7 LAND COVER AND LAND USE;

According to the Corine (2018) Land cover map shown in Figure F-1 in Appendix F, the surrounding landscape of the Proposed Wind Farm site comprises peat bog, pastures and mixed agriculture. Land use within the Proposed Wind Farm site is mixed, with peat cutting and agricultural land dominating.

3 KARST FEATURE DATABASE

The following resources were used to develop a preliminary database of karst features for the Proposed Wind Farm site, with all features identified within a 1km buffer of the Proposed Wind Farm site EIAR boundary recorded:

- The GSI Karst Feature Database;
- Anomalies recorded based on aerial and historic mapping, including:
  - Bing Aerial Imagery (2025);
  - Google Earth Multitemporal Aerial Imagery (2009-2025);
  - Ordnance Survey Ireland Orthophoto (OSI, 1995-2013);
  - OSI 6-inch and 25-inch historic base mapping; and
  - Changes in topography based on the available detailed topographic LiDAR survey (DTM – Bluesky, 2022);
- Additional surface features noted during site walkovers in August and November 2024

A total of 41 potential karst features have been identified within 1km of the Proposed Wind Farm site boundary, of which 13 are located within the EIAR boundary, and 11 of these have been visually inspected on site. The vast majority of identified features are classified as enclosed depressions/dolines, with two possible spring features identified at the Derrynacrick loughs. A full summary of the identified features is included in Appendix G.1, and the location of all identified features is shown in Figure G-1 in Appendix G. The GSI karst database was considered first, with the additional data sources used to sense check and to identify additional features.

Karst feature K6 provides an example of the doline features identified within the Proposed Wind Farm site boundary. This feature was identified from aerial imagery (Figure 3-1) and LiDAR (Figure 3-2), investigated and confirmed on-site (Figure 3-3).

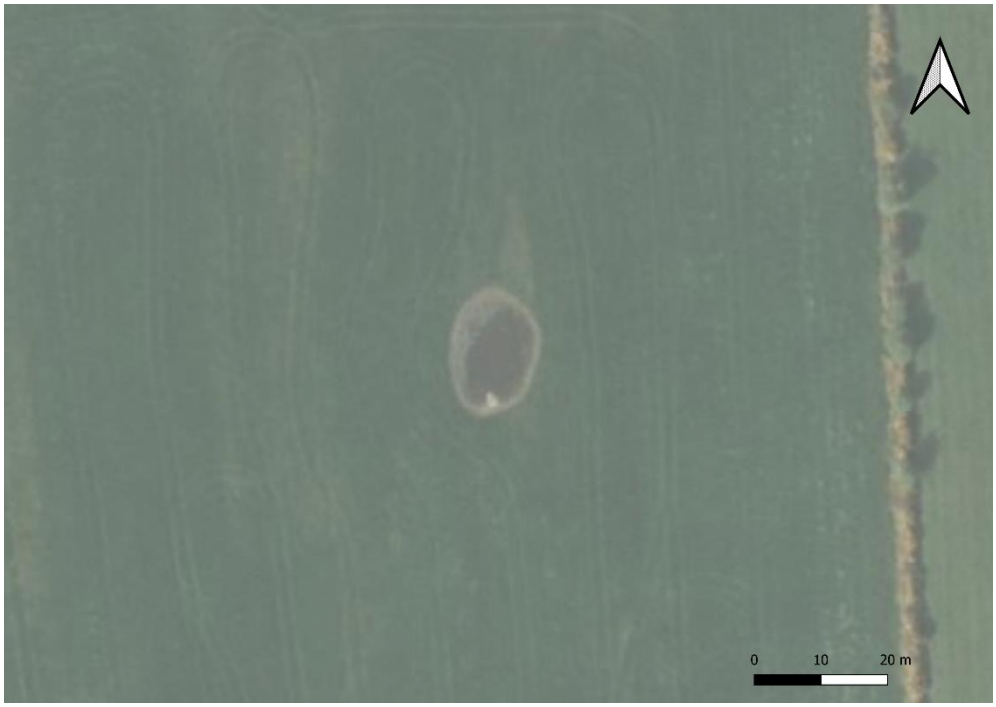


Figure 3-1: Karst feature K6 (Bing aerial, 2025).

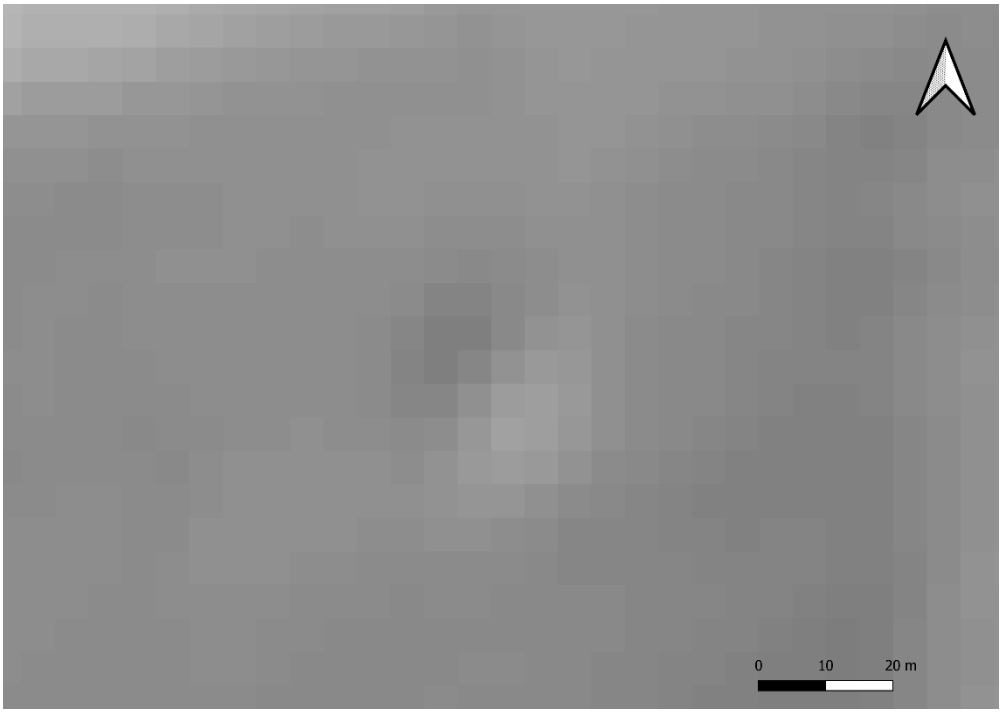


Figure 3-2: Karst feature K6 (LiDAR DTM Hillshade; Bluesky, 2022).

Figure 3-3: Karst feature K6

4 GROUND INVESTIGATION

4.1 SITE RECONNAISSANCE

GDG and MKO conducted preliminary ground investigation (GI) and site reconnaissance in the form of peat probes (PP), hand shear vanes (HSV), boreholes (BH) and trial pits (TP) between 2021 and 2025. Site reconnaissance included site walkovers by a chartered geologist to record potential karst features and to ground truth features identified from aerial imagery. The walkover inspections and GI campaign were carried out across the Proposed Wind Farm site. Access was limited to some areas, limiting the number of karst features which could be ground-truthed by site inspection.

A number of potential karst features were identified from aerial imagery and confirmed by visual inspection on-site. Two site walkovers targeted at identifying potential karst features were carried out by GDG:

- 27-28th August 2024; and
- 1st November 2024

4.2 GROUND INVESTIGATIONS

Seven project-specific ground investigations (GI) were carried out at the Proposed Wind Farm site:

1) MKO (October 2021-July 2022): 60 no. peat probes
2) GDG (August 2022): 35 no. peat probes and 11 no. trial pits.
3) Petersen Drilling Services Ltd. (August 2022): Two Rotary Core Boreholes (open hole well boreholes)
4) GDG (August 2024): 160 no. peat probes.
5) GDG (November 2024): 59 no. peat probes and two hand shear vanes.
6) GDG (February 2025): 15 no. trial pits with hand shear vanes, and associated lab testing, including:
    a) 25 no. Atterberg limit tests
    b) 28 no. Moisture Content tests
    c) 26 no. Particle size distribution tests
7) Minerex Geophysics Limited (August 2025): Geophysical survey including 4no. Electrical Resistivity Tomography (ERT) Lines (3m electrode spacing, total length 498m) and 1no. Seismic Refraction (P-Wave) Survey (69m).

In summary, intrusive ground investigations were carried out at 344 locations, of which 26 were trial pits, and two were open-hole drilled well boreholes. A map illustrating the available trial pit and borehole locations is included in Figure G-2 in Appendix G. Further information on the peat probing campaign is available in the Peat Stability Risk Assessment in Technical Appendix 8-2 of this EIAR

(GDG, 2025). A geophysical survey was carried out by Minerex in August 2025, targeting suspected karst features in close proximity to a section of access track to the north of T4.

4.3 PRELIMINARY GROUND MODEL

A preliminary ground model based on the available GI is presented in Table 4-1. This is a preliminary interpretation of the available trial pit data, and a detailed ground model will be produced following the completion of a detailed ground investigation. The ground conditions are generally variable across the Proposed Wind Farm site, and comprise Peat, Lacustrine Marl (CLAY/SILT), Cohesive Glacial Till (CLAY/SILT) and Granular Glacial Till (SAND/GRAVEL) layers overlying limestone bedrock. Soft lacustrine marls are encountered underlying the peat in some locations (particularly evident in the vicinity of T9). Topsoil has been encountered across the Proposed Wind Farm site in varying thicknesses. Minimum thicknesses of 0m indicate that the unit has not been encountered in all available GI locations.

Table 4-1: Summary of ground conditions

Strata	Typical Description	Thickness (m)			Depth to top (m BGL)
		Min.	Max.	Median	
Peat		0	7.1	0.4	0
Lacustrine Marl (CLAY/SILT)*	Very soft, greyish white sandy CLAY/SILT.	0	2.7	0.7	0.3 – 3.3
Cohesive Glacial Till (CLAY/SILT)	Soft to very stiff, greyish brown, slightly sandy, slightly gravelly CLAY with low to medium cobble and boulder content.	0	Not proven	Not proven	0.1 – 1.1
Granular Glacial Till (SAND / GRAVEL)**	Sandy GRAVEL with high cobble and boulder content.	0	2.5	0.4-1.95	0.0 – 4.9
Limestone Bedrock**	Weak to strong dark grey LIMESTONE with occasional shaley mudstone layers. Weathered profile is occasionally observed in trial pits.	Not proven	Not proven	Not proven	0.8 – Not Proven

*Soft lacustrine marl is only identified in TP06, TP07, TPBP3 and TPT9.

4.4 GEOPHYSICAL SURVEY

As outlined in Section 4.2, a geophysical survey was carried out in August 2025 by Minerex Geophysics Limited. The full geophysical report is provided in Appendix G.5. This survey was targeted to assess potential karst features K01 and K02, which are located in close proximity to access track AL6, approximately 250m north of T4. The survey consisted of four total ERT lines (3m electrode spacing, total length 498m) and 1no. Seismic Refraction (P-Wave) Survey (total length 69m).

These surveys indicated three distinct layers at the surveyed locations:

1) Layer 1 - (0- approximately 1.5m bgl). This layer displayed seismic velocities of 400m/s and is interpreted by Minerex as 'soil with a soft or loose stiffness or compaction'.
2) Layer 2 (~1.5-~7m bgl) an intermediate layer with a seismic velocity of 2200m/s between approximately 1.5m bgl and 7m bgl interpreted by Minerex as 'overburden with very stiff to hard or very dense strength or compaction or a very weathered rock with poor rock quality'.
3) Layer 3 - competent bedrock, with a seismic velocity of 4000m/s

Minerex interprets Layer 1 and 2 as sandy gravelly clay and silt overlying well-consolidated glacial till/weathered bedrock. TP 11, carried out by GDG in February 2025, approximately 10m north of ERT line R4 along the R2 line, logged rockhead at 2.35m bgl. This indicates that Layer 2, interpreted by Minerex as very stiff glacial till/weathered bedrock, may most likely consist of weathered bedrock.

The Minerex survey concluded that karst features, or karstified bedrock, were not identified within the survey extents, but noted that potential occurrence of karst features further west cannot be excluded. Based on the available information provided by this survey, karst features K01 and K02 have been excluded from the assessment of karst features, and the Karst Risk Assessment updated accordingly.

5 KARST RISK ASSESSMENT

A Karst Risk Assessment (KRA) has been carried out across the Proposed Wind Farm site, considering the karst hazard probability and potential consequences at each infrastructure location, including turbine foundations, turbine hardstands, the substation/BESS compound, the temporary construction compound, the met mast, and the internal access tracks. Following the calculation of hazard and consequence, risk scores are presented in a geotechnical risk register in Appendix I.

5.1 RISK DEFINITION

Risk is the potential or probability of adverse consequences, including economic losses, environmental or social harm, or detriment. Risk is expressed as the product of a hazard (e.g. karst features) and its adverse consequences (Lee & Jones, 2004; Corominas et al., 2014) (Eq. (5.1). Some use approximate synonyms and refer to risk as the product of the likelihood and the impact, or the product of susceptibility and the exposure.

$$\text{Risk} = (\text{Hazard}) \text{ x } (\text{Adverse Consequences}) \qquad \text{Eq. (5.1)}$$

5.2 GENERAL METHODS FOR RISK ASSESSMENT

There are various levels of risk assessment, ranging between:

- Detailed quantitative risk assessments (DQRA) where the objective is to generate more precise measures of the risks (e.g. expressing risk as a specific probability of loss). These require a large amount of quantitative input and time, and
- High-level qualitative assessments where the objective is to develop an approximate estimate of the risks, particularly in relative terms (e.g. low, medium, and high levels of risk).

In this assessment, a qualitative approach has been pursued to produce a high-level estimate of the karst risks associated with the Proposed Wind Farm. To apply Eq. (5.1) the factors that determine the hazard and the consequences need to be transformed into subjective ratings. The following sections address the calculation of the two risk components: hazard and consequence.

5.3 HAZARD ASSESSMENT

The karst hazard assessment methodology is compiled by assessing geological attributes likely to give rise to karst hazards, such as the presence of existing or known karst features as determined from site observations, trial pits and other information sources.

The karst hazard has been based on an assessment of the following geological and evidence-based risks outlined in Table 5-1. This hazard assessment has been completed in the absence of confirmatory intrusive ground investigation (e.g. rotary boreholes) or geophysical investigation, and shall be revised accordingly by a suitably qualified geotechnical engineer following detailed ground investigation, at the detailed design stage. Rankings have been assigned to each of the parameters, and these have been multiplied together to form a karst hazard assessment matrix, to which ratings of negligible, low, medium, high and very high have been applied. A detailed description of the

scoring methodology for each contributing factor is given in Sections 5.4 and 5.5. The methodology is based on that proposed by Rutty and Jennings (2012).

Table 5-1: Hazard Assessment factor categories.

Hazard factors		Description	Max Possible Score
Geological Factors	A. Underlying rock type	Susceptibility of the underlying bedrock to karstification.	2
	B. Proximity to mapped geological faults/boundaries	The geological structure of the bedrock can influence its susceptibility to karstification. Discontinuities such as faults, joints, or significant geological boundaries can initiate the formation of fissures, which can be exploited by water and begin the process of dissolution.	2
	C. Thickness of overburden cover	The thickness of overburden cover is considered to influence the distribution of karst features (Burke, 1998; Zhou et al., 2003). This is likely to be caused by a combination of factors, with existing features buried and obscured by the deposition of soil cover during the Quaternary. Thick soil cover may also protect the limestone and prolong the process of sinkhole formation.	3
	D. Overburden cover type	The material characteristics of the overburden cover can directly influence the likelihood and potential severity of karstic features for construction. This is because different soil types can directly influence the form of karstic features (particularly sinkholes/dolines/enclosed depressions) that may develop.	2
Geological Factor Total (AxBxCxD)			24
Evidence Factors	E. Density of identified karst features	A high density of karst features within 250m indicates that the development of karstic features at the location being assessed is more likely.	4

Hazard factors		Description	Max Possible Score
	F. Interaction with identified karst features	Karst features recorded as overlapping with the Proposed Development footprint pose a direct risk to the proposed infrastructure.	3
Evidence Factor Total (ExF)			12
Hazard Score Total (Geological x Evidence Factor Scores)			288

The hazard ratings adopted are outlined in Table 5-2.

Table 5-2: Karst Hazard classes

Hazard Class	Rationale
Negligible	Site not underlain by karst-susceptible bedrock.
Low	Significant karst development is unlikely, and unstable ground and significant cavities are not anticipated. Mitigation measures are unlikely to be required.
Medium	Some karst development is possible, which may lead to unstable ground or cavities. Following inspection of formation levels, design mitigation measures may be required.
High	Karst development is likely and active unstable ground and cavities already exist or may exist. Detailed assessment of the data, additional site investigation and geophysical surveying is recommended and mitigation is likely to be required.
Very High	Karst development is evident, and active unstable ground and cavities already exist or may exist. Detailed assessment of the data, additional site investigation and geophysical surveying is required and mitigation is likely to be required.

This hazard rating score has been calculated and applied across the Proposed Wind Farm site, with a particular focus on the proposed infrastructure (including turbine) locations. The raster maps used in the site-wide calculations are shown in Figure H-1 to H-10 in Appendix H, and the infrastructure specific hazard matrix is shown in Appendix H.

Each calculated hazard class has been assigned a normalised hazard class score from 1 to 5. The hazard classes are summarised in Table 5-3.

Table 5-3: Hazard classification and description of hazard classes.

Hazard Score	Hazard Class	Description	Normalised Hazard Class Score
0	**Negligible**	Site not underlain by karst susceptible bedrock.	**1**
0-12	**Low**	Significant karst development is unlikely and unstable ground and significant cavities are not anticipated. Mitigation measures are unlikely to be required.	**2**
12-36	**Medium**	Some karst development is possible which may lead to unstable ground or cavities. Following inspection of formation levels, design mitigation measures may be required.	**3**
36-60	**High**	Karst development is likely and active unstable ground and cavities may exist. Detailed assessment of the data, additional site investigation and geophysical surveying is recommended and mitigation is likely to be required.	**4**
>60	**Very High**	Karst development is evident, and active unstable ground and cavities already exist or may exist. Detailed assessment of the data, additional site investigation and geophysical surveying is required, and mitigation is likely to be required.	**5**

5.4 GEOLOGICAL HAZARD RATING

The following sections outline the factors that were considered in order to classify the risk rating based on geological factors. The selection of these factors is based on previous assessments carried out on large infrastructure projects in Ireland (Rutty and Jennings, 2012; Madden and O'Hara, 2016).

5.4.1 UNDERLYING ROCK TYPE

The nature of the underlying bedrock strongly influences its susceptibility to karstification. Siliceous or non-carbonate rocks are not susceptible to karstification. The chemical composition and the geological structure of limestone can impact the degree to which limestone is susceptible to karstification. Limestones are rocks which predominantly consist of calcium carbonate or magnesium carbonate (Dolomites). Pure limestone is almost pure carbonate, whereas impure limestone consists of portions of other materials, most commonly mud, shale and chert (Daly et al., 2005)

Pure limestones are more susceptible to karstification than impure limestones. The absence of clay minerals within the limestone beds makes these rocks more brittle than impure limestones, resulting in a high degree of fracturing and, consequently, permeability (Drew, 2018). In contrast, impure limestones tend to deform more readily, sealing up fractures and impeding water movement. It must be noted, however, that a substantial amount of non-carbonate material must exist in the rock to classify the limestone as impure.

The entirety of the Proposed Wind Farm site is mapped as being underlain by limestone bedrock, which is particularly prone to karstification. The rock is classified as pure bedded Dinantian Limestone of the Croghan Formation, Burren Formation, and Undifferentiated Viséan Limestone (likely Croghan Formation), as outlined in Sections 2.2 and 2.3.1. The bedrock-type geological hazard classes are outlined in Table 5-4. The classification is based on Rutty and Jennings (2012).

Table 5-4: Bedrock Type, significance and geological hazard score.

Bedrock Type	Significance	Geological Hazard Score
Pure Limestone	Pure limestones are considered susceptible to karstification.	2
Impure Limestone	Impure limestones are considered to be generally non-susceptible to karstification.	1
Non-Carbonate Rocks	Non-carbonate rocks are not susceptible to karstification. The absence of limestone excludes the risk assessment from progressing further.	0

As the entirety of the Proposed Wind Farm is underlain by pure limestones, all infrastructure is assigned a score of **2** (Figure H-1 in Appendix H).

5.4.2 PROXIMITY TO FAULTS/GEOLOGICAL BOUNDARIES

The geological structure of the bedrock can influence its susceptibility to karstification. Discontinuities such as faults, joints, or significant geological boundaries can initiate the formation of fissures, which can be exploited by water and begin the process of dissolution. These features may be difficult to identify or locate with confidence. One factor which was used was the break in bedrock formation, as mapped by the GSI. However, due to the ambiguity in relation to the exact change in rock formation, a 100m buffer zone was implemented along the seamless formation break.

For the purposes of this KRA, a 100m buffer has been applied to all faults and formation changes mapped by the GSI. A score of 1 is assigned to any areas which fall outside of the 100m buffer for any formation change, while a score of 2 is applied to any area that falls within the 100m buffer (Table 5-5).

Table 5-5: Fault/Geological Boundary Class, significance and geological hazard score.

Bedrock Type	Significance	Geological Hazard Score
Areas within a 100m buffer of fault/formation change	Pure limestones are considered susceptible to karstification.	2
Areas outside of a 100m buffer of fault/formation change	Impure limestones are considered to be generally non-susceptible to karstification.	1

Bedrock geological boundaries between the Croghan Formation, Burren Formation and Undifferentiated Viséan Limestone Formation are mapped by the GSI in the northern part of the Proposed Wind Farm site (Figure H-2 in Appendix H); however, only T7 and portions of the adjacent access tracks fall within a 100m buffer of these boundaries.

5.4.3 THICKNESS OF OVERBURDEN COVER

The thickness of overburden cover is considered to influence the distribution of karst features (Burke, 1999; Zhou et al., 2003). This is likely to be caused by a combination of factors, with existing features being buried and obscured by the deposition of soil cover during the Quaternary period. Thick soil cover may also protect the limestone and prolong the process of sinkhole formation. Based on this, it is generally considered that a thicker overburden cover will reduce the risk of karstic features. It is noted, however, that although very thick soils tend to preclude sinkhole development, it is very difficult to recognise an upper limit for cover thickness (Walthamet al. 2005). The thickness classes below are based on those found in Rutty and Jennings (2012). The hazard scoring for overburden thickness is outlined in Table 5-6.

Table 5-6: Overburden Thickness Class, significance and geological hazard score.

Overburden Thickness Class	Significance	Geological Hazard Score
0-5m Overburden Thickness	Thin overburden provides sufficient cover to bury some features but does not preclude their formation, and may be prone to collapse sinkholes.	3
5-10m Overburden Thickness	Thicker overburden provides greater cover to features and reduces the risk of encountering sinkholes or cavities during construction.	2
>10m Overburden Thickness	Significant thicknesses of overburden provide greater cover to features and reduce the risk of encountering sinkholes or cavities during construction.	1

Bedrock has not been proven at depths greater than 5m below ground level (bgl) in any trial pit or borehole location; however, peat probes have encountered peat/soft clay deposits of greater than 5m in thickness in some instances, particularly in the area between T5, T7, and T9. The hazard scores for overburden thickness are shown in Figure H-3 in Appendix H.

5.4.4 OVERBURDEN COVER TYPE

The material characteristics of the overburden cover can directly influence the likelihood and potential severity of karstic features for construction. This is because different soil types can directly influence the form of karstic features (particularly sinkholes/dolines/enclosed depressions) that may develop. Lei et al. (2001) suggest that soil type and structure may have a more direct influence on the formation of sinkholes than soil thickness.

Waltham et al. (2010) identify six main types of sinkholes (Section 1.4.2). Of these, three classes are assigned to sinkholes that form in soil cover:

- Dropout/Collapse Sinkholes – Sudden cohesive soil collapse
- Suffosion/Subsidence Sinkhole – Down-washing of granular soil into fissures within the bedrock
- Buried Sinkholes – Soil-filled sinkholes in the rock after environmental change

Dropout/collapse sinkholes pose the greatest risk to construction, as these failures can occur rapidly and often with little to no warning (Waltham et al., 2010). Dropout sinkholes only occur in soils with sufficient cohesion to bridge a cavity or void for long enough to allow a significant subsurface cavity to grow before sudden roof collapse. In granular soils with little or no cohesion, suffusion/subsidence sinkholes occur instead, with material gradually downwashed into the developing cavities.

Buried sinkholes may be covered by either cohesive or granular soils, as the deposition of the soils occurs following the formation of the sinkhole. Due to the increased risk inherent in cohesive overburden cover, the scores outlined in Table 5-7 have been applied for the KRA. These scores are based on a similar approach set out by Rutty and Jennings (2012).

For this KRA, it has been considered that where overburden thickness is less than 1m, any surface karst features will likely be readily apparent or identifiable during topsoil stripping, minimising the risk of sudden collapse sinkhole events. The overburden-type class scoring is outlined in Table 5-7.

Table 5-7: Overburden Type Class, significance and geological hazard score.

Overburden Type Class	Significance	Geological Hazard Score
Cohesive overburden deposits (e.g. cohesive glacial till)	Increased risk of potentially unidentified collapse sinkhole features.	2
Granular overburden deposits (e.g. sands and gravels)	Low risk of collapse sinkhole features. Suffosion features are more likely.	1
Peat	Low risk of collapse sinkhole features. Subsidence features are more likely.	1
Overburden <1m in thickness	For this KRA, it has been considered that where overburden thickness is less than 1m, any surface karst features will likely be readily apparent or identifiable during topsoil stripping, minimising the risk of sudden collapse sinkhole events.	1

The Proposed Wind Farm site is split relatively evenly between areas mapped by the GSI as consisting of peat and areas mapped as till. Turbines e.g. T1, T3, T4, T6 and T8 are mapped as till, with T2, T5, T7 and T9 mapped as peat. Localised areas of <1m of overburden are identified from trial pits close to T1 and at the substation. The overburden-type hazard scores for the Proposed Wind Farm site are shown in Figure H-4 in Appendix H.

5.5 EVIDENCE-BASED HAZARD RATING

The following sections outline the factors considered in classifying the rating based on karst evidence.

5.5.1 DENSITY OF IDENTIFIED KARST FEATURES

As outlined in Section 3, 43 potential karstic features have been identified within a 1km buffer of the Proposed Wind Farm site. The number of identified karst features within 250m of each pixel has been determined using ArcGIS Pro, and score classes assigned (Table 5-8). For infrastructure-specific analysis, the number of karst features within a 250m buffer of each infrastructure location has been

considered. A 250m buffer has been used for this analysis as this is considered to provide a localised yet sufficiently broad spatial context to capture nearby karst features that may pose indirect or cumulative risks to infrastructure. A high density of karst features within 250m indicates that the development of karstic features at the location being assessed is more likely.

Table 5-8: Karst Feature Density Class, significance and evidence score.

Karst Feature Density Class	Significance	Evidence Score
>4 Features within 250m	The greatest assigned risk of encountering karstic features within the footprint of infrastructure.	4
3-4 Features within 250m	Increased risk of encountering karstic features within the footprint of infrastructure.	3
1-2 Features within 250m	Lower risk of encountering karstic features within the footprint of infrastructure.	2
0 Features within 250m	Lowest assigned risk of encountering karstic features within the footprint of infrastructure.	1

Karst features were identified within 250m of T1, T2 hardstand, T4, T5 hardstand, T8 handstand, and various sections of access track alignment. The highest density of karst features was recorded in the area surrounding T4 and access track alignment AL6, with >4 features recorded within 250m of these locations (12 features are recorded within 250m of T4). The karst feature density scores are shown in Figure H-5 in Appendix H.

5.5.2 INTERACTION WITH IDENTIFIED KARST FEATURES

Due to the fixed nature of the proposed infrastructure, the most direct risk factor is the potential for karstic features to interact directly with the proposed infrastructure during construction of the Proposed Wind Farm. Although surface features in the surrounding area can indicate the level of karstification in the bedrock, these do not pose a direct risk to the Proposed Wind Farm, unlike those recorded within the Proposed Wind Farm footprint itself. To quantify the risk, the scores outlined in Table 5-9 have been applied to each infrastructure location (turbine foundations, turbine hardstands, substation/BESS compound, temporary construction compound, met mast and new internal access tracks). To visualise this in a map format, a 10m buffer was applied to all identified karst features. Areas within the 10m buffer were classed as being within karst features.

Table 5-9: Karst Feature Interaction Class, significance and evidence score.

Karst Feature Interaction Class	Significance	Evidence Score
Karst feature recorded within the infrastructure location.	The presence of identified karst features within infrastructure locations indicates that karst features may pose a risk during construction.	3
Karst features are absent within the infrastructure location	The absence of identified karst features within infrastructure locations indicates that karst features may pose a reduced risk during construction.	1

Identified karst features were found to overlap with the Proposed Wind Farm infrastructure in one location at access track alignment AL6. Geophysical surveying carried out in August 2025 (Section 4.4) found no evidence for large karstic cavities beneath the AL6 alignment, at the K01 and K02 locations. As a result, these features were removed from the Karst Interaction scoring.

Identified features were located at a distance of >10m from all other proposed infrastructure locations. The karst feature interaction scores are shown in Figure H-5 in Appendix H-6.

5.6 HAZARD ASSESSMENT RESULTS

As outlined in Section 5.3, an overall hazard score has been calculated by multiplying the geological hazard score and the evidence-based hazard score. The site-wide hazard calculation is presented in Figure H-7 in Appendix H. A summary of the hazard score calculated at each proposed infrastructure element is outlined in Figure 5-1 to Figure 5-2. The full risk matrix at each location is included in Appendix H.

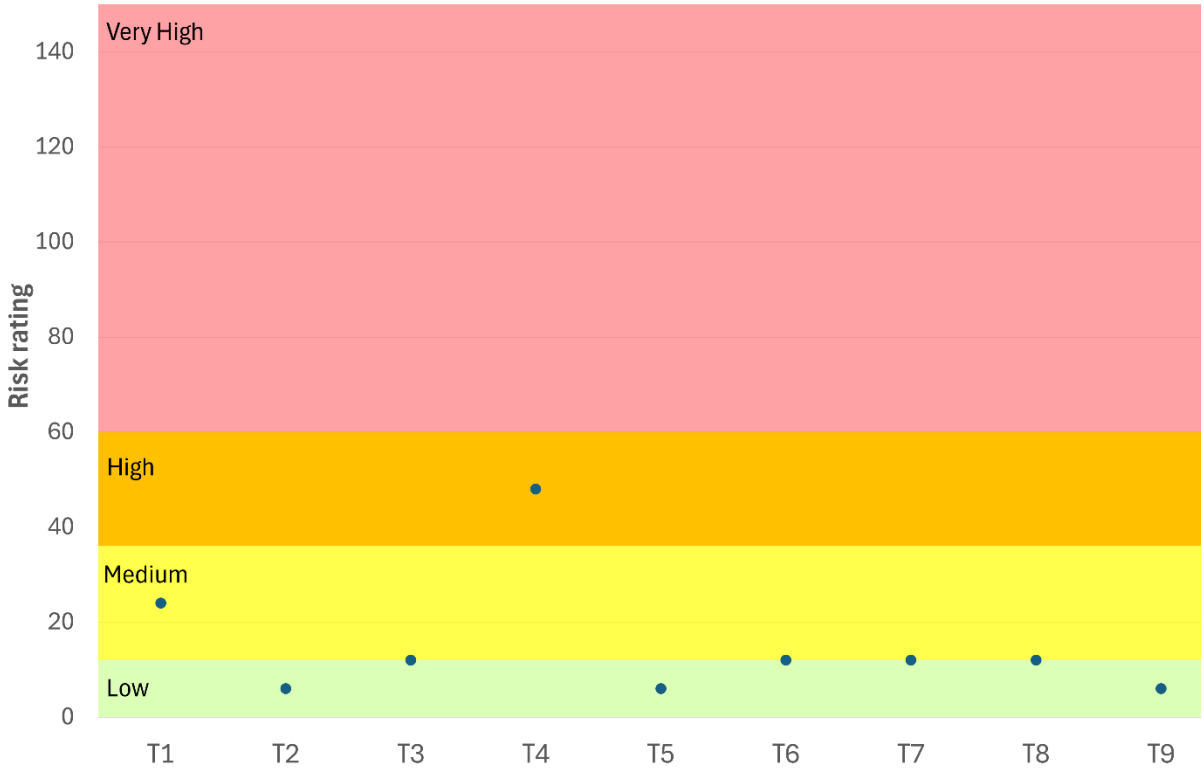


Figure 5-1: Karst hazard at each turbine location.

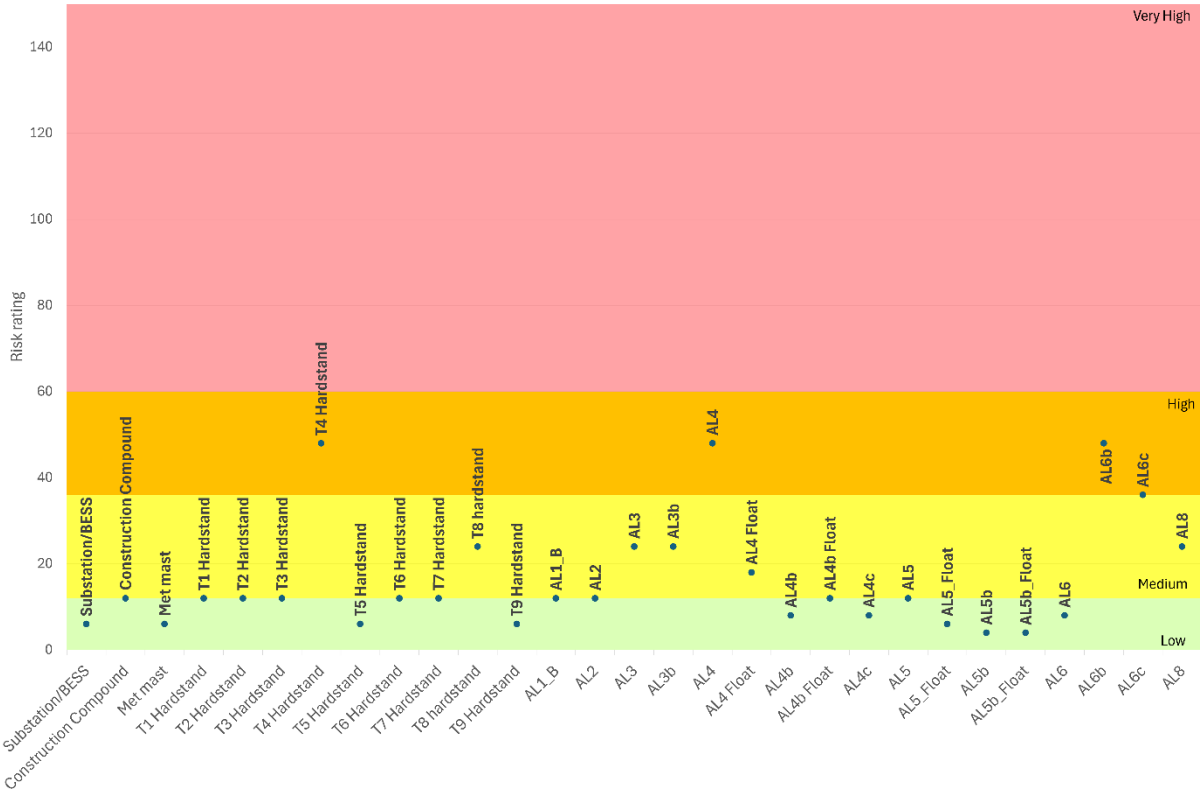


Figure 5-2: Karst hazard at each infrastructure location.

The normalised hazard rating across the Proposed Wind Farm site is shown in Figure H-8 in Appendix H. The identified karst risk at the Proposed Wind Farm site is generally classed as low; however, portions of the Proposed Wind Farm site, particularly in the vicinity of T1 and T8, are classified as medium hazard. A portion of the centre of the Proposed Wind Farm site, in the vicinity of T4, is calculated to have a high hazard rating, with small, localised areas of very high hazard rating identified at specific karst features, primarily in the area surrounding T4. A detailed view of the karst hazard at T4 is shown in Figure H-9 in Appendix H. Areas identified as being of very high karst hazard within the Proposed Wind Farm site do not interact with any of the proposed infrastructure footprint.

5.7 ADVERSE CONSEQUENCES ASSESSMENT

The adverse consequences assessment has been compiled based on the criteria outlined in Table 5-10. This scoring system has been applied at all infrastructure locations and is presented in the Geotechnical Karst Risk Register in Appendix I. For each infrastructure location, a series of potential risks are identified (e.g. collapse of dolines, subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations). For each risk, an adverse consequence score is applied.

It is recommended that the consequence assessment be revised and updated at the detailed design stage by a suitably qualified Geotechnical Engineer as new consequences are identified and development timelines and costs are finalised.

Table 5-10: Adverse consequences assessment scoring.

Description	Project Time Impact	Project Cost Impact	Environmental Impact	Health and Safety Impact	Adverse Consequence Score
Negligible	Negligible	Negligible	Negligible	Injuries requiring first aid treatment or occupational ill-health conditions with no lost time	1
Low	Low	Low	Low	Lost Time Injury (<7 days lost time); or multiple minor injuries; or Occupational Health Condition (<7 days lost time)	2
Medium	Medium	Medium	Medium	Reportable injury or Occupational Health Condition (>=7 days lost time)	3
High	High	High	High	Single non-life changing injury, occupational health condition (>=14 days lost time)	4
Very High	Very High	Very High	Very High	One or more fatalities or major injuries or occupational health conditions resulting in life life-changing disability.	5

Table 5-11: Adverse consequence scores.

Karst Hazard	Description	Engineering Risk	Infrastructure Elements Affected	Adverse Consequence Score (1-5)
Rapid Collapse of Doline	Sudden collapse of a sinkhole.	Immediate and severe ground collapse.	Access tracks, turbine hardstands, turbine foundations, substation/BESS compound, met mast	5
Subsidence Dolines	Gradual settlement into underlying voids.	Progressive settlement and deformation.	Access tracks, turbine hardstands, turbine foundations, substation/BESS compound, met mast	4 (turbine foundations), 3 at other infrastructure locations
Cavities / Voids	Subsurface voids formed by dissolution.	Foundation failure or differential settlement.	Turbine foundations, substation/BESS compound, met mast	3 (turbine foundations), 2 at other infrastructure locations
Variable Rockhead	Irregular rockhead profiles due to dissolution.	Uneven bearing capacity and excavation difficulty.	All infrastructure elements	3 (turbine foundations), 2 at other infrastructure locations
Solutionally Weathered Rock	Deeply weathered limestone with voids and softened zones.	Excavation instability and reduced bearing capacity.	Turbine foundations, access tracks, cable trenches	3 (turbine foundations), 2 at other infrastructure locations

5.8 RISK ASSESSMENT

Following the calculation of the hazard and adverse consequence scores at each location, for the individual identified risks, Eq. (5.1) is applied (Section 5.1) to calculate an overall risk score prior to the implementation of mitigation measures. The calculated risk scores are classified following the risk matrix illustrated in Figure 5-3.

		Description	Hazard Score				
			Negligible	Low	Medium	High	Very High
Description			1	2	3	4	5
Adverse Consequence Score	Very High	5	5	10	15	20	25
	High	4	4	8	12	16	20
	Medium	3	3	6	9	12	15
	Low	2	2	4	6	8	10
	Very Low	1	1	2	3	4	5

Figure 5-3: Risk matrix for karst risk assessment.

The risk matrix allows for risk scores to be classified into four risk classes, as outlined in Table 5-12.

Table 5-12: Karst risk classes

Score	Risk Level	Suggested Actions
20-25	Very High	Detailed assessment of the data, additional site investigation and geophysical surveying are recommended and mitigation will be required.
10-19	High	Detailed assessment of the data, additional site investigation, and geophysical surveying is required and mitigation is likely to be required.
4-9	Medium	Additional detailed ground investigation, including geophysical surveying recommended; design mitigation measures may be required.
1-3	Low	Standard detailed ground investigation should proceed. Mitigation measures are unlikely to be required.

The risk classes identified are compiled in the Geotechnical Karst Risk Register in Appendix I. Geophysical surveying carried out in August 2025 (Section 4.4) found no evidence for large karstic cavities beneath the AL6 alignment, at the K01 and K02 locations. As a result, a slight reduction in hazard score was applied at this location in the risk assessment, as noted in Appendix I.

6 MITIGATION MEASURES

The findings of the karst risk assessment, as outlined in Section 5.6, indicate that the majority of the Proposed Wind Farm site can be classed as having a low to medium karst risk. In these locations, it is considered that significant karst development is unlikely and unstable ground and significant cavities are not anticipated. All proposed infrastructure has been sited to avoid areas of very high karst hazard. Mitigation measures are not envisaged based on the available information, but the risk of encountering a karst feature is not negligible.

Despite this, all earthworks will be designed by a suitably qualified Geotechnical Engineer during the detailed design stage and informed by a post-consent detailed confirmatory ground investigation (GI) campaign. This investigation will include intrusive methods, such as trial pitting and borehole drilling, with a specified suite of in-situ and geotechnical laboratory testing to further assess the engineering characteristics of the infrastructure locations. Possible mitigation measures in relation to peat instability are considered below. Geophysical surveying is recommended to assist in the identification of any potential karstic voids not identified in this assessment.

Portions of the central areas of the Proposed Wind Farm site (particularly the areas in the vicinity of T4) have been classed as having high karst hazard, with some localised areas being classed as very high hazard. In these locations, high to very-high karst risk scores have been calculated in the most onerous cases, prior to mitigation. In these areas, additional site investigations and mitigation measures may be required. Recommendations for additional ground investigation and potential mitigation measures are considered below.

6.1 ADDITIONAL GROUND INVESTIGATION

To reduce the potential risk of encountering unexpected karstic features within the Proposed Wind Farm footprint, the following additional ground investigation works are to be carried out at infrastructure locations identified as having medium or high karst risk:

- Rotary core boreholes to confirm rockhead depth and quality.
- Geophysical Surveying to detect voids and solution features, including:
    - Electrical Resistivity Tomography (ERT)
    - Ground Penetrating Radar (GPR)
    - Microgravity; and
    - Seismic Refraction
- Trial pits and dynamic probing to assess near-surface variability and collapse-prone soils.

6.2 ENGINEERING MITIGATION MEASURES

Should the additional grounds investigation identify interactions between the Proposed Wind Farm infrastructure footprint and karstic features, where avoidance is not feasible, a suite of engineering

solutions will be implemented as appropriate to ensure structural integrity and long-term performance.

6.2.1 PILED FOUNDATIONS

Where small-scale dissolution and voiding are encountered at turbine foundations during detailed ground investigation, one potential mitigation strategy is the use of drilled or grouted piles. The use of piles transfers structural loads to competent rock beneath karst-affected zones. This approach bypasses voids and weak soils, reducing the risk of differential settlement or collapse.

Waltham (2009) notes that driven piles may lose integrity where they bear on rock over a cave, are bent due to meeting a pinnacle rockhead, or are founded on loose blocks ('floaters') or unstable pinnacles within the soil. It is therefore recommended that drilled/bored or grouted piles be used.

6.2.2 ROCK INFILL

Waltham et al. (2005) and De Bruyn and Bell (2001) outline an approach for the remediation of shallow sinkhole features that are a few metres deep. This methodology involves 'choking' the throat of the sinkhole with coarse granular fill, and progressive backfilling upwards with progressively finer granular fill. All backfill is to be placed in layers 150mm deep and compacted. Soil around the sinkhole is to be excavated to a radius of 3-5m, before being replaced and compacted with or without incorporation of anchored geogrid. This methodology has been used effectively on Irish road projects in similar karst terrains in East Galway (Madden and O'Hara, 2016). An example standard detail is shown in Figure 6-1. This methodology is applicable to the Proposed Wind Farm site access tracks, and shall be implemented if small scale sinkhole features (<5m in depth) are encountered beneath access tracks.

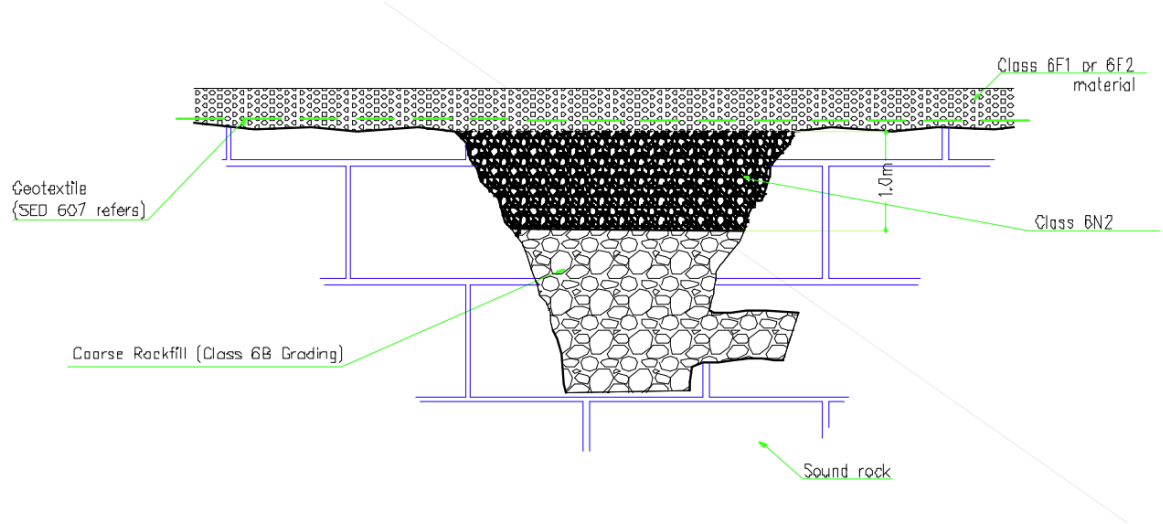


Figure 6-1: Example of rock infill to remediate small-scale karst sinkholes in Ireland (Madden and O'Hara, 2016).

6.2.3 GROUTING

Pressure grouting can be employed to stiffen soil over limestone and prevent its suffosion into fissures, to fill localised fissures, and to stabilise fractured rock. It is worth noting that the injection

of a fluid grout can result in significant losses into adjacent caves before sealing karstic fissures. The detailed designer/contractor shall consider which grouting method would be most appropriate and the potential negative consequences for contamination and pollution of the aquifer.

6.2.4 BRIDGING LAYERS AND GEOGRID BLANKETS

One of the most effective and widely adopted engineering solutions to mitigate the risks of unacceptable settlement and unexpected collapse at access tracks is the use of bridging layers reinforced with geogrids.

Bridging layers are designed to span across potential voids or weak zones, redistributing loads and preventing localised collapse. When combined with geogrid reinforcement, these layers gain enhanced tensile strength and load-spreading capacity, allowing them to maintain structural integrity even in the event of subsurface failure.

Geogrids are polymeric materials with a grid-like structure that interlock with the surrounding aggregate. When embedded within a granular fill layer, they:

- Improve load distribution across voids or soft spots.
- Increase the factor of safety against collapse.
- Reduce differential settlement and rutting.
- Enhance the resilience of road and platform structures under dynamic loads (e.g., turbine transport or crane operations).

A 2021 study by Conrado-Palafox et al. demonstrated through finite element modelling that geogrid-reinforced road structures in karst terrain significantly improved performance, even in the presence of up to 19 subsurface cavities. The study found that embedding the geogrid between the subgrade and base layer increased the factor of safety and reduced deformation under heavy truck loads.

Where construction takes place in areas of high or very high karst hazard, and if karstic features are identified elsewhere during construction, the following measures shall be implemented:

- Access tracks will incorporate geogrid-reinforced bridging layers over areas identified as having potential voids or collapse-prone soils.
- Crane hardstands will be designed with enhanced bridging layers to accommodate high point loads and dynamic stresses.

6.2.5 DRAINAGE CONTROL

Drainage control is identified by Waltham (2009) as the single most important mitigation measure. Surface and subsurface drainage systems will be designed to prevent water ingress into karst features, reducing the potential for solutional enlargement and subsidence. This includes the installation of sub-drainage systems, the use of impermeable liners or membranes, and pumping and dewatering during construction. Uncontrolled lowering of the water table during construction can lead to sinkhole collapse or the initiation of new sinkholes (Waltham et al., 2005).

Proper drainage control is therefore essential to maintain the stability of foundations and prevent erosion of fill materials. All works will be supervised by a suitably qualified geotechnical engineer or hydrogeologist.

6.2.6 MONITORING AND MAINTENANCE

A post-construction monitoring plan will be implemented, including periodic visual inspections, settlement monitoring, and geophysical re-surveys where necessary. This proactive approach ensures that any emerging issues are detected and addressed promptly, maintaining the long-term integrity of the wind farm infrastructure.

6.3 MITIGATION BY AVOIDANCE

All proposed infrastructure has been sited to avoid areas of very high karst hazard. Following additional detailed ground investigation works, if engineering mitigation measures outlined in Section 6.2 are not considered feasible, it is recommended that infrastructure elements (in particular turbine foundations) that are identified to interact with large karst features, such as dolines of subsurface cavities, be micro-sited and that any future development layout iterations avoid areas of identified very high hazard rating.

Avoidance is considered the most effective and least intrusive mitigation strategy.

6.4 RESIDUAL RISK

Following the implementation of the mitigation measures outlined in Section 6, the risk scores generated in Section 5.8 have been updated to reflect the residual risk score. The residual risks are included in the Geotechnical Karst Risk Register in Appendix I. Following the implementation of mitigation measures, the residual risk at each infrastructure location ranges from low to medium.

7 DESIGN RISK ASSESSMENT

The register included in Table 7-1 lists significant potential karst geotechnical hazards and associated risks concerning the Proposed Wind Farm, and recommended mitigations. Following the implementation of mitigation measures, the residual risk at each infrastructure location ranges from low to medium.

Table 7-1: Design Risk Assessment

Ref.	Risk	Contributing factor	Mitigation
1	Incomplete understanding of karst features	Limited intrusive ground investigations at depth, limited to trial pits and two well boreholes.	The GI completed to date is considered to be thorough and robust for the purposes of the EIAR. Detailed ground investigations, including rotary boreholes, laboratory testing and geophysical surveying, will be carried out at the detailed design phase to inform detailed design and mitigation measures. This karst risk assessment is to be updated when additional GI data becomes available.
2	Uncertainty in the lateral extent of karst features	Karst features identified from aerial imagery/site walkovers. Lack of geophysical surveying.	Following the completion of geophysical surveying at the key infrastructure locations, detailed mapping of subsurface features can be completed to further constrain areas of potential karst risk.
3	Potential for undetected near-surface voids or dissolution channels	Karst features identified from aerial imagery/site walkovers. Lack of geophysical surveying	Assessment of satellite imagery and topographical data for evidence of karst features was carried out as part of the desk study, in addition to site walkovers. During the site walkovers, the site GDG engineers examined the landscape and the areas surrounding the identified karst features and proposed infrastructure locations. Some karst features at the surface may not have been identified. It is noted that the geomorphological features associated with dolines and other karst features are softened with time through erosion, drying, and re-vegetation. Access was limited to some areas of the Proposed Wind Farm site with restrictions relating to raised peat bogs traversed by large drainage ditches. Further inspection will be required during the detailed design stage to inspect for karst features. This will be carried out by the Contractors team. The design team will develop their own inspection and testing criteria to satisfy and de-risk the possibility of karst risk at these locations.
4	Potential for undetected subsurface voids or dissolution channels	Karst features identified from aerial imagery/site walkovers. Lack of geophysical surveying	Assessment of satellite imagery and topographical data for evidence of karst features was carried out as part of the desk study, in addition to site walkovers. During the site walkovers, the site GDG engineers examined the landscape and the areas surrounding the identified karst features and proposed infrastructure locations.

Ref.	Risk	Contributing factor	Mitigation
			Features at depth within the bedrock, or buried beneath overburden cover, may not have been identified, as these features may not be apparent at the surface. Detailed GI, including rotary core boreholes and geophysical surveying, must be carried out to identify and reduce the risk of subsurface cavities.
5	Misidentification of karst features	Karst features identified from aerial imagery/site walkovers. Lack of geophysical surveying	Assessment of satellite imagery and topographical data for evidence of karst features was carried out as part of the desk study, in addition to site walkovers. During the site walkovers, the site GDG engineers examined the landscape and the areas surrounding the identified karst features and proposed infrastructure locations. Some features identified as karst features from the available desk study information and site walkovers may be caused by other geomorphological phenomena (e.g. periglacial features, surface hydrology, anthropomorphic modification of the landscape). A conservative identification approach has been adopted whereby all visible features of uncertain origin have been assumed as karstic for the purposes of risk assessment, until proven otherwise. Detailed ground investigation will be required to ground-truth identified features.

8 CONCLUSIONS AND RECOMMENDATIONS

The assessment findings showed that the majority of the proposed infrastructure locations are located in areas of low to medium karst hazard, with localised areas of high and very high hazard identified. One turbine (T4) was identified as being located in an area of high karst hazard, with a section of access track immediately north of T4 also identified as having a high karst hazard. The karst risk assessment shows that the risk at each infrastructure location ranges from medium to very high (at T4) prior to the application of mitigation measures.

Following the implementation of mitigation measures, the residual risk at each infrastructure location ranges from low to medium, indicating that development can proceed as long as mitigation measures are implemented and that the risk assessment is further refined following further confirmatory ground investigation.

REFERENCES

Burke A.M. (1998) *Assessing Karstification in Ireland*. Unpublished (Research) MSc. Thesis, Department of Geography, Trinity College Dublin.

Conrado-Palafox, A. L., Equihua-Anguiano, L. N., & Hernández-Hernández, V. A. (2021). Numerical evaluation for roads considering the addition of geogrids in karst geohazards zones. Infrastructures, 6(9), 120.

Copernicus Land Monitoring Service. (2018). *CORINE Land Cover 2018 (vector), Europe, 6-yearly* [Data set]. European Environment Agency. https://doi.org/10.2909/71c95a07-e296-44fc-b22b-415f42acfdf0

Corominas, J., van Westen, C., Frattini, P., Cascini, L., Malet, J.-P., Fotopoulou, S., … others. (2014). Recommendations for the quantitative analysis of landslide risk. *Bulletin of Engineering Geology and the Environment*, *73*(2), 209–263.

Coxon, C. E. (1987). The spatial distribution of turloughs. *Irish Geography*, *20*(1), 11-23.

Daly, D., Drew, D., Deakin, J., Ball, D., Parkes, M., & Wright, G. (2005). The Karst of Ireland Booklet. Geological Society of Ireland. Karst Working Group.

De Bruyn, I. A., & Bell, F. G. (2001). The occurrence of sinkholes and subsidence depressions in the Far West Rand and Gauteng Province, South Africa, and their engineering implications. *Environmental & Engineering Geoscience*, *7*(3), 281-295.

Drew, D. (2018) Karst of Ireland: Landscape Hydrogeology Methods. Published by Geological Survey Ireland.

Ford, D., & Williams, P. D. (2007). *Karst hydrogeology and geomorphology*. John Wiley & Sons.

Gutiérrez, F. (2010). 13 Hazards associated with karst. *Geomorphological hazards and disaster prevention*, 161.

Geological Survey Ireland. (2004) Clare-Corrib Groundwater Body: Summary of Initial Characterisation (1st Draft, July 2004).

Geological Survey Ireland. (2025). *GSI Map Viewer*. Retrieved June 16, 2025, from https://www.gsi.ieGoogle

Google Earth. (2025). *Imagery of [insert location]*. Imagery sources: Maxar Technologies, CNES/Airbus, Landsat/Copernicus, U.S. Geological Survey. Retrieved June 16, 2025, from https://earth.google.com

Lee, E. M., & Jones, D. K. C. (2004). *Landslide risk assessment*. Thomas Telford London.

Lei, M., Jiang, X., & Yu, L. (2001). New Advances of Karst Collapse Research in China. In B. Beck, & J. Herring, Geotechnical and Environmental Applications of Karst Geology and Hydrology (pp. 145-151). Balkema: Lisse.

Madden, E, & O'Hara, D (2016). The treatment of karst features encountered during road construction in County Galway. Civil Engineering Research in Ireland 2016 – 169.

Microsoft Corporation. (2025). *Bing Maps Aerial Imagery*. Retrieved June 16, 2025, from https://www.bing.com/maps

Ordnance Survey Ireland. (2025). *GeoHive Map Viewer*. Retrieved June 16, 2025, from https://www.geohive.iePracht, M., Somerville, I. D., & Wang, Y. (2015). A revised Mississippian lithostratigraphy of County Galway (western Ireland) with an analysis of carbonate lithofacies, biostratigraphy, depositional environments and palaeogeographic reconstructions utilising new borehole data. *Journal of Palaeogeography*, *4*(1), 1-26.

Rutty P. and Jennings P. (2012) *Investigation, Design and Construction in Karst*. *Geotechnics on Irish Roads, 2000–2010, A Decade of Achievement*. Conference 11th October, 2012. Engineers Ireland.

Skeffington, M. S., & Gormally, M. (2007). Turloughs: a mosaic of biodiversity and management systems unique to Ireland. *Acta Carsologica*, *36*(2).

Waltham, T. (2009). *Foundations of Engineering Geology 3rd Edition*. CRC press.

Waltham, A. C., & Fookes, P. G. (2003). Engineering classification of karst ground conditions. Quarterly Journal of Engineering Geology and Hydrogeology, 36(2), 101-118.

Waltham, T., Bell, F., & Culshaw, M. S. (2005). Subsidence. Karst and Cavernous Rocks in Engineering and Construction.

Zhou, W., Beck, B. F., & Adams, A. L. (2003). Sinkhole risk assessment along highway I-70 near Frederick, Maryland. In *Sinkholes and the Engineering and Environmental Impacts of Karst* (pp. 591-604).

APPENDIX A SITE LAYOUT

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

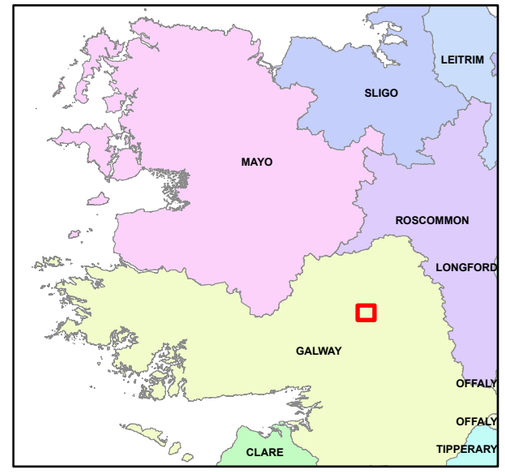
N W E S

T7 T6 T9 T5 T8 T3 T4 T2 T1

AL4b Float AL4c AL4b AL4 Float AL5 AL5_Float AL5b AL5b_Float AL8 AL6c AL4 AL3b AL6b AL6 AL3 AL2 AL1_B AL1

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads - Floated
- Proposed New Roads - Founded
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure A-1: Proposed Wind Farm Layout

File: 22098-GDG-02-LAY-MP-C-01

Sheet size: A3	CRS: 2157	Authored: CE
Date: 08/09/2025	Source: GDG/ MKO	Checked: AL

APPENDIX B GEOLOGY

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

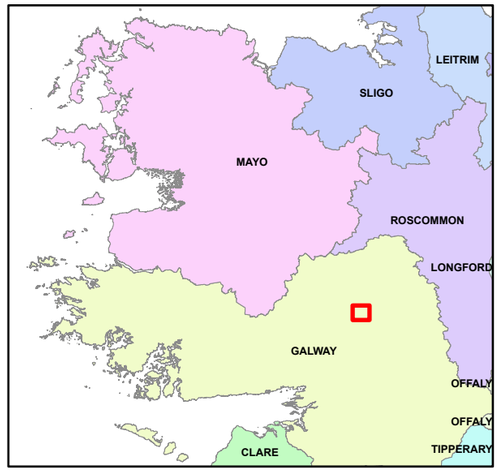
T7 GSI-17-003 T9 T6 Derrynacrick Lough T8 T5 T3 T4 T2 T1

Cooloo National School

L6506 L62311 L62312 L2302 L2301 N63

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri

0 0.25 0.5 1 km



Legend

- Proposed Temporary Construction Compound
- Proposed Turbine Layout
- EIAR Site Boundary
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Grid Connection Route
- Proposed New Roads
- Proposed Onsite Substation and Battery Storage Compound
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Route
- Proposed Turbine Hardstands
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Turbine Foundations
- GSI Boreholes

GSI Karst Features

- Enclosed Depression
- Swallow Hole

GSI Bedrock Geology 100k

- Burren Formation
- Croghan Limestone Formation
- Visean Limestones (undifferentiated)
- GSI Bedrock Outcrop

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure B-1: Bedrock Geology and Karst Features

File: 22098-GDG-02-BGE-MP-C-02

Sheet size: A3	CRS: 2157	Authored: CE
Date: 05/09/2025	Source: GSI	Checked: AL

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T4 T3 T2 T1

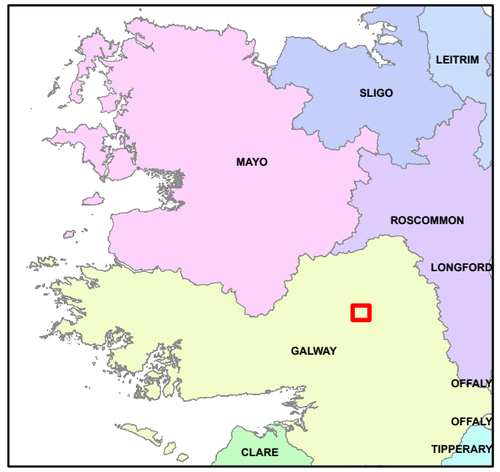
Derrynacrick Lough

Cooloo National School

L6506 L62312 L62311 L2302 L2301 N63

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- Proposed Temporary Construction Compound
- Proposed Turbine Layout
- EIAR Site Boundary
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Grid Connection Route
- Proposed New Roads
- Proposed Onsite Substation and Battery Storage Compound
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Route
- Proposed Turbine Hardstands
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Turbine Foundations

GSI Quaternary Sediments

- A, Alluvium
- BasEsk, Eskers comprised of gravels of basic reaction
- Cut, Cut over raised peat
- GLs, Gravels derived from Limestones
- KaRck, Kartsified bedrock outcrop or subcrop
- L, Lacustrine sediments
- TLs, Till derived from limestones
- Water

Client: MKO	GDG GAVIN & DOHERTY GEOSOLUTIONS	
Project: Cooloo Wind Farm		
Map title: Quaternary Sediments - GSI		
File: 22098-GDG-02-QSE-MP-C-03		
Sheet size: A3	CRS: 2157	Authored: CE
Date: 05/09/2025	Source: GSI	Checked: AL

APPENDIX C HYDROGEOLOGY

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T3 T4 T2 T1

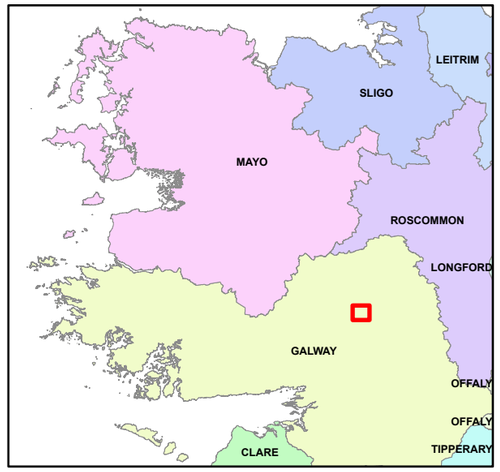
Derrynacrick Lough

Cooloo National School

L6506 L2302 L2301 L62311 L62312 N63

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

GSI Karst Features

- Enclosed Depression
- Swallow Hole

GSI Hydrostratigraphic Rock Units

- Dinantian Pure Bedded Limestones

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure C-1: GSI Hydrostratigraphic Rock Units

File: 22098-GDG-02-HRU-MP-C-26

Sheet size: A3	CRS: 2157	Authored: CE
Date: 12/09/2025	Source: GSI	Checked: AL

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T4 T3 T2 T1

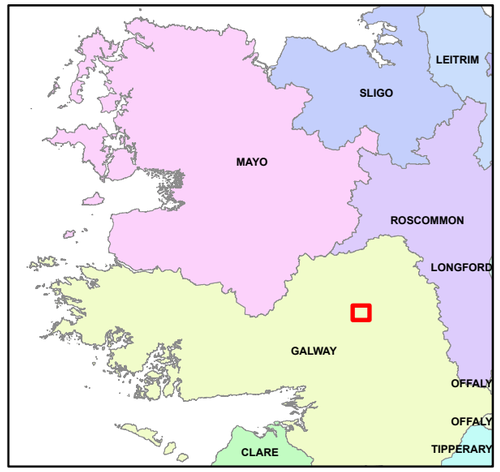
Derrynacrick Lough

Cooloo National School

L6506 L62311 L62312 L2302 L2301 N63

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

GSI Bedrock Aquifers

- Rkc - Regionally Important Aquifer - Karstified (conduit)

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure C-2: GSI Bedrock Aquifers

File: 22098-GDG-02-HGE-MP-C-5

Sheet size: A3	CRS: 2157	Authored: CE
Date: 05/09/2025	Source: GSI	Checked: AL

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T3 T4 T2 T1

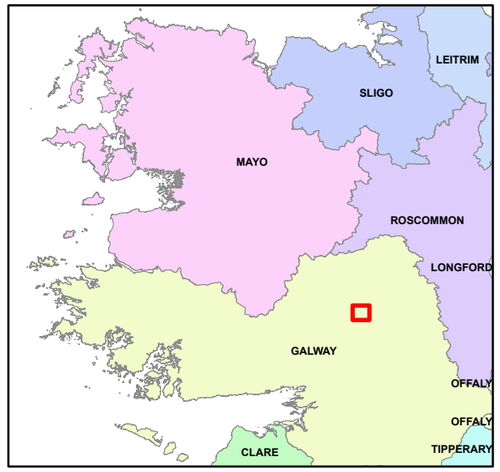
Derrynacrick Lough

Cooloo National School

L6506 L62311 L62312 L2302 L2301 N63

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

GSI/EPA Groundwater Bodies

- Clare-Corrib

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure C-3: GSI/EPA Groundwater Bodies

File: 22098-GDG-02-GWB-MP-C-26

Sheet size: A3	CRS: 2157	Authored: CE
Date: 12/09/2025	Source: GSI/EPA	Checked: AL

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T6 T9 T8 T5 T3 T4 T2 T1

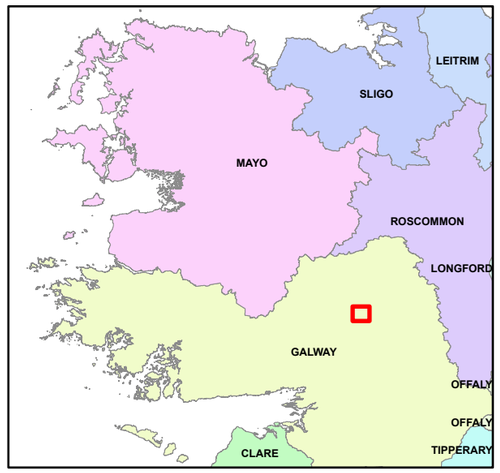
Derrynacrick Lough

Cooloo National School

L6506 L62311 L62312 L2302 L2301 N63

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

GSI Groundwater Vulnerability

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

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure C-4: GSI Groundwater Vulnerability

File: 22098-GDG-02-GWV-MP-C-27

Sheet size: A3	CRS: 2157	Authored: CE
Date: 12/09/2025	Source: GSI	Checked: AL

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T4 T3 T2 T1

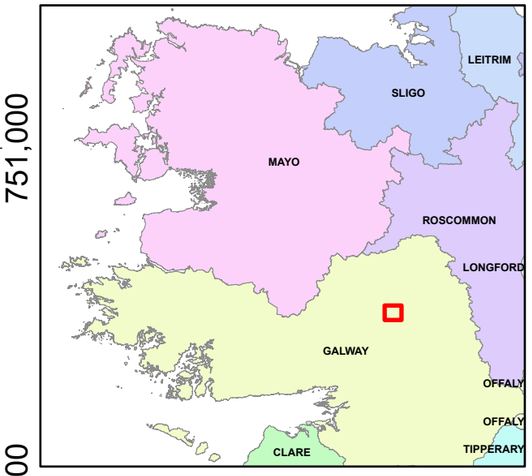
Derrynacrick Lough

Cooloo National School

L6506 L62311 L62312 L2302 L2301 N63 L230

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri

0 0.25 0.5 1 km



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

GSI Subsoil Permeability

- High
- Medium
- Low
- Water
- Not mapped

Client: MKO GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure C-5: GSI Subsoil Permeability

File: 22098-GDG-02-PER-MP-C-06

Sheet size: A3	CRS: 2157	Authored: CE
Date: 05/09/2025	Source: GSI	Checked: AL

APPENDIX D TOPOGRAPHY

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

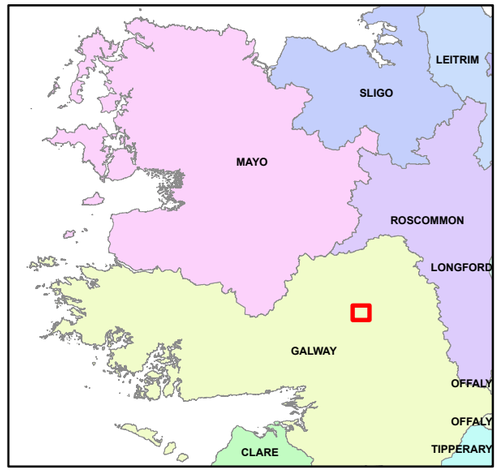
T1 T2 T3 T4 T5 T6 T7 T8 T9

Cooloo National School

L2302 L2301 N63 L6506 L62312

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Elevation (mAOD)

- 58.93 - 60
- 60.001 - 65
- 65.001 - 70
- 70.001 - 75
- 75.001 - 80
- 80.001 - 85
- 85.001 - 90

Client: MKO	GDG GAVIN & DOHERTY GEOSOLUTIONS	
Project: Cooloo Wind Farm		
Figure ~~D~~-1: ~~Elevation~~		
File: 22098-GDG-02-DTM-MP-C-7		
Sheet size: A3	CRS: 2157	Authored: CE
Date: 05/09/2025	Source: Bluesky	Checked: AL

554,000 555,000 556,000 557,000 558,000

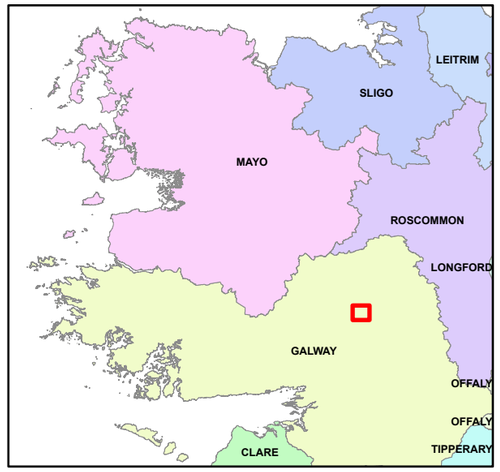
751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T4 T3 T2 T1

L6506 L62312 L2302 L2301 N63 L230

Cooloo National School



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

0 0.25 0.5 1 km

Client: MKO GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure D-2: Hillshade

File: 22098-GDG-02-DTM-MP-C-29

Sheet size: A3	CRS: 2157	Authored: CE
Date: 12/09/2025	Source: Bluesky	Checked: AL

APPENDIX E HYDROLOGY

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

GINNAUN

Grange [Galway]

DERRYNAGRAN 30

GRANGE (GALWAY)_020

GRANGE (GALWAY)_010

DANGAN_EIGHTER

T7 T9 T6 T8 T5 T3 T4 T2 T1

Derrynamuck Lough

ANGLORA GH

FORTY_ACRES

ABBERT_030

LECARROW 30

Cooloo National School

L6506 L62311 L62312 L2302 L2301 N63

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri

N W E S

LEITRIM SLIGO MAYO ROSCOMMON LONGFORD GALWAY OFFALY OFFALY CLARE TIPPERARY

Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area
- Rivers
- Lakes
- Abbert (030)
- Grange (Galway - 010)
- Grange (Galway - 020)

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure 8-1: Hydrology

File: 22098-GDG-02-HYD-MP-C-14

Sheet size: A3	CRS: 2157	Authored: CE
Date: 06/09/2025	Source: EPA	Checked: AL

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T6 T9 T8 T5 T3 T4 T2 T1

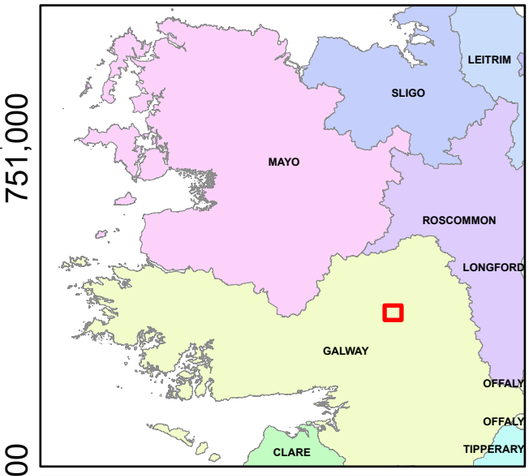
Derrynacrock Lough

Cooloo National School

L6506 L62311 L62312 L2302 L2301 N63

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

GSI Historic Groundwater Flooding Extents

- Groundwater
- Groundwater/Surface water
- Winter 2015/2016 Surface Water Flooding

Client: MKO / GDG Gavin & Doherty Geosolutions		
Project: Cooloo Wind Farm		
Figure E-2: Groundwater Flooding		
File: 22098-GDG-02-HYD-MP-C-12		
Sheet size: A3	CRS: 2157	Authored: CE
Date: 12/09/2025	Source: GSI	Checked: AL

APPENDIX F LANDCOVER

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

N W E S

T7 T6 T9 T8 T5 T4 T3 T2 T1

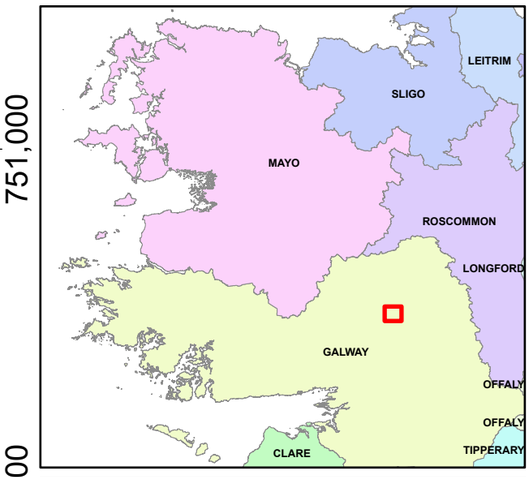
Derrynacrick Lough

Cooloo National School

L6506 L2302 L2301 N63 L62311 L62312

0 0.25 0.5 1 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Land Cover (Corine)

- Land principally occupied by agriculture
- Pastures
- Peat bogs

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure F-1: Corine 2018 Land Cover

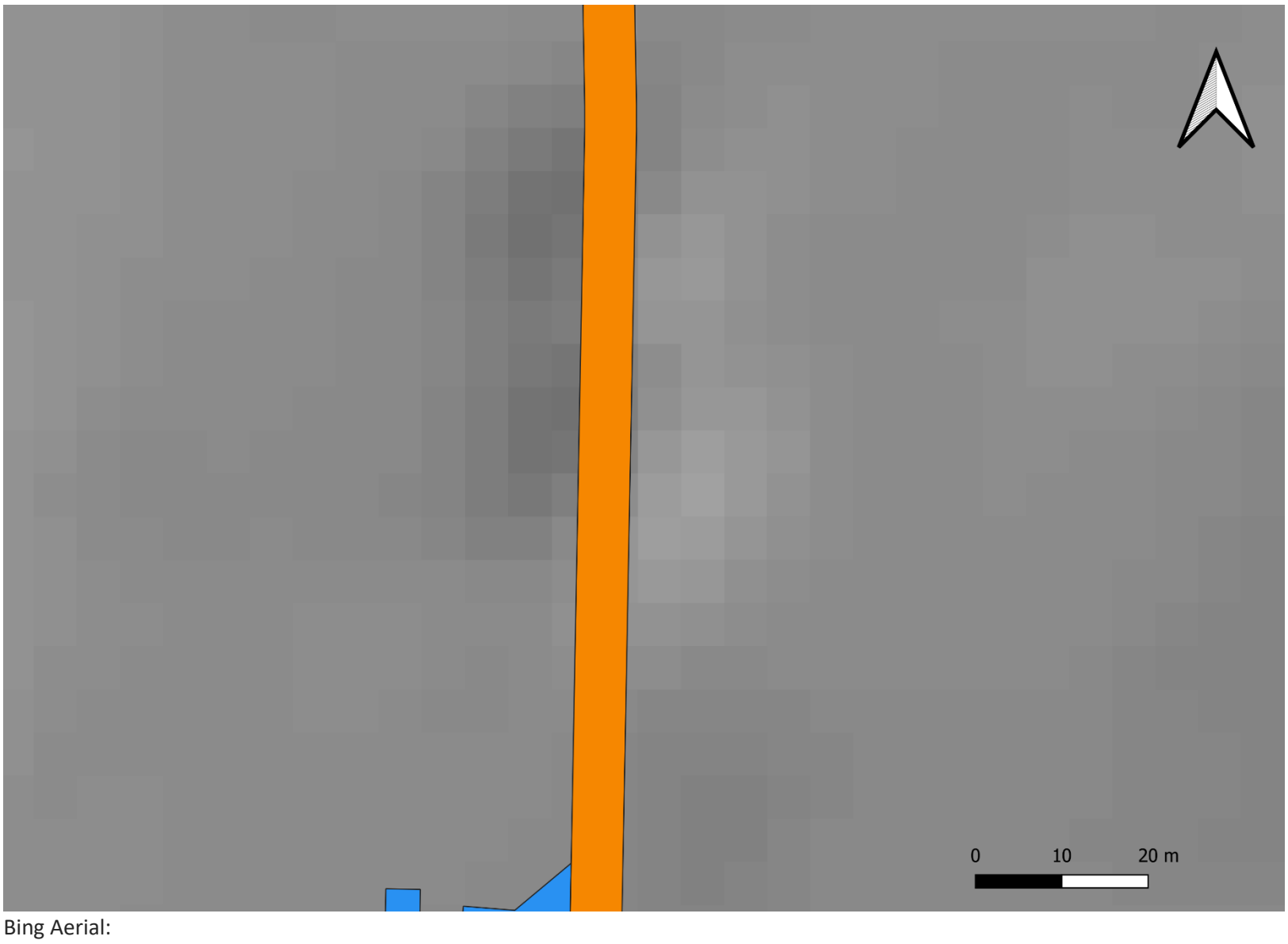
File: 22098-GDG-02-LCO-MP-C-15

Sheet size: A3	CRS: 2157	Authored: CE
Date: 06/09/2025	Source: Corine 2018	Checked: AL

APPENDIX G SITE RECONNAISANCE AND GROUND INVESTIGATION

G.1 KARST DATABASE

Table G-1: Site Reconnaissance at Karst feature K1

Feature ID	**K1**
Feature Type	Enclosed Depression
Coordinates	E:556202, N:748844
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial:

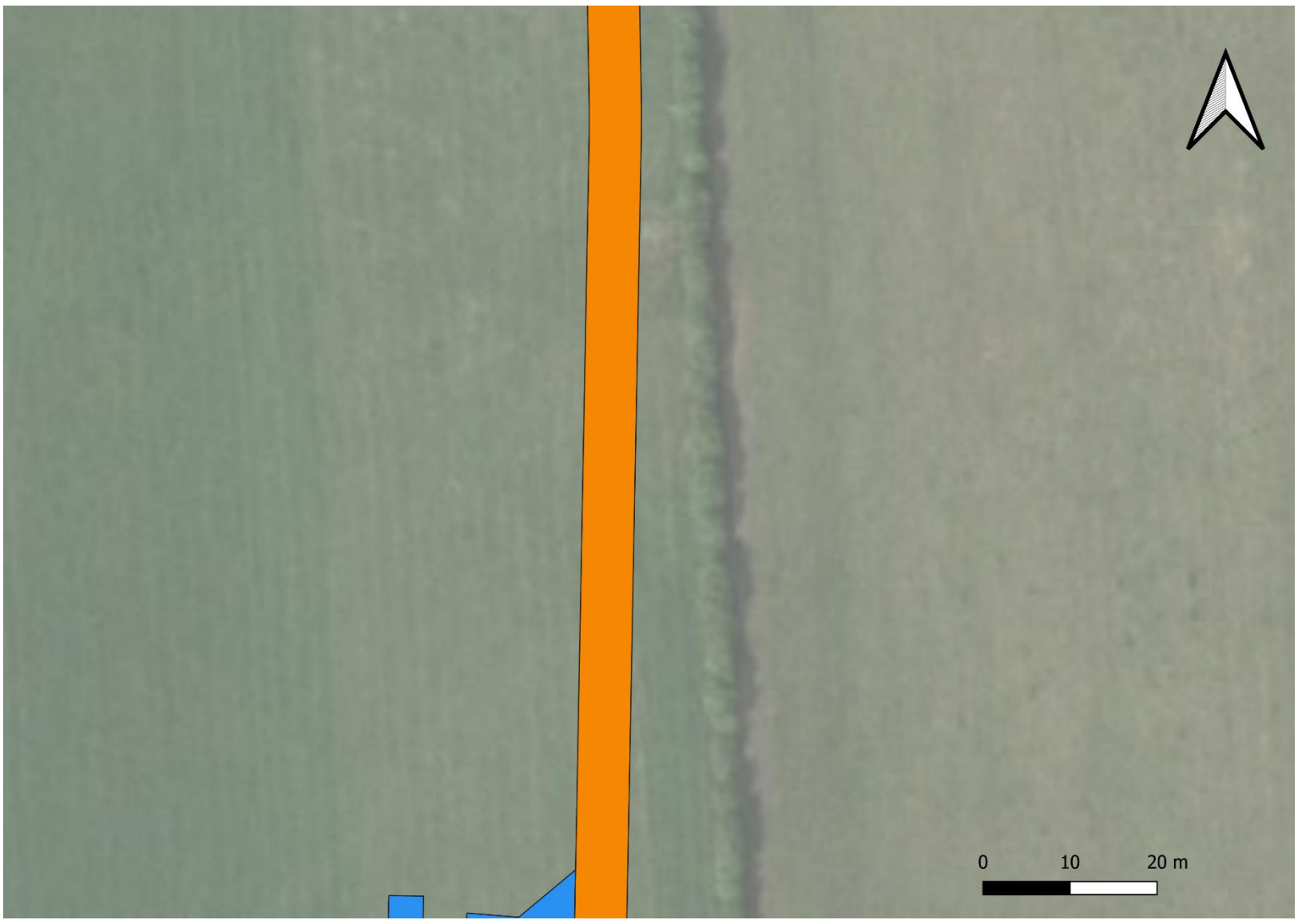
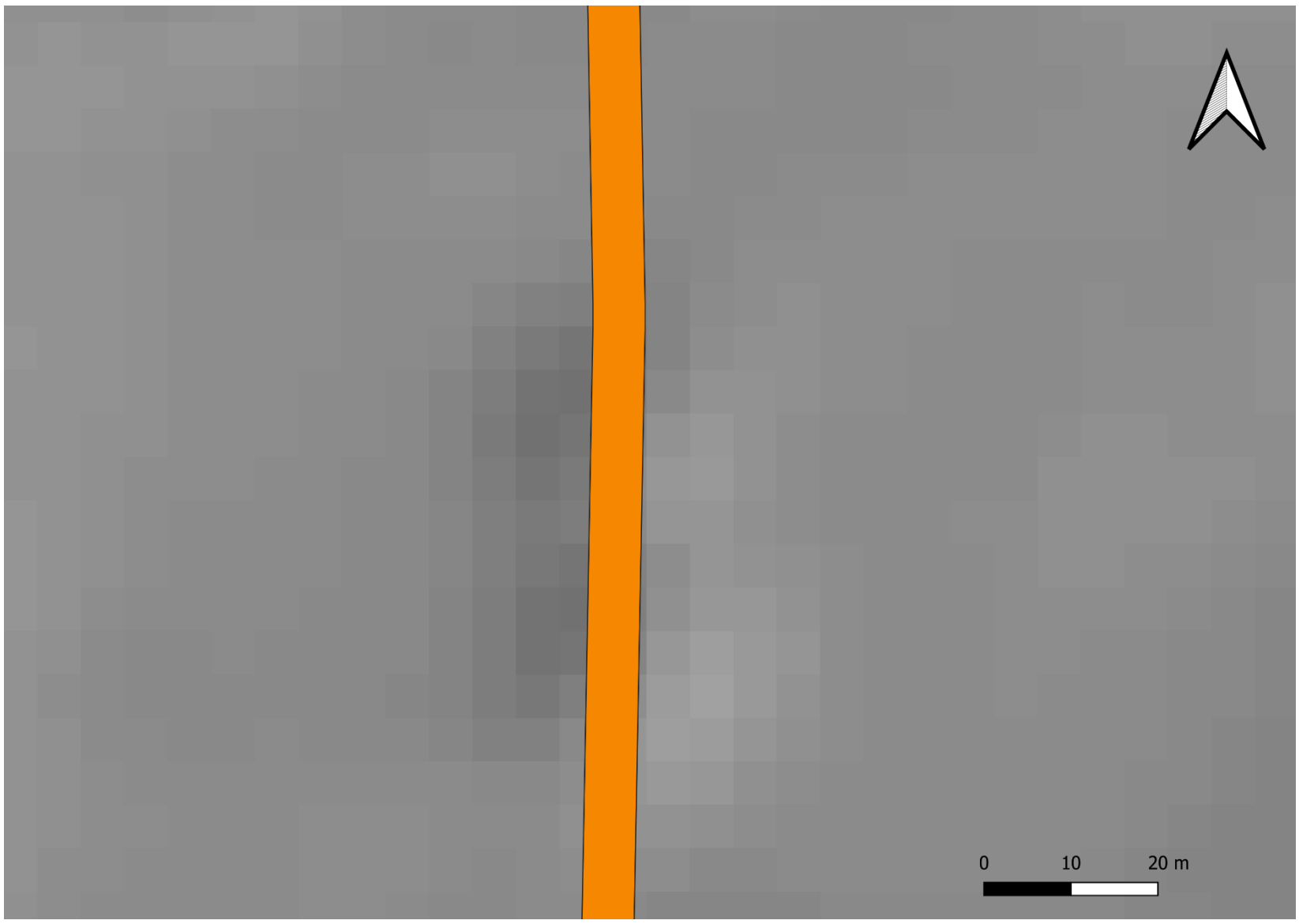
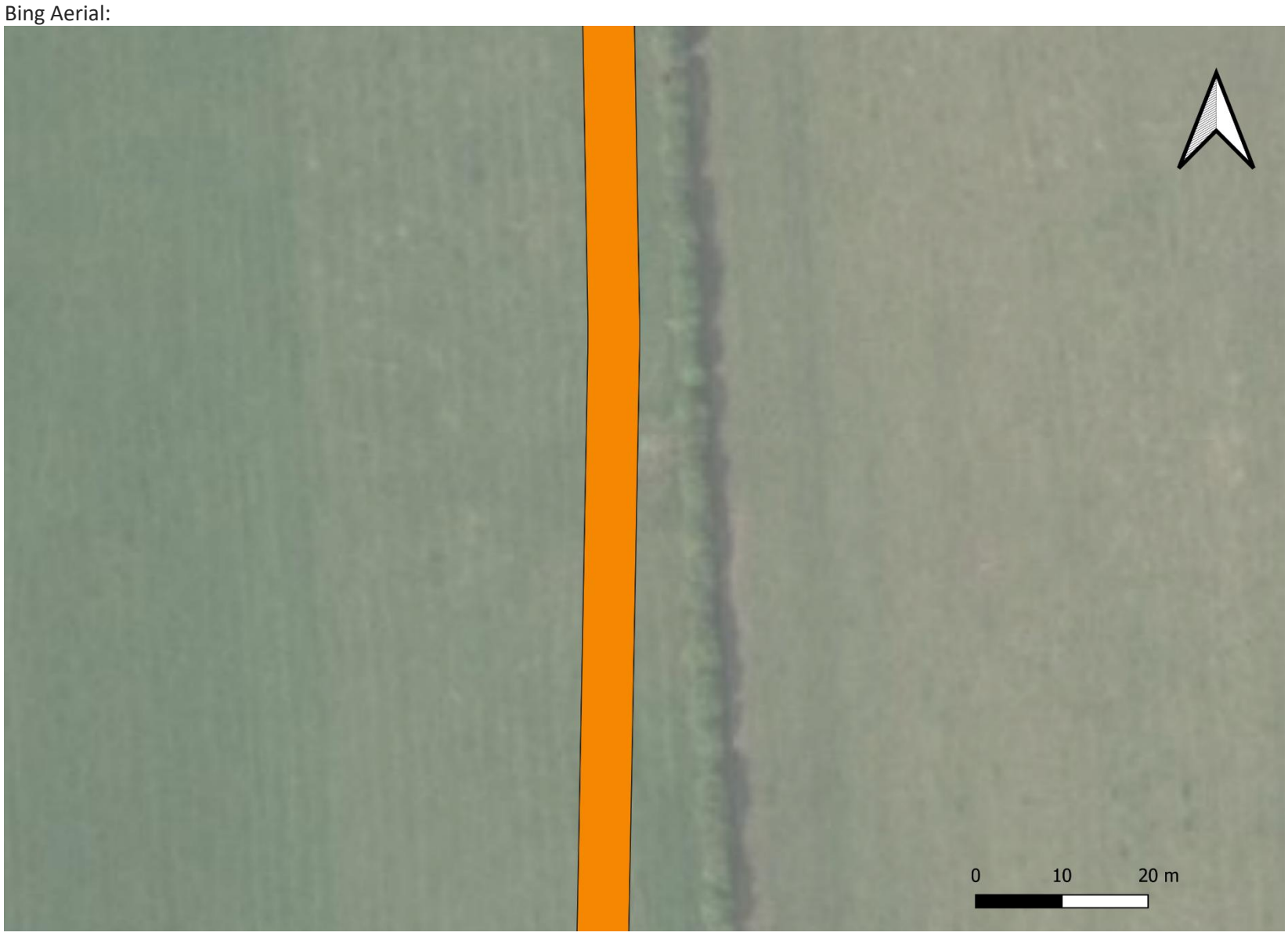
Feature ID	**K1**
	
Site Reconnaissance Date	27-28/08/2024 and 01/11/2024
Site Reconnaissance Outcome	Visual evidence for surface depression. Minerex Geophysical survey in August 2025 found no conclusive evidence for significant subsurface cavities.
Water Presence	No
Additional Information	Saucer-shaped depression, approximately 15-20m in diameter and 1m deep.
Site Photos	

Table G-2: Site Reconnaissance at Karst feature K2

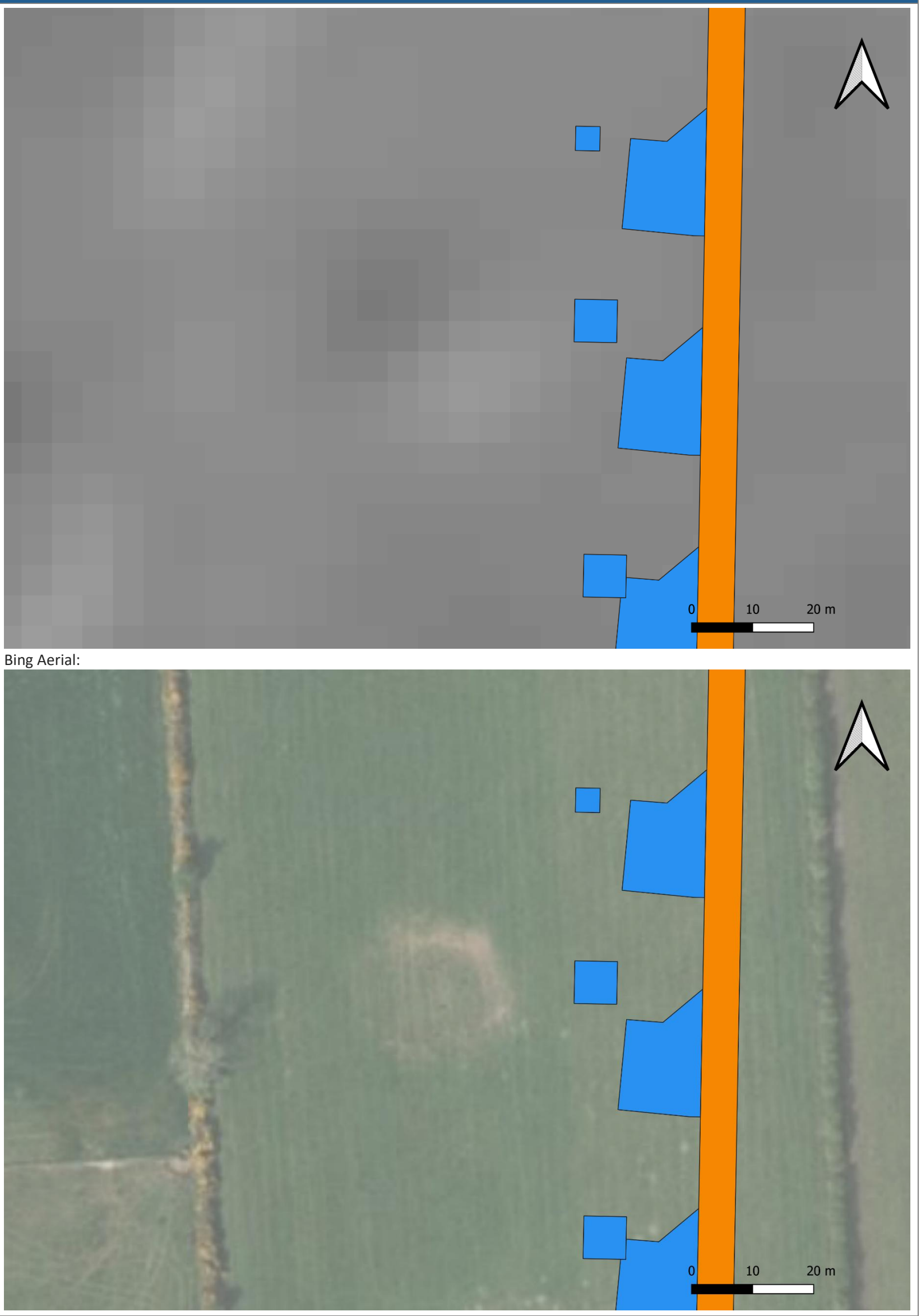
Feature ID	**K2**
Feature Type	Enclosed Depression

Feature ID	**K2**
Coordinates	E:556201, N:748867
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial: 
Site Reconnaissance Date	27-28/08/2024 and 01/11/2024

Feature ID	**K2**
Site Reconnaissance Outcome	Visual evidence for surface depression. Minerex Geophysical survey in August 2025 found no conclusive evidence for significant subsurface cavities.
Water Presence	No
Additional Information	Saucer-shaped depression, approximately 15-20m in diameter and 1m deep.
Site Photos	 

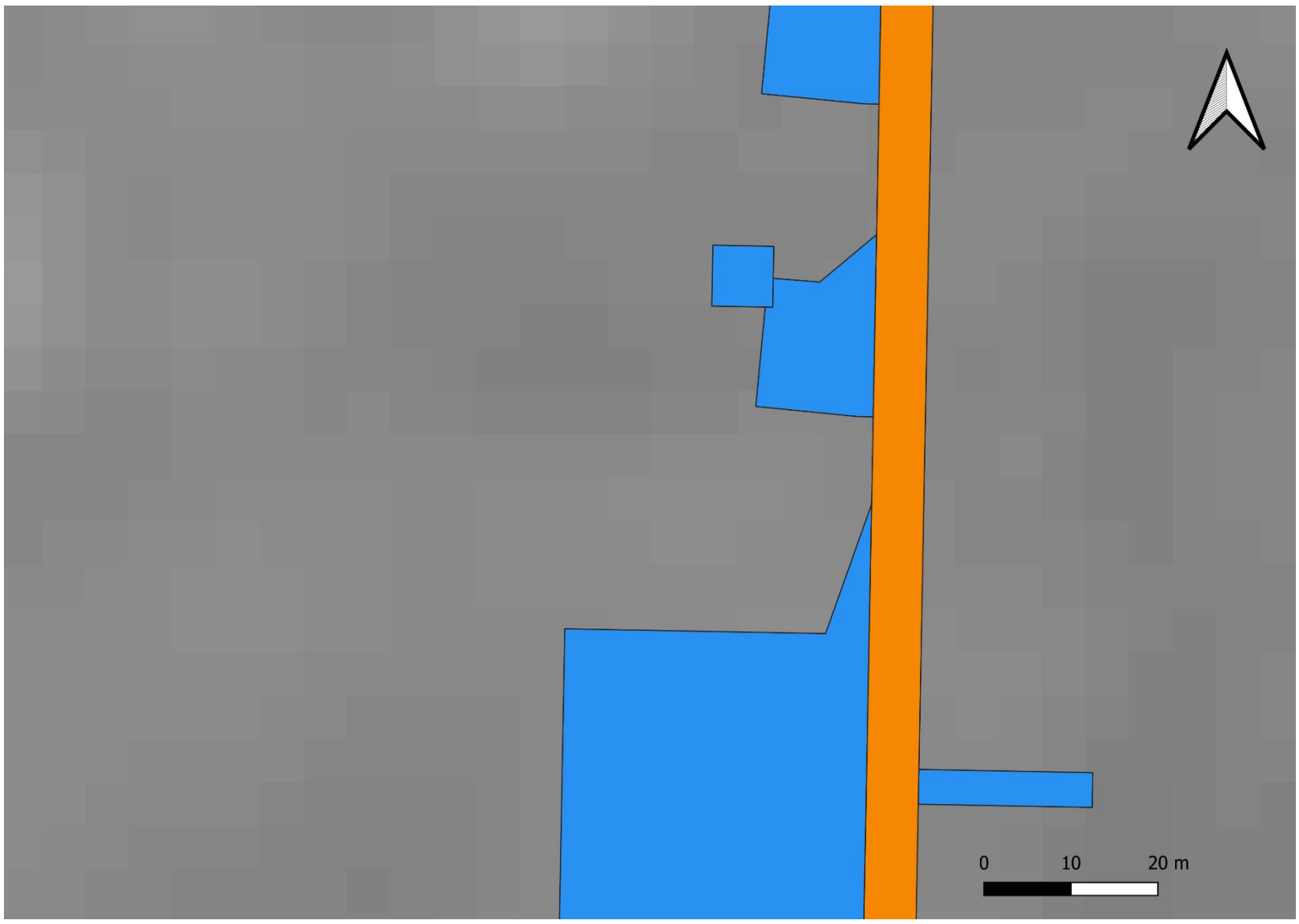
Table G-3: Site Reconnaissance at Karst feature K3

Feature ID	**K3**
Feature Type	Enclosed Depression
Coordinates	E:556152, N:748761
Source	Aerial Imagery/Site Observation
Imagery	DTM:

Feature ID	K3
	 Bing Aerial:
Site Reconnaissance Date	27-28/08/2024 and 01/11/2024
Site Reconnaissance Outcome	Confirmed

Feature ID	**K3**
Water Presence	No
Additional Information	Nearly flat depression, approximately 15m in diameter.
Site Photos	

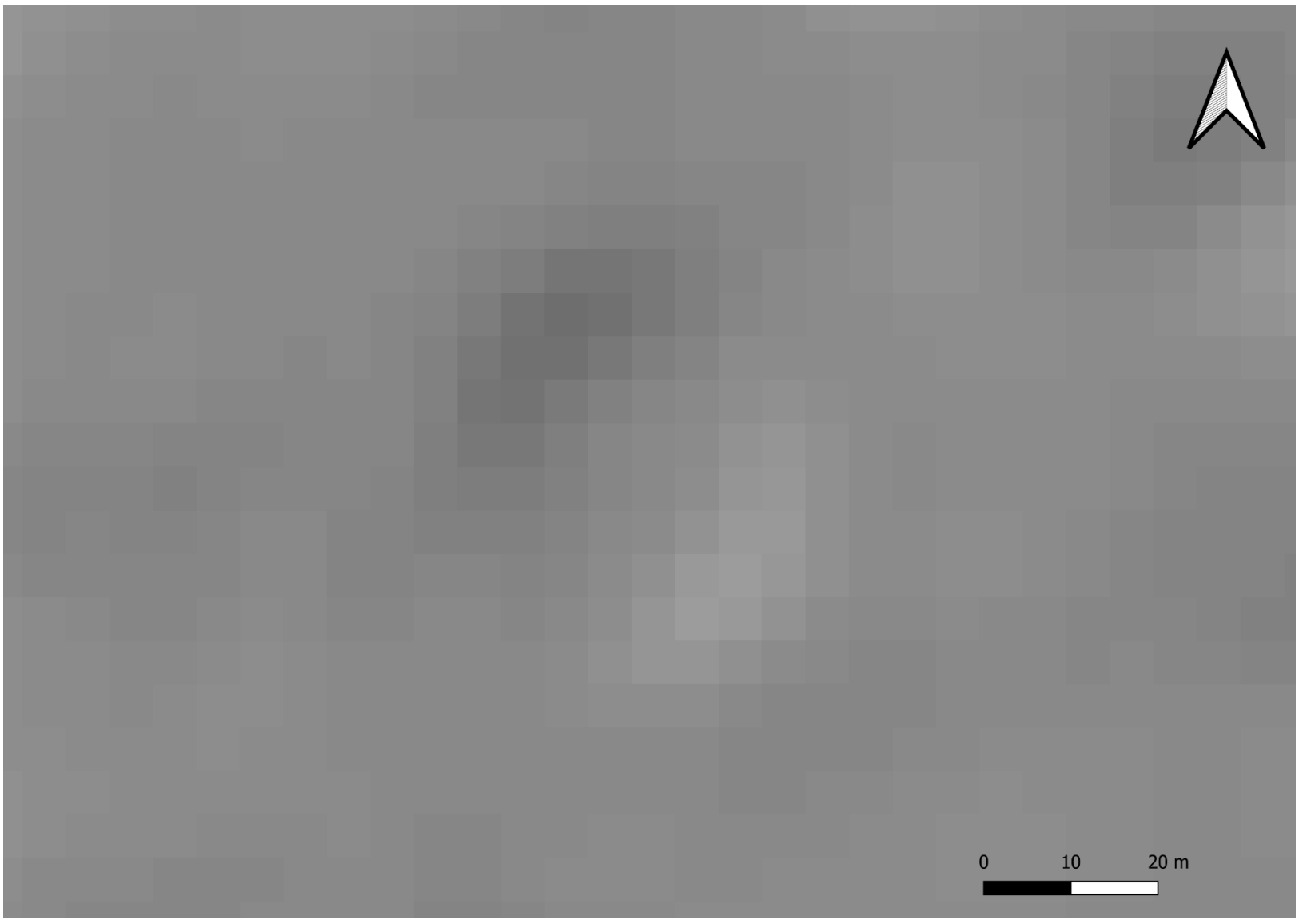
Table G-4: Site Reconnaissance at Karst feature K4

Feature ID	**K4**
Feature Type	Enclosed Depression
Coordinates	E:556166, N:748699
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial:

Feature ID	K4
	
Site Reconnaissance Date	27-28/08/2024 and 01/11/2024
Site Reconnaissance Outcome	Confirmed
Water Presence	No
Additional Information	Nearly flat depression, approximately 10m in diameter.
Site Photos	

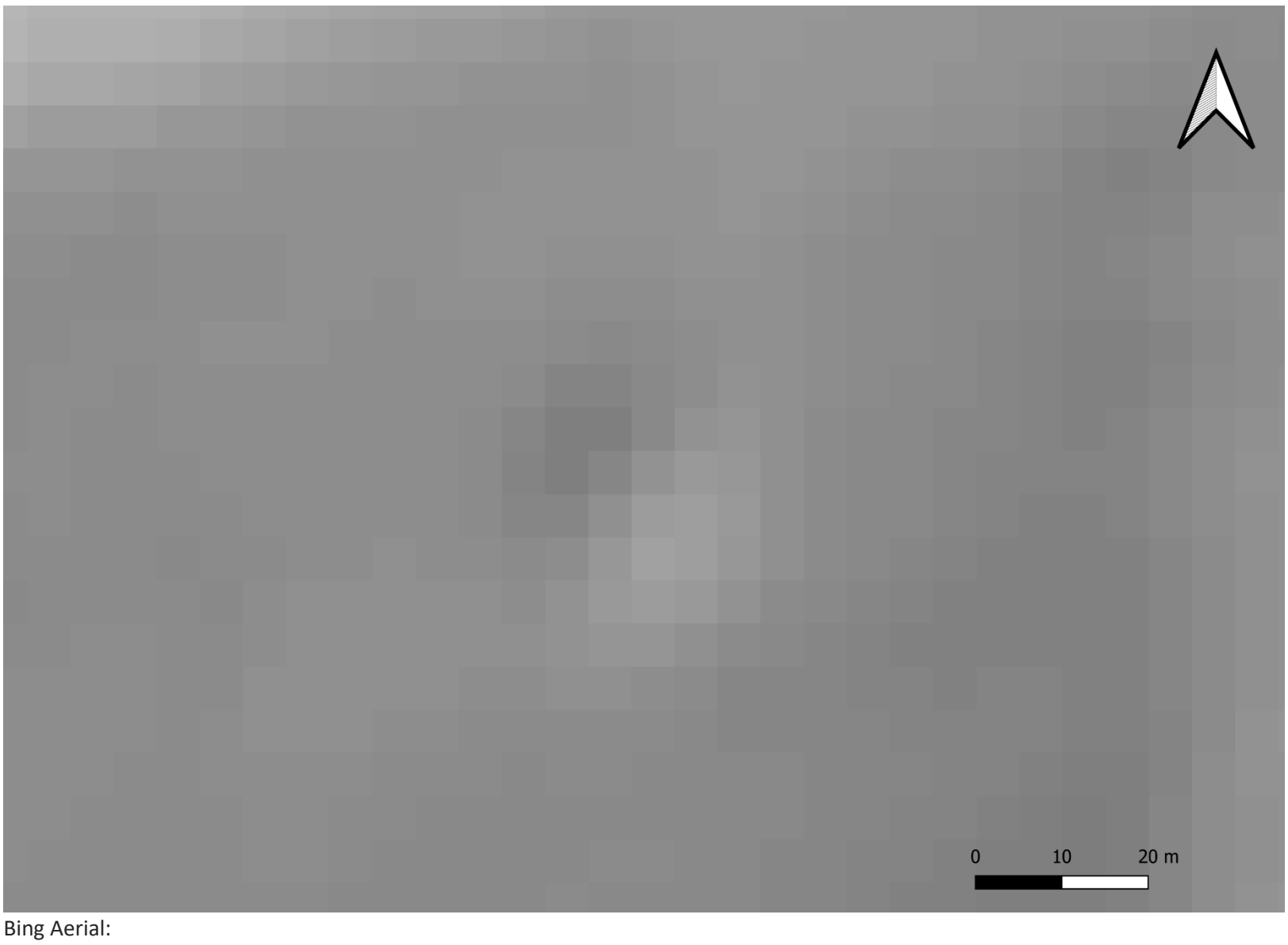
Table G-5: Site Reconnaissance at Karst feature K5

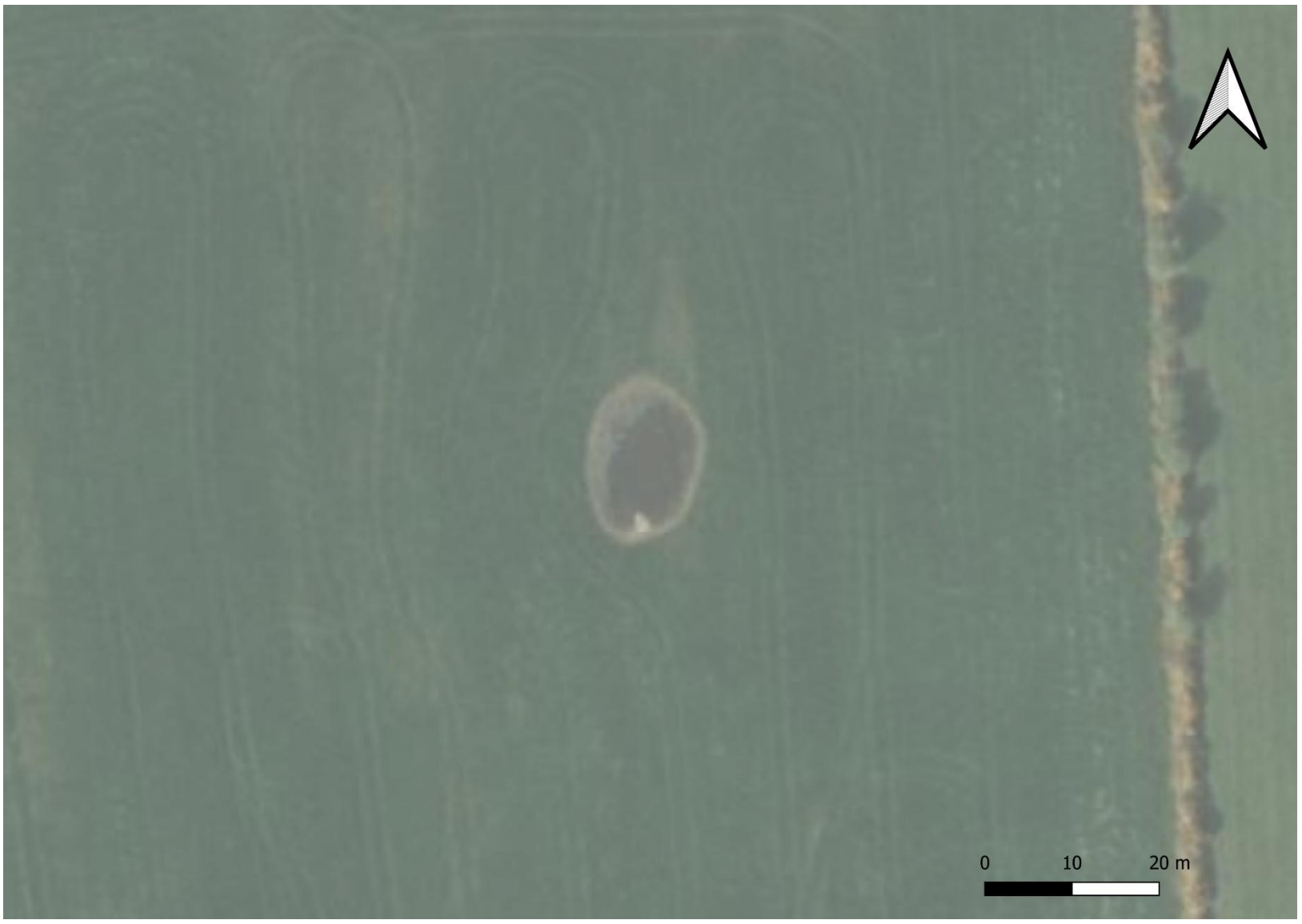
Feature ID	K5
Feature Type	Enclosed Depression
Coordinates	E:556078, N:748728

Feature ID	**K5**
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial: 
Site Reconnaissance Date	27-28/08/2024

Feature ID	**K5**
Site Reconnaissance Outcome	Confirmed
Water Presence	No
Additional Information	Nearly flat depression, approximately 20m in diameter.
Site Photos	

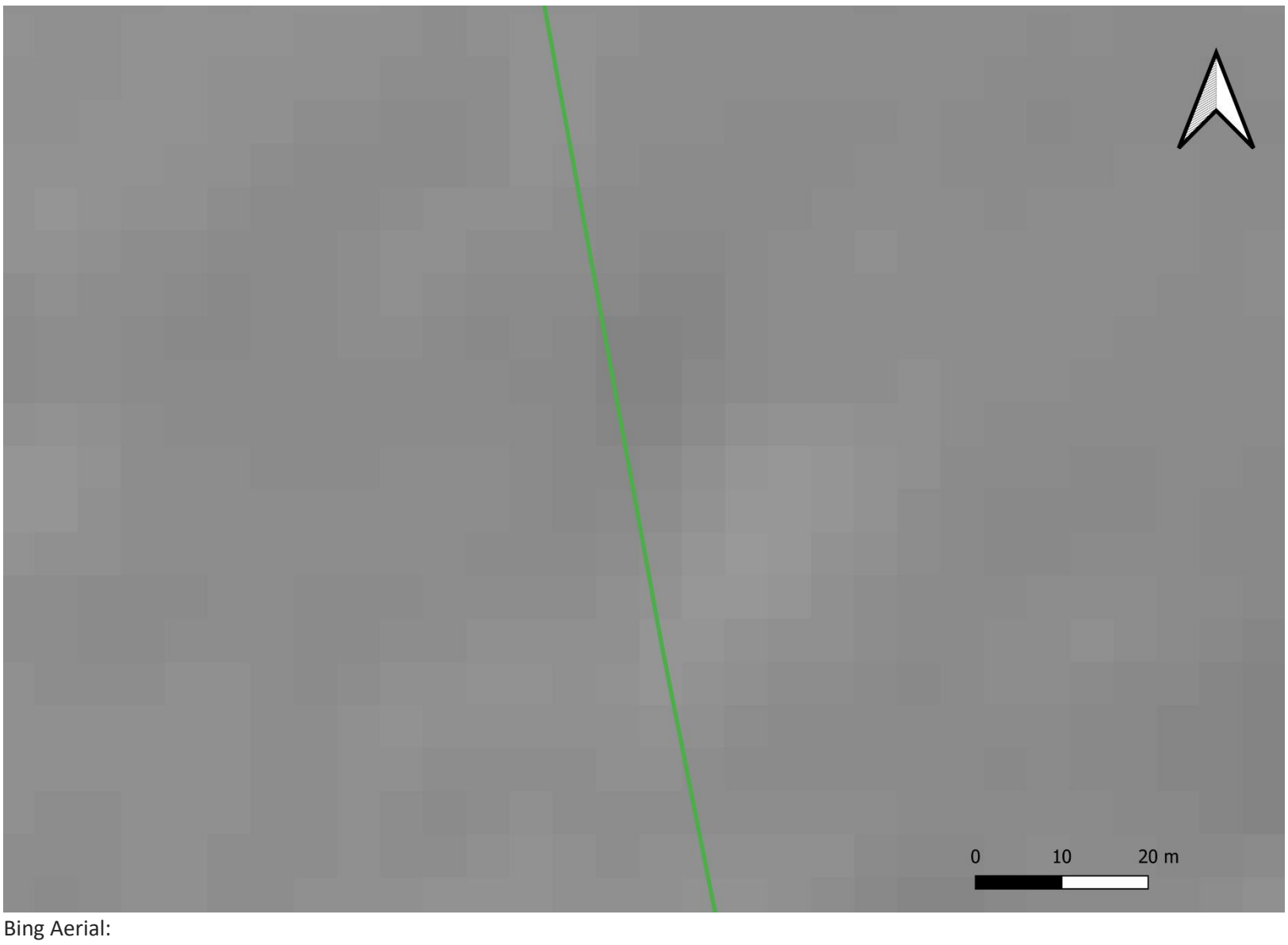
Table G-6: Site Reconnaissance at Karst feature K6

Feature ID	**K6**
Feature Type	Enclosed Depression
Coordinates	E:556042, N:748882
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial:

Feature ID	K6
	
Site Reconnaissance Date	27-28/08/2024
Site Reconnaissance Outcome	Confirmed
Water Presence	Yes
Additional Information	Saucer shaped depression, approximately 15-20m in diameter.
Site Photos	

Feature ID	**K6**
	

Table G-7: Site Reconnaissance at Karst feature K7

Feature ID	**K7**
Feature Type	Enclosed Depression
Coordinates	E:555922, N:748826
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial:

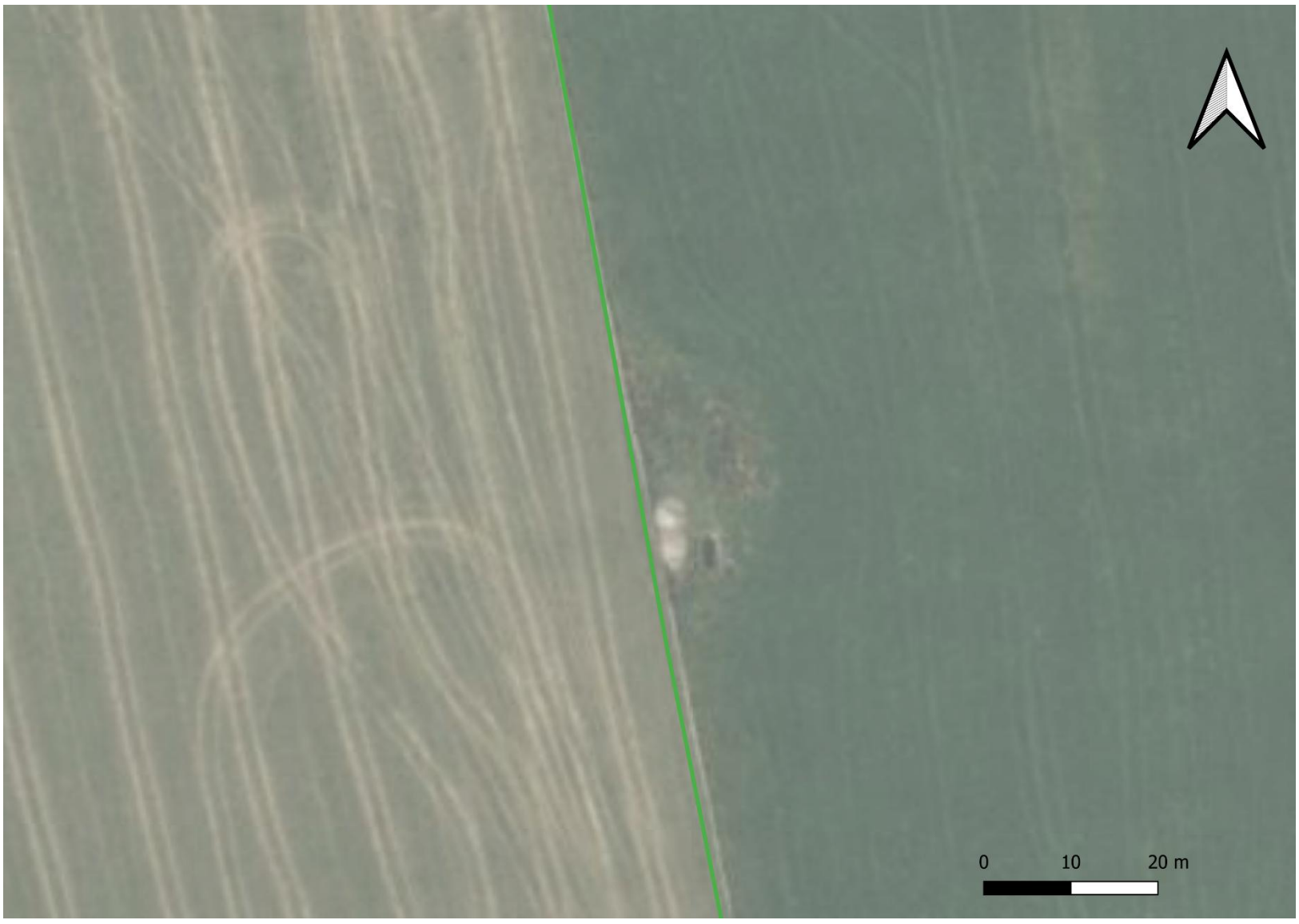
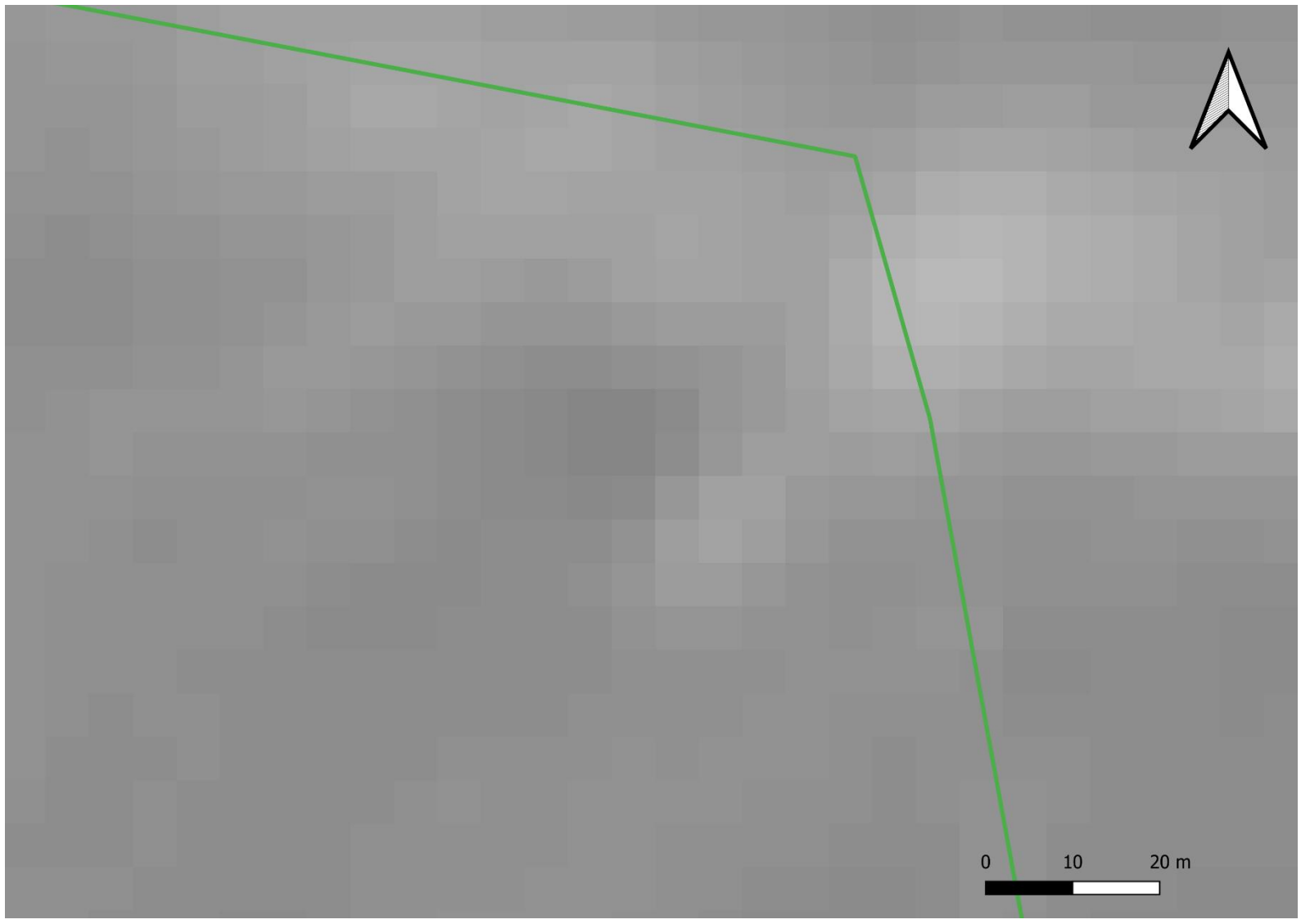
Feature ID	K7
	
Site Reconnaissance Date	27-28/08/2024
Site Reconnaissance Outcome	Confirmed
Water Presence	Yes
Additional Information	Nearly flat depression, approximately 10m in diameter.
Site Photos	

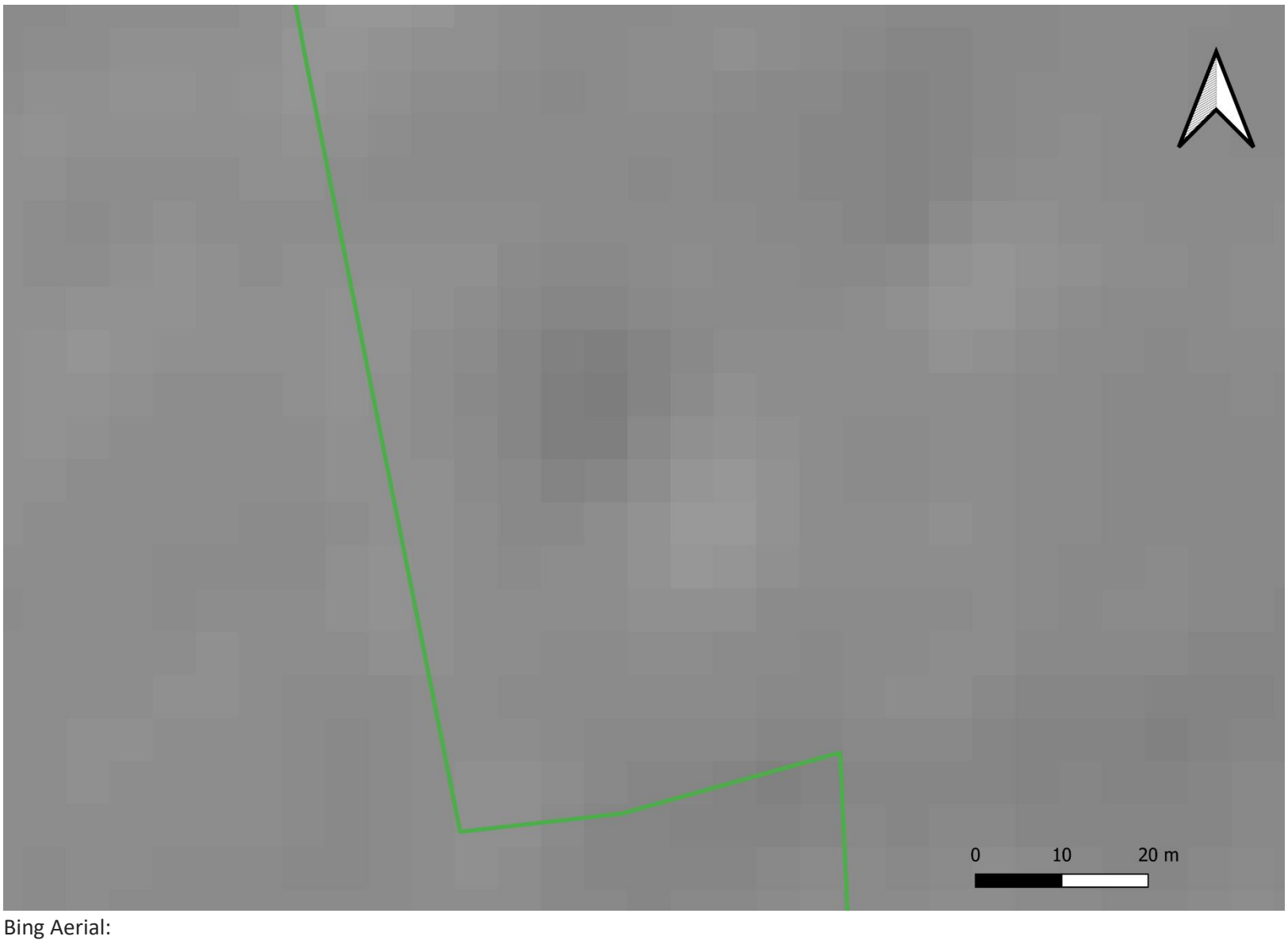
Table G-8: Site Reconnaissance at Karst feature K8

Feature ID	K8
Feature Type	Enclosed Depression
Coordinates	E:555871, N:748914

Feature ID	**K8**
Source	Aerial Imagery
Imagery	DTM:  Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A

Feature ID	K8
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-9: Site Reconnaissance at Karst feature K9

Feature ID	K9
Feature Type	Enclosed Depression
Coordinates	E:555963, N:748758
Source	Aerial Imagery
Imagery	DTM:  Bing Aerial:

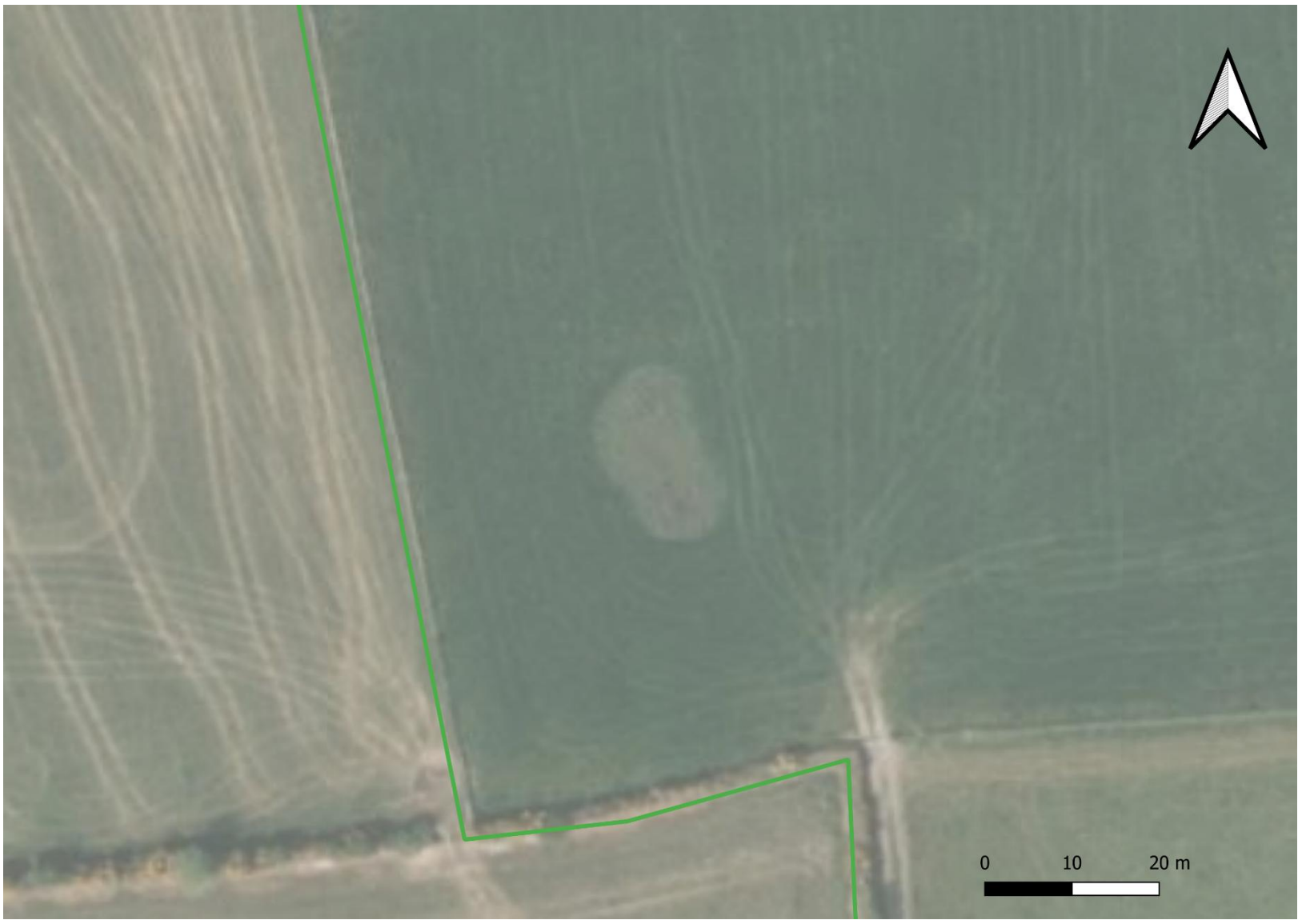
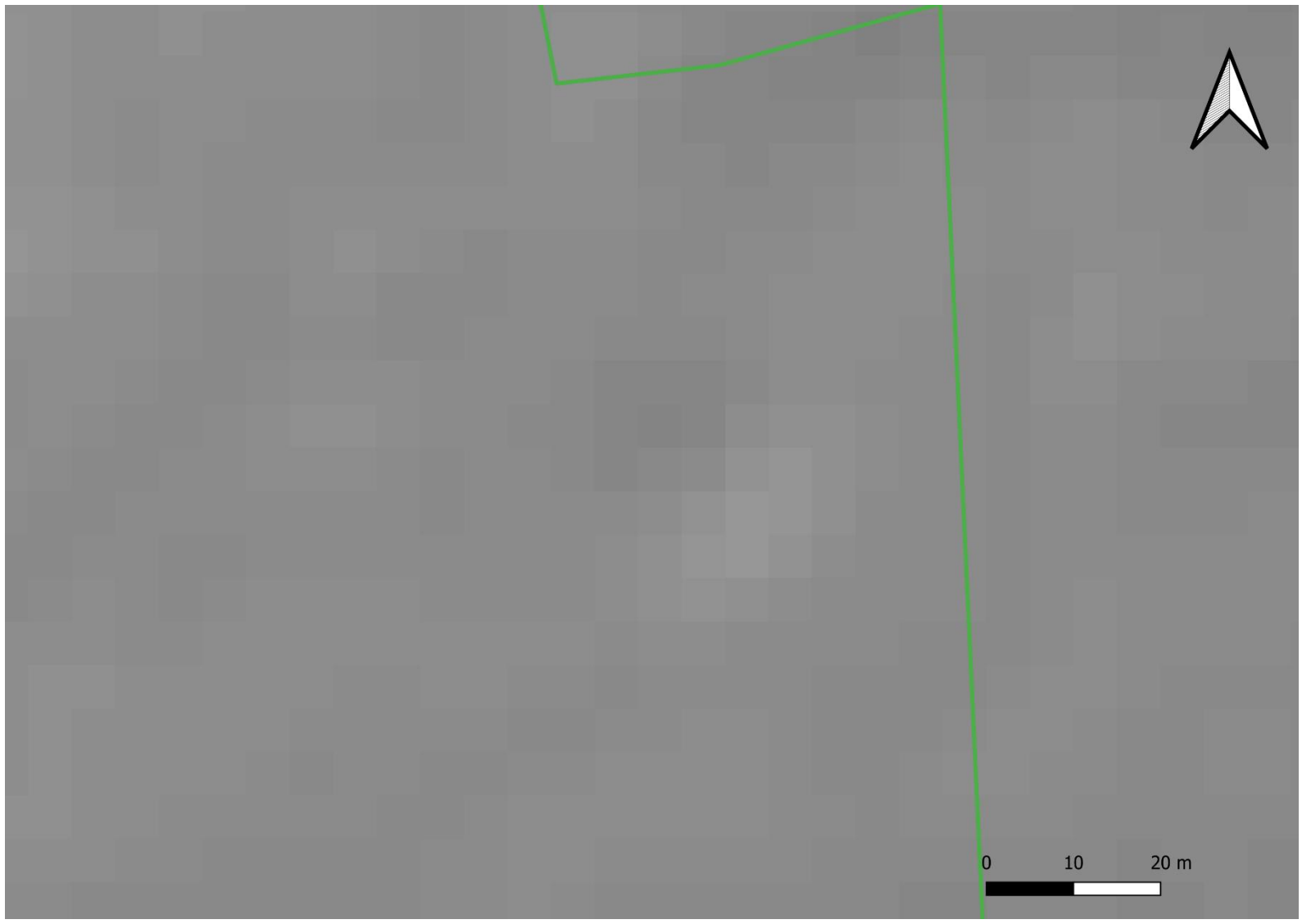
Feature ID	**K9**
	
Site Reconnaissance Date	27-28/08/2024
Site Reconnaissance Outcome	Confirmed
Water Presence	No
Additional Information	Nearly flat depression, approximately 10m in diameter.
Site Photos	

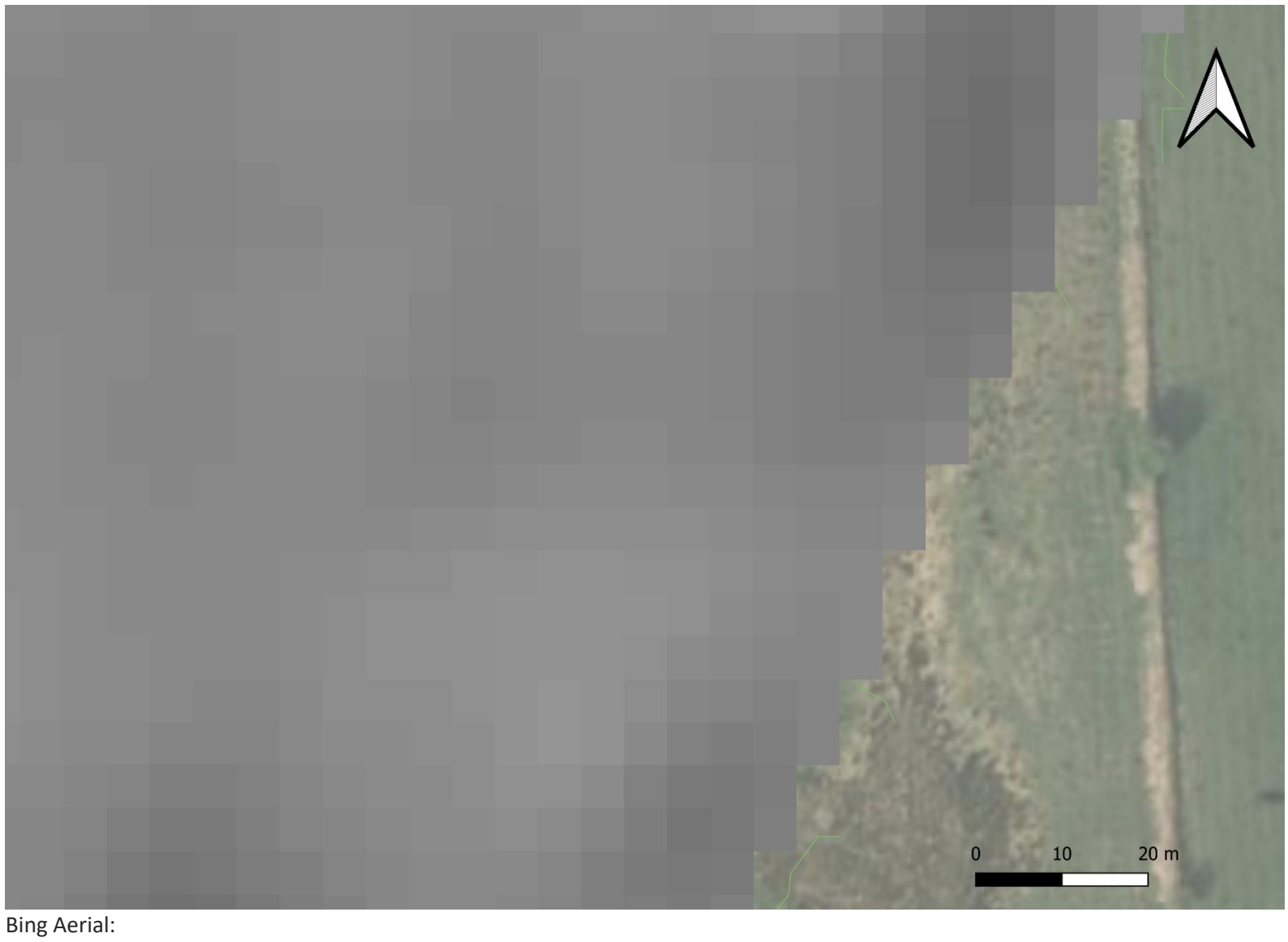
Table G-10: Site Reconnaissance at Karst feature K10

Feature ID	**K10**
Feature Type	Enclosed Depression
Coordinates	E:555953, N:748671
Source	Aerial Imagery

Feature ID	**K10**
Imagery	DTM:  Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible

Feature ID	**K10**
Additional Information	N/A
Site Photos	N/A

Table G-11: Site Reconnaissance at Karst feature K11

Feature ID	**K11**
Feature Type	Enclosed Depression
Coordinates	E:556363, N:748603
Source	Aerial Imagery
Imagery	DTM:  Bing Aerial:

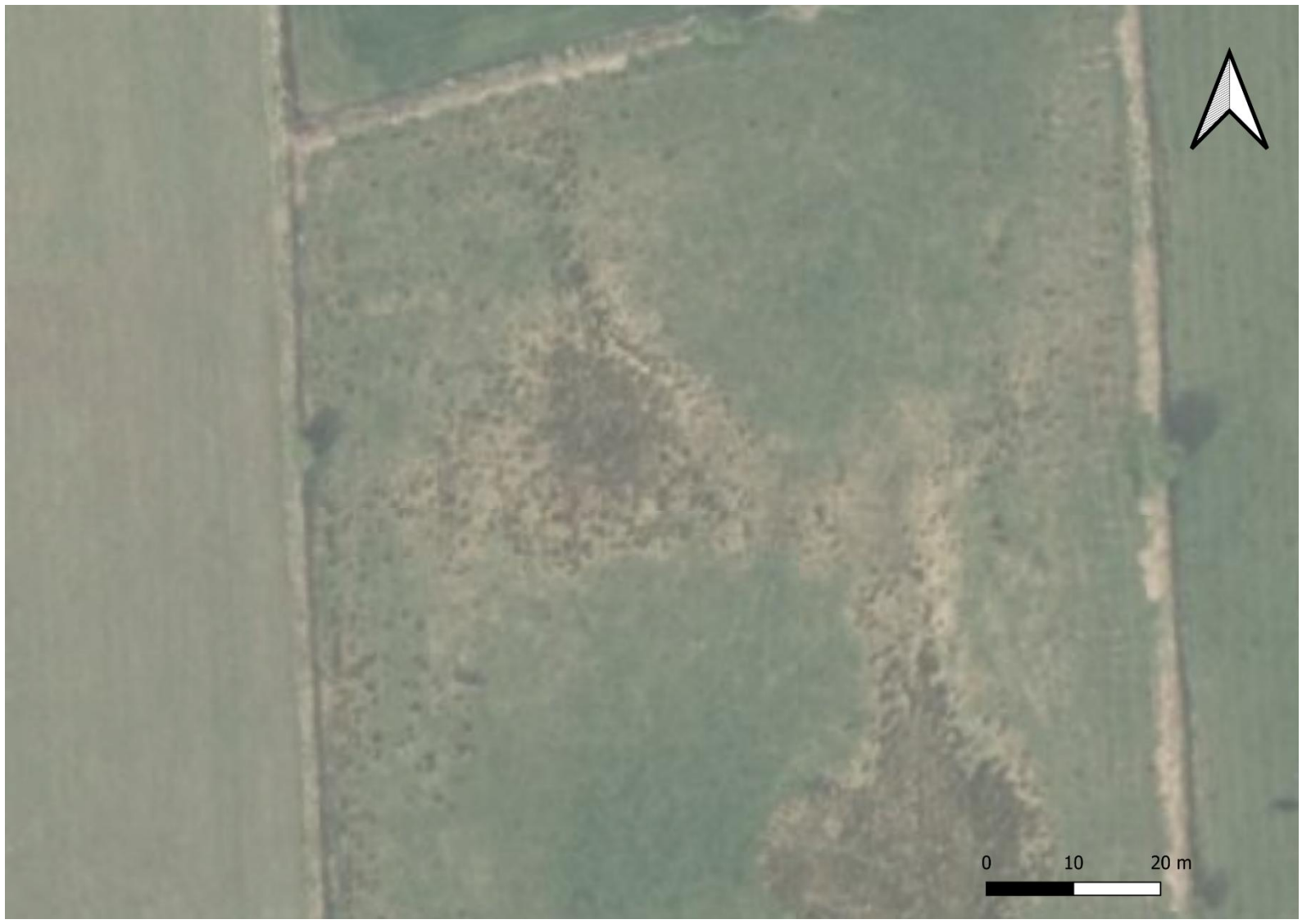
Feature ID	**K11**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-12: Site Reconnaissance at Karst feature K12

Feature ID	**K12**
Feature Type	Enclosed Depression
Coordinates	E:556554, N:748717
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial:

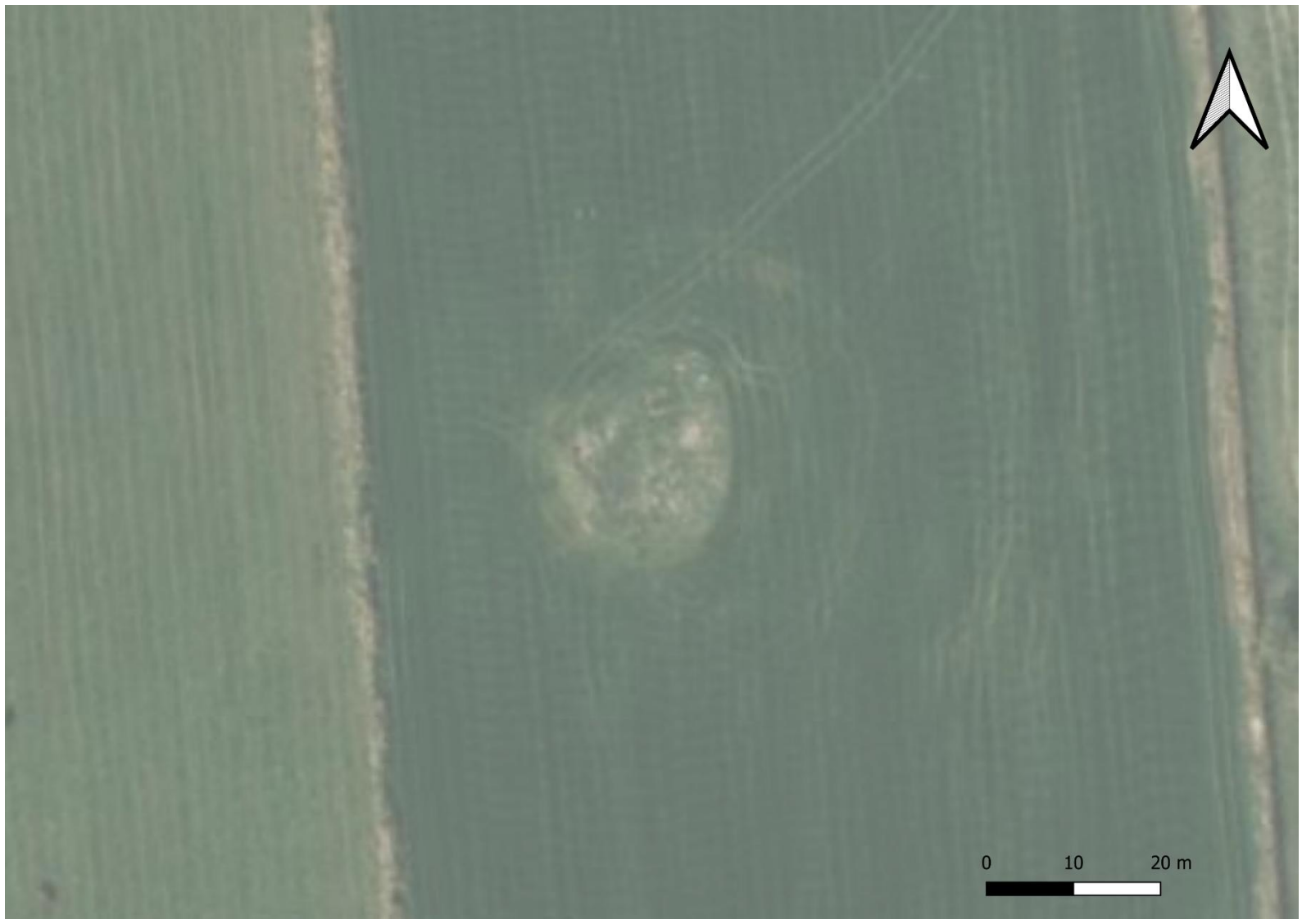
Feature ID	**K12**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-13: Site Reconnaissance at Karst feature K13

Feature ID	**K13**
Feature Type	Enclosed Depression
Coordinates	E:556464, N:748669
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial:

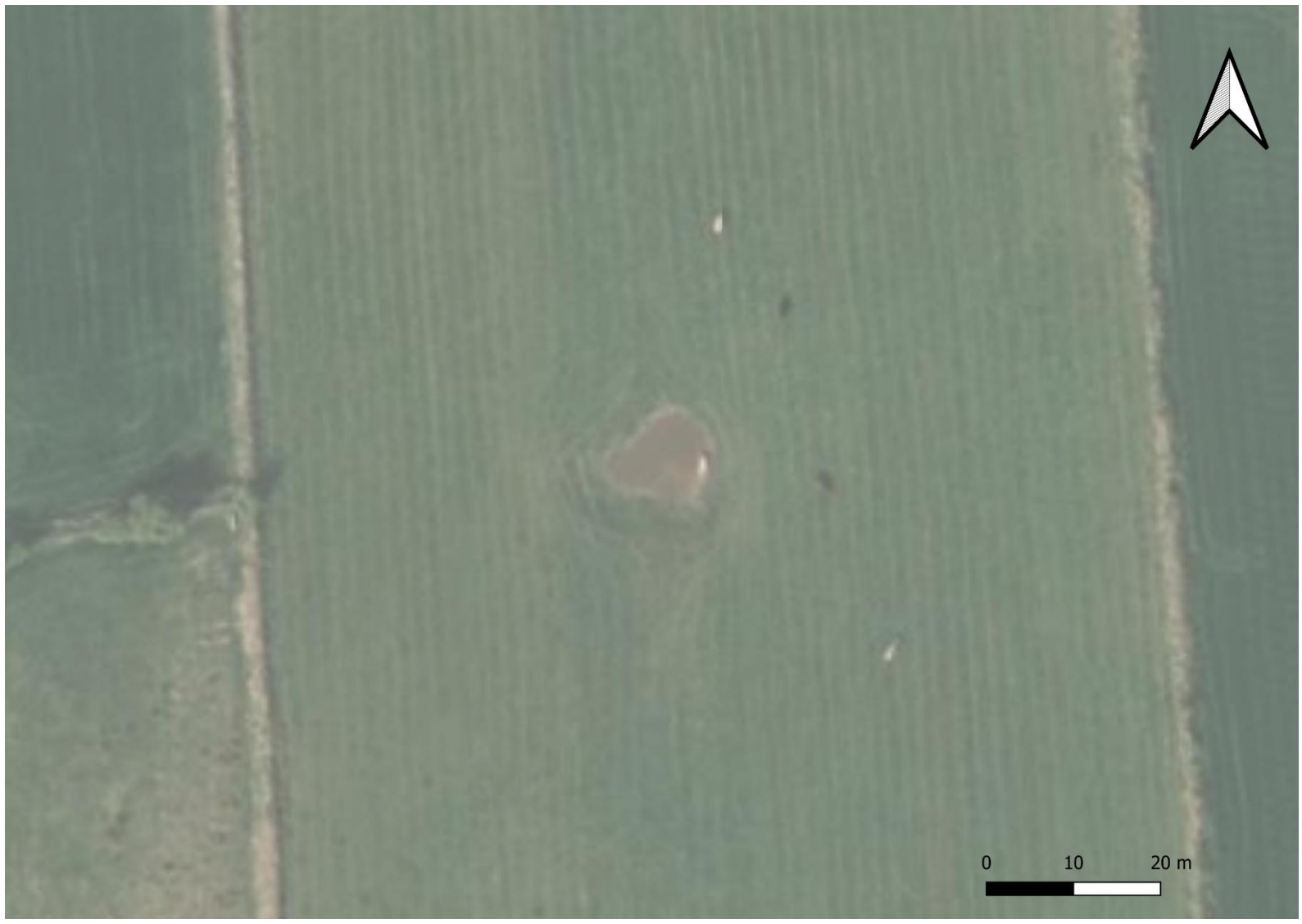
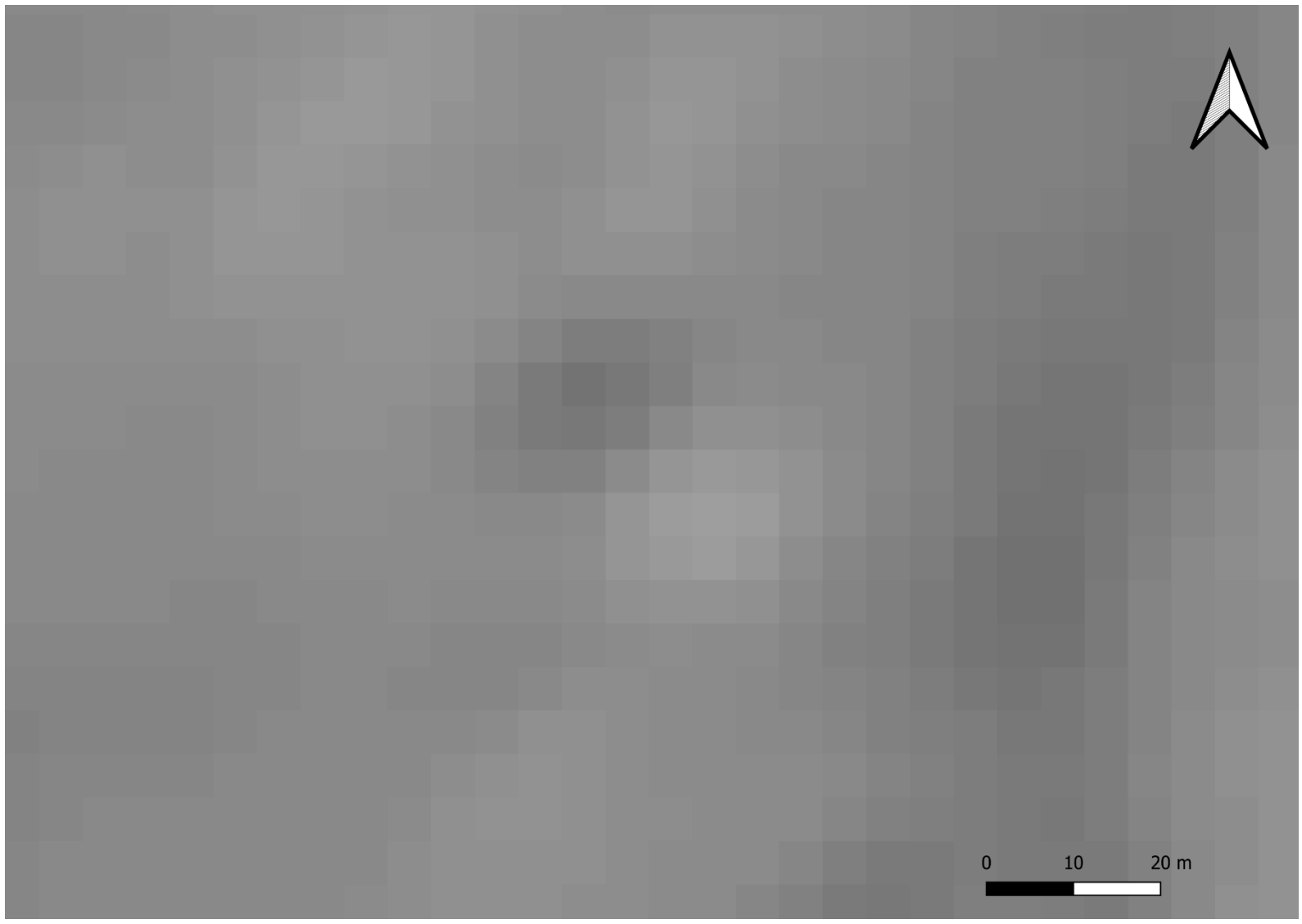
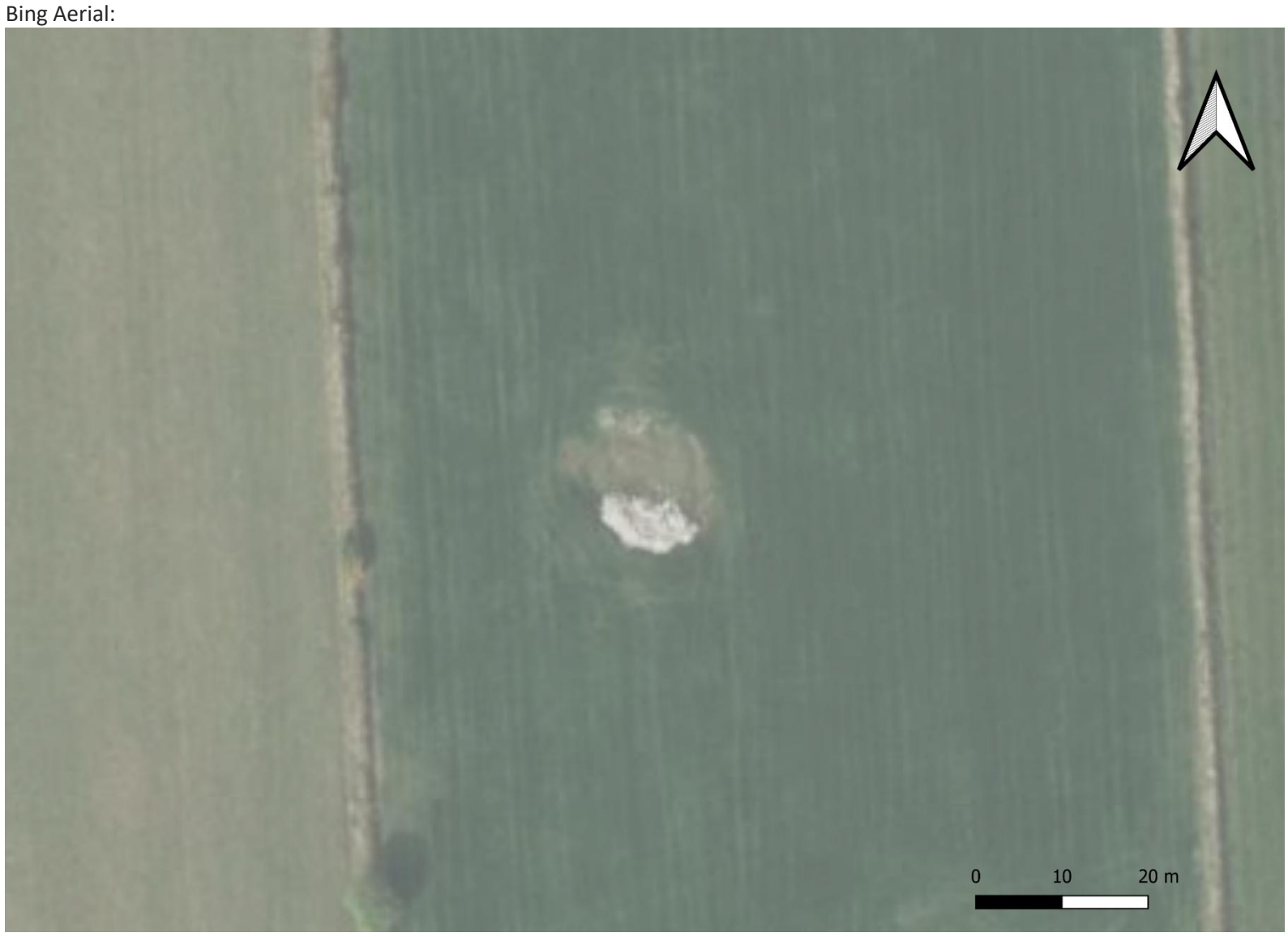
Feature ID	**K13**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Yes
Additional Information	N/A
Site Photos	N/A

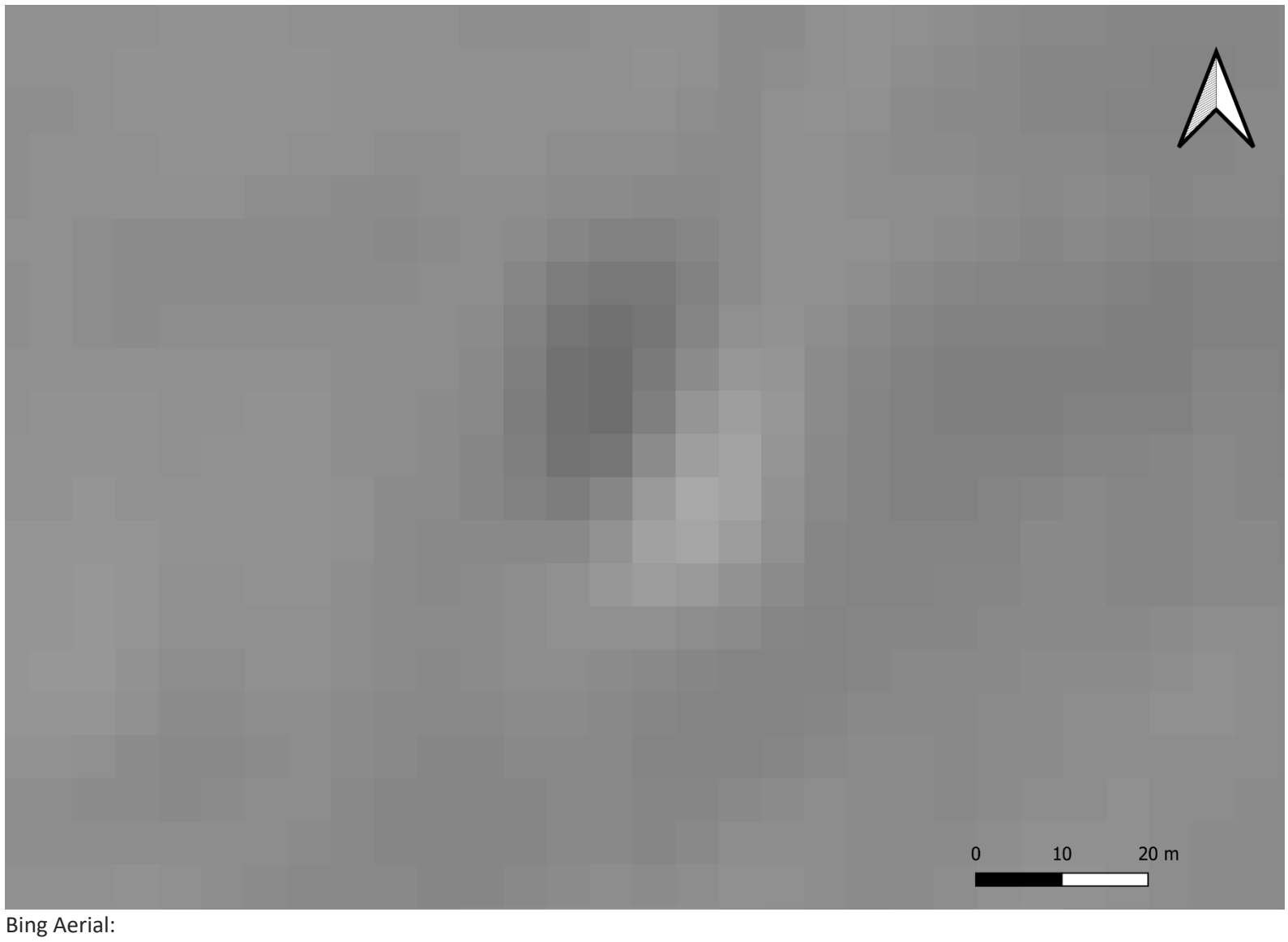
Table G-14: Site Reconnaissance at Karst feature K14

Feature ID	**K14**
Feature Type	Enclosed Depression
Coordinates	E:556351, N:748726
Source	Aerial Imagery
Imagery	DTM:

Feature ID	K14
	 Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible

Feature ID	**K14**
Additional Information	N/A
Site Photos	N/A

Table G-15: Site Reconnaissance at Karst feature K15

Feature ID	**K15**
Feature Type	Enclosed Depression
Coordinates	E:555927, N:748440
Source	Aerial Imagery
Imagery	DTM:  Bing Aerial:

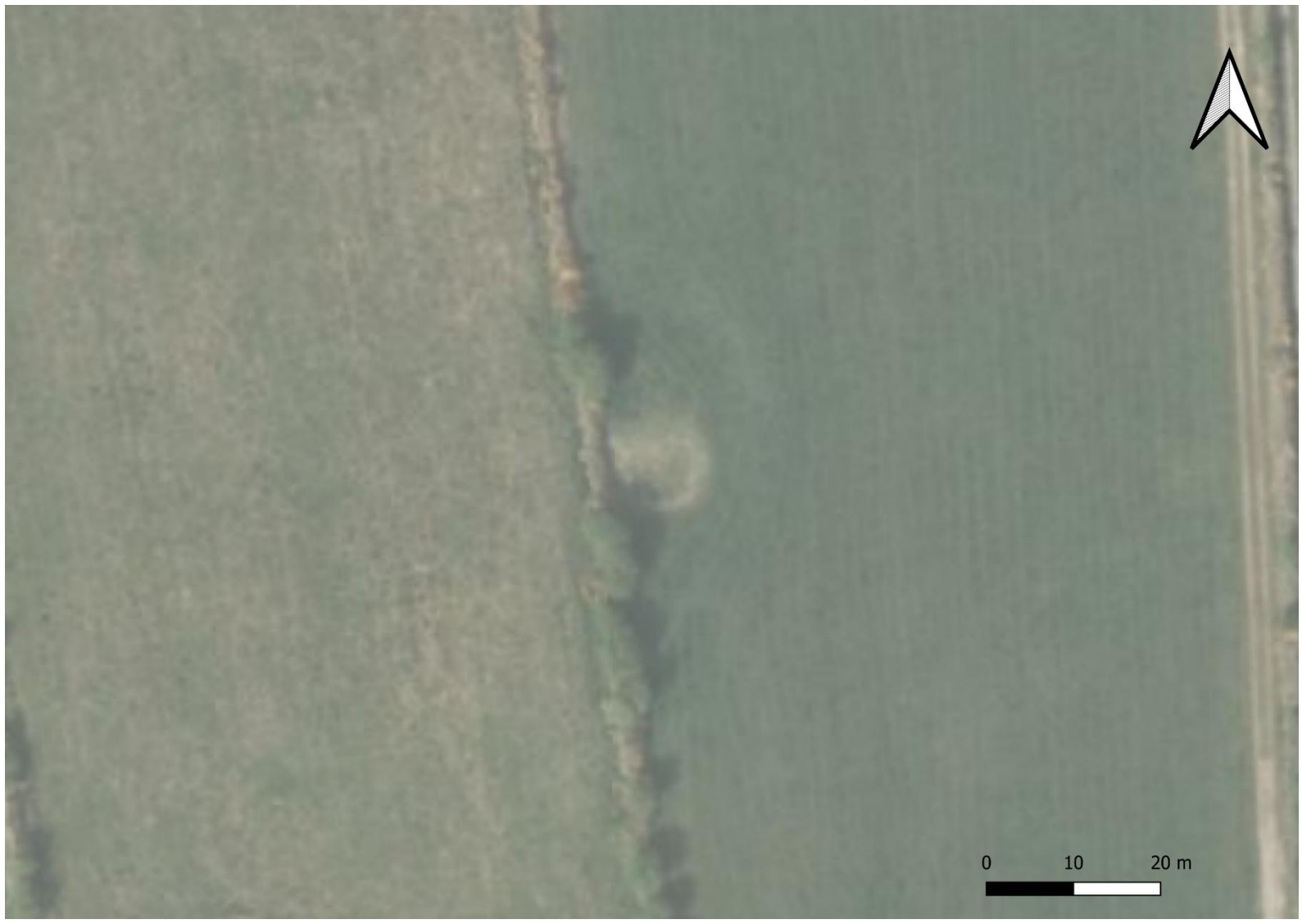
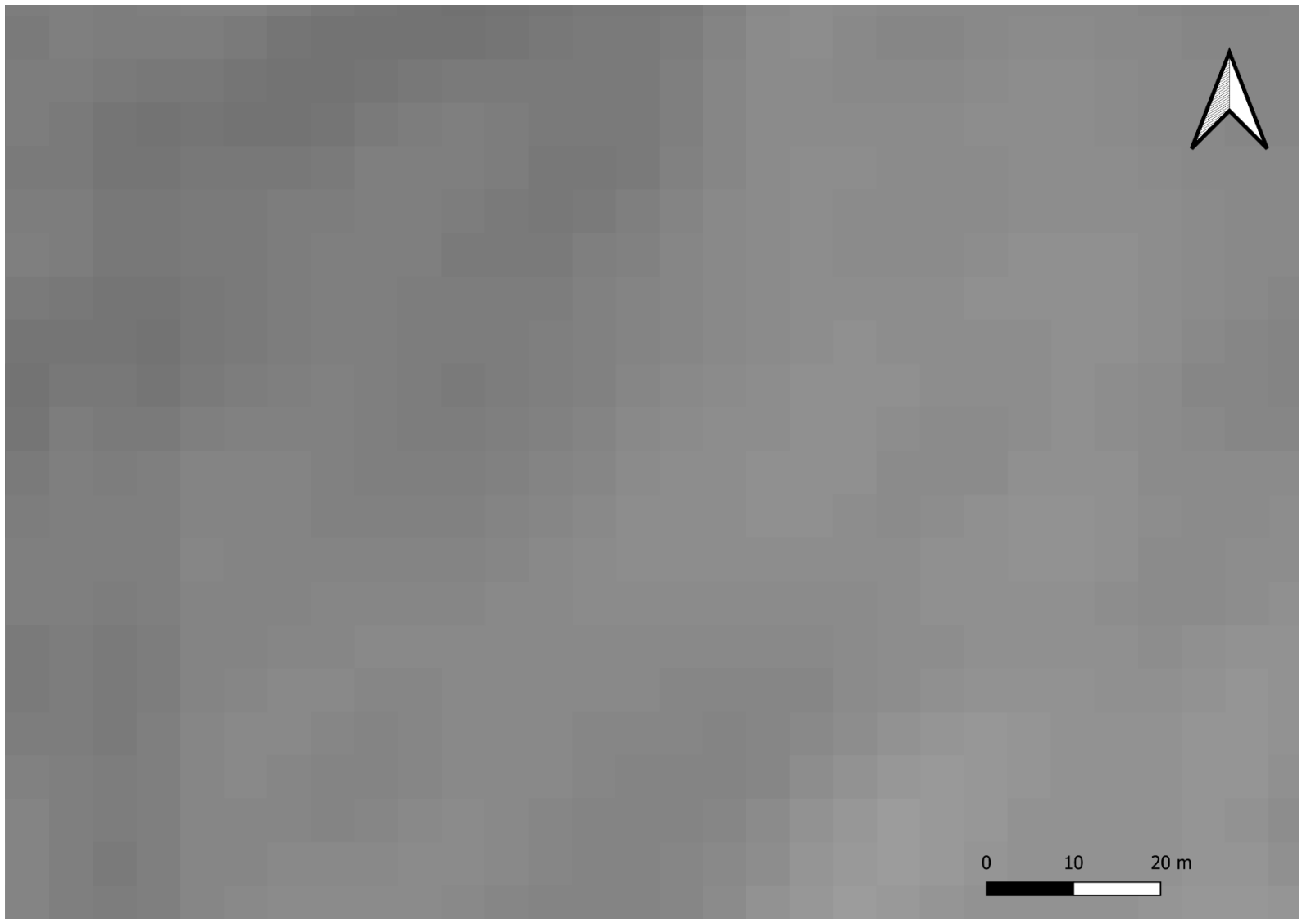
Feature ID	**K15**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-16: Site Reconnaissance at Karst feature K16

Feature ID	**K16**
Feature Type	Enclosed Depression
Coordinates	E:556060, N:748231
Source	GSI
Imagery	DTM:

Feature ID	K16
	 Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Yes

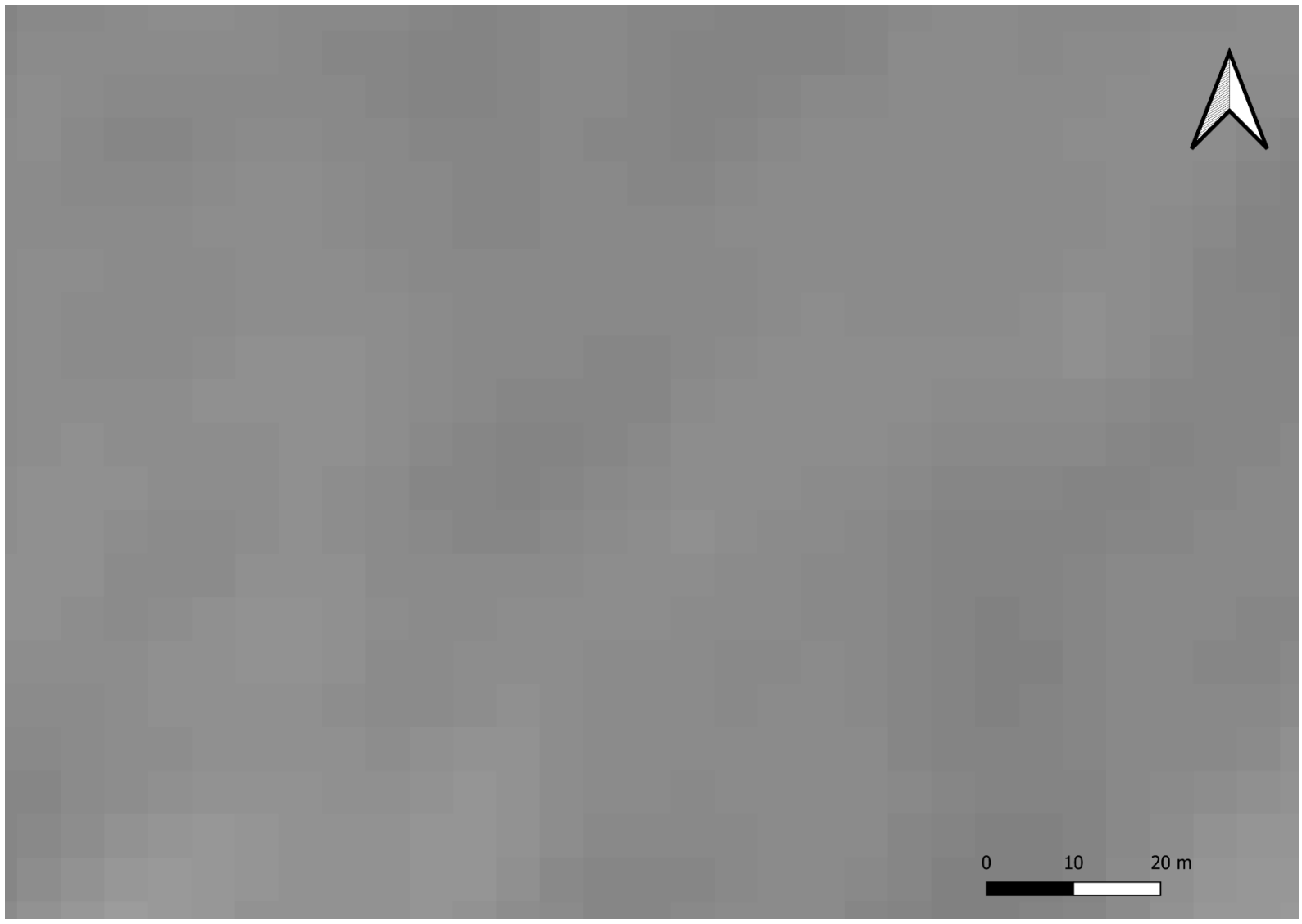
Feature ID	K16
Additional Information	Described by GSI as an enclosed depression, however, this feature appears to hold significant amounts of water, and is recorded in the GSI historic groundwater flooding database. It is therefore considered as a possible turlough.
Site Photos	N/A

Table G-17: Site Reconnaissance at Karst feature K17

Feature ID	K17
Feature Type	Enclosed Depression
Coordinates	E:556311, N:748174
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

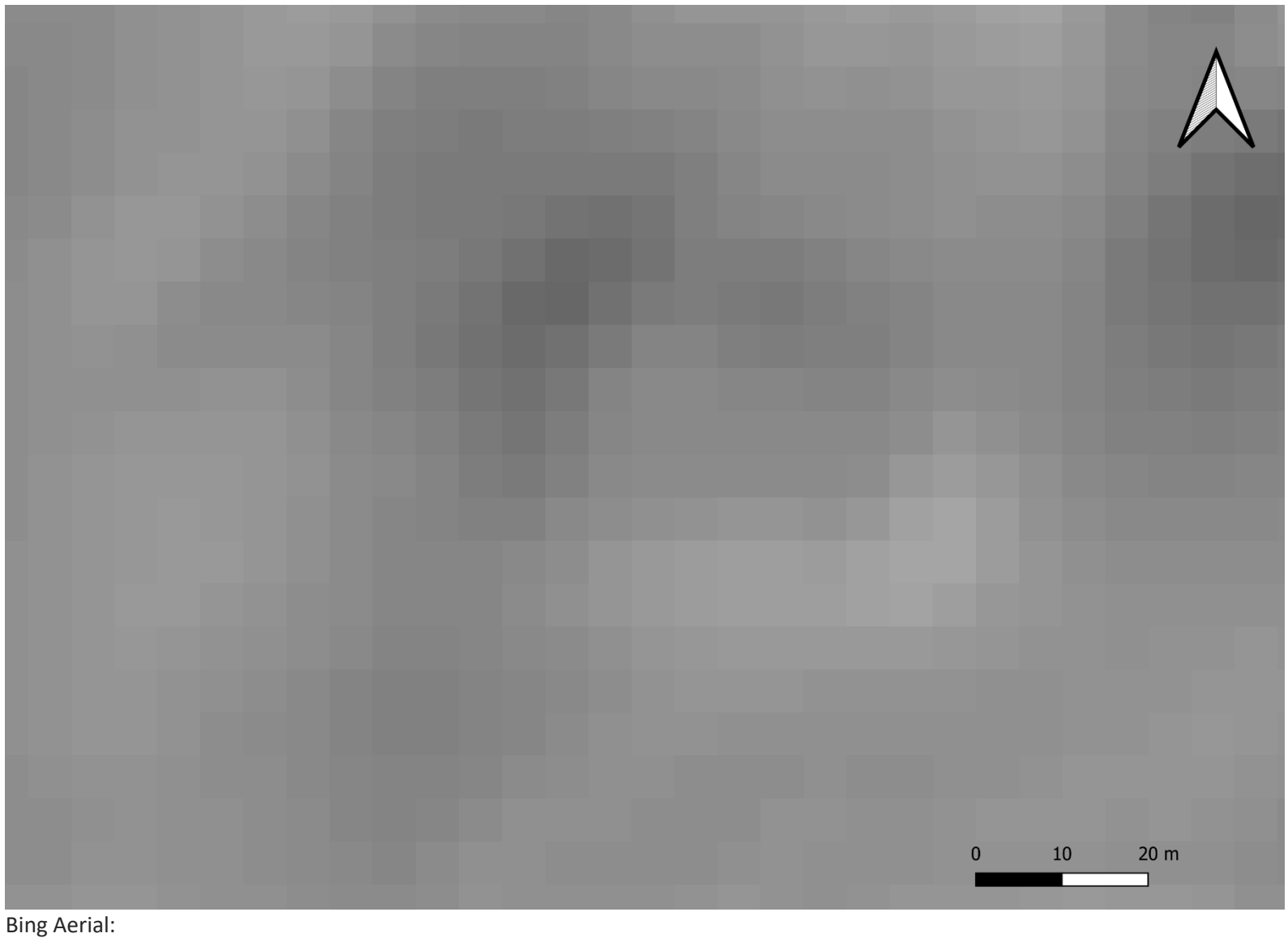
Table G-18: Site Reconnaissance at Karst feature K18

Feature ID	K18
Feature Type	Enclosed Depression
Coordinates	E:556149, N:748243
Source	GSI
Imagery	DTM:

Feature ID	K18
	 Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible

Feature ID	K18
Additional Information	N/A
Site Photos	N/A

Table G-19: Site Reconnaissance at Karst feature K19

Feature ID	K19
Feature Type	Enclosed Depression
Coordinates	E:555953, N:748052
Source	Aerial Imagery
Imagery	DTM:  Bing Aerial:

Feature ID	**K19**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Yes
Additional Information	N/A
Site Photos	N/A

Table G-20: Site Reconnaissance at Karst feature K20

Feature ID	**K20**
Feature Type	Enclosed Depression
Coordinates	E:556176, N:748091
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial:

Feature ID	**K20**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-21: Site Reconnaissance at Karst feature K21

Feature ID	**K21**
Feature Type	Enclosed Depression
Coordinates	E:556118, N:748053
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial:

Feature ID	**K21**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Yes
Additional Information	Described by GSI as an enclosed depression, however, this feature appears to hold significant amounts of water, and is recorded in the GSI historic groundwater flooding database. It is therefore considered as a possible turlough.
Site Photos	N/A

Table G-22: Site Reconnaissance at Karst feature K22

Feature ID	**K22**
Feature Type	Enclosed Depression
Coordinates	E:556616, N:748004
Source	GSI
Imagery	DTM: N/A Bing Aerial:

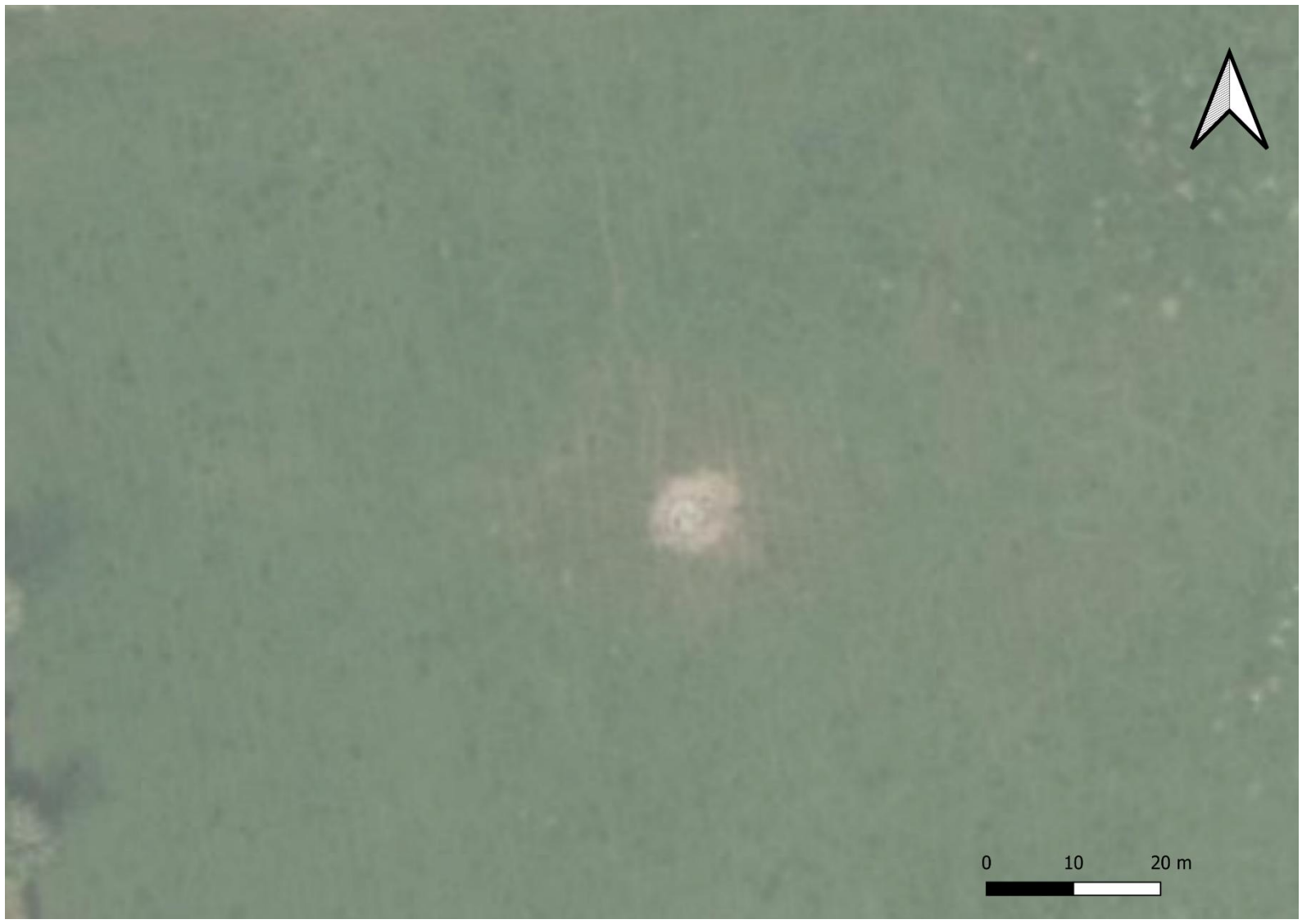
Feature ID	**K22**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-23: Site Reconnaissance at Karst feature K23

Feature ID	**K23**
Feature Type	Enclosed Depression
Coordinates	E:556713, N:747813
Source	GSI
Imagery	DTM: N/A Bing Aerial:

Feature ID	K23
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-24: Site Reconnaissance at Karst feature K24

Feature ID	K24
Feature Type	Enclosed Depression
Coordinates	E:556685, N:748029
Source	GSI
Imagery	DTM: N/A Bing Aerial:

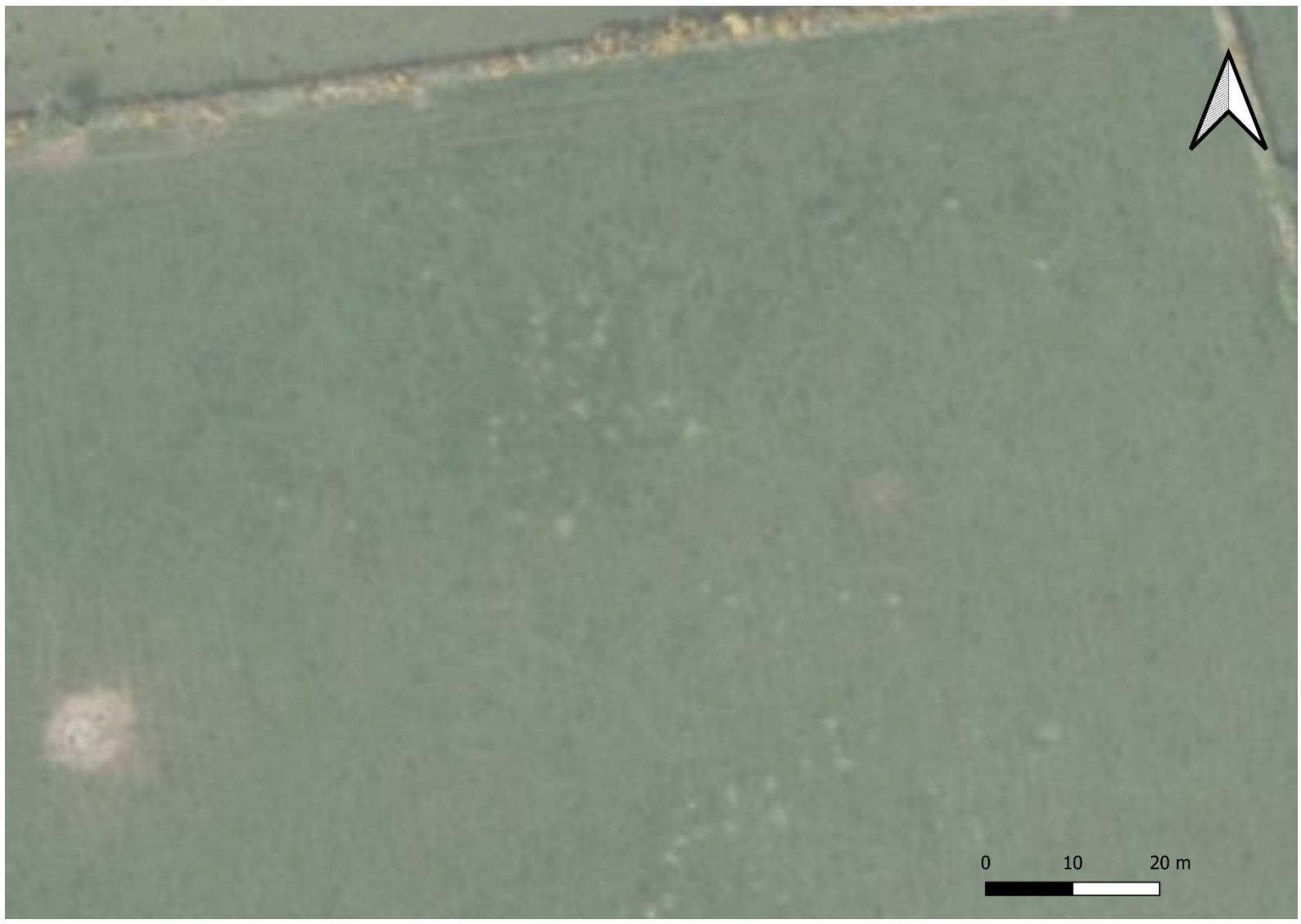
Feature ID	**K24**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-25: Site Reconnaissance at Karst feature K25

Feature ID	**K25**
Feature Type	Enclosed Depression
Coordinates	E:555999, N:747895
Source	GSI
Imagery	DTM: N/A Bing Aerial:

Feature ID	**K25**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

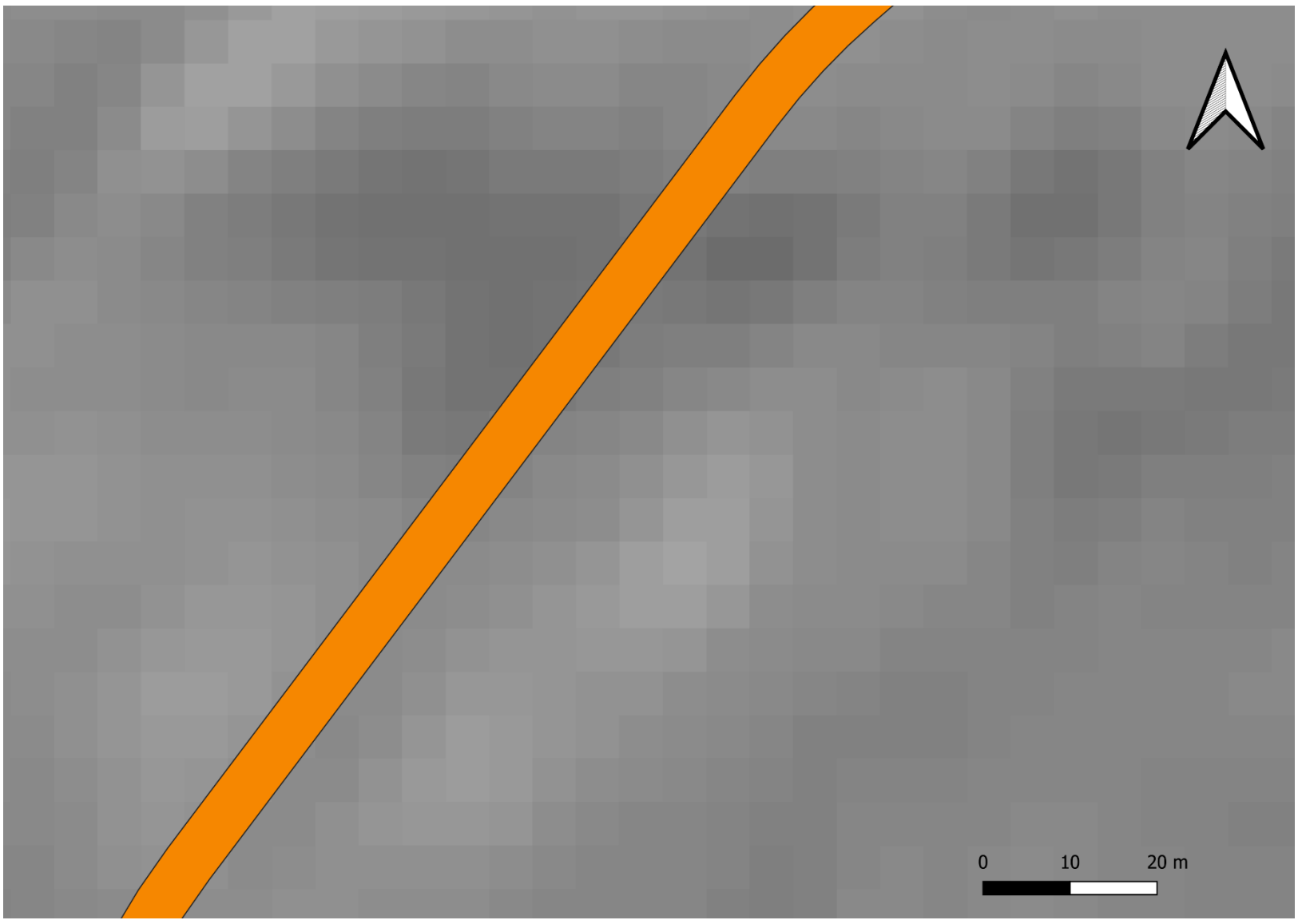
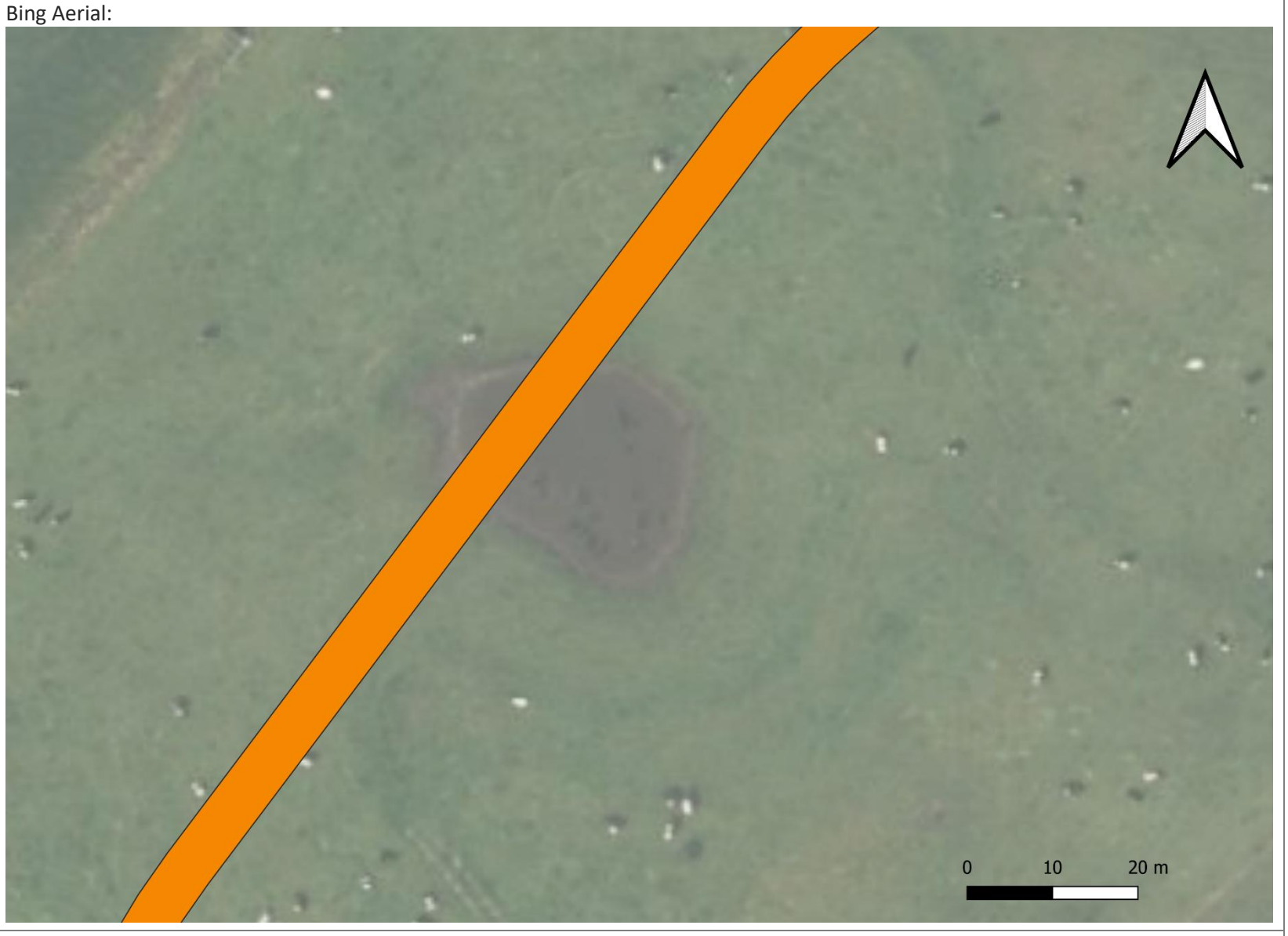
Table G-26: Site Reconnaissance at Karst feature K26

Feature ID	**K26**
Feature Type	Enclosed Depression
Coordinates	E:556260, N:747849
Source	GSI
Imagery	DTM: N/A Bing Aerial:

Feature ID	**K26**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

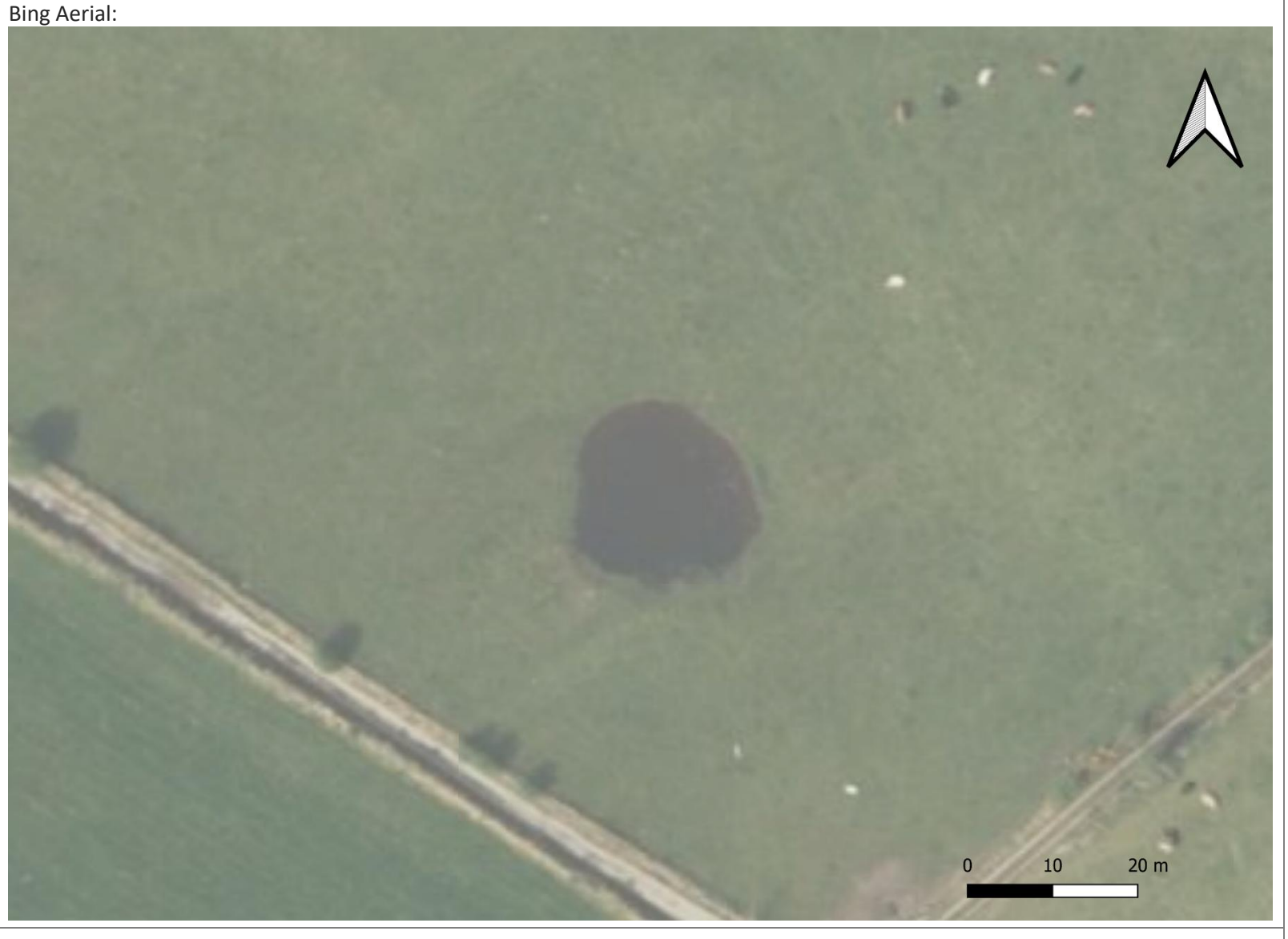
Table G-27: Site Reconnaissance at Karst feature K27

Feature ID	**K27**
Feature Type	Enclosed Depression
Coordinates	E:555419, N:747792
Source	Aerial Imagery/Site Observation
Source	DTM:

Feature ID	K27
	 Bing Aerial: 
Site Reconnaissance Date	28/08/2024 and 20/02/2025
Site Reconnaissance Outcome	Confirmed

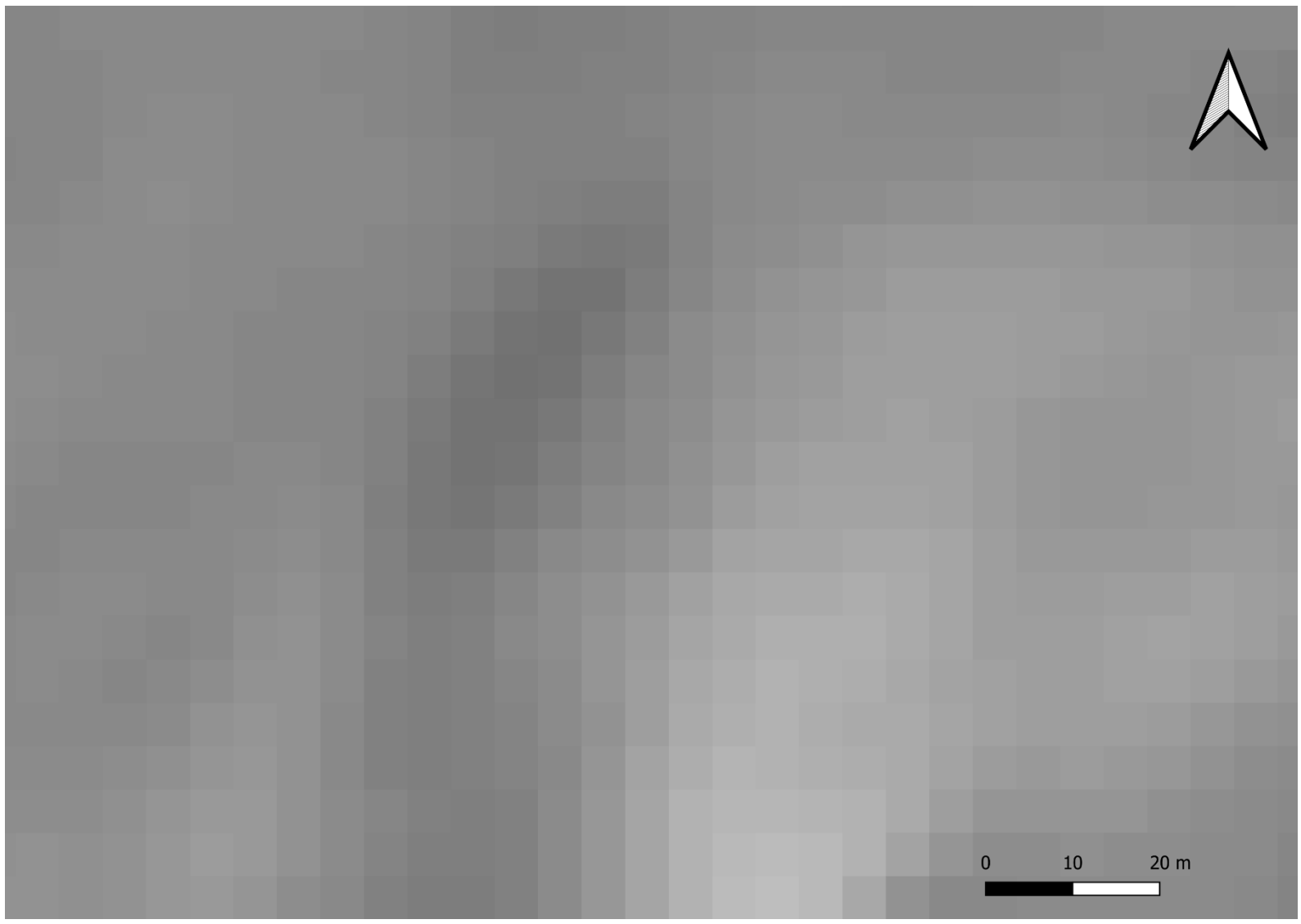
Feature ID	**K27**
Water Presence	Yes
Additional Information	Waterlogged shallow depression, approximately 30m in diameter.
Site Photos	

Table G-28: Site Reconnaissance at Karst feature K28

Feature ID	**K28**
Feature Type	Enclosed Depression
Coordinates	E:555294, N:747166
Source	Aerial Imagery/Site Observation
Imagery	DTM: N/A Bing Aerial: 
Site Reconnaissance Date	N/A

Feature ID	K28
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

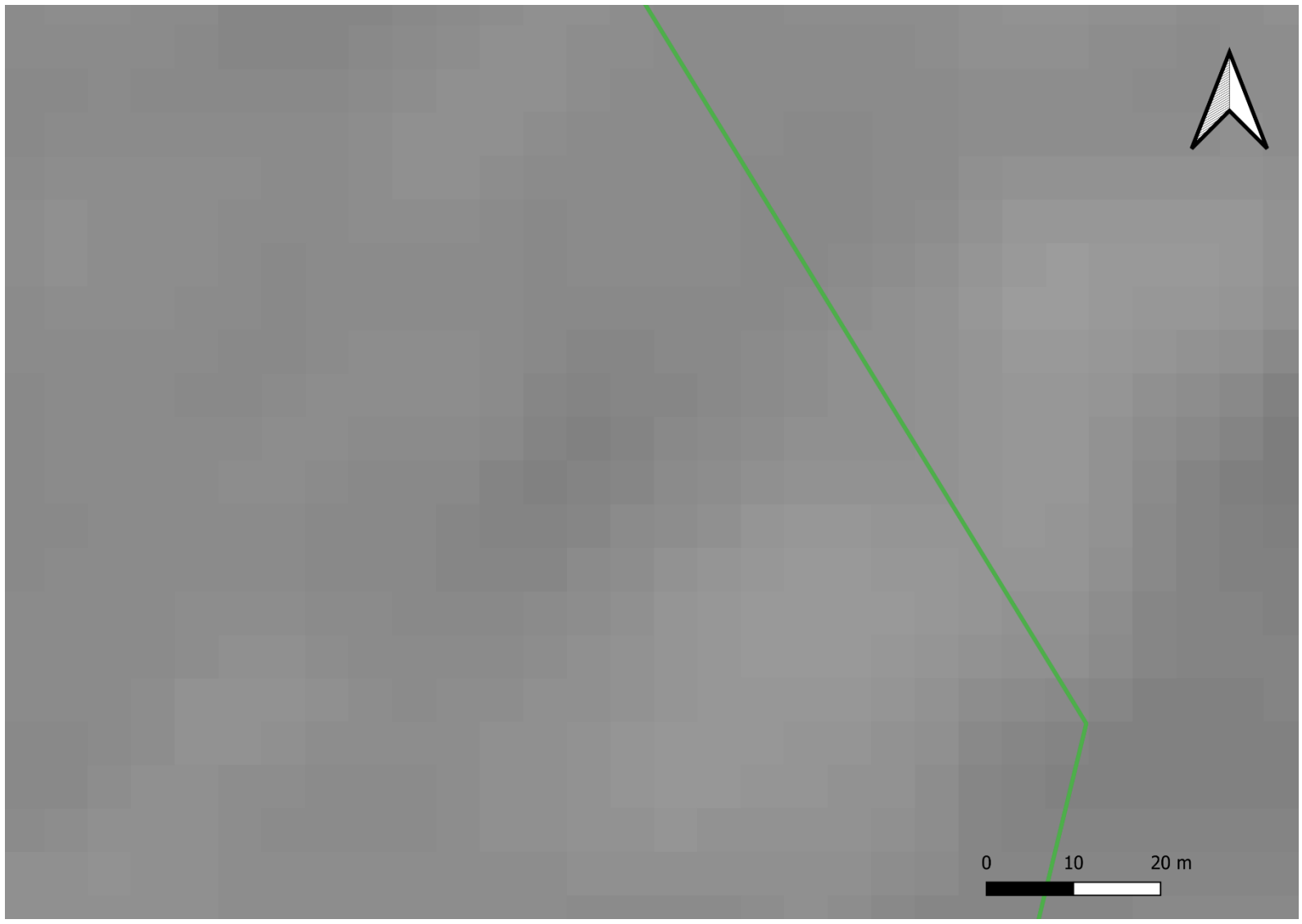
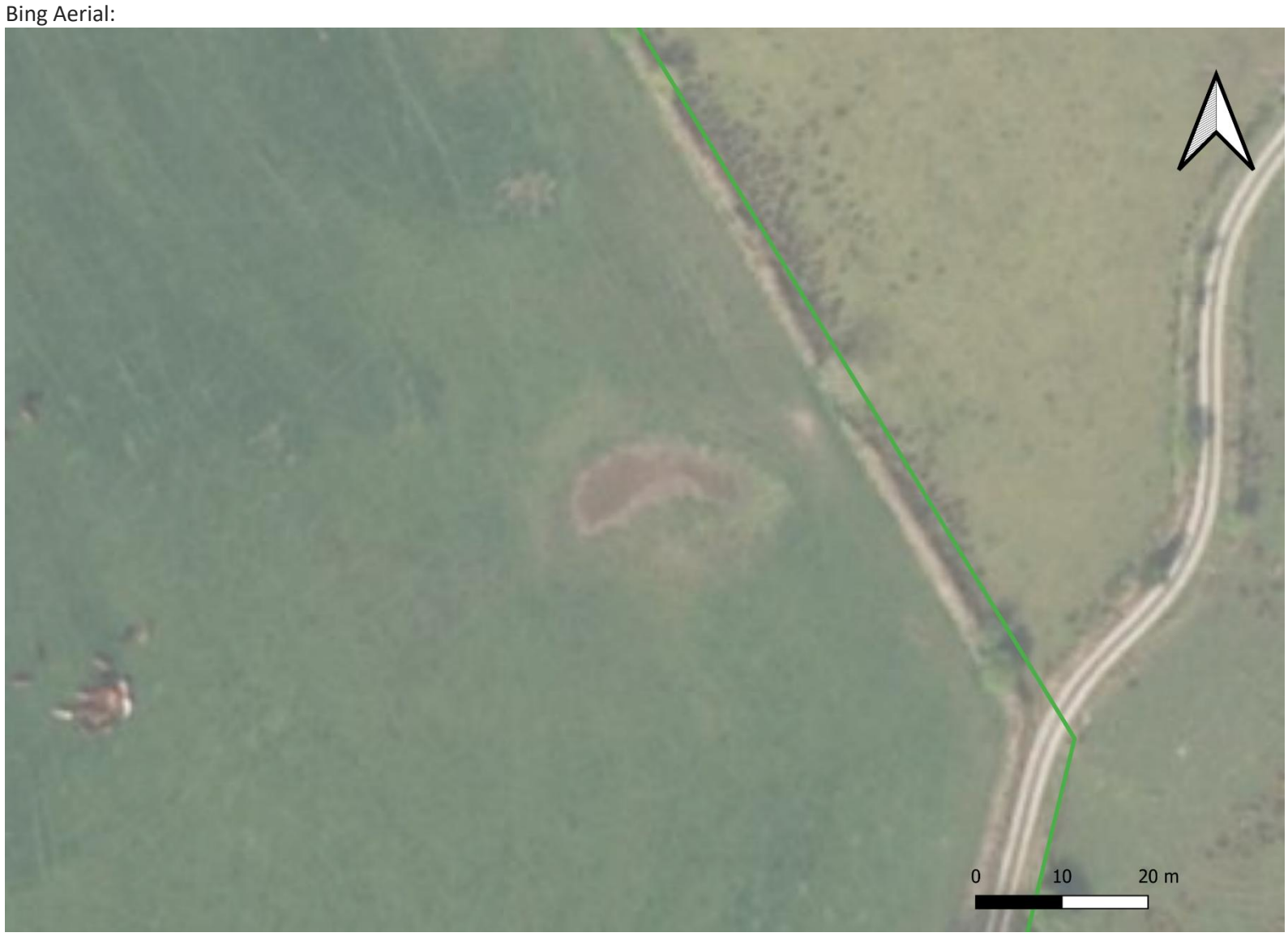
Table G-29: Site Reconnaissance at Karst feature K29

Feature ID	K29
Feature Type	Enclosed Depression
Coordinates	E:557334, N:748690
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial:

Feature ID	**K29**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

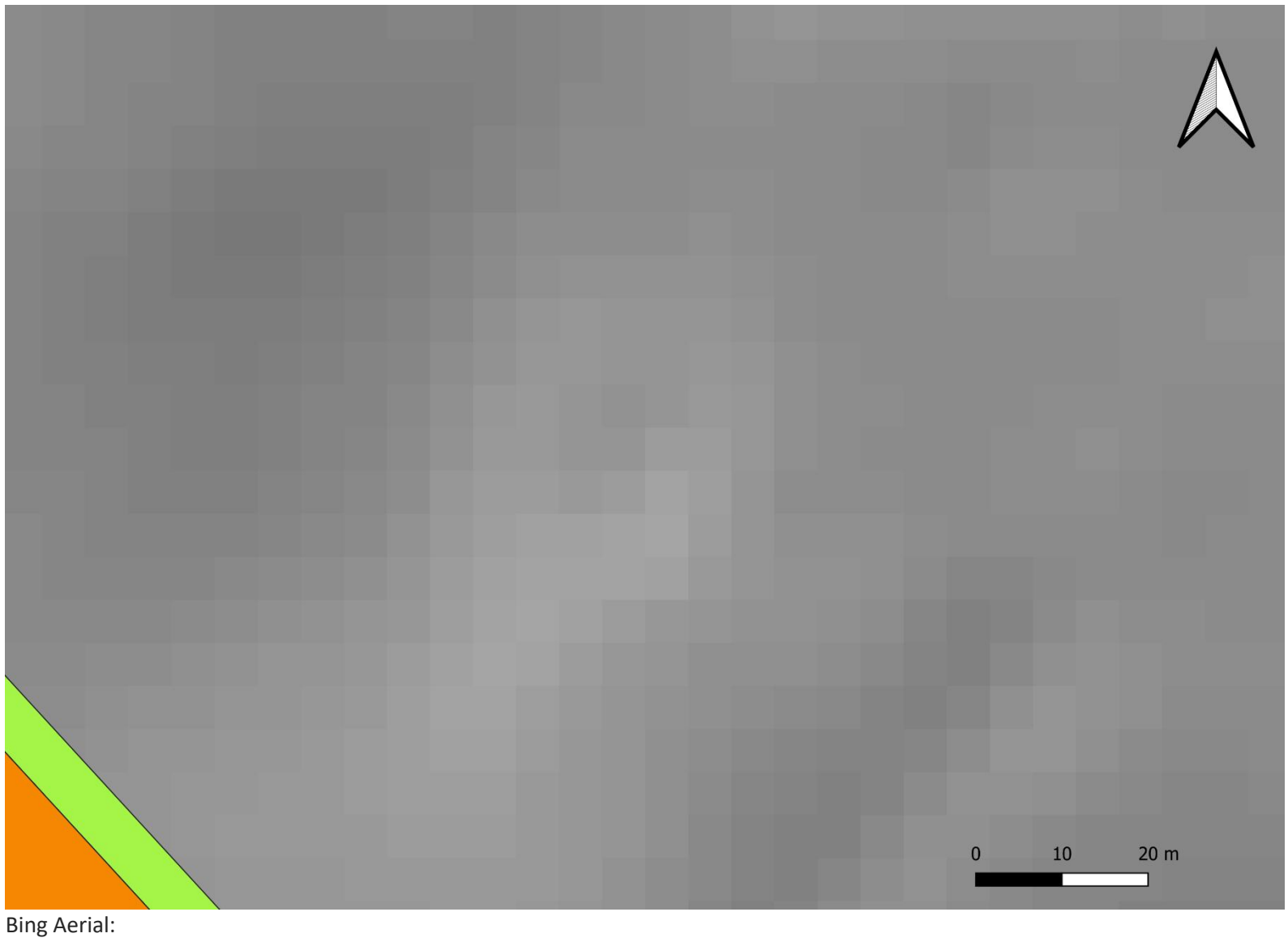
Table G-30: Site Reconnaissance at Karst feature K30

Feature ID	**K30**
Feature Type	Enclosed Depression
Coordinates	E:557316, N:749477
Source	Aerial Imagery
Imagery	DTM:

Feature ID	K30
	 Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible

Feature ID	**K30**
Additional Information	N/A
Site Photos	N/A

Table G-31: Site Reconnaissance at Karst feature K31

Feature ID	**K31**
Feature Type	Enclosed Depression
Coordinates	E:556766, N:749504
Source	Aerial Imagery/Site Observation
Imagery	DTM:  Bing Aerial:

Feature ID	**K31**
	
Site Reconnaissance Date	27/08/2025
Site Reconnaissance Outcome	Not confirmed – access issues due to livestock.
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-32: Site Reconnaissance at Karst feature K32

Feature ID	**K32**
Feature Type	Enclosed Depression
Coordinates	E:556527, N:748134
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial:

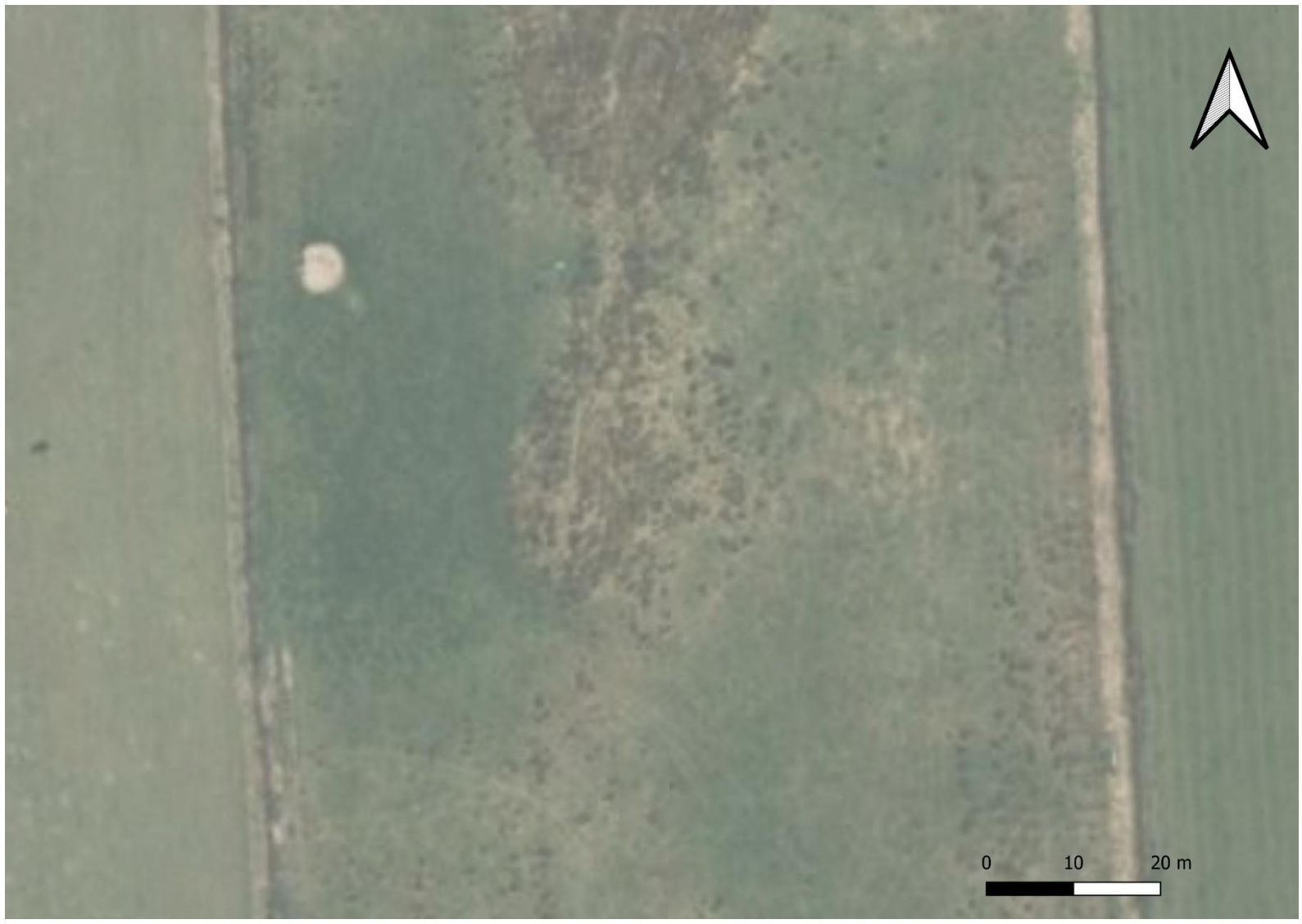
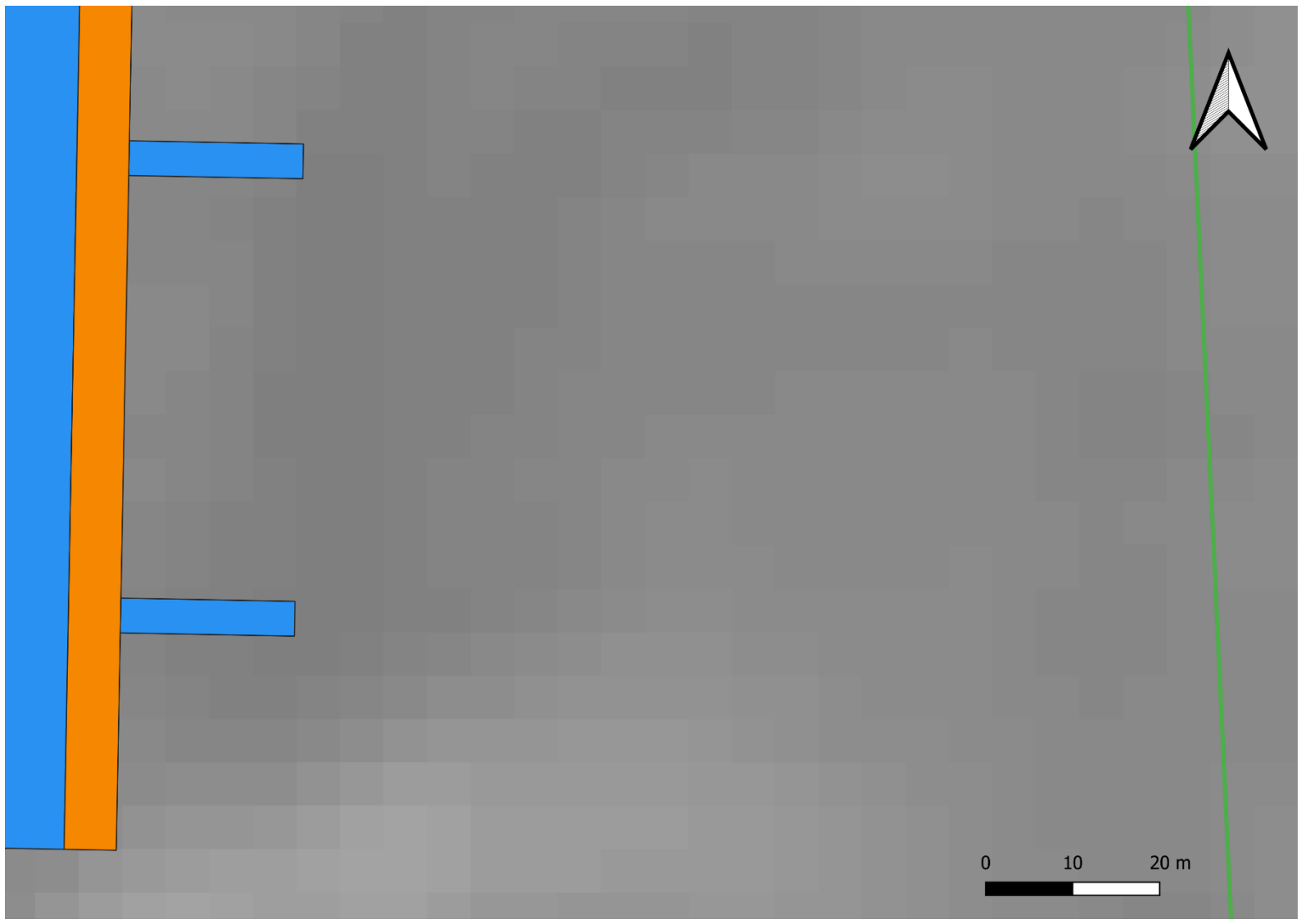
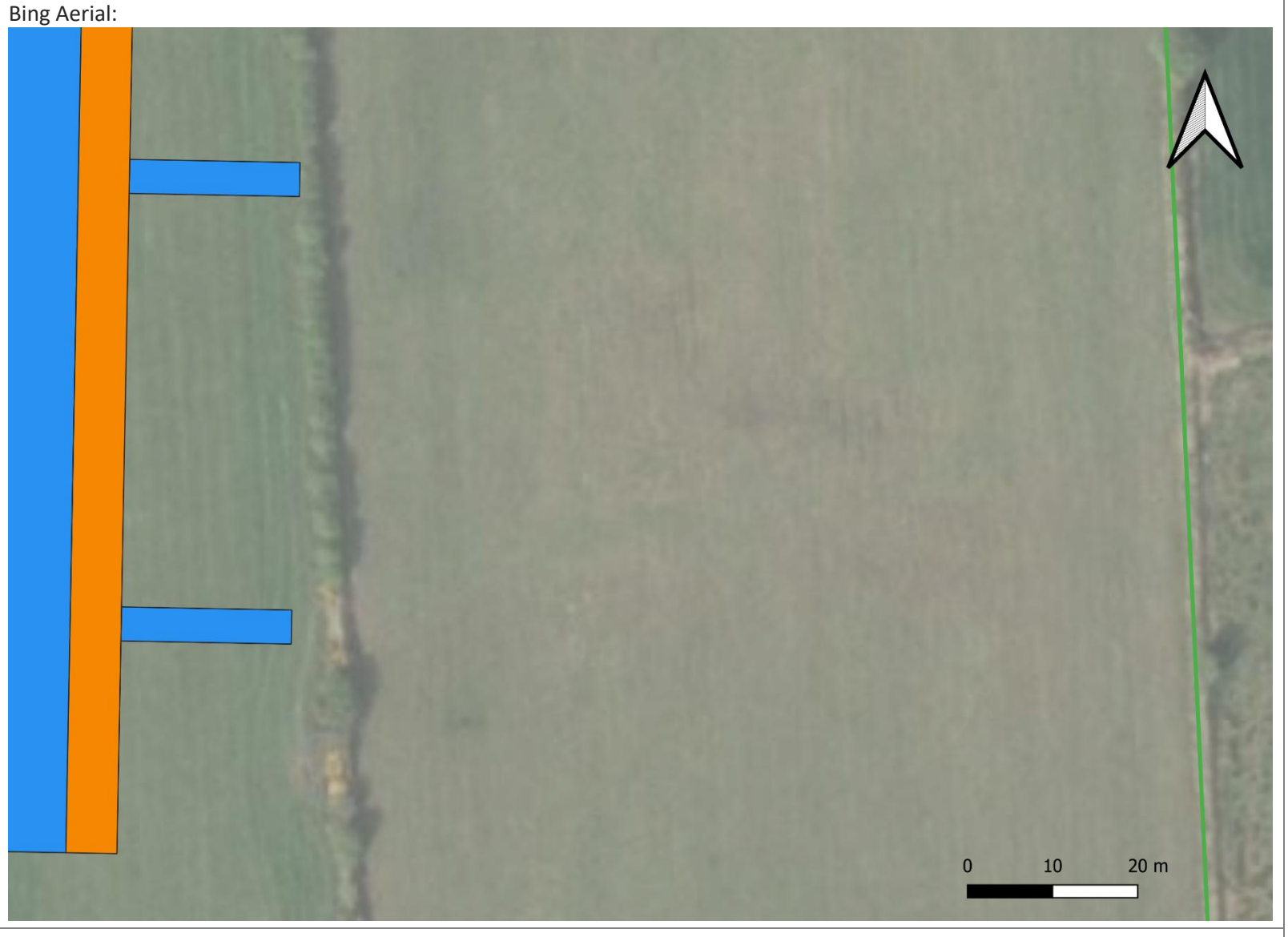
Feature ID	**K32**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-33: Site Reconnaissance at Karst feature K33

Feature ID	**K33**
Feature Type	Enclosed Depression
Coordinates	E:556527, N:748134
Source	Aerial Imagery
Imagery	DTM:

Feature ID	K33
	 Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible

Feature ID	**K33**
Additional Information	N/A
Site Photos	N/A

Table G-34: Site Reconnaissance at Karst feature K34

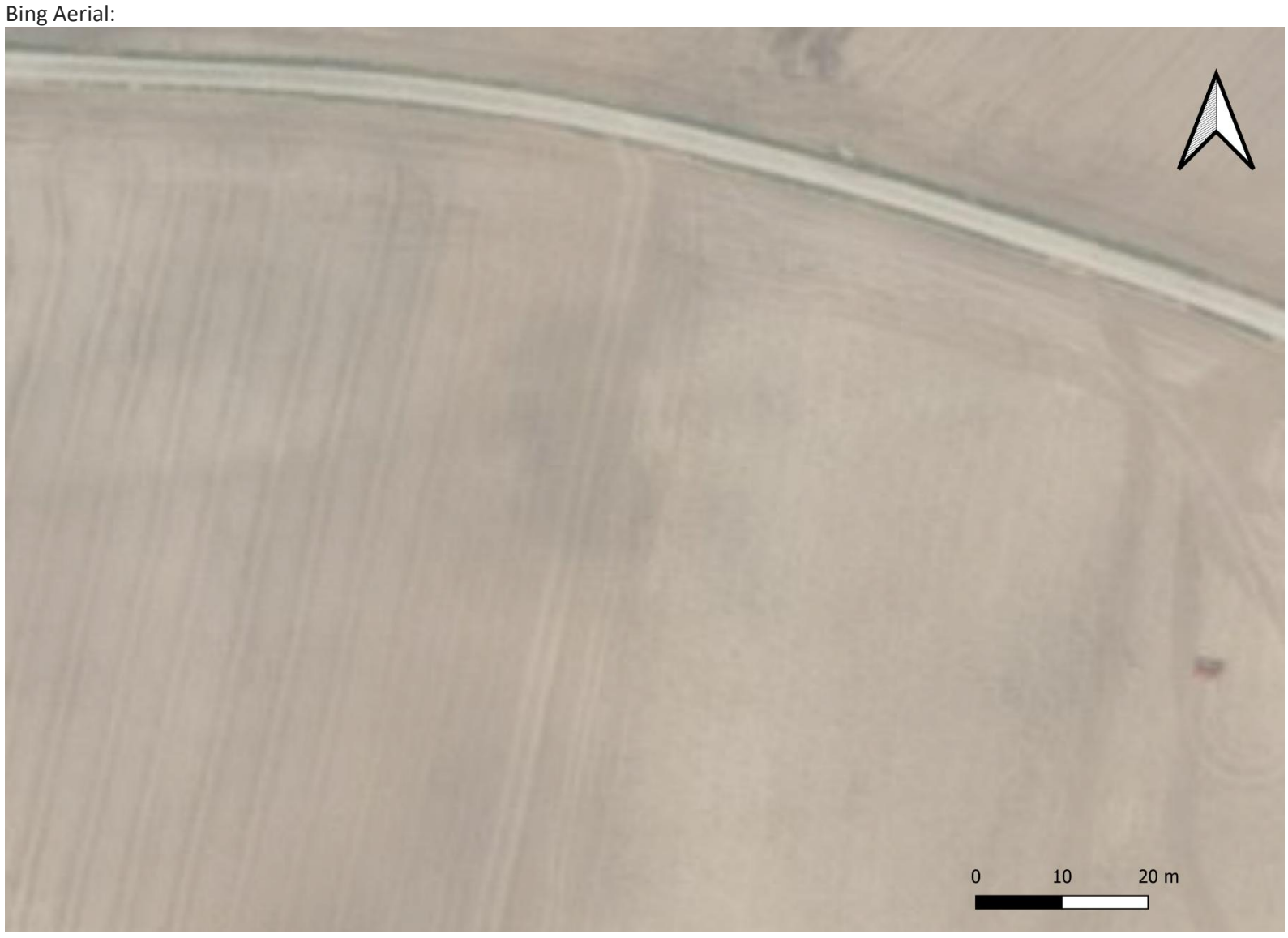
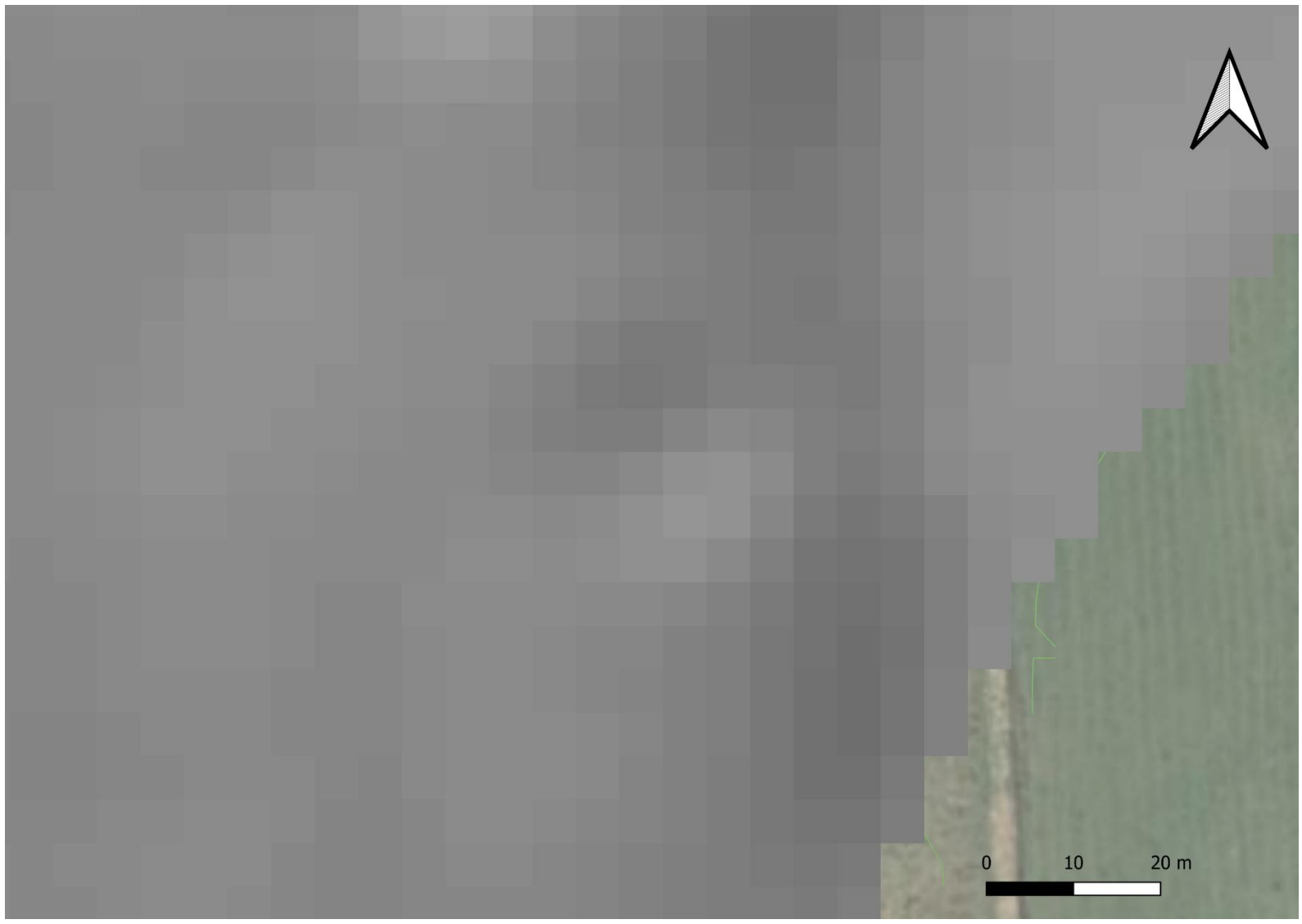
Feature ID	**K34**
Feature Type	Enclosed Depression
Coordinates	E:553797, N:748439
Source	GSI
Imagery	DTM: N/A Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-35: Site Reconnaissance at Karst feature K35

Feature ID	**K35**
Feature Type	Enclosed Depression
Coordinates	E:556380, N:748666
Source	Aerial Imagery
Imagery	DTM:

Feature ID	K35
	 Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible

Feature ID	K35
Additional Information	N/A
Site Photos	N/A

Table G-36: Site Reconnaissance at Karst feature K36

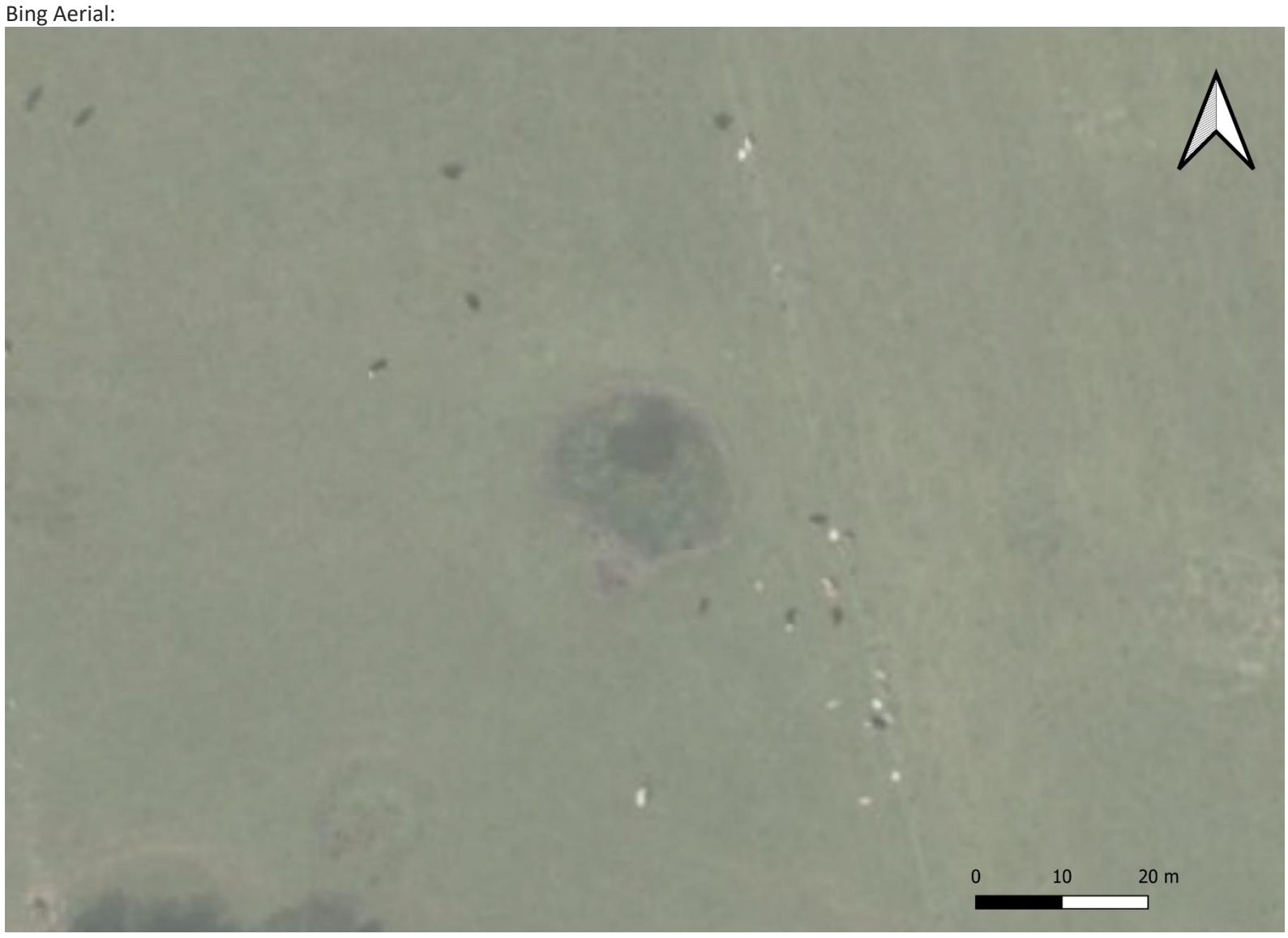
Feature ID	K36
Feature Type	Enclosed Depression
Coordinates	E:556775, N:748329
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-37: Site Reconnaissance at Karst feature K37

Feature ID	K37
Feature Type	Enclosed Depression
Coordinates	E:556802, N:748480
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial:

Feature ID	**K37**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-38: Site Reconnaissance at Karst feature K38

Feature ID	**K38**
Feature Type	Enclosed Depression
Coordinates	E:556527, N:748134
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial:

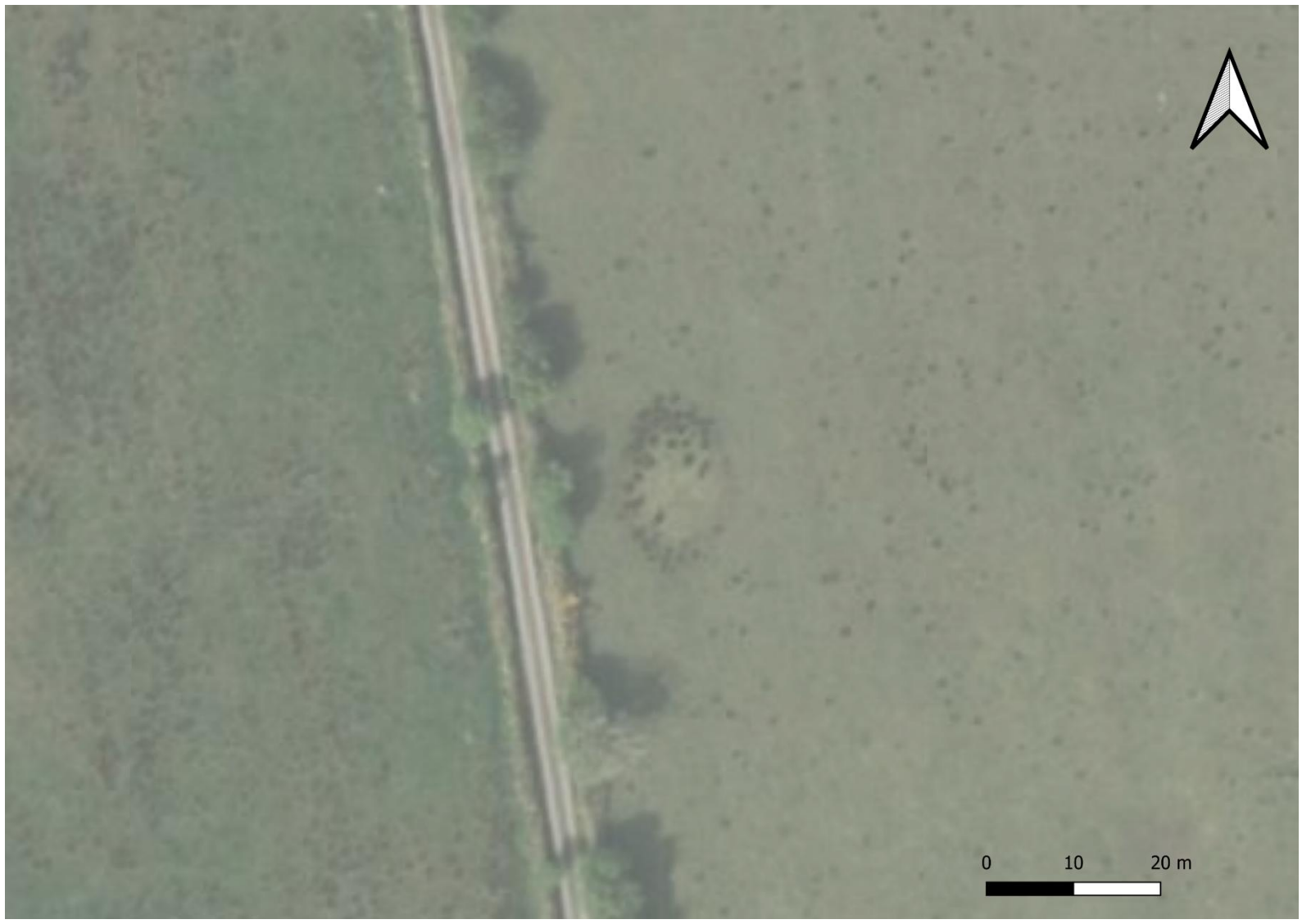
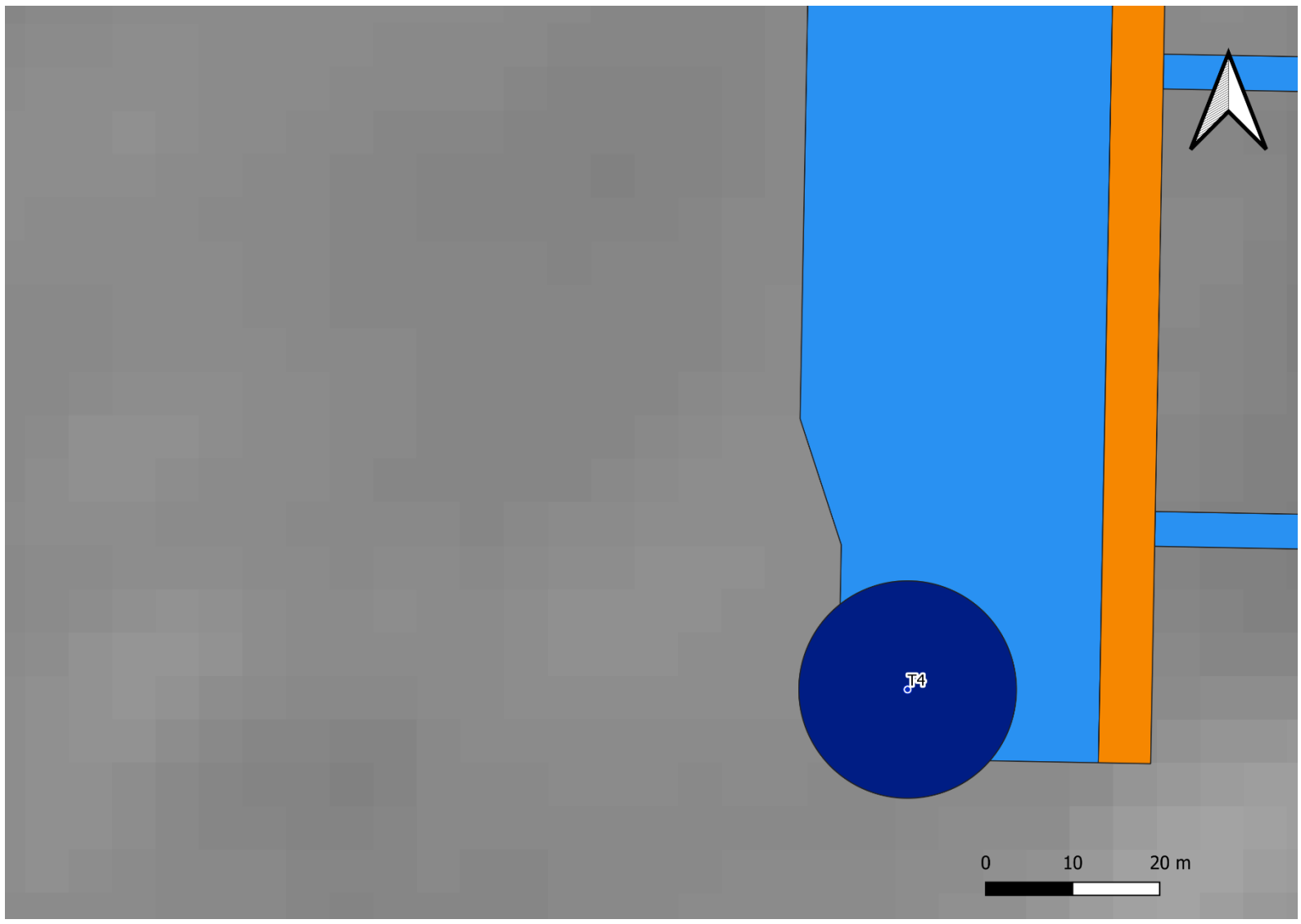
Feature ID	**K38**
	
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

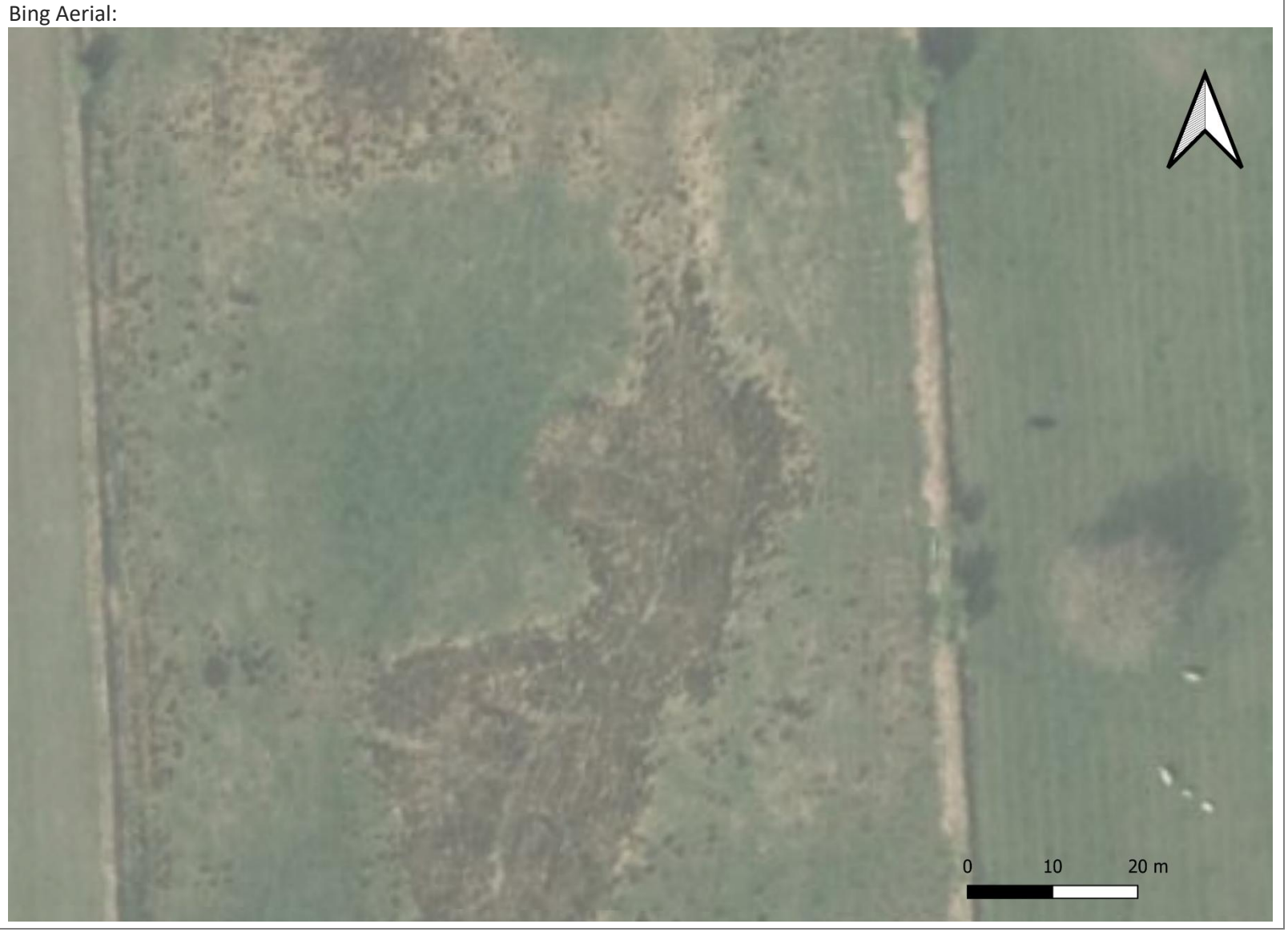
Table G-39: Site Reconnaissance at Karst feature K39

Feature ID	**K39**
Feature Type	Enclosed Depression
Coordinates	E:556527, N:748134
Source	Aerial Imagery
Imagery	DTM:

Feature ID	K39
	 Bing Aerial: 
Site Reconnaissance Date	27/08/2024, 01/11/2024
Site Reconnaissance Outcome	Not confirmed – access hampered by presence of livestock in field.
Water Presence	No

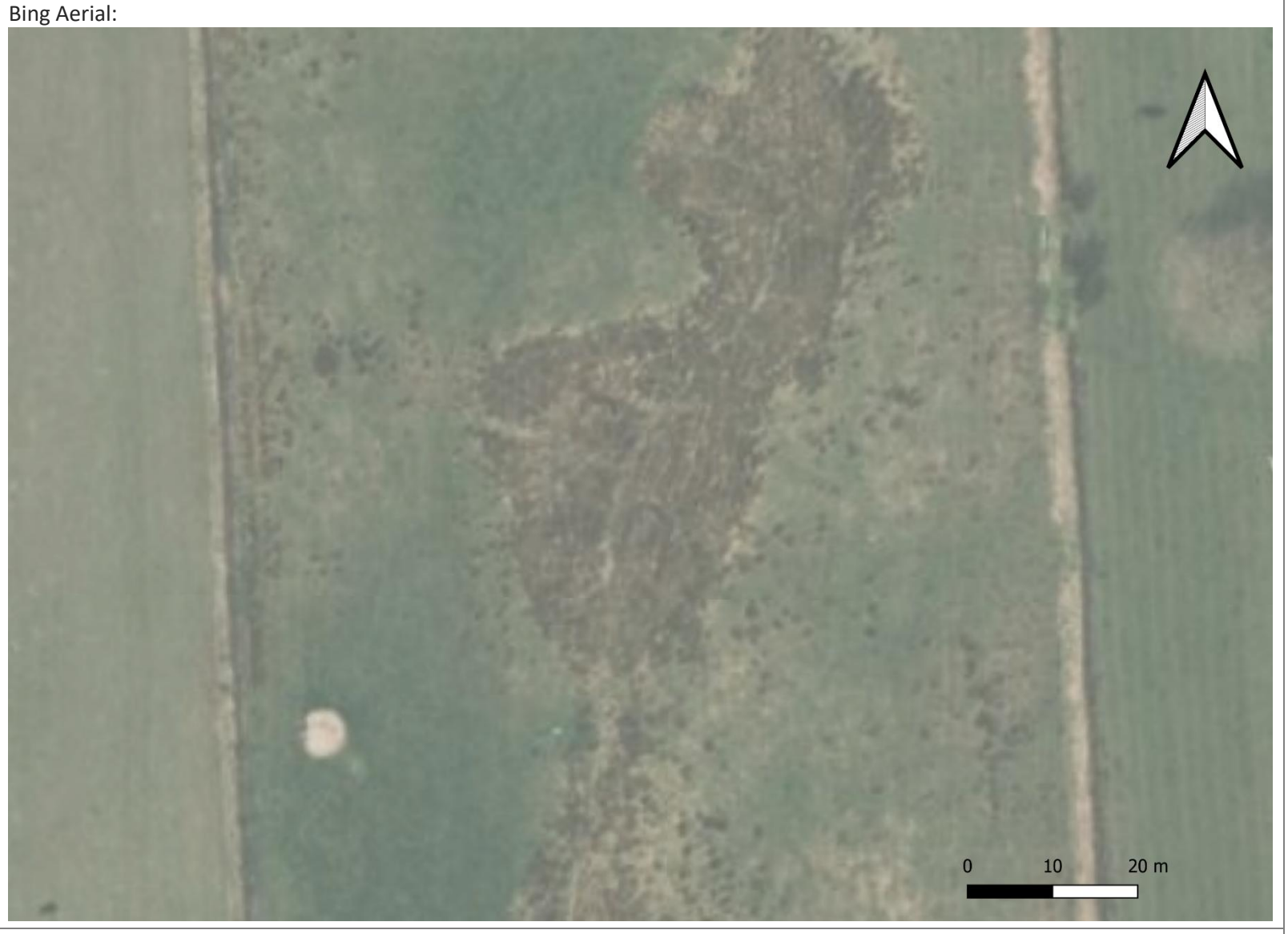
Feature ID	**K39**
Additional Information	Only identified from 2009 Google earth imagery. Possible shallow depression identified from LiDAR.
Site Photos	

Table G-40: Site Reconnaissance at Karst feature K40

Feature ID	**K40**
Feature Type	Enclosed Depression
Coordinates	E:556527, N:748134
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial: 

Feature ID	K40
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

Table G-41: Site Reconnaissance at Karst feature K41

Feature ID	K41
Feature Type	Enclosed Depression
Coordinates	E:556527, N:748134
Source	Aerial Imagery
Imagery	DTM: N/A Bing Aerial: 
Site Reconnaissance Date	N/A
Site Reconnaissance Outcome	N/A
Water Presence	Possible
Additional Information	N/A
Site Photos	N/A

554,000 555,000 556,000 557,000 558,000

751,000 750,000 749,000 748,000 747,000

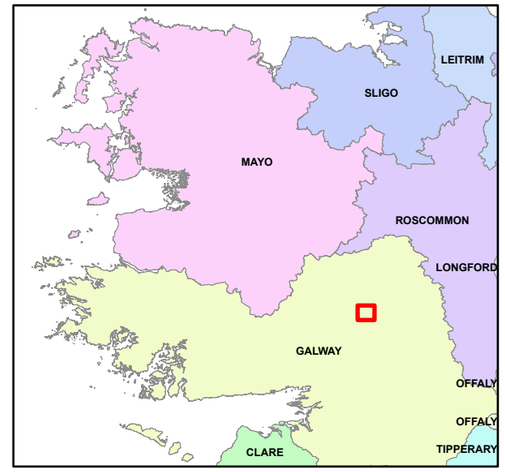
N W E S

T7 T9 T6 T8 T5 T3 T4 T2 T1

K32 K33 K31 K30 K08 K06 K02 K01 K07 K03 K09 K04 K14 K12 K10 K05 K43 K13 K39 K11 K40 K41 K42 K29 K34 K15 K37 K36 K16 K18 K17 K38 K19 K20 K22 K24 K21 K25 K26 K23 K27 K28

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Identified Karst Features

- Enclosed Depression
- Spring/Turlough

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure G-1: Identified Karst Features

File: 22098-GDG-02-KFI-MP-C-40

Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GSI	Checked: AL

G.2 GROUND INVESTIGATION LOCATIONS

554,000 555,000 556,000 557,000 558,000

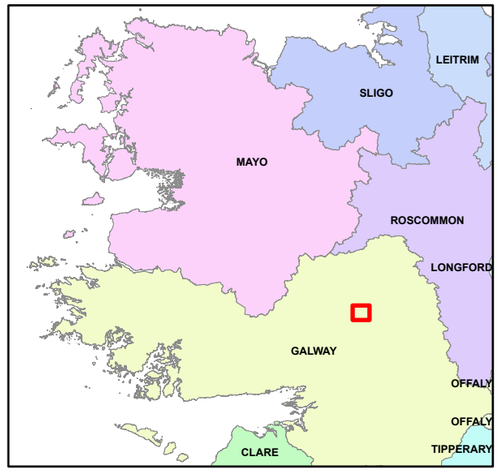
751,000 750,000 749,000 748,000 747,000

N W E S

TPBP3 T7 TPT9 T9 TP07 TPBP2 TPT6 T6 TP08 TP10 T8 TPT8 TPSSa TP06 T5 TP12 TP15 TPBP1 TP11 TPSSB TP01 T3 TPT3 TP02 T4 TPT4 BH2 TP05 TP03 TPT2 T2 TP14 TP13 T1 TP04 BH1 TP09

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- GDG Trial Pit Locations
- Borehole Locations
- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Client: MKO / GDG Gavin & Doherty Geosolutions		
Project: Cooloo Wind Farm		
Figure G-1: Ground Investigation Locations		
File: 22098-GDG-02-GIE-MP-C-15		
Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GDG/ MKO	Checked: AL

G.3 BOREHOLE RECORDS

Petersen Drilling Services Ltd. on behalf of HES — Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description
0.00	Firm brown TOPSOIL
0.30	Soft to firm light brown silty gravelly CLAY
2.10	Stiff greyish brown silty sandy gravelly CLAY with frequent limestone fracments possible highly weathered rock
4.90	Weak weathered dark grey LIMESTONE mudstone layers
7.00	Strong dark grey LIMESTONE

Sample / Hole / Test Details

No	Type	Insitu test	From (m)	To (m)	Liner Dia (mm)
	RO		0.00	20.00	

Drilling Details

Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour
0000		100	grey

Standard Penetration Test

Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
										0.00	0.00

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
1215			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1735			

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer
C	140.00	0.00	8.00					Sim. Casing			
RO	154.00	0.00	8.00				DTH Button Bit		115	Air	No
RO	120.00	8.00	20.00				DTH Button Bit			Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1210	2.30	2.30	Slow	0.00	0.00	0.00	0.00	3.00
1325	7.00	7.00	Slow	0.00	0.00	0.00	0.00	N/S
1400	13.00	8.00	Medium	0.00	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
1215		CAT Scanned: Yes
1215		Permit Completed: Yes
		DREM (14.50m - 15.00m): Fractured Rock Zone
1600	0030	Dayworks: Airlift development of well

SPT I.D. Number	PD1	Calibration Date	01/02/2021
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details		CSCS No	
Support Operative	John Whyte		
Lead Driller	Stephan Petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Cooloo WF

Weather	Fine	Project No	33/22
Date	15/08/2022	Day	Monday
Rig type	Knebel HY79	Borehole Number	
Inclination		Orientation	BH 1
Sheet	1 of 1	Completed	Y

AGS

Produced by KeyLogbook

Petersen Drilling Services Ltd. on behalf of HES — Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Liner Dia (mm)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Soft to firm brown peaty TOPSOIL		RO		0.00	20.00		0000		100	grey											0.00	0.00
0.40	Medium dense coarse grey well rounded SAND AND GRAVEL with frequent cobbles and boulders																						
2.60	Strong to Very strong dark grey LIMESTONE with occasional shaley mudstone layers																						

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0805			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1540			

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer
C	140.00	0.00	3.60					Sim. Casing			
RO	154.00	0.00	3.60				DTH Button Bit		115	Air	No
RO	120.00	3.60	20.00				DTH Button Bit			Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
0825	2.00	2.00	Slow	0.00	0.00	0.00	0.00	N/S
1725	3.50	3.50	Medium	0.00	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
0805		CAT Scanned: Yes
0805		Permit Completed: Yes
		DREM (7.50m - 9.00m): Fractured Rock Zone
1340	0030	Dayworks: Airlift development of well

SPT I.D. Number	PD1	Calibration Date	01/02/2021
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details		CSCS No	
Support Operative	John Whyte		
Lead Driller	Stephan Petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Cooloo WF

Weather	Variable	Project No	33/22
Date	16/08/2022	Day	Tuesday
Rig type	Knebel HY79	Borehole Number	
Inclination		Orientation	BH 2
Sheet	1 of 1	Completed	Y

AGS

Produced by KeyLogbook

G.4 TRIAL PIT RECORDS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP01
Sheet 1 of 1

Project Name:	Cooloo Wind Farm	Project No. 22098	Co-ords: 556177.00 - 748660.00
			Level: m OD
Location:	Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00
Client:	MKO		Depth 2.80

Date: 18/02/2025
Scale: 1:25
Logged: PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30			TOPSOIL comprise of soft brown sandy clay with grass rootlets
	0.80	B					Soft to firm mottled light brown slightly sandy gravelly cobbly SILT. Cobbles are sub-rounded of limestone.
	1.00		HSV 62kPa	0.90			Firm grey brown sandy gravelly cobbly CLAY with boulders 200-300mm in diameter. Cobbles and boulders are sub- rounded of limestone.
	2.00	B					
				2.75			Dark grey massive LIMESTONE
				2.80			End of Pit at 2.8m

1 2 3 4 5

Remarks: Terminated due to Bedrock. No groundwater encountered

Stability: Good

AGS

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Trial Pit Log

TrialPit No
TP02
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555570.00 - 748556.00	Date 19/02/2025
		Level: m OD	
Location: Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00 Depth 2.60	Scale 1:25
Client: MKO			Logged PK

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth	Type	Results				
				0.25			TOPSOIL comprise of soft brown sandy slightly gravelly clay with grass rootlets
	0.50		HSV 54kPa				Soft to firm brown grey slightly gravelly sandy cobbly CLAY. Cobbles are sub-rounded of limestone
	0.80	B					
				1.10			Soft to firm brown grey slightly sandy gravelly cobbly SILT with occasional boulders. Cobbles and boulders are sub-rounded of limestone.
▼	2.00	B					
				2.50			Grey massive LIMESTONE
				2.60			End of Pit at 2.6m

1
2
3
4
5

Remarks: Terminated due to possible bedrock. Moderate ingress groundwater

Stability: Poor - Collapse from 1m

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP03
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555538.00 - 748001.00	Date 20/02/2025
Location: Cooloo, Co. Galway Ireland		Level: m OD	Scale 1:25
Client: MKO		Dimensions (m): 2.50 x 2.00 Depth 2.10	Logged PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.10			TOPSOIL comprised of clay, grass and reeds
▼	0.50	B					Firm dark brown oxidising to black very woody course fibrous wet PEAT. H1 B2 R3 W3 N5 A1
	1.00		HSV 20kPa	1.00			Soft grey silty, sandy GRAVEL with abundant boulders and cobbles. Cobbles and boulders are sub-rounded of limestone.
	1.50	B					
				2.00			Grey massive LIMESTONE
				2.10			End of Pit at 2.1m

1
2
3
4
5

Remarks: Terminated due to possible bedrock. Slow ingress of groundwater

Stability: Moderate

AGS

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Trial Pit Log

TrialPit No
TP04
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555302.00 - 747590.00	Date 20/02/2025
		Level: m OD	
Location: Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00 Depth 1.00	Scale 1:25
Client: MKO			Logged PK

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			TOPSOIL comprised of soft brown sandy clay with grass rootlets
	0.40	B					Soft to firm grey white slightly sandy, gravelly CLAY. Sand is fine to coarse.
	0.60		HSV 40kPa	0.60			Firm brown gravelly CLAY. Gravel is sub-rounded and comprise of limestone.
				0.75			Soft grey brown slightly sandy gravelly SILT with occasional cobbles. Gravel and cobbles are sub rounded of limestone.
	0.90	B		0.95			Weathered grey LIMESTONE. Heavily fractured limestone.
				1.00			End of Pit at 1.0m

Remarks: Terminated due to possible bedrock. No groundwater encountered

Stability: Good

AGS

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Trial Pit Log

TrialPit No
TP05
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 554936.00 - 748146.00	Date 19/02/2025
		Level: m OD	
Location: Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00 Depth 0.90	Scale 1:25
Client: MKO			Logged PK

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 0.50	B	HSV 52kPa	0.20			TOPSOIL comprised of soft brown sandy clay with grass rootlets
							Firm brown slightly gravelly , sandy SILT. Gravel is sub-rounded of limestone
	0.70	B		0.60			Loose grey sandy GRAVEL. Gravel is sub rounded to sub angular of limestone
				0.80 0.90			Grey massive weather LIMESTONE. Minor oxidation of fracture faces
							End of Pit at 0.9m

Remarks: Terminated due to possible bedrock. No groundwater encountered

Stability: Good

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP06
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 556183.00 - 749155.00	Date 18/02/2025
		Level: m OD	
Location: Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00	Scale 1:25
Client: MKO		Depth 3.60	Logged PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							Firm to spongy dark brown/black very fibrous PEAT. Weak organic odour. H2 B2 F2 R2 W1 N5 A1
	1.00		HSV 20kPa	1.00			
	1.10	B					Plastic light brown pseudo-fibrous Peat. H5 B2 F2 R2 W1 N5 A1
▼							
				2.90			Very soft grey white sandy SILT. Possibly Marl.
	3.10	B					
				3.60			Grey massive LIMESTONE
				3.61			End of Pit at 3.6m

1
2
3
4
5

Remarks: Terminated due to possible bedrock. Rapid ingress of groundwater

Stability: Good

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP07
Sheet 1 of 1

Project Name:	Cooloo Wind Farm	Project No.: 22098	Co-ords: 556824.00 - 749835.00
			Level: m OD
			Date: 19/02/2025
Location:	Cooloo, Co. Galway Ireland	Dimensions (m):	2.50 x 2.00
			Scale: 1:25
Client:	MKO	Depth: 3.55	Logged: PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			TOPSOIL comprised of soft brown sandy clay with grass rootlets
							Sponge /plastic dark brown pseudo-fibrous PEAT . H5 B2 F2 R2 W1 N5 A1
	1.00		HSV 42kPa	1.00			Plastic brown pseudo-fibrous PEAT. H5 B2 F2 R2 W1 N5 A1
	1.50	B					
▼				3.30			Very soft greyish white slightly sandy CLAY (Marl). Sand is fine to medium.
	3.50	B		3.55			End of Pit at 3.6m

1 2 3 4 5

Remarks: Terminated due to very rapid water ingress. Rapid ingress of groundwater

Stability: Good

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP08
Sheet 1 of 1

Project Name:	Cooloo Wind Farm	Project No.: 22098	Co-ords: 555699.00 - 749633.00
			Level: m OD
Date	18/02/2025		
Location:	Cooloo, Co. Galway Ireland	Dimensions (m):	2.50 x 2.00
Scale	1:25		
Client:	MKO	Depth	2.75
Logged	PK		

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
▼	1.00 1.00	B	HSV 30kPa	1.10			Soft light brown slightly sandy gravelly cobbly CLAY with large boulders . Boulders are sub-rounded and 200-300mm in diameter of limestone.
	2.20	B					Soft-firm light brown very sandy very gravelly cobbly CLAY with boulders. Boulders and cobbles comprise of limestone.
				2.70 2.75			Grey angular gravel and cobbles (possibly weathered LIMESTONE) End of Pit at 2.8m

1
2
3
4
5

Remarks: Terminated due to possible bedrock. Slow ingress of groundwater

Stability: Poor - Collapse from 0.5m

AGS

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Trial Pit Log

TrialPit No
TP09
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 554930.00 - 747229.00	Date 20/02/2025
		Level: m OD	
Location: Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00 Depth 1.80	Scale 1:25
Client: MKO			Logged PK

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			TOPSOIL comprised of soft brown sandy clay with grass rootlets
	0.50	B					Soft to firm slightly sandy, gravelly CLAY . Gravel is sub-rounded of limestone
				0.80			
	1.00		HSV 74kPa				Soft to firm brown sandy slightly gravelly cobbly CLAY. Gravel is sub-rounded of limestone.
	1.50	B					
				1.80			Grey massive LIMESTONE
				1.81			End of Pit at 1.8m

Remarks: Terminated due to possible bedrock. No groundwater encountered

Stability: Good

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP10
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 556912.00 - 749360.00	Date 19/02/2025
		Level: m OD	
Location: Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00 Depth 2.70	Scale 1:25
Client: MKO			Logged PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			TOPSOIL comprised of soft brown sandy clay with grass rootlets
	0.40	B		0.50			Soft brown slightly sandy slightly gravelly SILT. Gravel is sub-rounded. Sand is fine to coarse. Gravel is of limestone.
	1.00		HSV 96kPa				Firm brown grey slightly sandy gravelly cobbley SILT with occasional boulders. Boulders are sub-rounded of limestone
	2.00	B					
				2.70			Grey massive LIMESTONE
				2.72			End of Pit at 2.7m

1
2
3
4
5

Remarks: Terminated due to possible bedrock. No groundwater encountered

Stability: Good

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP11
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 556197.00 - 748883.00	Date 18/02/2025
Location: Cooloo, Co. Galway Ireland		Level: m OD	Scale 1:25
Client: MKO		Dimensions (m): 2.50 x 2.00 Depth 2.35	Logged PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			TOPSOIL comprised of brown sandy clay with grass rootlets
	0.80 0.80	B	HSV 30kPa	0.90			Soft to firm sandy slightly, gravelly SILT. Gravel is sub-rounded of limestone. Sand is fine to coarse.
▼	2.00	B					Very stiff grey brown slightly sandy, gravelly, cobbly CLAY with occasional boulders. Cobbles and boulders are sub-rounded of limestone
				2.35			Grey massive LIMESTONE
				2.45			End of Pit at 2.4m

1 2 3 4 5

Remarks: Terminated due to possible bedrock. Slow ingress of groundwater

Stability: Good

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP12
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555943.00 - 749063.00	Date 18/02/2025
Location: Cooloo, Co. Galway Ireland		Level: m OD	Scale 1:25
Client: MKO		Dimensions (m): 2.50 x 2.00 Depth 3.20	Logged PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			TOPSOIL comprised of soft brown sandy clay with grass rootlets
	0.80	B					Soft brown sandy, slightly gravelly SILT. Gravel is sub-rounded of limestone
	1.00		HSV 48kPa	1.00			Firm grey brown slightly sandy, slightly gravelly cobbly SILT with abundant boulders. Cobbles and boulders are sub-rounded of limestone
	2.40	B					
				3.20			Grey fractured LIMESTONE
				3.22			End of Pit at 3.2m

1
2
3
4
5

Remarks: Terminated due to possible bedrock. No groundwater encountered

Stability: Moderate

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP13
Sheet 1 of 1

Project Name:	Cooloo Wind Farm	Project No.: 22098	Co-ords: 555411.00 - 747813.00
			Level: m OD
			Date: 20/02/2025
Location:	Cooloo, Co. Galway Ireland	Dimensions (m): 2.50 x 2.00	Scale: 1:25
Client:	MKO	Depth: 2.50	Logged: PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			TOPSOIL comprised of slighly sandy gravelly clay with grass rootlets
	0.40	B					Soft to firm light brown sandy slightly gravelly SILT. Gravel are sub-rounded of limestone
	0.50		HSV 38kPa	0.60			Loose to medium dense sandy, GRAVEL with abundant boulders. Boulders are 200-300mm in diameter of limestone.
	2.00	B					
				2.60			Grey massive LIMESTONE
				2.61			End of Pit at 2.5m

Remarks: Terminated due to possible bedrock. No groundwater encountered

Stability: Very poor - Collapse from 1m

AGS

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Trial Pit Log

TrialPit No
TP14
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555104.00 - 747925.00	Date 19/02/2025
		Level: m OD	
Location: Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00 Depth 0.80	Scale 1:25
Client: MKO			Logged PK

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 0.50	B	HSV 63kPa	0.15			TOPSOIL comprised of slightly gravelly slightly sandy CLAY
							Firm to stiff light brown slightly sandy sightly gravelly SILT with occasional boulders. Boulder and cobbles are sub-rounded of limestone.
	0.70	B		0.60			Firm dark brown silty sandy GRAVEL. Gravel and cobbles are sub-angular of limestone
				0.80 0.82			Grey brown weathered LIMESTONE. Oxidation on fracture faces and abundant fractures. End of Pit at 0.8m

Remarks: Terminated due to possible bedrock. No groundwater encountered

Stability: Good

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TP15
Sheet 1 of 1

Project Name:	Cooloo Wind Farm	Project No.: 22098	Co-ords: 556313.00 - 749138.00
			Level: m OD
Location:	Cooloo, Co. Galway Ireland		Dimensions (m): 2.50 x 2.00
Client:	MKO		Depth 3.15

Date: 18/02/2025
Scale: 1:25
Logged: PK

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30			Soft black peaty CLAY with pockets of white clayey marl
	1.00 1.00	B	HSV 12kPa				Sponge very fibrous woody PEAT with pockets of sand. H1 B2 R3 W3 N5 A1
				1.95			Grey sandy cobbly GRAVEL. Gravel and cobbles are sub-angular and sub-rounded of limestone.
▼	2.50	B					
				3.15 3.16			Grey massive LIMESTONE End of Pit at 3.2m

1 2 3 4 5

Remarks: Terminated due to possible bedrock. Slow ingress of groundwater

Stability: Good

AGS

TP01 - 1 of 2

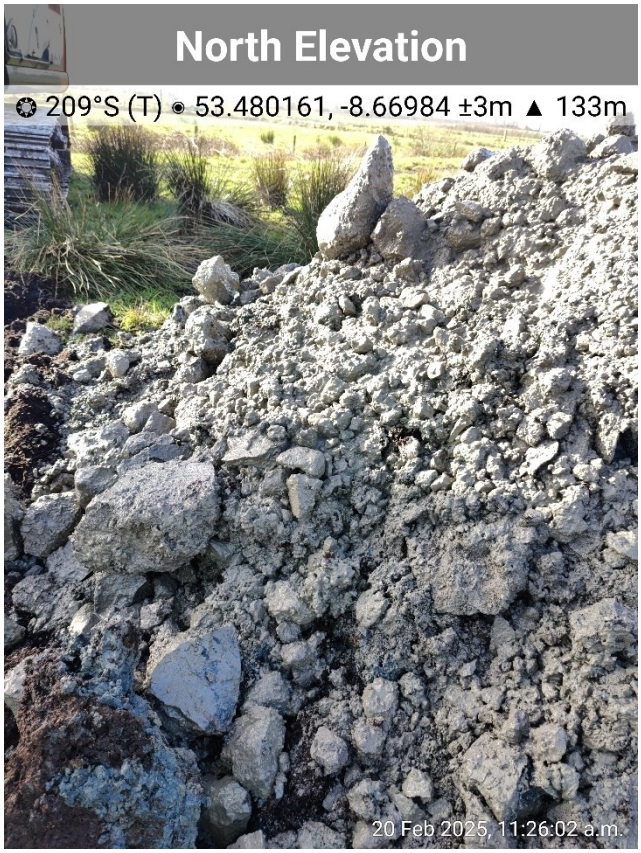
TP01 - 2 of 2

TP02 - 1 of 2

TP02 - 2 of 2

TP03 - 1 of 2

TP03 - 2 of 2



TP04 - 1 of 2

TP04 - 2 of 2

TP05 - 1 of 2

TP05 - 2 of 2

TP06 - 1 of 2

TP06 - 2 of 2

TP07 - 1 of 2

TP07 - 2 of 2

TP08 - 1 of 2

TP08 - 2 of 2

TP09 - 1 of 2

TP09 - 2 of 2

TP10 - 1 of 2

TP10 - 2 of 2

TP11 - 1 of 2

TP11 - 2 of 2

TP12 - 1 of 2

TP12 - 2 of 2

TP13 - 1 of 2

TP13 - 2 of 2

TP14 - 1 of 2

TP14 - 2 of 2

TP15 - 1 of 2

TP15 - 2 of 2

GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Trial Pit Log

TrialPit No
TPBP1
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555689.00 - 749020.00 Level:	Date 30/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 3.10	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Brown slightly sandy slightly gravelly CLAY. Sand is medium to coarse. Gravel is fine to coarse. Presence of pockets of black organic material at 0.8m
				0.80			Light brown slightly sandy gravelly SILT. High cobble content and some boulders. Gravel is fine to coarse, angular to subrounded. At 2.6m presence of large boulders (<0.6m) rounded to subrounded.
				3.10			End of Pit at 3.10m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPBP2
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555463.00 - 749672.00 Level:	Date 30/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 3.00	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Brown slightly sandy gravelly silty CLAY. Sand is medium to coarse. Gravel is fine to coarse. Presence of boulders, rounded to subrounded.
				0.50			Grey slightly gravelly SAND with large boulders.
				3.00			End of Pit at 3.00m

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPBP3
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555352.00 - 750647.00 Level:	Date 31/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 1.93	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown peat.
				0.40			Firm light grey mottled yellow SILT.
				1.00			Grey slightly sandy gravelly CLAY. Sand and gravels are angular to subangular. Sand is medium to coarse, gravel is fine to coarse. Presence of boulders (0.3m). End of the TP due to rock head.
				1.93			End of Pit at 1.93m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPSSA
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 557466.00 - 749301.00 Level:	Date 31/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.80	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Peat with high root content.
				0.70			Light grey slightly sandy slightly gravelly SILT with some cobbles. Sand is medium to coarse, subangular to subrounded. Gravel is fine to coarse, subangular to subrounded.
▼				2.80			End of Pit at 2.80m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPSSB
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 557383.00 - 748868.00 Level:	Date 31/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.10	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			[TOPSOIL] Brown slightly gravelly slightly sandy CLAY. Gravel and sand are angular to subangular, fine to coarse.
							Grey slightly sandy very gravelly SILT with large angular to subangular boulders. Sand is medium to coarse. Gravel is fine to coarse, both angular to subrounded.
▼				2.10			End of Pit at 2.10m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPT2
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555608.00 - 748029.00 Level:	Date 30/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 1.64	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown slightly mottled orange PEAT with high wood content
				0.50			Light grey slightly sandy clayey GRAVEL. Sand is medium to coarse, subangular to rounded. Gravel is fine to coarse, subangular to subrounded.
				1.10			Grey slightly sandy gravelly SILT. Gravel is fine to coarse, angular to subangular with few cobbles.
				1.64			End of Pit at 1.64m

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPT3
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555566.00 - 748639.00 Level:	Date 30/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.10	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Brown PEAT. Presence of roots and wood.
				0.90			Grey slightly sandy slightly gravelly SILT with some cobble content. Gravel is subangular to angular, fine to coarse.
				1.52			Grey SILT. Cobble content increases with depth.
				2.10			End of Pit at 2.10m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPT4
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 556170.00 - 748592.00 Level:	Date 30/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.70	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.50			Orangish brown slightly gravelly CLAY. Gravel is fine to medium, angular to subangular.
							Brownish grey slightly sandy slightly gravelly CLAY. Presence of large boulders (<0.50m). Gravel and sand is angular to subangular. High water content.
				2.70			End of Pit at 2.70m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPT6
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 555649.00 - 749698.00 Level:	Date 30/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 3.20	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Light brown CLAY.
				0.70			Grey gravelly SILT with cobble content. Gravel is fine to coarse, angular to subrounded. Pocket of organic material at 1m deep. Very large boulders subangular to rounded at 2.7m deep.
				3.00			Cobbles and boulders. Boulders are 0.2-0.5m subangular to subrounded. [Possible weathered bedrock]
				3.20			End of Pit at 3.20m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPT8
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 556994.00 - 749351.00 Level:	Date 31/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 3.50	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Brown gravelly CLAY. Gravel is fine to coarse, subangular to subrounded. Presence of rounded cobbles.
				1.00			Light grey slightly sandy gravelly CLAY. Sand is medium to coarse. Gravel is fine to coarse. Presence of large boulders (>0.5m) rounded to subrounded.
				3.50			End of Pit at 3.50m

1
2
3
4
5

Remarks:

Stability:

AGS

GDG GAVIN & DOHERTY GEOSOLUTIONS

Trial Pit Log

TrialPit No: TPT9
Sheet 1 of 1

Project Name: Cooloo Wind Farm	Project No. 22098	Co-ords: 556825.00 - 749874.00 Level:	Date 31/08/2022
Location: Cooloo, Co. Galway Ireland		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 4.00	Logged IPP

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.25			Black peat with high rootlet content. Strong odour.
				1.20			Cream slightly sandy SILT. Shell content.
▼				2.50			Very soft yellowish brown CLAY. Shell and root content.
				4.00			Very soft white SILT.
							End of Pit at 4.00m

1 2 3 4 5

Remarks:

Stability:

AGS

G.5 GEOPHYSICAL SURVEY

Cooloo Wind Farm

Cooloo, County Galway

Geophysical Survey

Report Status: Final

MGX Project Number: 6903

MGX File Reference: 6903f-005.doc

5th September 2025

Confidential Report To:

MKO
Tuam Road
Galway
H91 VW84

Report submitted by:
Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare, W23X7Y5
Ireland
Tel.: 01-6510030
Email: info@mgx.ie

Issued by:

Author: Jan Stach (Geophysicist)

Reviewer: John Connaughton (Geophysicist)

Minerex
Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of the methods 2D-Resistivity (ERT) and Seismic Refraction (p-wave). The survey was carried out for the ground investigation for the Cooloo Wind Farm, Co Galway.
2. The main objectives of the survey are to detect possible karstified zones within the rock or karst features, to determine the ground conditions under the site and to determine the depth to rock and the overburden thickness.
3. Ground conditions were modelled with two layers.
4. Layer A is interpreted as highly consolidated overburden consisting of sandy gravelly clay and silt, which may represent glacial till or weathered limestone.
5. Layer B is interpreted as fresh limestone, with a depth generally shallower than 10 m across most of the site, except in the western sections of lines R3 and R4, where it deepens and exceeds 10 m bgl.
6. No karst features or karstified rock were identified within the survey area, but considering the increasing depth to bedrock to the west, their potential occurrence further west cannot be excluded.
7. Trial Pit logs were provided after the survey. TP11 was carried out within the survey area and terminates on possible bedrock at 2.4m.

CONTENTS

List of Tables, Maps and Figures:

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the ground investigation for Cooloo Wind Farm, Co Galway. The survey consisted of 2D-Resistivity (ERT) and Seismic Refraction (p-wave). The survey was commissioned by MKO acting on behalf of Neoen Ltd.

This survey utilized two complementary geophysical methods to improve the final interpretation. The role of geophysics as a non-destructive fast method is to provide a geological interpretation over a wide area to complement direct ground investigation at specific locations.

The geophysical survey was carried out in the area close to the proposed wind turbine T04, as part of the Environmental Impact Assessment Report (EIAR). The objective of the survey was to investigate potential karst features in the bedrock, previously identified in the risk assessment (GDG, 2025) as an area of a high hazard. Within the survey area, surface depressions (dips) were observed, which often indicate the presence of karst features. The results were intended to confirm the presence or absence and nature of karst structures and to provide data to support the development of appropriate mitigation measures.

1.2 Objectives

The main objectives of the geophysical survey were:

- To detect possible karstified zones within the rock or karst features
- To determine the ground conditions under the site
- To determine the depth to rock and the overburden thickness

1.3 Site Description

The site is located in the townland Cooloo, Co. Galway. The survey area is on one grass field. Elevations across the area range from 79.5 mOD to 83.5mOD with the lowest elevations in the northern edge of the site and the highest elevations in the south. The area is surrounded by agricultural fields. Access was available from the local farm road to the north.

1.4 Geology

Online geological maps of Ireland (GSI, 2025) give the following information:

The overburden geology consists of till derived from limestones.

In terms of rock the survey area is underlain by the Visean Limestones, described as undifferentiated Limestone

The Visean Limestones is karstifiable and there are karst features noted in close proximity of the site described as Enclosed Depression.

1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The description of soil, rock and the use of geotechnical terms (soft, stiff, dense etc) follows Eurocode (2007) and BSI (2020) standards. The terms are defined in the standards and the physical parameters are related from experience. This geophysical survey has been acquired, processed, interpreted and reported in accordance with these guidelines.

An aerial image was used as the map background as we did not receive a topographical survey map or Ordnance Survey background map. Elevations were surveyed on site and are used in the vertical sections.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology consists of using four 2D-Resistivity (ERT) lines as well as one seismic line along a proposed access road in order to detect potential karst features.

The survey locations are indicated on Map 1. The lines and parameters are tabulated in Table 1.

Table 1: Geophysical Survey Locations and Acquisition Parameters

Resistivity Line	**Electrode Spacing/m**	**Number of Electrodes**	**Line Length/m**
R1	3	53	156
R2	3	53	156
R3	3	32	93
R4	3	32	93
SUM			**498**
Seismic Line	**Geophone Spacing/m**	**Number of Geophones**	**Line Length/m**
S1	3	24	69
SUM			**69**

2.2 2D-Resistivity (ERT)

2D-Resistivity lines were surveyed with electrode spacing of 3m, up to 53 electrodes per set-up and a maximum length of 156m per set-up. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes and a laptop with ImagerPro acquisition software.

During 2D-Resistivity surveying, data is acquired in the form of linear arrays using a suite of metal electrodes. A current is induced into the ground via a pair of electrodes whilst a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the line. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

The penetration depth of a resistivity set-up increases towards the centre where it reaches an approx. value of $1/6^{th}$ of the array length.

2D-Resistivity has previously proven zones of karstified rock with lateral extents of 5m and more.

2.3 Seismic Refraction (p-waves)

The seismic refraction line was surveyed with geophone spacing of 3 m and 24 geophones resulting in a 69m length line. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero-delay trigger was used to start the recording. Seven shot points were used.

The seismic refraction survey method focuses on propagating p-waves travelling through the subsurface, which are generated by a seismic source. As the wave propagates through the subsurface, its velocity varies as it travels through overburden, rock with different elastic properties, and along geological boundaries. Velocity data is recorded via the surveying equipment, which is then processed, allowing geological layer thicknesses and boundaries to be established.

Seismic Refraction generally determines the depth to horizontal or near horizontal layers where the compaction or strength or rock quality changes with an accuracy of around 20% of the depth to that layer. Where the layers are shallower than the geophone spacing depth deviations of +- 1m to top of layers can occur. Where low velocity layers or shadow zones are present (e.g., below solid ground surface) or where layers dip with more than 20 degrees angle the accuracy becomes much less.

The seismic refraction set-up with 69 m length has a reasonable penetration depth of around 15 m. An internationally accepted maximum depth estimate for a seismic refraction set-up is 1/6 of the set-up length including offshots. The depth penetration varies according to the velocity structure of the subsurface.

2.4 Site Work

The data acquisition was carried out on the 26st of August 2025. The weather conditions were fair throughout the acquisition period. Health and safety standards were adhered to at all times.

The locations and elevations were surveyed with a Carlson NR3 RTK-GPS to accuracy < 0.05m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data is executed utilizing the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

The interpretation is primarily based on the 2D-Resistivity method. One seismic line was carried out for the purpose of correlating the resistivity data.

3.1 2D-Resistivity (ERT)

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of <3.0%. The resulting models were colour contoured with the same resistivity scale for all lines and they are displayed as cross sections (Figure 1).

Resistivities are characteristic for certain overburden and rock types. If there is a high content of clay minerals (which are electrically conductive) then the overburden resistivity will be lower than as if there is a high content of clastic grains like sand or gravel. The purer the clay and the lower the sand and gravel content, the lower the resistivity. Water content in overburden layers can influence the resistivities, but generally clay content has a more dominating effect.

Karstified rock is defined in this report as a formerly intact clean limestone rock, liable to karstification, that has been partially dissolved by water over long geological time scales and where the cavities and voids have either remained empty (filled by air) or became filled by overburden sediment (clay, silt, sand), weathering product of the broken rock itself or water. This process would lead to a reduction of the resistivity of the overall rock and therefore karstified rock has a lower resistivity than intact clean limestone rock. This is generally indicated by lower resistivities embedded within high resistivity at depth.

The resistivities cover a range typical for materials from clay rich overburden (low resistivities) to fresh strong unweathered bedrock (high resistivities). The ranges have been taken into the consideration for the interpretation. Lower resistivity values (<500Ωm) typically indicate overburden with clay content. Higher resistivities (>500Ωm) indicate bedrock types like clean limestone.

Table 2: Summary of Interpretation (Resistivity only)

Layer	General Resistivity Range (Ωm)	Interpretation
A	<500	Overburden (Sandy gravelly Clay and Silt) or weathered limestone
B	>500	Fresh Limestone

3.2 Seismic Refraction (p-wave)

The seismic refraction data was positioned and processed with the SEISIMAGER software package to give a layered model of the subsurface. The number of layers has been determined by analysing the seismic traces and 3 layers are used in the models. All seismic lines were subject to a standardised processing sequence which consisted of a topographic correction which was based on integrated elevation data, first break picking, tomographic inversion, travel-time computation via ray-tracing and velocity modelling. Residual deviations of typically 0.4 to 1.8 msec RMS have been obtained for each line. Following each processing stage QC procedures were adhered to. The resulting layer boundaries are shown as thick lines overlaid on the 2D-Resistivity cross sections (Figure 1). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

The p-wave seismic velocity is closely linked to the density of subsurface materials and to parameters like compaction, stiffness, strength and rock quality. The higher the density of the subsurface materials the higher the seismic velocity. More compacted, stiffer, denser and stronger material will have a higher seismic velocity. For rock, the seismic velocity is higher when the rock is stronger, less weathered and has a higher quality. If the rock is more weathered, broken, fractured, fissured or karstified then the seismic velocity will be reduced compared to that of intact fresh rock.

Because of the above relationship, the seismic refraction method and seismic velocities are suitable to investigate ground where the layers get denser, more compacted and stronger with depth.

The modelled seismic data has created the following layered ground model:

Layer 1 has a thickness of around 1.5 m and seismic velocities of 400m/s. This overburden would be soil with a soft or loose stiffness or compaction.

Layer 2 velocity of 2200m/s indicate overburden with very stiff to hard or very dense strength or compaction or a very weathered rock with poor rock quality. The thickness varies between 5 and 7m.

Competent rock (Layer 3) is indicated by seismic velocity of 4000m/s and the depth to the top of this rock varies between 7 and 9m bgl.

Layer 2 identified in the seismic refraction survey corresponds to Layer A from the resistivity interpretation Overburden (Sandy gravelly Clay and Silt) or weathered limestone, while Layer 3 correlates with Layer B (fresh limestone).

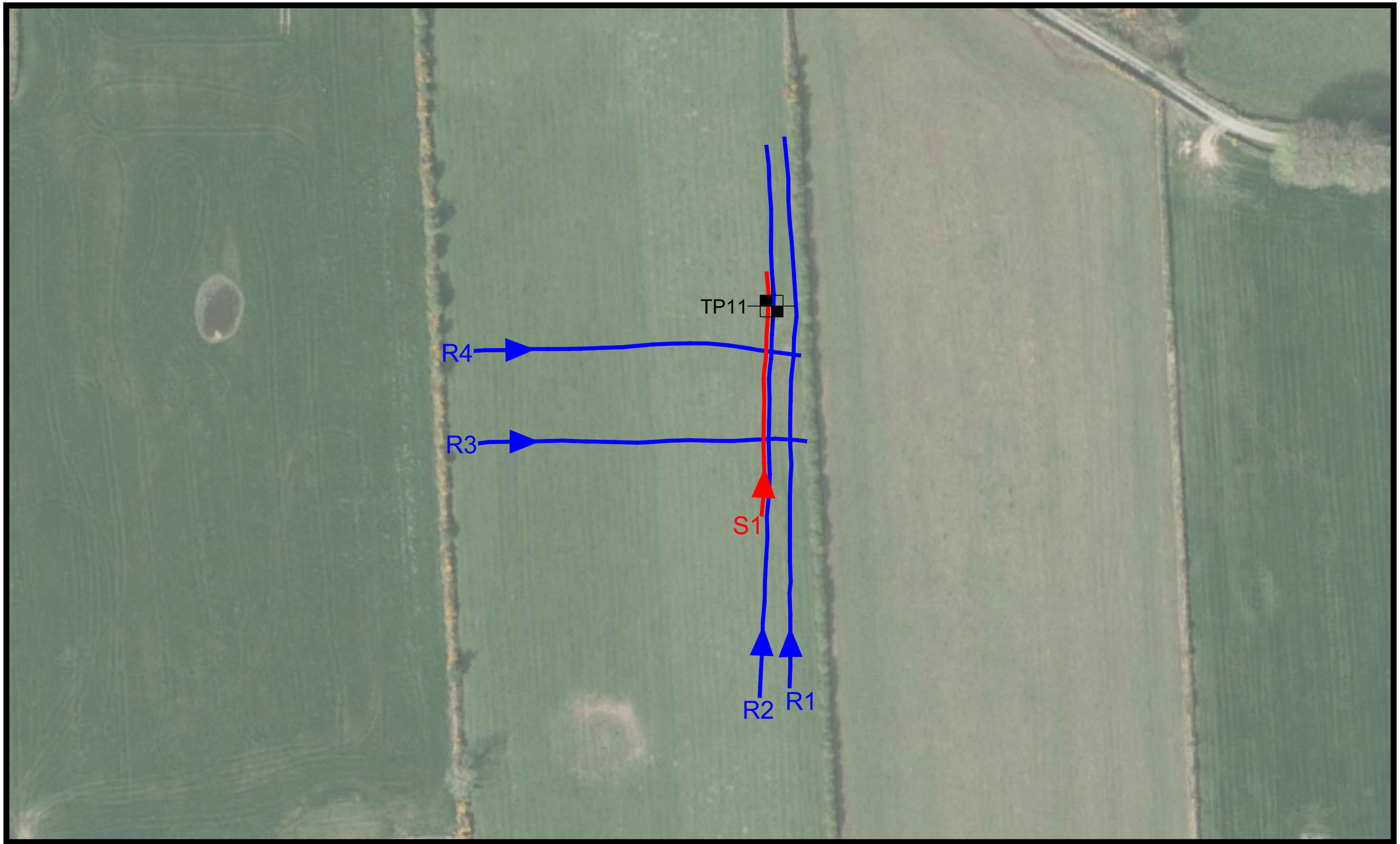
4. CONCLUSIONS

The following conclusions are made:

- The geophysical surveys carried out at the Cooloo Wind Farm, Co. Galway consisted of 2D-Resistivity (ERT) and Seismic Refraction (p-wave).
- The main objective of the survey was to identify possible karst feature or karstified rock within the survey area.
- The interpretation is based on 2D-Resistivity data, and two layers have been identified. The seismic refraction survey ties in well with the results from the 2D-Resistivty survey.
- Layer A with resistivities <500 Ωm is interpreted as overburden consisting of sandy gravelly clay and silt or weathered limestone.
- This layer may represent glacial till and, as it corresponds to seismic Layer 2 with a p-wave velocity of 2200 m/s, it is described as a highly consolidated overburden. The resistivities and seismic velocities could also be interpreted as weathered limestone.
- Layer B with resistivities >500 Ωm is interpreted as fresh limestone. The depth to this layer varies along the lines between 7 and 13 m, but in the most of the site is shallower than 10 m.
- The depth to good bedrock is relatively consistent along the entire length of the survey lines, except in the western sections of lines R3 and R4, where it deepens and exceeds 10 m bgl.
- Considering the increasing depth to good bedrock to the west, the potential occurrence of karst features further west cannot be excluded.
- No karst features or karstified rock were identified within the survey area.
- The trial pit log TP11 describes very stiff slightly sandy gravelly cobbly clay from 0.9 – 2.35m bgl which would be consistent with glacial till. The trial pit terminates on possible bedrock at 2.4m bgl within layer A.

5. REFERENCES

1. **BSI, 2020.** BS5930: 2015+A1:2020, Code of Practice for Ground Investigations, British Standards Institute 2020
2. **Eurocode, 2007.** EN 1997-2:2007. Eurocode 7. Part 2 Ground Investigation and Testing 2007
3. **GSEG, 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002
4. **GSI, 2025.** www.gsi.ie. Online Geological Map of Ireland. Geological Survey of Ireland 2025
5. **Milsom, 1989.** Field Geophysics. John Wiley and Sons, 1989
6. **Reynolds, 1997.** An Introduction to Applied and Environmental Geophysics. John Wiley and Son, 1997
7. **Weaver, 1975.** Geological Factors significant in the Assessment of Rippability, 1975
8. **GDG, 2025.** Geotechnical Karst Risk Assessment. Gavin & Doherty Geosolutions, 2025



Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	MKO
PROJECT	Cooloo Wind Farm, Co. Galway Geophysical Survey
TITLE	Map 1: Geophysical Survey Location Map

SCALE:	1:1000 @ A3
PROJECT:	6903
DRAWN:	JS
DATE:	05/09/2025
MGX FILE:	6903f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

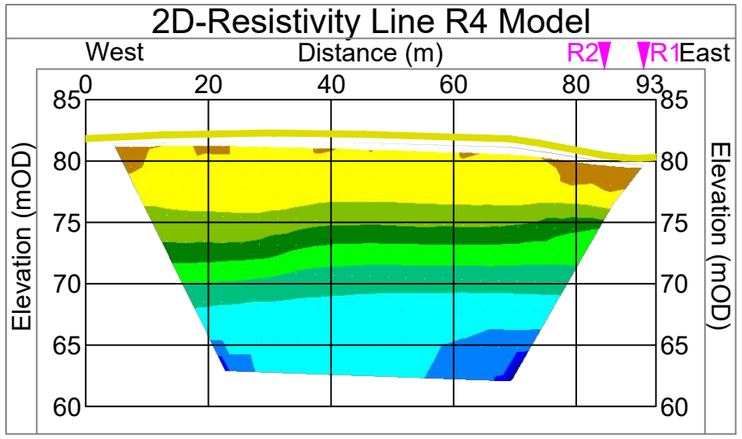
R2 — 2D-Resistivity Line

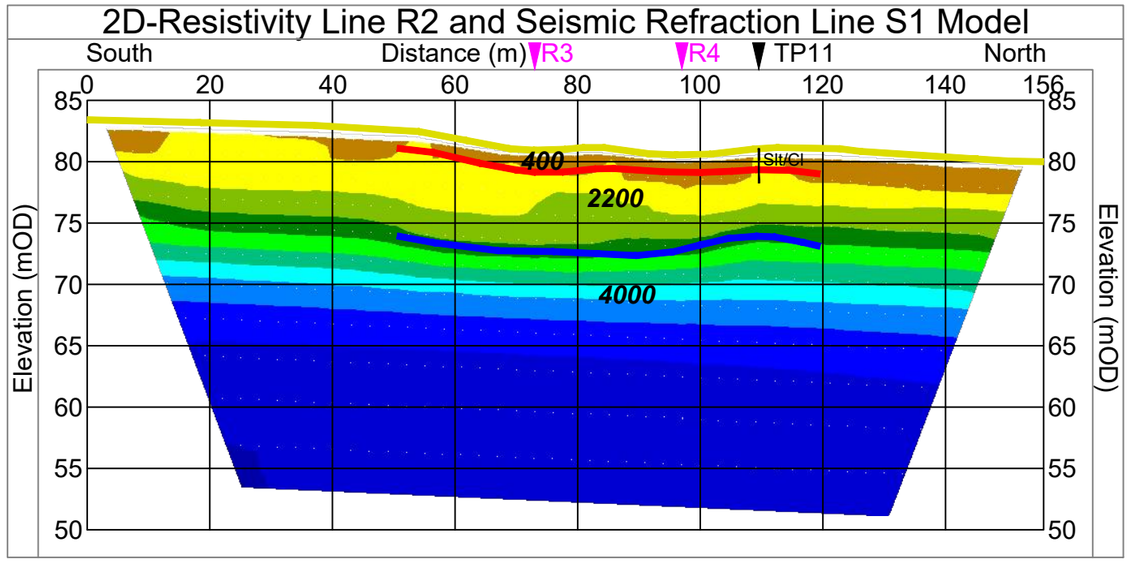
S1 — Seismic Refraction Line

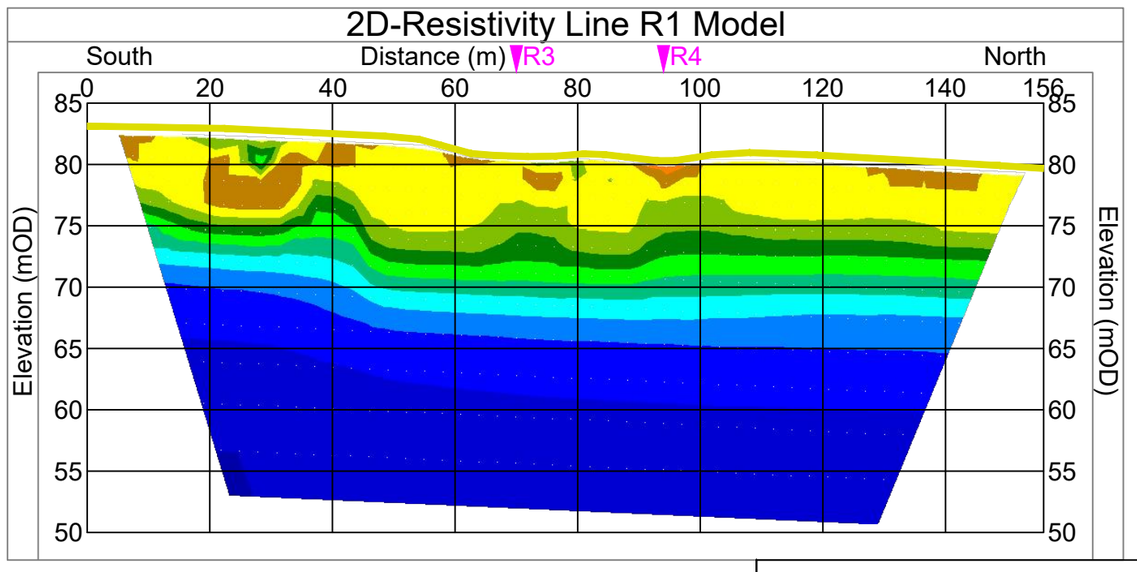
Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

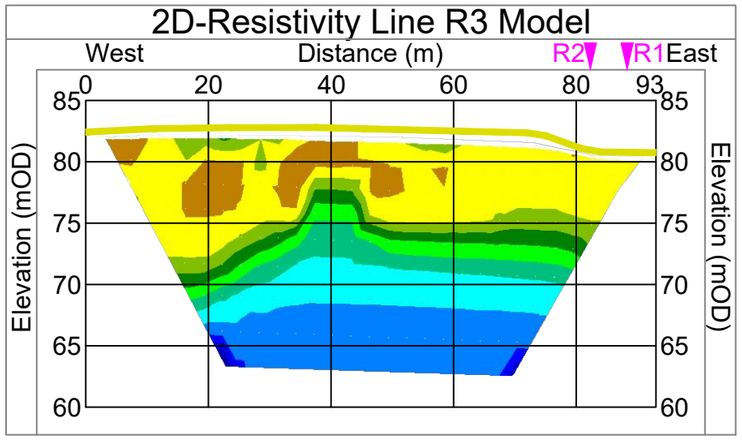
Direct Ground Investigation Locations:

TP1 — Trial Pit









Abbreviated GI Logs:

TP01	Trial Pit Name and Location
Cl	Clay
Slt	Silt

Minerex
Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	MKO
PROJECT	Cooloo Wind Farm, Co. Galway Geophysical Survey
TITLE	Figure 1: Models of Geophysical Survey

SCALE:	1:1000 @ A3, VE x 2
PROJECT:	6903
DRAWN:	JS
DATE:	05/09/2025
MGX FILE:	6903f_Drawings.dwg
STATUS:	Final

2D-Resistivity Model Values:

Resistivities (Ohmm)

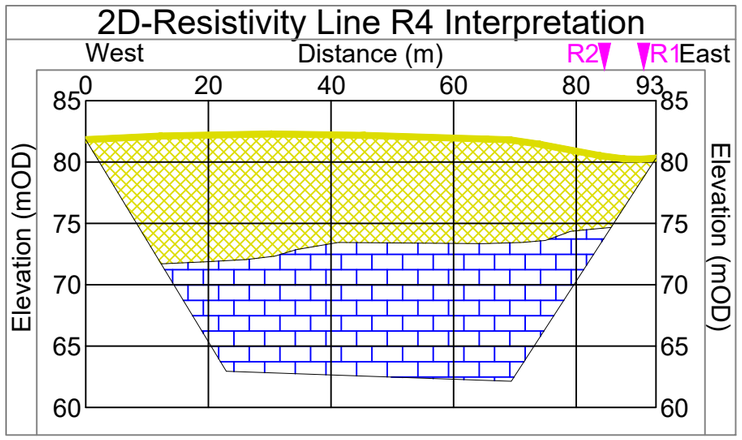
31.2 62.5 125 250 500 1000 2000 4000

Existing Ground Surface along Survey Line

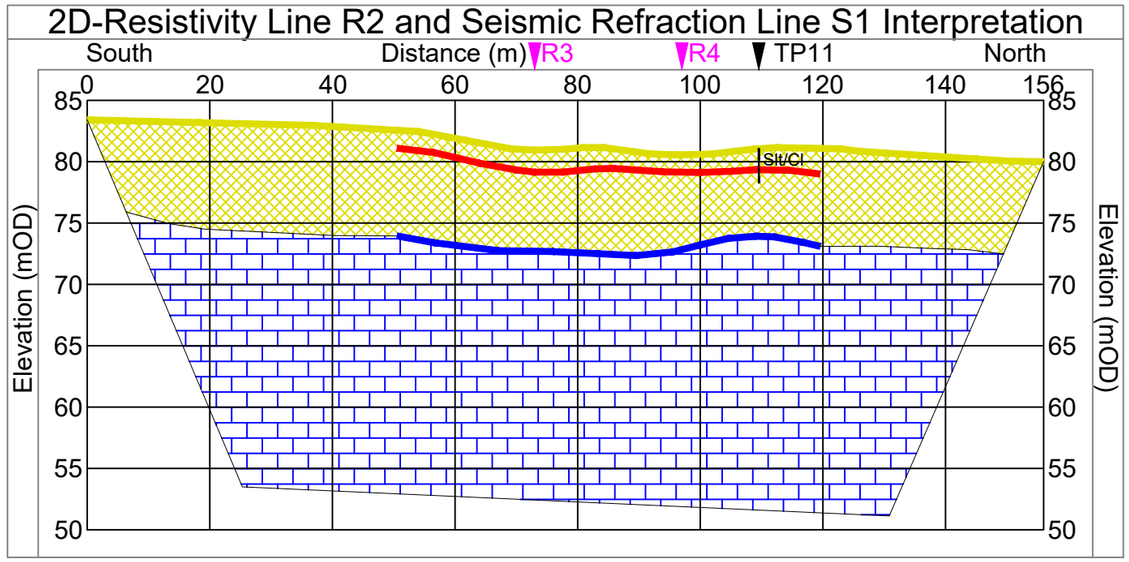
Layers from Seismic Refraction Model:

Ground Surface/Top of Layer 1 (400 m/s)
Top of Layer 2 (2200 m/s)
Top of Layer 3 (4000 m/s)
2200 Seismic Velocity in m/s

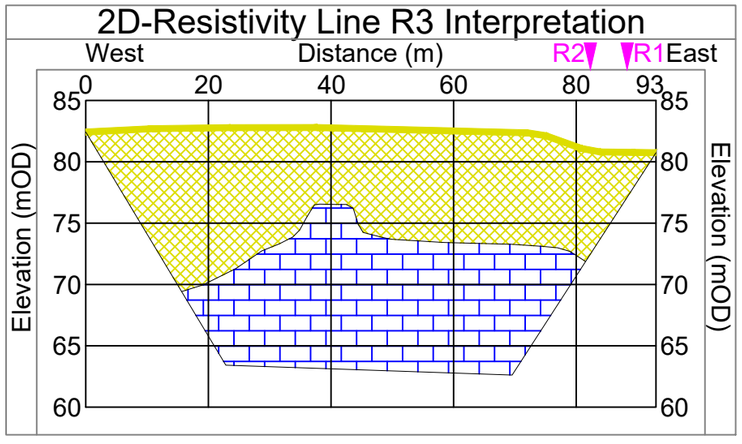
2D-Resistivity Line R4 Interpretation



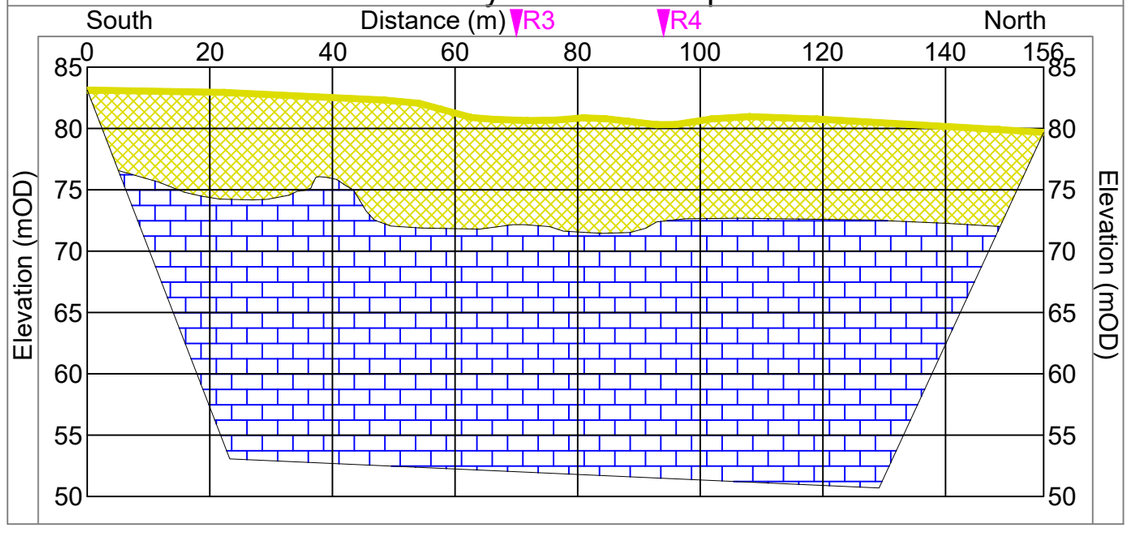
2D-Resistivity Line R2 and Seismic Refraction Line S1 Interpretation



2D-Resistivity Line R3 Interpretation



2D-Resistivity Line R1 Interpretation



Minerex
Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	MKO
PROJECT	Cooloo Wind Farm, Co. Galway Geophysical Survey
TITLE	Figure 2: Interpretation of Geophysical Survey

SCALE:	1:1000 @ A3, VE x 2
PROJECT:	6903
DRAWN:	JS
DATE:	05/09/2025
MGX FILE:	6903f_Drawings.dwg
STATUS:	Final

Interpretation Figures:

1 Overburden (Sandy gravelly Clay and Silt) or Weathered Limestone
2 Fresh Limestone

Abbreviated GI Logs:

TP01	Trial Pit Name and Location
Cl	Clay
Slt	Silt

APPENDIX H HAZARD RATING MATRIX

	A	B	C	D		E	F				
Location	Underlying Rock	Bedrock Formation Change	Rating of Overburden Thickness	Cover	Geological rating = A*B'*C*D	Density of Karstic Features within 250m	Karst within Feature Boundary	Evidence - Rating= E* F	Evidence and Geological Ratings Combined	Overall Karst Hazard	Normalised Hazard Class Score
	Susceptible = 2 Non Susceptible Limestone = 1 Not Susceptible= 0	Within 100m = 2Over 100m = 1	1-5m = 3 5-10m = 2 >10m<1m = 1	Low Cover=1 Granular=1 Peat=1 Glacial Deposits=2	Min=0 Max=24	None=1 1-2=2 3-4=3 >4=4	Yes=3 No=1	Min=1 Max=12	Min=1 Max=288	Very High>60, High36-60 Medium 12 - 36, Low 0-12, Negligible = 0	Very High= 5, High=4, Medium=3, Low=2, Negligible = 1
T1	2	1	3	2	12	2	1	2	24	Medium	3
T1 Hardstand	2	1	3	2	12	1	1	1	12	Low	2
T2	2	1	3	1	6	1	1	1	6	Low	2
T2 Hardstand	2	1	3	1	6	2	1	2	12	Low	2
T3	2	1	3	2	12	1	1	1	12	Low	2
T3 Hardstand	2	1	3	2	12	1	1	1	12	Low	2
T4	2	1	3	2	12	4	1	4	48	High	4
T4 Hardstand	2	1	3	2	12	4	1	4	48	High	4
T5	2	1	3	1	6	1	1	1	6	Low	2
T5 Hardstand	2	1	3	1	6	1	1	1	6	Low	2
T6	2	1	3	2	12	1	1	1	12	Low	2
T6 Hardstand	2	1	3	2	12	1	1	1	12	Low	2
T7	2	2	3	1	12	1	1	1	12	Low	2
T7 Hardstand	2	2	3	1	12	1	1	1	12	Low	2
T8	2	1	3	2	12	1	1	1	12	Low	2
T8 Hardstand	2	1	3	2	12	2	1	2	24	Medium	3
T9	2	1	3	1	6	1	1	1	6	Low	2
T9 Hardstand	2	1	3	1	6	1	1	1	6	Low	2
Substation	2	1	3	1	6	1	1	1	6	Low	2
Construction Compound	2	1	3	2	12	1	1	1	12	Low	2
Met Mast	2	1	3	1	6	1	1	1	6	Low	2
AL1	2	1	3	2	12	1	1	1	12	Low	2
AL1_B	2	1	3	2	12	1	1	1	12	Low	2
AL2	2	1	3	2	12	2	1	2	24	Medium	3
AL3	2	1	3	2	12	2	1	2	24	Medium	3
AL3b	2	1	3	2	12	4	1	4	48	High	4
AL4	2	1	3	1	6	1	1	1	6	Low	2
AL4 Float	2	1	2	1	4	1	1	1	4	Low	2
AL4b	2	1	3	1	6	2	1	2	12	Low	2
AL4b Float	2	2	2	1	8	1	1	1	8	Low	2
AL4c	2	2	3	1	12	1	1	1	12	Low	2
AL5	2	1	3	1	6	1	1	1	6	Low	2
AL5_Float	2	1	2	1	4	1	1	1	4	Low	2
AL5b	2	1	2	1	4	1	1	1	4	Low	2
AL5b_Float	2	1	2	1	4	2	1	2	8	Low	2
AL6	2	1	3	2	12	4	1	4	48	High	4
AL6b	2	1	3	2	12	3	1	3	36	Medium	3
AL6c	2	1	3	2	12	2	1	2	24	Medium	3
AL8	2	1	3	2	12	1	1	1	12	Low	2

554,000 555,000 556,000 557,000 558,000

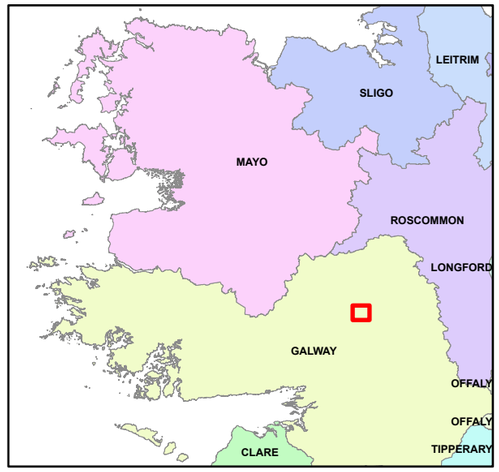
751,000 750,000 749,000 748,000 747,000

T7 T9 T6 T8 T5 T4 T3 T2 T1

N W E S

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Bedrock Karst Susceptibility

- Susceptible- 2

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure H-1: Bedrock Karst Susceptibility Rating

File: 22098-GDG-02-BKS-MP-C-30

Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GSI/GDG	Checked: AL

554,000 555,000 556,000 557,000 558,000

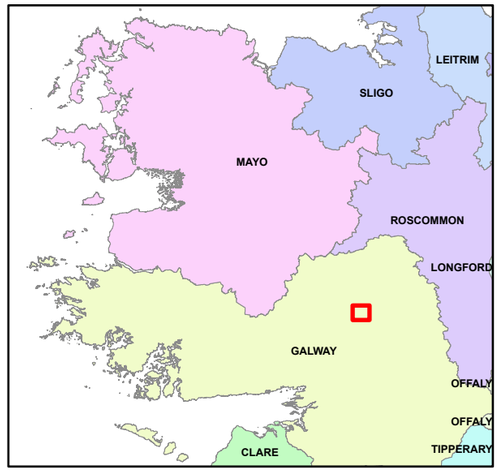
751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T4 T3 T2 T1

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Bedrock Boundary/Fault 100m Buffer

- >100m - 1
- <100m - 2

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure H-2: Proximity to Faults/Geological Boundaries Rating

File: 22098-GDG-02-GBS-MP-C-31

Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GSI/GDG	Checked: AL

554,000 555,000 556,000 557,000 558,000

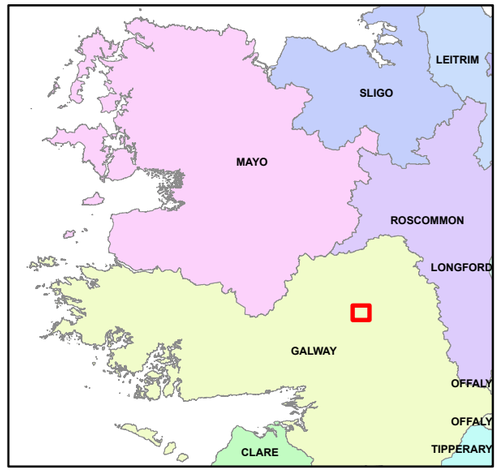
751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T3 T4 T2 T1

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Overburden Thickness Class

- 5-10m -2
- 0-5m - 1

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure H-3: Overburden Thickness Rating

File: 22098-GDG-02-OTS-MP-C-32

Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GSI/GDG	Checked: AL

554,000 555,000 556,000 557,000 558,000

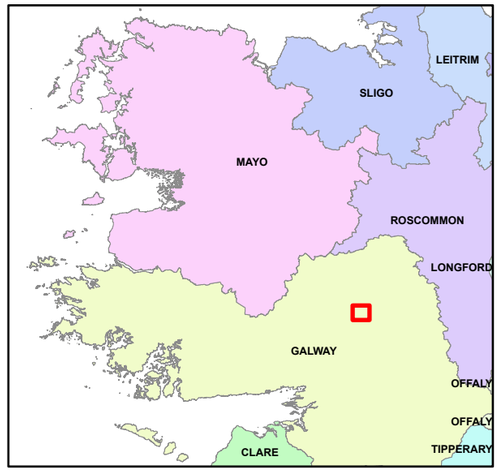
751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T4 T3 T2 T1

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Overburden Composition Class

- Granular/Peat/No Overburden - 1
- Cohesive Overburden - 2

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure H-4: Overburden Composition Rating

File: 22098-GDG-02-OCS-MP-C-32

Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GSI/GDG	Checked: AL

554,000 555,000 556,000 557,000 558,000

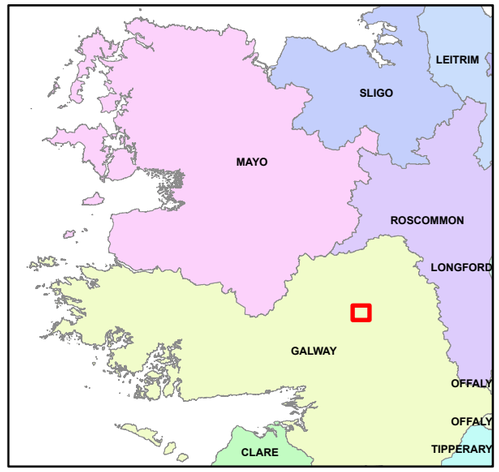
751,000 750,000 749,000 748,000 747,000

N W E S

T7 T9 T6 T8 T5 T4 T3 T2 T1

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Karst Feature Density Class

- 0 Features within 250m -1
- 1-2 Features within 250m -2
- 3-4 Features within 250m -3
- >4 Features within 250m -4

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure H-5: Karst Feature Density Rating

File: 22098-GDG-02-KFD-MP-C-35

Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GSI/GDG	Checked: AL

554,000 555,000 556,000 557,000 558,000

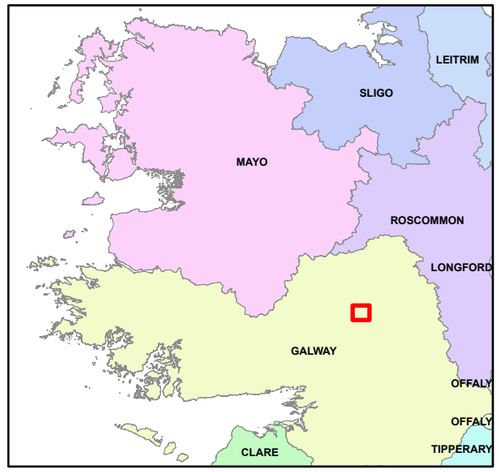
751,000 750,000 749,000 748,000 747,000

T7 T9 T6 T8 T5 T3 T4 T2 T1

N W E S

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Karst Feature 10m Buffer Class

- Outside 10m Buffer of Karst features- 1
- Inside 10m Buffer of Karst features- 3

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure H-5: Karst Feature 10m Buffer Rating

File: 22098-GDG-02-KFB-MP-C-36

Sheet size: A3	CRS: 2157	Authored: CE
Date: 15/09/2025	Source: GSI/GDG	Checked: AL

554,000 555,000 556,000 557,000 558,000

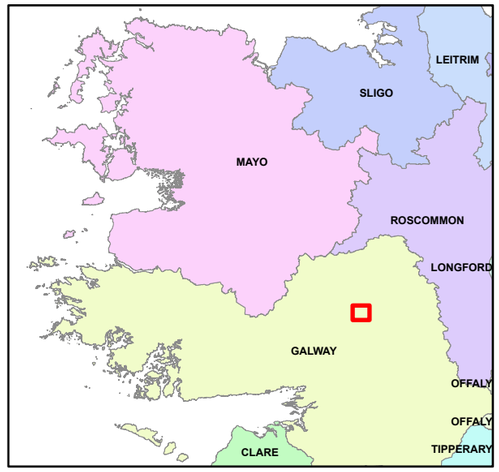
751,000 750,000 749,000 748,000 747,000

T7 T6 T9 T8 T5 T3 T4 T2 T1

N W E S

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Karst Hazard Rating - Raw Scores

- 0 - 12
- 12 - 36
- 36 - 60
- >60

Client: MKO | GDG Gavin & Doherty Geosolutions

Project: Cooloo Wind Farm

Figure H-7: Karst Feature 10m Buffer Rating

File: 22098-GDG-02-KHS-MP-C-37

Sheet size: A3	CRS: 2157	Authored: CE
Date: 19/09/2025	Source: GDG	Checked: AL

554,000 555,000 556,000 557,000 558,000

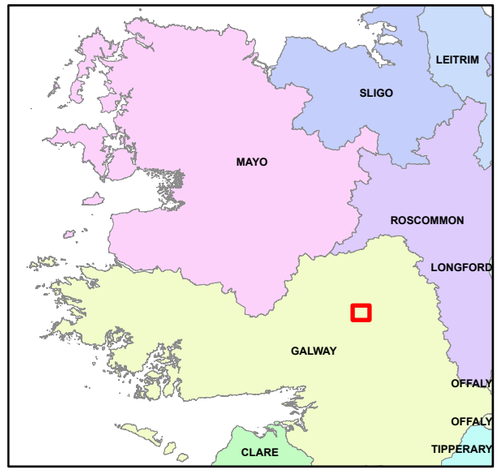
751,000 750,000 749,000 748,000 747,000

N W E S

T7 T6 T9 T8 T5 T4 T3 T2 T1

0 0.25 0.5 1 km

Maxar, Microsoft



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Karst Hazard Rating - Normalised Scores

- 2
- 3
- 4
- 5

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure H-8: Karst Hazard Rating - Normalised Scores

File: 22098-GDG-02-KHR-MP-C-38

Sheet size: A3	CRS: 2157	Authored: CE
Date: 19/09/2025	Source: GDG	Checked: AL

556,000

749,000

N
W
E
S

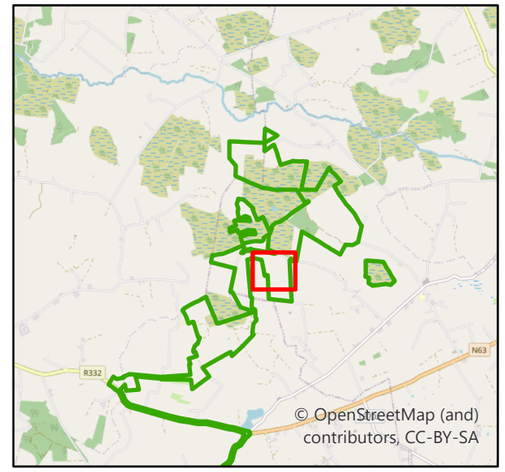
T4

0 25 50 100
Meters

Maxar, Microsoft

556,000

749,000



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Turbine Foundations
- Proposed Turbine Hardstands
- Proposed New Roads
- Proposed Existing Roads to be Upgraded
- Proposed Met Mast
- Proposed Temporary Construction Compound
- Proposed Turbine Delivery Route
- Proposed Turbine Delivery Route Overrun Area
- Proposed Turbine Delivery Junction Accommodation Area
- Proposed Grid Connection Route
- Proposed Onsite Substation and Battery Storage Compound
- Peat Repository Area
- Spoil Repository Area

Karst Hazard Rating - Normalised Scores

- 2
- 3
- 4
- 5

Client: MKO | GDG GAVIN & DOHERTY GEOSOLUTIONS

Project: Cooloo Wind Farm

Figure H-9: Hazard Rating -Normalised Scores (T4)

File: 22098-GDG-02-KHC-MP-C-39

Sheet size: A3	CRS: 2157	Authored: CE
Date: 19/09/2025	Source: GDG	Checked: AL

APPENDIX I GEOTECHNICAL RISK REGISTER

Geotechnical Risk ID	Infratructure Location	Hazard Title	Risk Description	Risk Cause	Risk Impact	Hazard Score	Impact Score	Risk Rating	Mitigation measures	Residual Hazard Score	Residual Impact Score	Residual Risk Rating
1	T1 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	3	5	15	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
2		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	4	12	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
3		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	3	9	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
4		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	3	9	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
5		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	3	9	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
4	T1 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
5		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
6		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
7		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
8		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
9	T2 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
10		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	4	8	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
11		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
12		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
13		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
14	T2 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
15		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
16		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
17		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
18		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
19	T3 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
20		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	4	8	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
21		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
22		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
23		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
24	T3 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
25		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
26		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
27		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
28		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2

29	T4 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	4	5	20	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
30		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	4	16	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	2	4	8
31		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	3	12	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	2	3	6
32		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	3	12	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	2	3	6
33		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	3	12	Detailed ground investigation, mitigation through use of piled foundations if appropriate	2	3	6
34	T4 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	4	5	20	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
35		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	4	3	12	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	2	3	6
36		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	2	8	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	2	2	4
37		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	4	2	8	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	2	2	4
38		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	2	8	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	2	2	4
39	T5 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
40		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	4	8	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
41		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
42		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
43		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
44	T5 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
45		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
46		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
47		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
48		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
49	T6 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
50		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	4	8	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
51		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
52		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
53		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
54	T6 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
55		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
56		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
57		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
58		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
59	T7 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
60		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	4	8	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
61		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
62		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
63		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
64	T7 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
65		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
66		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
67		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
68		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2

69	T8 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
70		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	4	8	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
71		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
72		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
73		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
74	T8 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	3	5	15	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
75		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	3	3	9	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
76		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
77		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	3	2	6	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
78		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
79	T9 Foundation	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
80		Subsidence of soils overlying suffosion or buried dolines	Subsidence over buried or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	4	8	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	4	4
81		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	3	3
82		Variable rockhead,	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	3	3
83		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	3	6	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	3	3
84	T9 Hardstand	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of turbine if significant cavities are encountered	1	5	5
85		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
86		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
87		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
88		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
89	Substation/BESS Compound	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of compound if significant cavities are encountered	1	5	5
90		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
91		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
92		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	2	2
93		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	2	2
94	Construction Compound	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of compound if significant cavities are encountered	1	5	5
95		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
96		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
97		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	2	2
98		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	2	2
99	Met Mast	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of Met Mast if significant cavities are encountered	1	5	5
100		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at hardstand	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement	2	3	6	Detailed ground investigation if required, mitigation through use of grouted piled foundations, or bridging cavities if appropriate, micrositing of turbine if significant cavities are encountered.	1	3	3
101		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through use of grouted piled foundations, or bridging cavities with concrete, or geogrid and coarse granular fll if appropriate.	1	2	2
102		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. ground improvement	2	2	4	Detailed ground investigation, mitigation through use of piled foundations if appropriate.	1	2	2
103		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation, mitigation through use of piled foundations if appropriate	1	2	2
104	Access Track - AL1	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
105		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
106		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
107		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2

108		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
109	Access Track - AL1b	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
110		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
111		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
112		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
113		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
114	Access Track - AL2	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	3	5	15	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
115		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
116		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
117		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
118		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
119	Access Track - AL3	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	3	5	15	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
120		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
121		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
122		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
123		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
124	Access Track - AL3b	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	4	5	20	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
125		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
126		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
127		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
128		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
129	Access Track - AL4	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
130		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
131		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
132		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
133		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
134	Access Track - AL4 Float	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
135		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
136		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
137		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
138		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2

139	Access Track - AL4b	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
140		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
141		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
142		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
143		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
144	Access Track - AL4b Float	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
145		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
146		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
147		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
148		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
149	Access Track - AL4c	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
150		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
151		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
152		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
153		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
154	Access Track - AL5	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
155		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
156		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
157		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
158		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
159	Access Track - AL5 float	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
160		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
161		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
162		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
163		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
164	Access Track - AL5b	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
165		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
166		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
167		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
168		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2

169	Access Track - AL5b Float	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
170		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
171		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
172		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
173		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
174	Access Track - AL6	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover. Slight reduction in hazard score applied due to lack of evidence for large cavities in geophysical surveying.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	1	5	5	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
175		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
176		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
177		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
178		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	4	2	8	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	2	2	4
179	Access Track - AL6b	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	3	5	15	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
180		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
181		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
182		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
183		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
184	Access Track - AL6c	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	3	5	15	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
185		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
186		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
187		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
188		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	3	2	6	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
189	Access Track - AL8	Rapid collapse of sikhole/doline cavity	Rapid collapse of cavity roof during construction	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Risk of severe injuries or death 2.Bearing capacity failure. 3. Severe damage to foundations and plant	2	5	10	Detailed ground investigation if required, micrositing of access track alignment if significant buried cavities with potential for collapse are encountered	1	5	5
190		Subsidence of soils overlying suffosion or buried dolines	Subsidence overburied or suffosion dolines, leading to differential settlement at turbine foundations	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation throughe .g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
191		Variable rockhead, or unexpected cavities	Variable rockhead, or unexpected cavities leading to unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Requirement for remediation through e.g. geogrid blanket, or thicker structural fill make up	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
192		Cavities / Voids	Foundation failure or differential settlement.Unforeseen requirement for piled foundations or geotechnical re-design	Development of subsurface cavities due to karstification of underlying bedrock, with cohesive soil cover.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2
193		Solutionally Weathered Rock	Excavation instability and reduced bearing capacity.	Deeply weathered limestone with voids and softened zones.	1. Unacceptable amounts of settlement. 2. Bearing capacity failure. 3. Requirement for remediation through e.g. ground improvement or the use of piled foundations.	2	2	4	Detailed ground investigation if required, inspection of subformation following topsoil strip, backfill of cavities with selected coarse granular fill, installation of geogrid/geofabric reinforcement over features	1	2	2

GLOBAL PROJECT REACH

Offices

Dublin (Head Office)
Gavin & Doherty Geosolutions
Unit A2, Nutgrove Office Park
Rathfarnham
Dublin 14, D14 X627
Phone: +353 1 207 1000

Cork
Gavin & Doherty Geosolutions
First Floor, 12 South Mall
Cork
T12 RD43

London
Gavin & Doherty Geosolutions (UK) Limited
85 Great Portland Street, First Floor
London
W1W 7LT

Utrecht
Gavin & Doherty Geosolutions
WTC Utrecht, Stadsplateau 7
3521 AZ Utrecht
The Netherlands

Belfast
Gavin & Doherty Geosolutions (UK) Limited
Scottish Provident Building
7 Donegall Square West
Belfast
BT1 6JH

Edinburgh
Gavin & Doherty Geosolutions (UK) Limited
22 Northumberland Street SW Lane
Edinburgh
EH3 6JD

Rhode Island
Gavin & Doherty Geosolutions Inc.
225 Dyer St, 2nd Floor
Providence, RI 02903
USA

Website: www.gdgeo.com
Email: info@gdgeo.com

A Venterra Group Plc Member Company