Appendix G

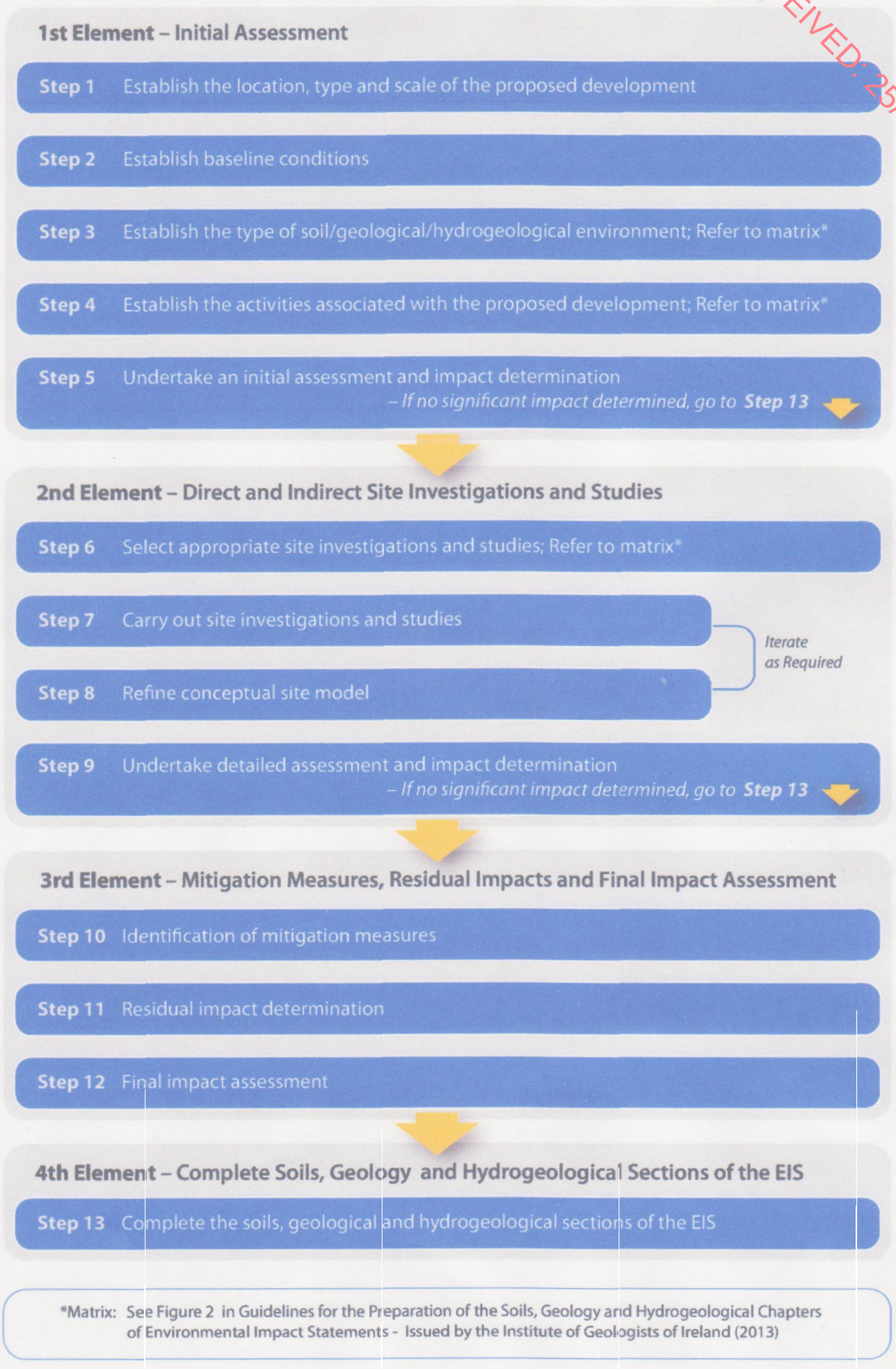
LAND, SOILS (GEOLOGY)

Appendix G Contents

Kilchreest Quarry Expansion EIAR – Chapter 6 Land/Soil (Geology)

Appendix 6.1 – IGI EIS Guideline Matrices

Figure 1 Flow Chart



*Matrix: See Figure 2 in Guidelines for the Preparation of the Soils, Geology and Hydrogeological Chapters of Environmental Impact Statements - Issued by the Institute of Geologists of Ireland (2013)

Figure 2 Activities /Environments Matrix

Environments	Activities: Earthworks	Storage / transmission of leachable and/or hazardous materials	Lowering of groundwater levels by pumping or drainage	Discharges to ground	Excavation of materials above the water table	Excavation of materials below the water table	Land-spreading	Abstraction / Discharge of energy (heat) from/to the ground
Type A	Invasive site works to characterise nature[1] and thickness of soil and subsoil e.g. trial pits or augering.	Establish nature and quantity of leachable materials.	Establish details of borehole /spring construction or drainage system structure details (as appropriate).	Complete a Risk Assessment as per EPA (2011) Guidance on the Authorisation of Discharges to Groundwater[2]; Apply Tier 1, 2 or 3 Assessment as appropriate	Site works to characterise nature[1], thickness, permeability and stratification of soils and subsoils e.g. trial pits, augering.	Site works to characterise nature[1], thickness, permeability and stratification of soils and subsoils e.g. trial pits, augering.	Establish the type of waste to be landspread.	Provide details of type of system (open/closed, shallow/deep). The site works required and described below will reflect the design parameters of the system being installed.
		Site works to characterise nature[1], thickness, permeability and stratification of soils, subsoils and bedrock geology e.g. trial pits, boreholes.	Establish sustainable yield and proposed daily abstraction rate or drainage system invert levels (as appropriate).		Site works to fully characterise the bedrock geology and in order to to define the resource volume/weight according to The PERC Reporting Standard[3] e.g. trenching, drilling, geophysics.	Site works to fully characterise the bedrock geology and in order to to define the resource volume/weight according to The PERC Reporting Standard[3] e.g. trenching, drilling, geophysics.	Undertake a walkover survey of the site.	Site works to characterise nature[1], thickness, permeability and stratification of soils, subsoils and bedrock geology.
		Works to determine groundwater level, e.g.mapping, monitoring in stand pipes, piezom-eters, or boreholes.	Works to determine summer level of the water table, annual actual recharge and proposed maximum drawdown. Measurement of effects of change in water level on nearby abstractions.		Works to determine groundwater level, flow direction and gradient; e.g.monitoring in stand pipes, piezometers, or boreholes.	Works to determine groundwater level, flow direction and gradient; e.g.monitoring in stand pipes, piezometers, or boreholes.	Review Groundwater Protection Responses for Landspreading[4], and apply Departmental[5] and Regularory[6] guidelines and best practice.	Design parameters for the system will be required to be collected, however these are out of the remit of this document - although any information gathered for design purposes should be used in the EIS.
						Characterisation of groundwater chemistry and quality.	Assign a response category.	
						If lowering of groundwater levels is required, then proceed also as for activity Lowering of water levels by pumping of drainage.		
Type B	*In addition to all the above;*	*In addition to all the above;*	*In addition to all the above;*	*As above;*	*As above;*	*As above;*	*In addition to all the above;*	*In addition to all the above;*
	Works to determine groundwater level, flow direction and gradient; e.g. monitoring in stand pipes, piezometers, or boreholes.	Works to determine groundwater flow direction and gradient; e.g. monitoring in stand pipes, piezometers, or boreholes.	Works to determine aquifer properties, seasonal variations in water levels, extent of cone of depression or drawdown of surrounding water levels (as appropriate) and alterations in groundwater flow pattern.				Site works to characterise subsoil/soil characteristics e.g. trial pits or augering.	Characterise baseline temperature of soil / groundwater and groundwater hydrochemistry and quality.
	Works to determine groundwater - surface water interactions.	Works to determine groundwater - surface water interactions.	Works to determine groundwater - surface water interactions and measure effects of drawdown in water levels on hydraulically connected surface waters and springs.					Works to determine groundwater level e.g.monitoring in stand pipes, piezometers, or boreholes.
								If it is proposed to discharge to surface water, then characterisation surface water quality, baseline temperature and flow rates.
Type C	*In addition to all the above;*	*In addition to all the above;*	*In addition to all the above;*	*As above;*	*As above;*	*As above;*	*In addition to all the above;*	*In addition to all the above;*
	Identify location and abstraction rate of nearby groundwater abstractions.	Measure or determine rate of groundwater flow/travel time.	Installation of sufficient monitoring wells to provide groundwater flow direction, gradient, flow pattern and rate of flow/travel time.				Confirm subsoil permeability in laboratory. Delineate inner and outer source protection areas and source protection zones.	Works to determine thermal and hydraulic conductivity of soil, subsoil and bedrock.
			Identify nearby geothermal systems, and discharges to groundwater				Establish water quality of groundwater abstraction. Undertake risk assessment if appropriate.	Identify location and abstraction rate of nearby groundwater abstractions.
Type D	*In addition to all the above;*	*In addition to all the above;*	*In addition to all the above;*	*In addition to all the above;*	*In addition to all the above;*	*In addition to all the above;*	*As for Type C above*	*In addition to all the above;*
	Regional study of karst in an area, including identified karst features (both mapped and identified during site walkovers).	Full detailed hydrogeo-logical assessment required in this situation.	Geotechnical assessment of risk of landslide or subsidence.	Geotechnical assessment of risk of landslide or subsidence.	Full detailed hydrogeological assessment required in this situation.	Geotechnical assessment of risk of landslide or subsidence.		Geotechnical assessment of risk of landslide or subsidence.
	Map bedrock topography.	Geotechnical assessment of risk of landslide or subsidence.			Geotechnical assessment of risk of landslide or subsidence.			
	Geotechnical assessment of risk of landslide or subsidence.							
Type E	Full detailed hydrogeological assessment required in this situation.	Full detailed hydrogeological assessment required in this situation.	Full detailed hydrogeo-logical assessment required in this situation.	Complete a Risk Assessment as per EPA (2011); Apply Tier 1, 2 or 3 Assessment as appropriate.	Full detailed hydrogeological assessment required in this situation.	Full detailed hydrogeological assessment required in this situation.	*As for Type C above*	Full thermogeological and/or hydrogeological assessment required in this situation.

Type A	Passive geological / hydrogeological environments
Type B	Natural dynamic hydrogeological environments
Type C	Man-made dynamic hydrogeological environments
Type D	Sensitive geological / hydrogeological environments
Type E	Groundwater dependent eco systems

Where works are required to characterise, establish, measure, determine or otherwise provide information, the level of activity and detail required will be informed by a combination of a) the potential impact of the proposed development , b) the scale of the proposed development and c) the professional judgement of the project geoscientist. In addition, the works are likely to be iterative, with new works required in reponse to information acquired during any phase of works.

1 Characterisation of soil and sub-soils to be carried out in accordance with a recognised standard or nomenclature system e.g. BS5930:1990 for subsoils or EPA Code of practice for Environmental Risk Assessment for Unregulated Waste Disposal sites where relevant
2 EPA, 2011. Guidance on the Authorisation of Discharges to Groundwater - Version 1 December 2011. www.epa.ie
3 The PERC Reporting Standard
4 Groundwater Protection Schemes (DoELG/EPA/GSI, 1999)
5 Control of Farm Pollution (DAFF, 1992) and the Code of Good Agricultural Practice to Protect Waters from Pollution by Nitrates (DoE and DAFF, 1996)
6 Landspreading of Organic Waste - Guidance on Groundwater Vulnerability Assessment of Land (EPA 2004)

Kilchreest Quarry Expansion EIAR – Chapter 6 Land/Soil (Geology)

Appendix 6.2 – Old Tailte Eireann Maps & Aerial Photos

Image 6.2.0 Tailte Eireann 1:50,000 scale site location map with Kilchreest Quarry shown by the orange star.

(Sourced from GSI Web Site – Reproduced under Licence Ref CYAL50388987 © Tailte Eirann – Surveying)

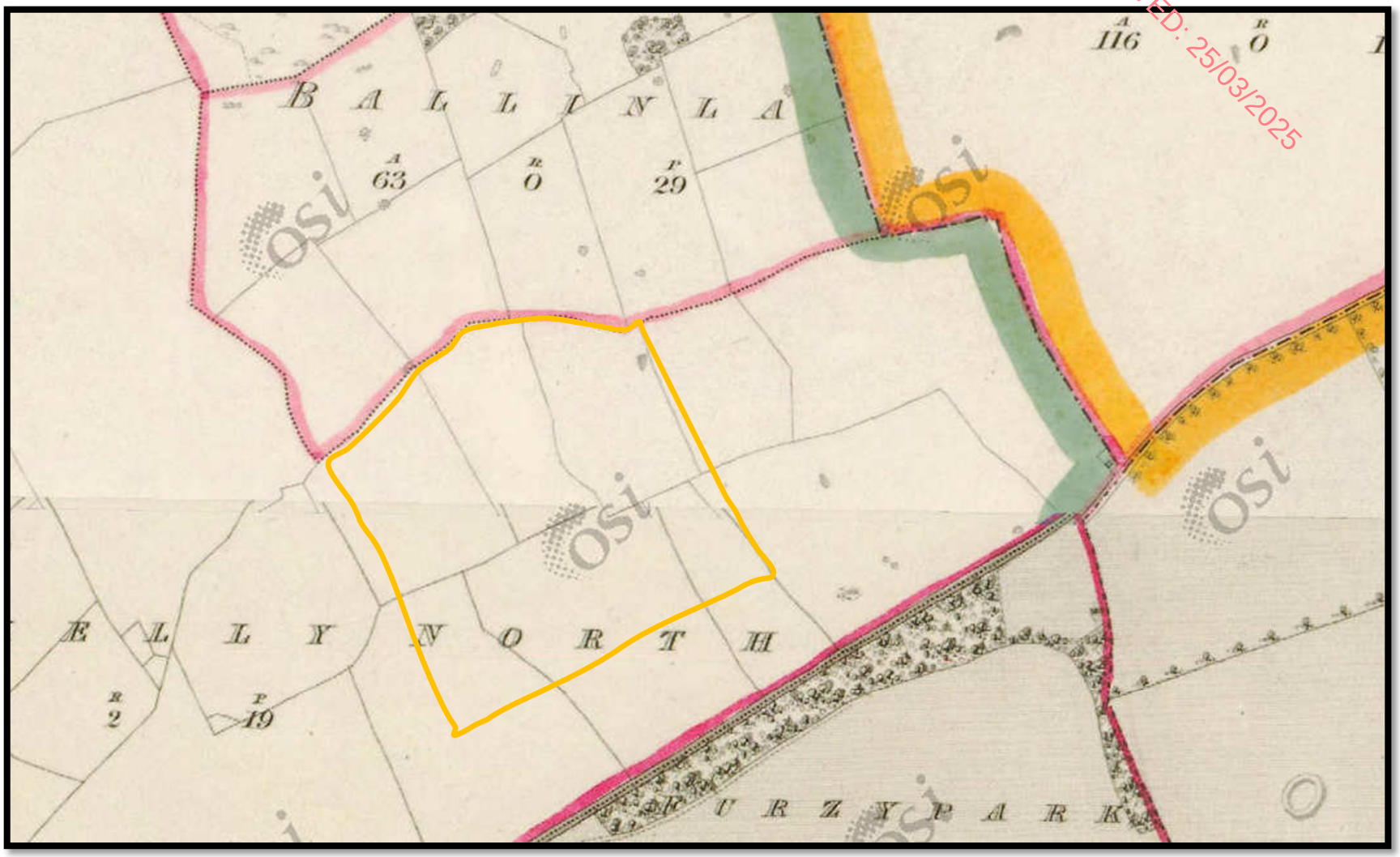


Image 6.2.1 Old OSI 1840's 6" Map of the existing and proposed quarry expansion area – historically composed of open fields . (Approximate final quarry boundary shown by orange line).

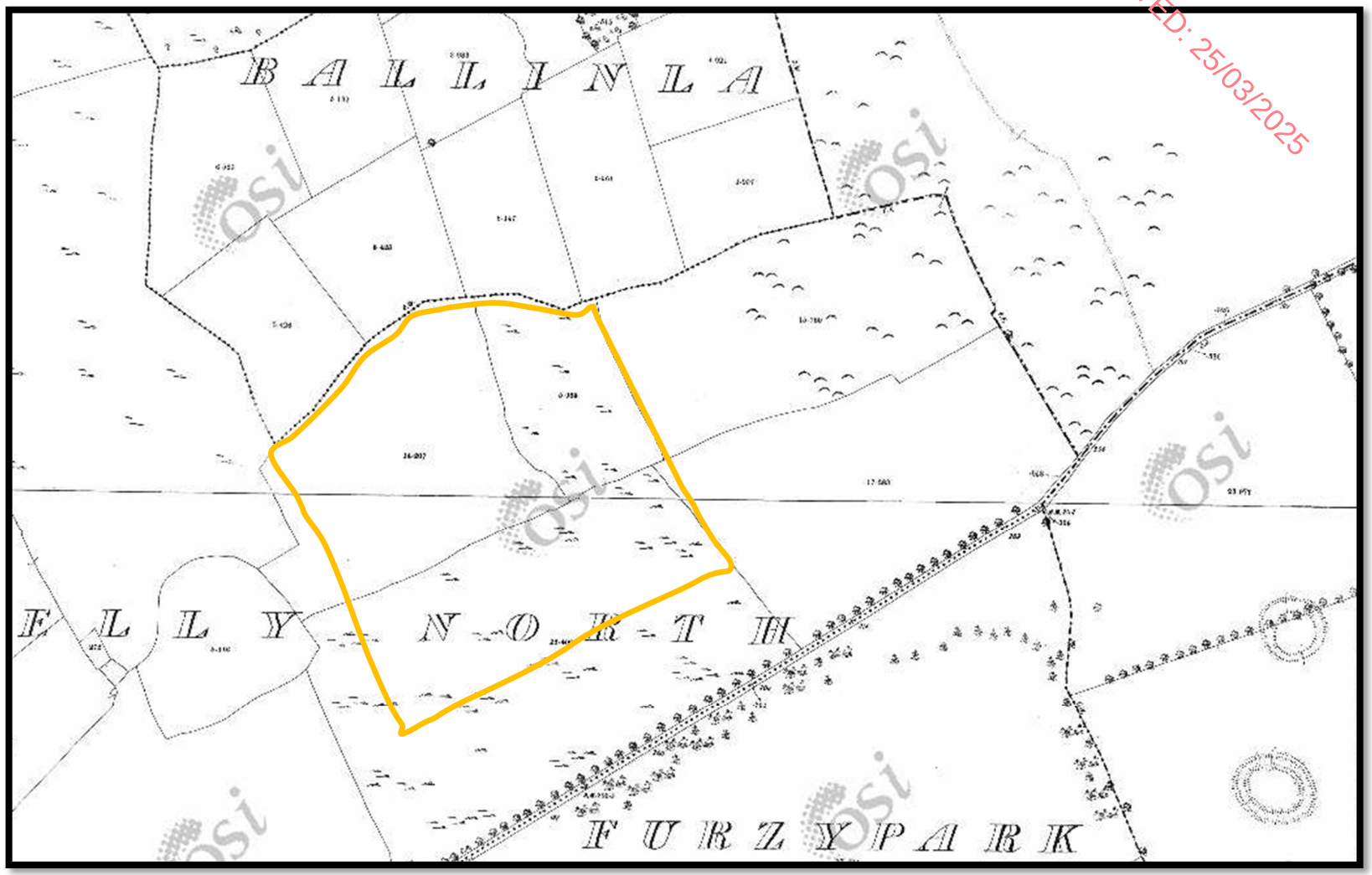


Image 6.2.2 OSI early 1900's 25" Map of the existing and proposed quarry expansion area – historically composed of open fields . (Proposed final quarry - approximate boundary shown by orange line).

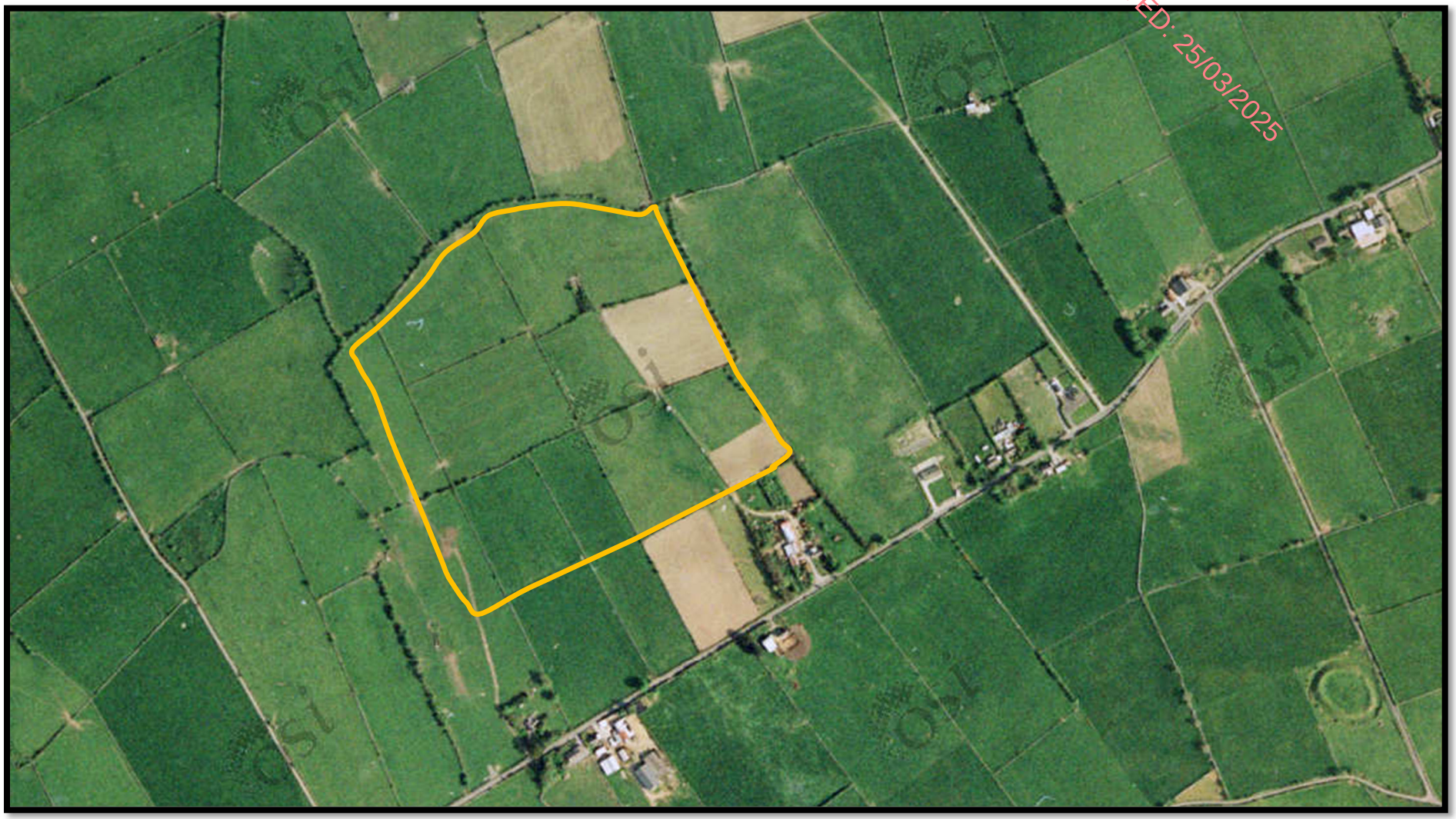


Image 6.2.3 Old Aerial Photograph of local area from 1996. Field Patten is more or less the same as the 1840's.

Image 6.2.4 Old Aerial Photograph of local area from 2001. Land clearance and commencement of excavations at the Roadstone Quarry.

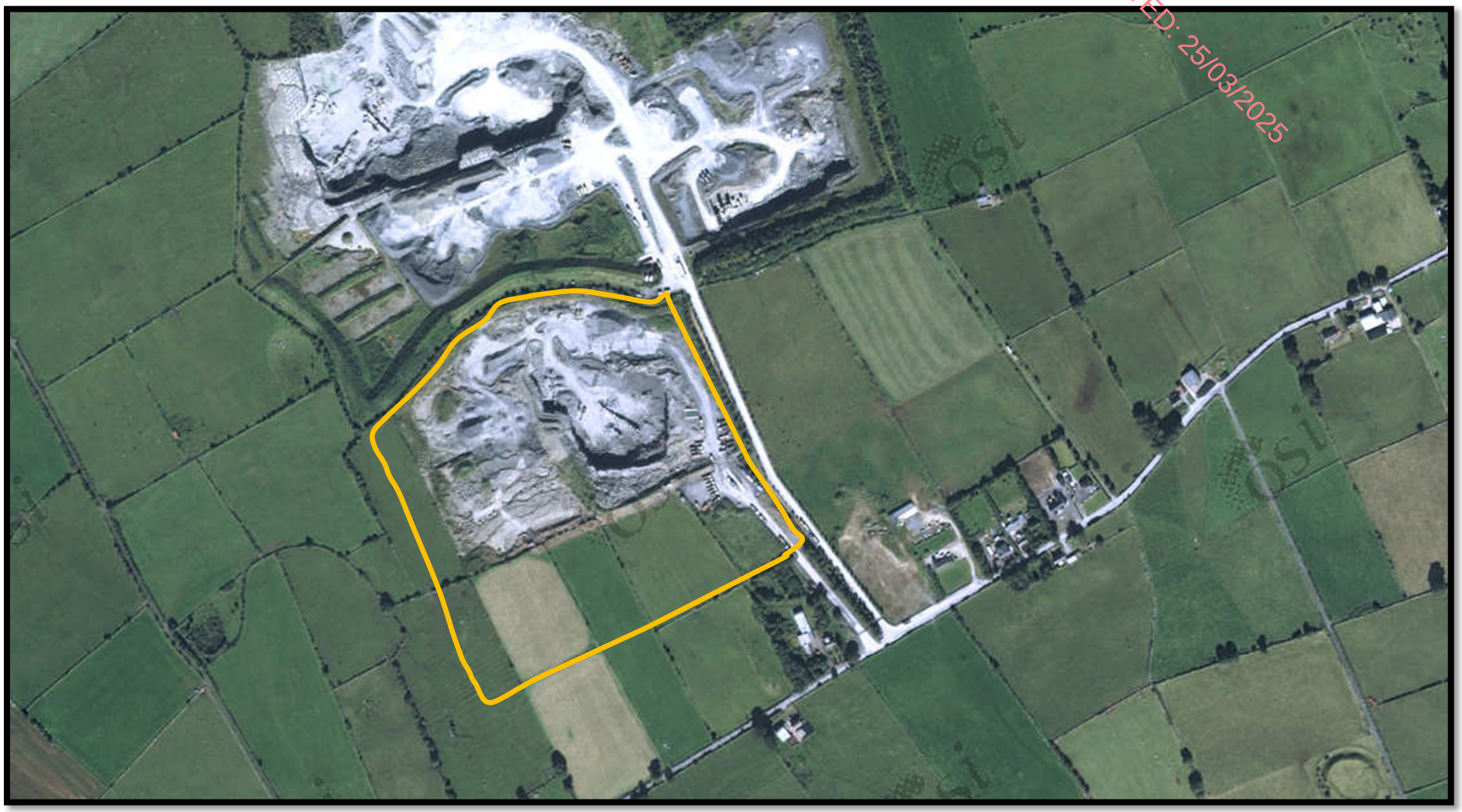


Image 6.2.5 OSI Aerial Photograph of study area from 2006. Work on Kilchreest Quarry has started with soil removed in field to west too. (Proposed final quarry - approximate boundary shown by orange line).

Kilchreest Quarry Expansion EIAR – Chapter 6 Land/Soil (Geology)

Appendix 6.3 – GSI Contour & Karst Mapping

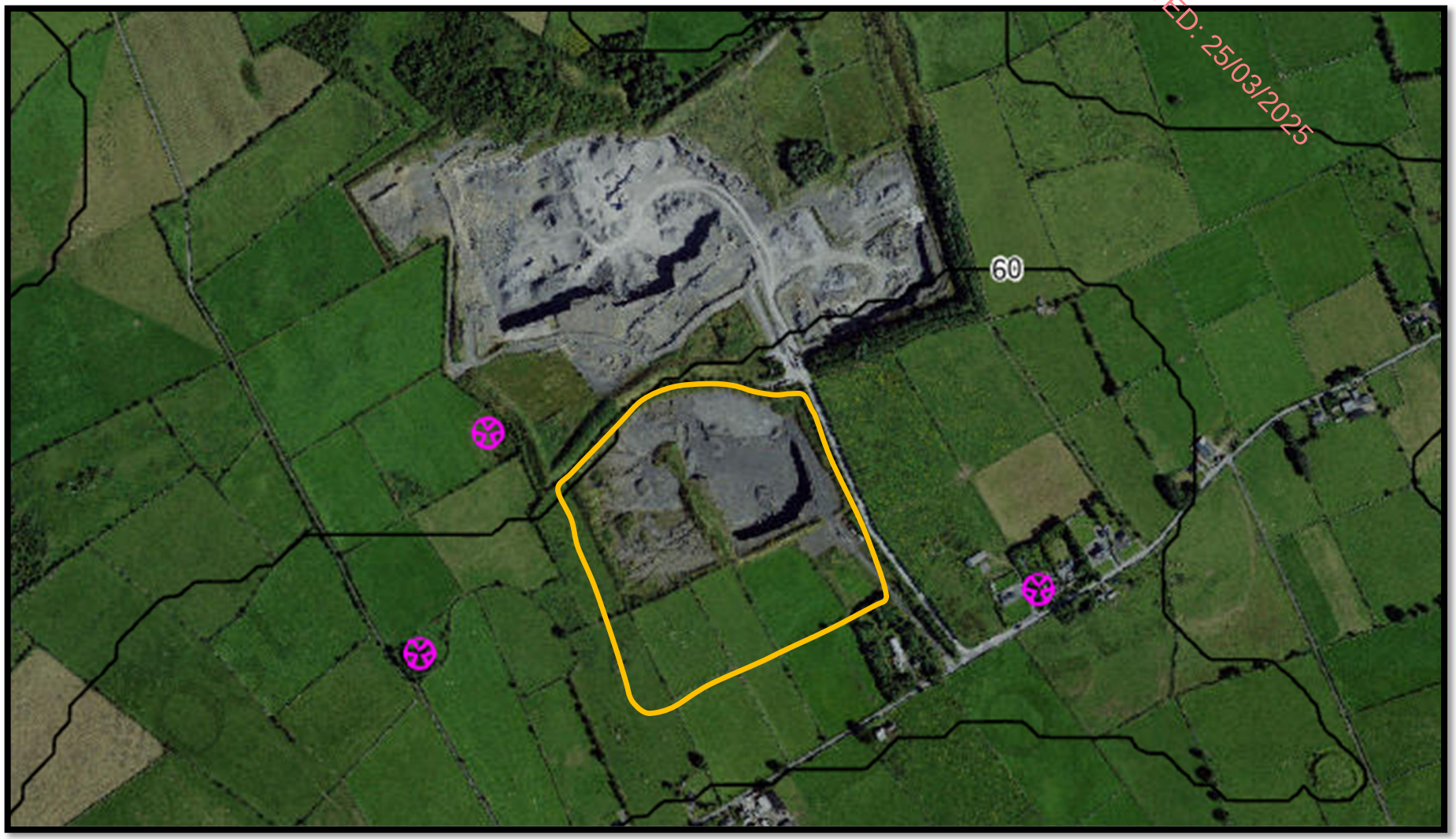


Image 6.3.1 – GSI Contour Mapping (black lines) with karst features (pink) and approximate boundary of future quarry area is shown by the orange line.

Kilchreest Quarry Expansion EIAR – Chapter 6 Land/Soil (Geology)

Appendix 6.4 – GSI/Teasgac/Cranfield Soils Maps

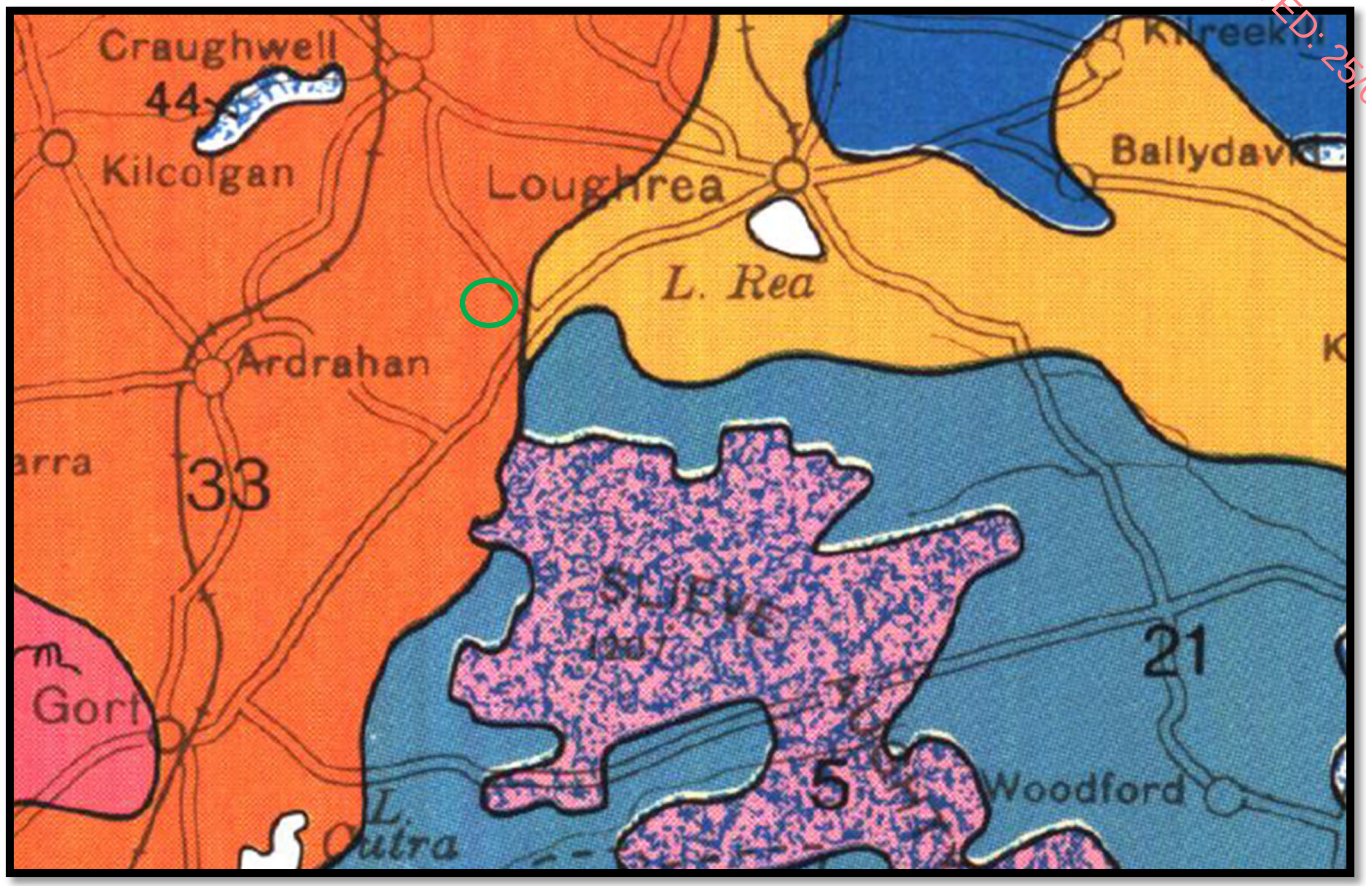


Image 6.4.1: Extract from the General Soil Map of Ireland (2nd Edition 1980) , with approx. study area shown by green circle, in Soil Area No.33.

Flat to Undulating Lowland (Mainly dry Mineral Soils)	33	Shallow Brown Earths and Rendzinas (60)	Grey Brown Podzolics(25) Gleys (10) Peat (5)	Limestone till, shallow in places
	34	Minimal Grey Brown Podzolics (70)	Gleys (20) Brown Earths (10)	Limestone glacial till
	35	Grey Brown Podzolics (80)	Gleys (10), Brown Earths (10)	Stony limestone glacial till

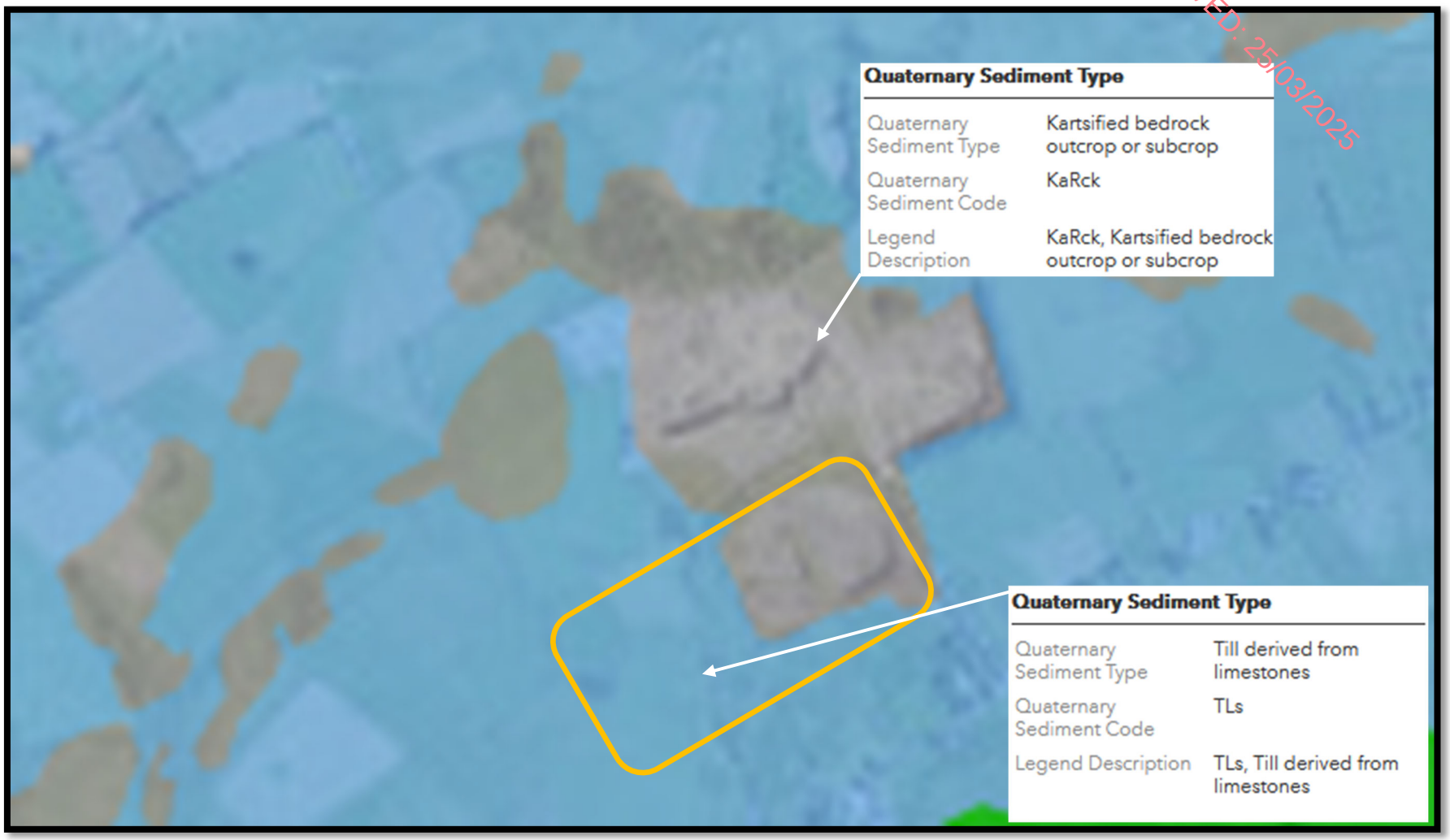


Image 6.4.2: GSI web site Quaternery Soil Mapping, (Till is blue & rock is grey) with approximate study area shown by orange shape.

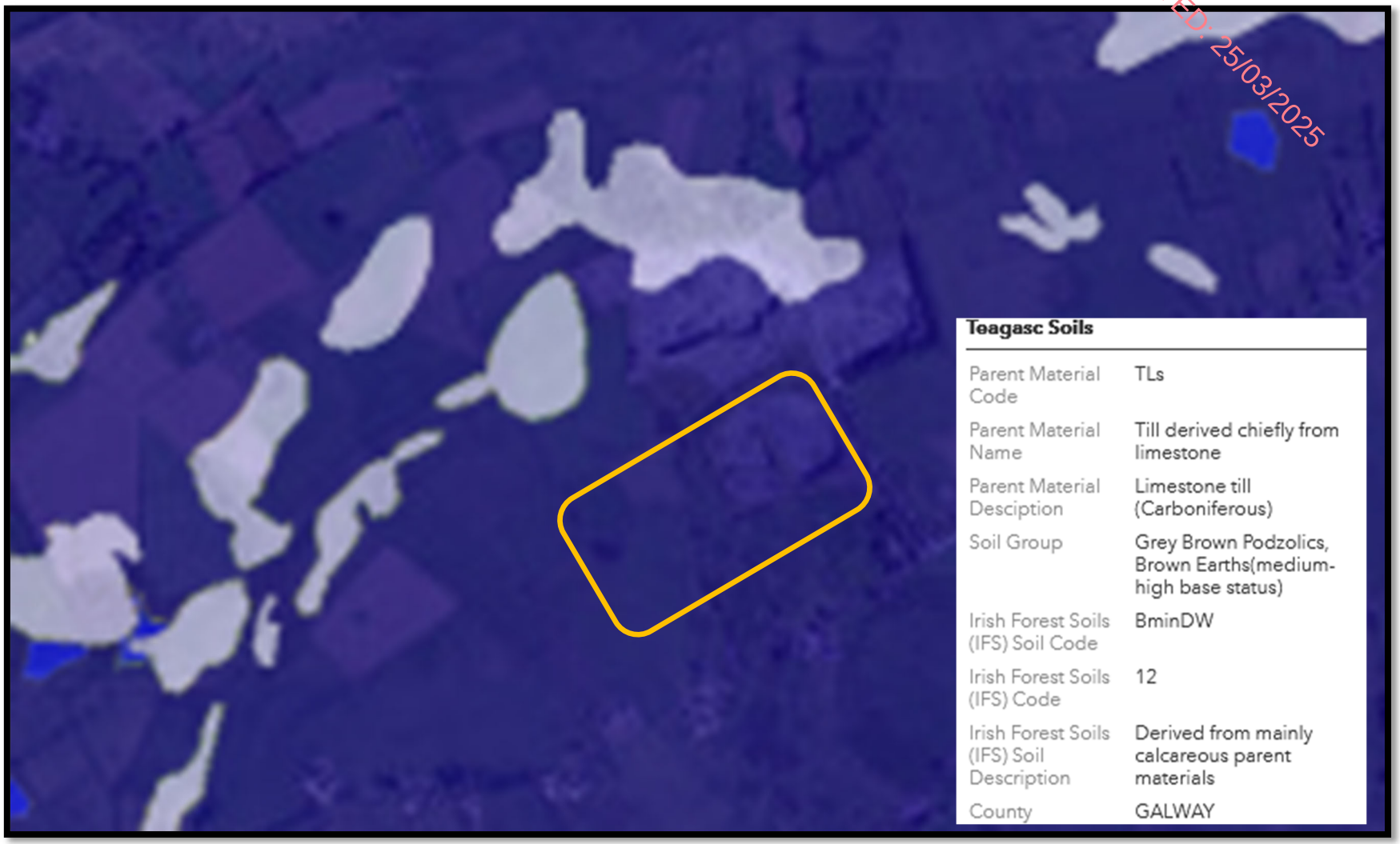


Image 6.4.3: GSI/Teagasc Soil Mapping, with approximate study area shown by orange rectangle shape.

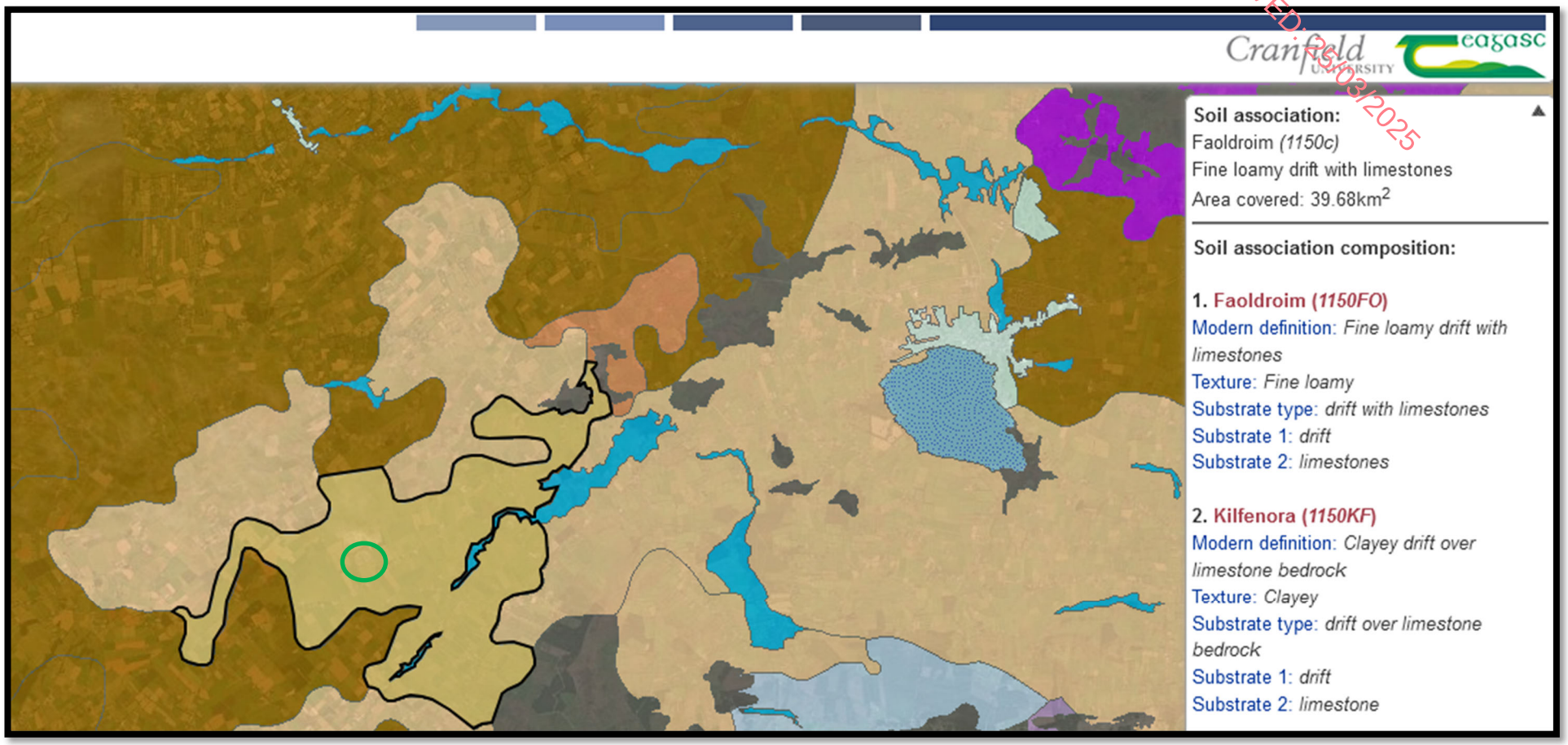


Image 6.4.4: Cranfield/Teasgasc Soil Association Mapping – location of the Kilchreest Quarry study area location shown by green circle.

The Soil Association is identified as the Faoldroim Soil Unit which is described as Fine loamy drift with limestones.

Kilchreest Quarry Expansion EIAR – Chapter 6 Land/Soil (Geology)

Appendix 6.5 – GSI Bedrock Mapping

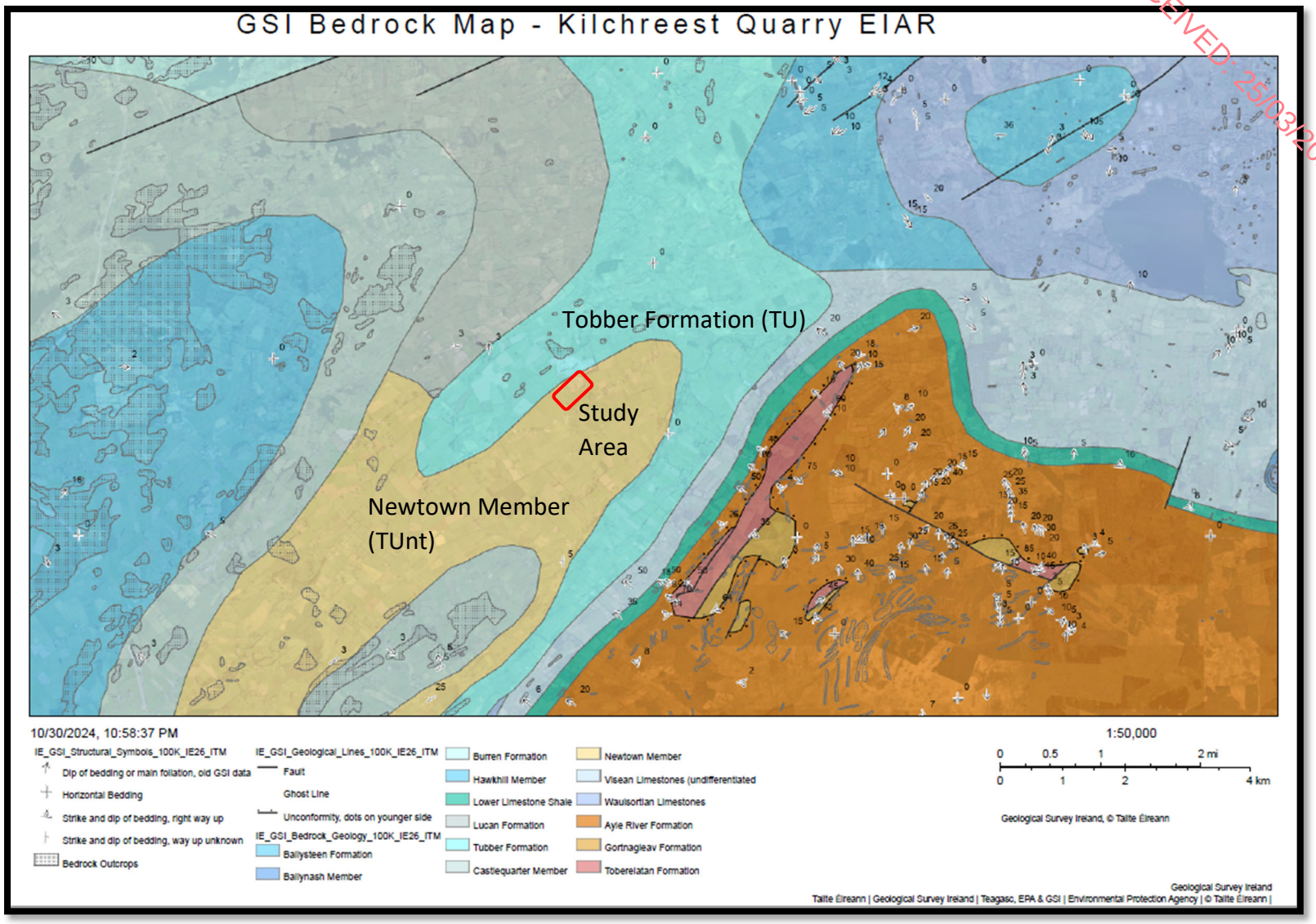


Image 6.5.1: GSI Bedrock Geology Mapping with hatched areas represent mapped rock outcrop. (Location of study area shown by red rectangle.)

(Sourced from GSI or EPA Web Sites – Reproduced under Licence Ref CYAL50388987 © Tailte Eirann – Surveying)

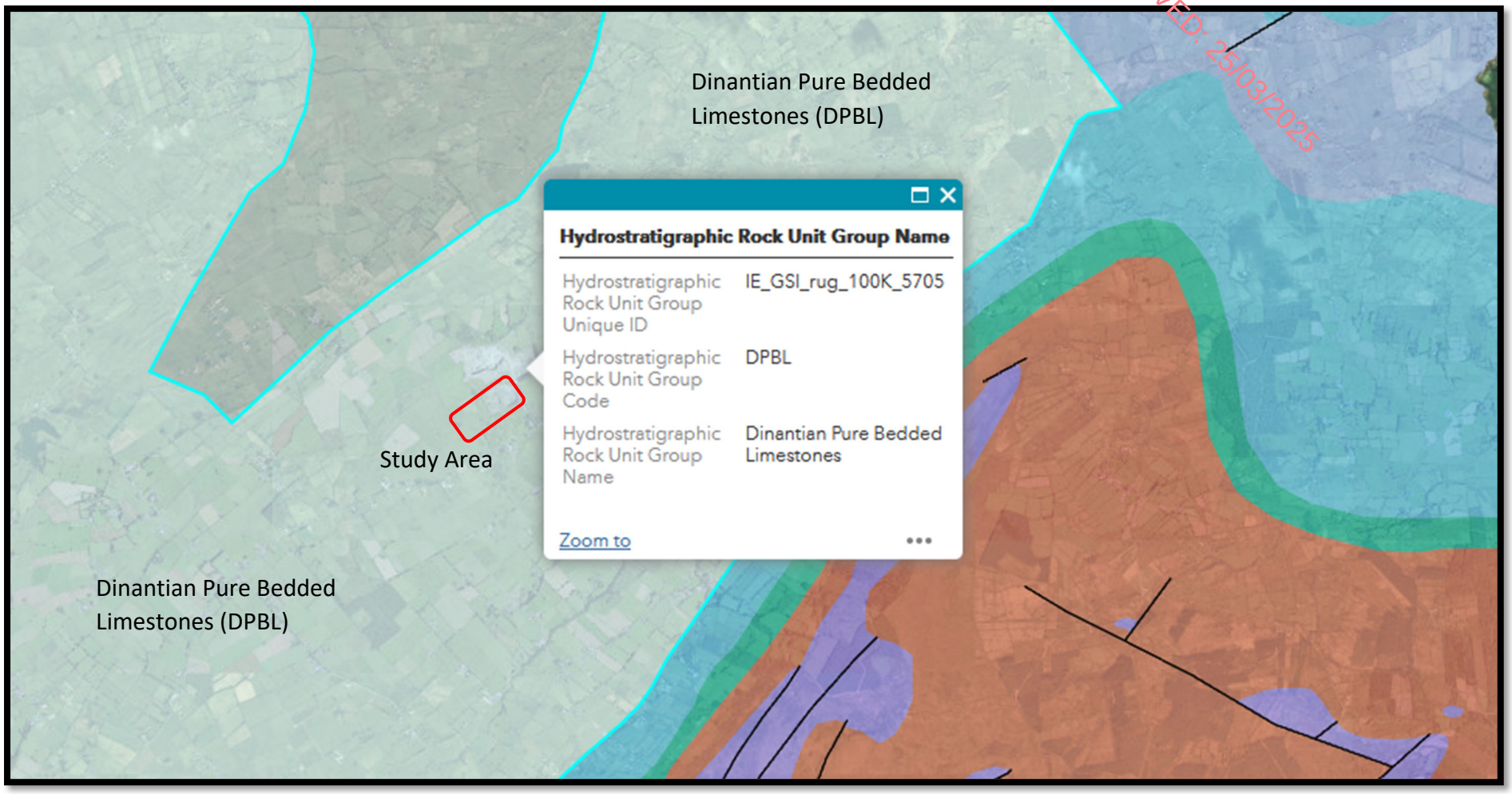


Image 6.5.2: Kilchreest Quarry GSI Hydrostatic Rock Unit Group – Dinantian Pure Bedded Limestone. (Study area shown by red rectangle.)

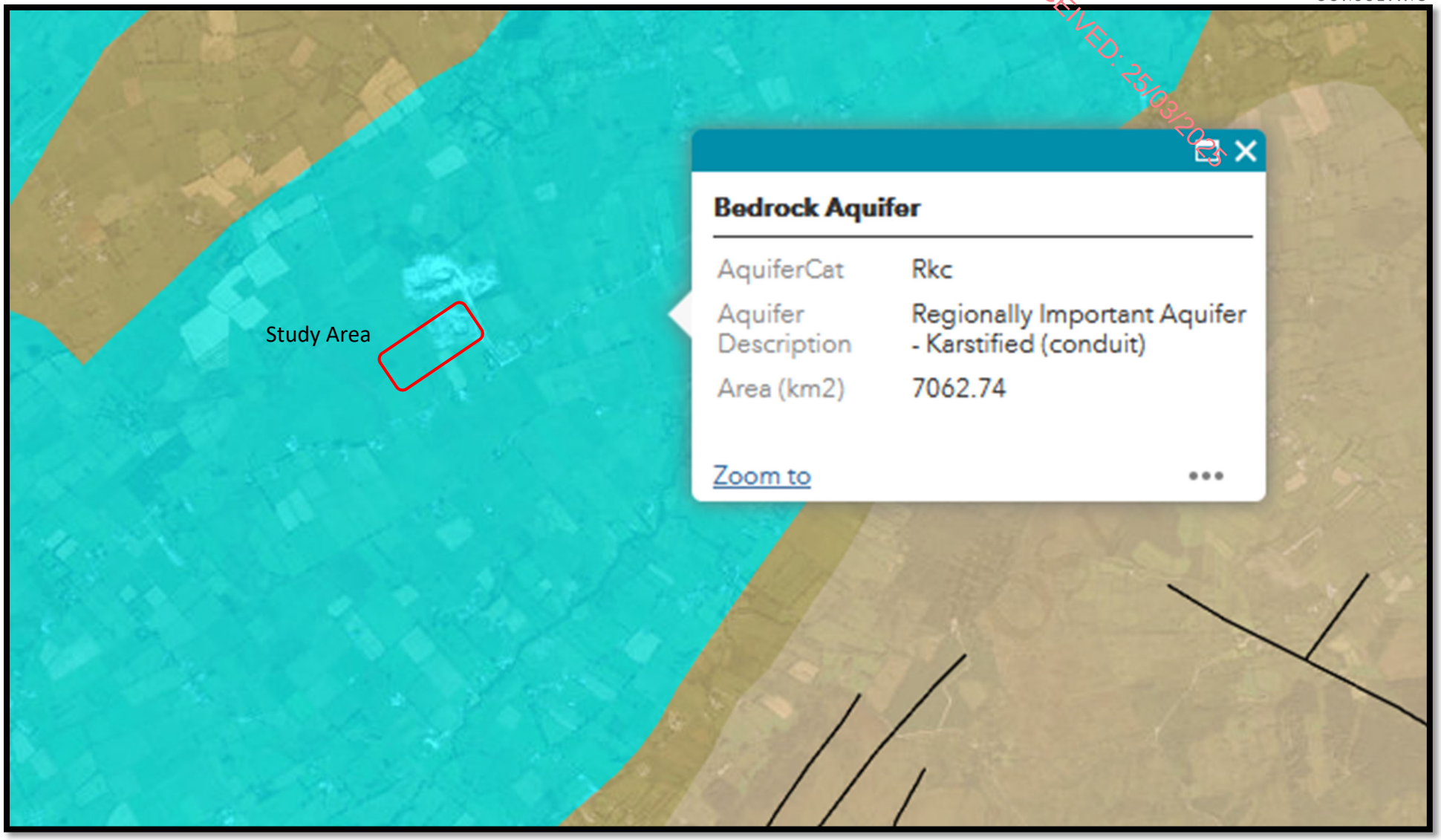


Image 6.5.3: GSI Aquifer Mapping showing that the limestone bedrock in the site area is classified as a Regionally Important Aquifer (Rkc).

(Sourced from GSI or EPA Web Sites – Reproduced under Licence Ref CYAL50388987 © Tailte Eirann – Surveying)

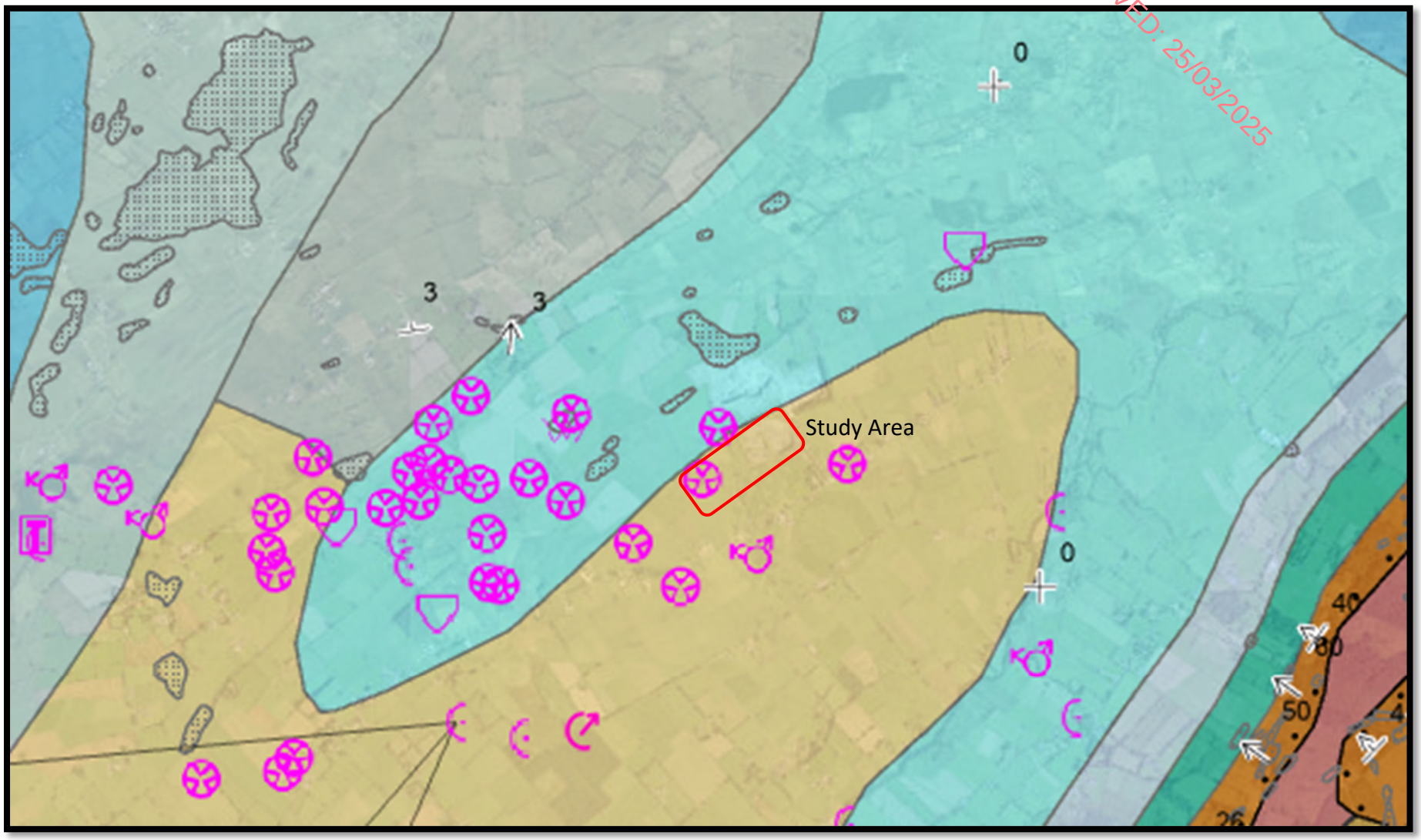


Image 6.5.4: GSI Karst with enclosed depressions shown by pick circles, springs with circle with arrows, caves are pink triangles and sink holes are semi-circles.

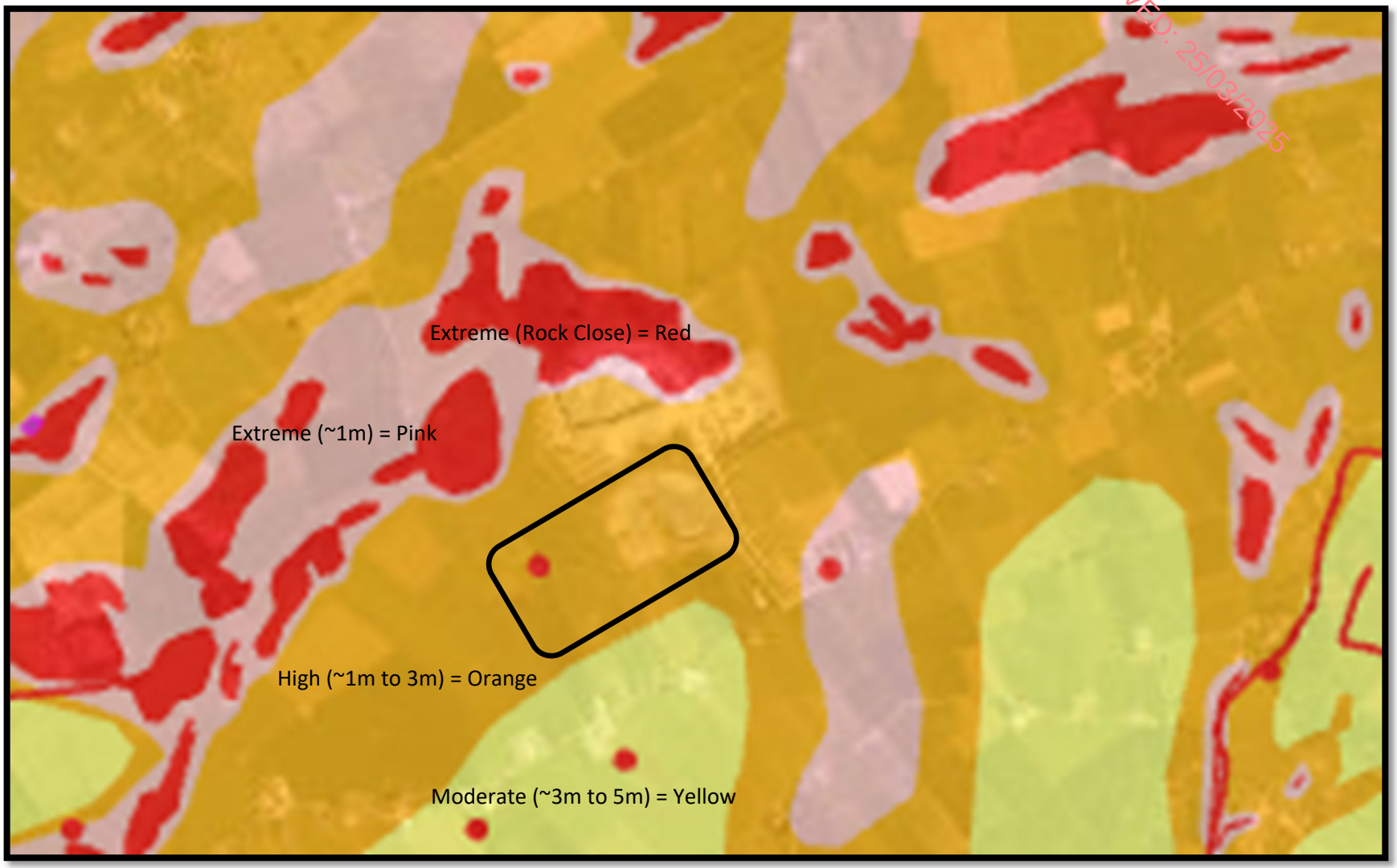


Image 6.5.5: GSI Vulnerability Mapping indicating Extreme to High Vulnerability of the site area. (Site location shown by black rectangle shape.)

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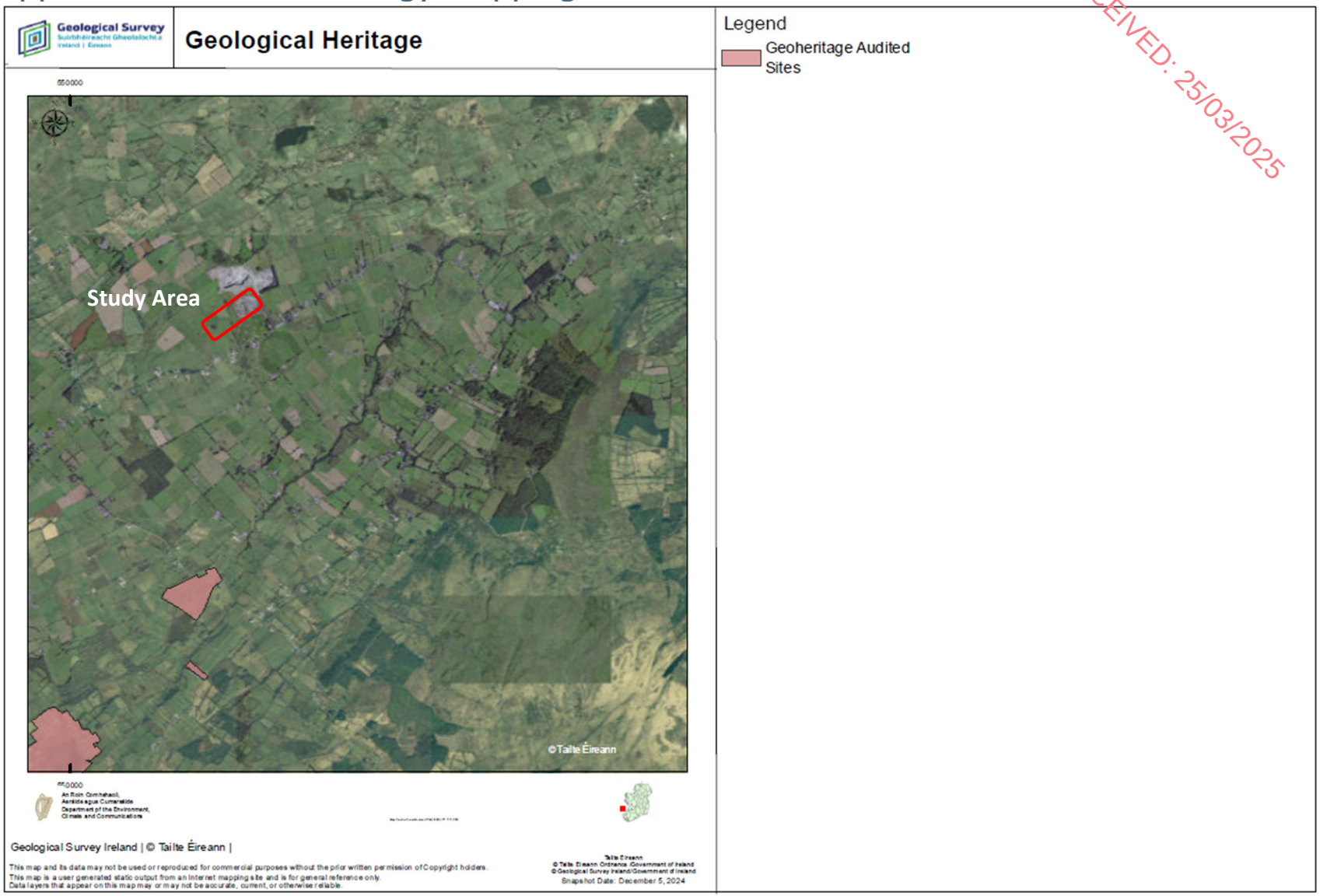

Image 6.5.6: GSI Heritage Mapping with no Geological Heritage Sites Located within or near (<3km) the quarry site.

(Sourced from GSI or EPA Web Sites – Reproduced under Licence Ref CYAL50388987 © Tailte Eirann – Surveying)

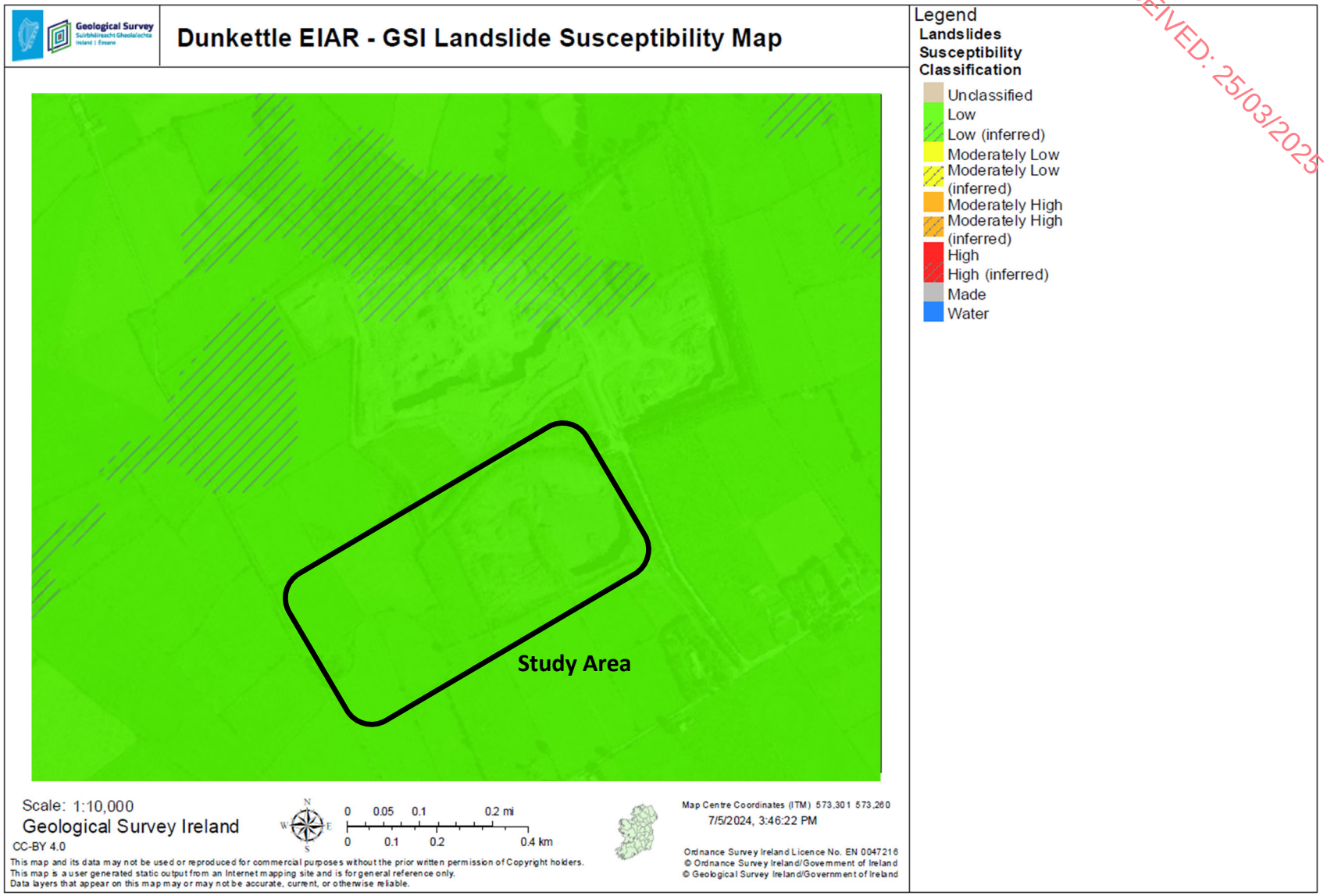

Image 6.5.7: GSI Slope Stability Hazard Mapping showing the locality as a Low Susceptibility Landslide Risk.

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Image 6.5.8: GSI Crushed Aggregate Quarry Mapping showing active quarries in the local area. (Rock quarries shown by blue squares)

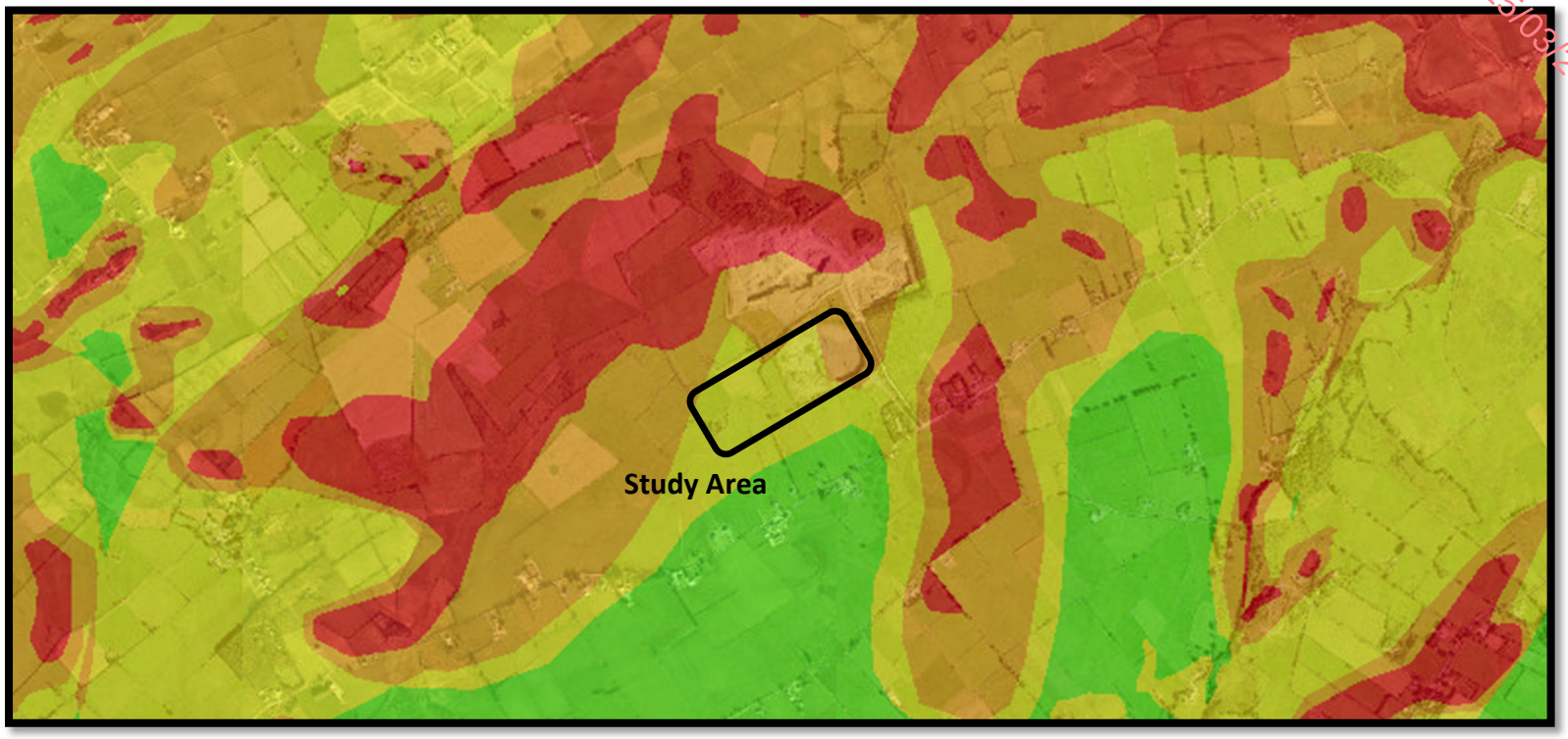

Image 6.5.9: GSI Crushed Aggregate Resource Mapping showing the proposed site area as a Moderate (yellow) to High (orange) aggregate potential.

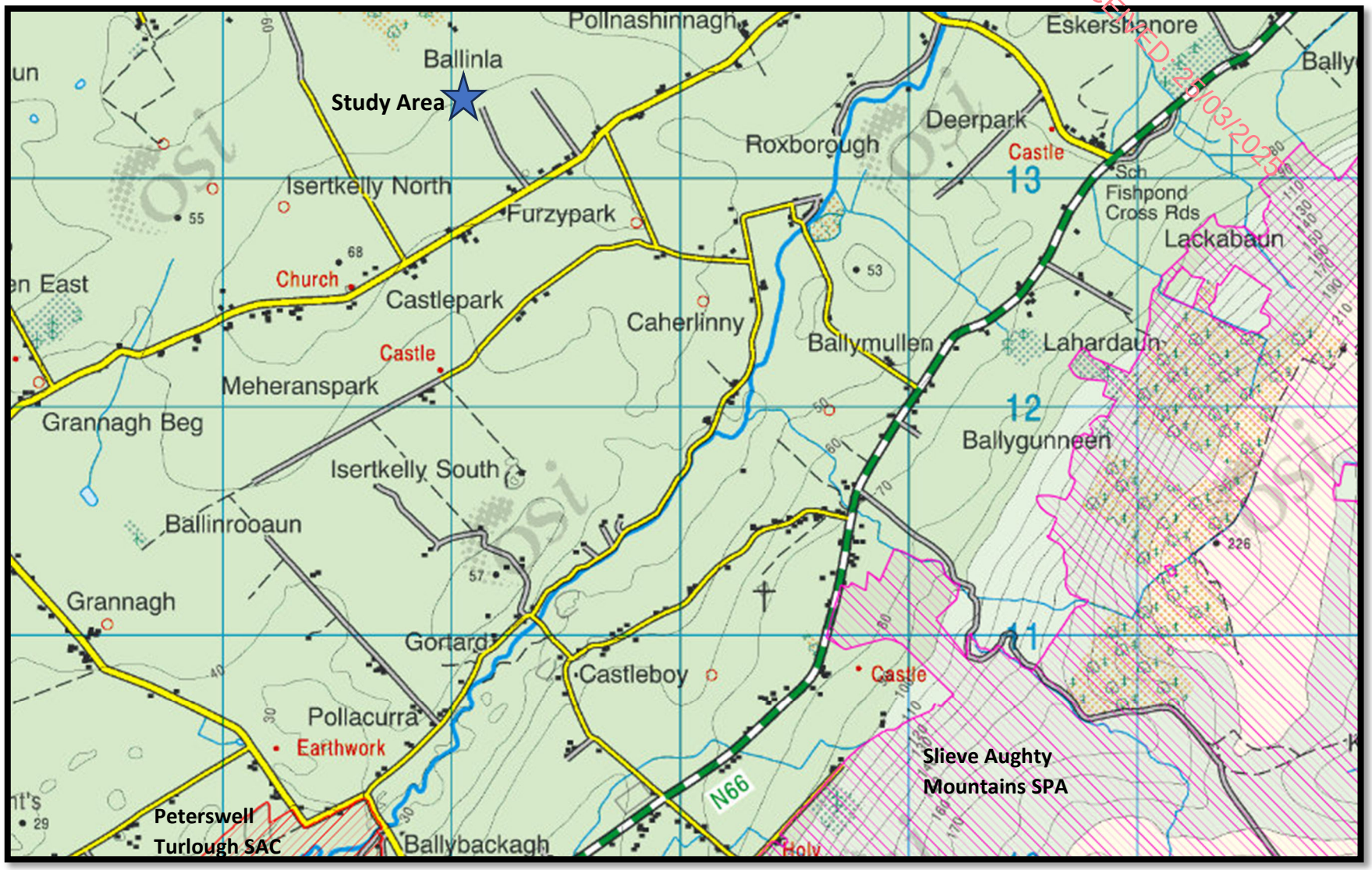

Image 6.5.10: NPWS mapping showing Slieve Aughty Mountains SPA (Code 004168) SE & Peterswell Turlough SAC (Code 000318) South of the site. (Blue Star).